University of Kentucky Department of Plant and Soil Sciences Self-study
August 28, 2017

Submitted by the Chair, Dr. Todd Pfeiffer, and faculty of the Department of Plant and Soil Sciences to the Dean of the College of Agriculture, Food and Environment, Dr. Nancy Cox, and to the Program Review Committee

The following academic programs are included in this report:
HPLS B.S.
IPSS M.S. and Ph.D.
Crop Science M.S. and Ph.D.
Soil Science Ph.D.
Plant Physiology Ph.D.

Table of Contents

Executive Summary

The Department of Plant and Soil Sciences is one of 14 academic departments in the College of Agriculture, Food and Environment (CAFE). The department's programs are diverse in both our mission areas – teaching, research, and extension; and in our broad areas of interest – crop science, plant molecular biology, and soil science. The department has 43 faculty members, 9 adjunct faculty members, 68 staff members, 7 post-doctoral scholars, and 32 graduate research assistants.

Organizing and planning for this 2017 periodic review began in fall 2016 with the department's advisory committee and the college's Office of the Assistant Dean for Academic Administration. The advisory committee recommended individuals to serve on the review committee. Following approval of the recommendations by Dean Nancy Cox, the Office of the Assistant Dean for Academic Administration composed the review committee and invited the participants based on those recommendations. In the 2016 fall semester nine listening sessions were scheduled, six for faculty and three for staff. Within the advisory committee, our initial discussions revolved around the big questions we felt needed to be addressed to move the department forward. Those questions were discussed and refined at the January and May 2017 faculty meetings. Our recommendations for quality enhancement were discussed and refined at the August 2017 staff and faculty meetings.

The self-study document was developed by Todd Pfeiffer and the department's 2016-2017 Advisory Committee. Sub-groups contributed to different sections: Research – Rebecca McCulley, Chris Matocha, Jan Smalle, Hongyan Zhu; Instruction – Mark Coyne, Elisa D'Angelo, Art Hunt, Tim Phillips; Extension – Ray Smith, Brad Lee, Gregg Munshaw, Edwin Ritchey; Budget – Christine Tarne.

Overview of progress since the last review

Our response to the last review committee recommendations report is detailed further in this self-study. In addition to the review committee recommendations, our department listed numerous specific recommendations for our last review. The departmental recommendations and our success at addressing them are as follows:

Departmental recommendations for improvement to the undergraduate programs	
Recommendation	**Implementation status**
1. Meeting the needs recommended as we decide how to proceed 'Enrolling students in the HPLS undergraduate program'	Yes, the department hired an academic coordinator for recruiting.
2. Increasing our contributions to, and integration in, campus wide initiatives	This recommendation was not prioritized.

3. Defining teaching responsibilities within the ABT, NRES and SAG curricula as we hire for new faculty positions	Yes
4. Hiring a 50% lecturer to provide a statistical reasoning undergraduate course in the UK Core specific for agriculture students	No, we did not increase our UK Core participation beyond PLS 103/104.
5. Modernizing and fully equipping the soil science teaching lab	Yes
6. Modernizing and fully equipping the agricultural biotechnology teaching lab	Partially improved

Departmental recommendations for improvement to the Integrated Plant and Soil Science graduate program	
Recommendation	**Implementation status**
1. Higher stipends: $20,000 for PhD and $17,000 for MS students	Yes
2. Developing specific teaching experiences for graduate students	Yes
3. Continue providing funds for students to attend research conferences	Yes
4. Creating an MS level distance education program with an extension agent focus	No, we did not address this recommendation.
5. Broadening graduate student exposure to diverse ideas by inviting more seminar speakers from other institutions and facilitating visiting scientists and their participation in our graduate education program	Partially addressed
6. Reviewing graduate courses with the intention of consolidating courses. Offer new courses in cooperation with graduate programs at other universities.	Beginning – we have shared one course with University of Tennessee
7. To encourage graduate student recruitment, creating a safety net guaranteeing RA funding for the duration of a student's program if grant funding runs out before the student finishes.	Yes, by practice if not policy.
8. Identifying additional graduate student desk space	Yes, renovated Ag North graduate student offices to accommodate more students.

Departmental recommendations for improvement to the Cooperative Extension programs	
Recommendation	**Recommendation**
1. Meeting the needs recommended as we answer the question regarding 'Organizing our extension faculty to serve the state'	Yes, filled vacant Extension faculty positions.
2. Providing partial extension associate or research technician positions for each faculty specialist	Yes, this will be completed soon.
3. Providing staff support for electronic communication technologies, e.g. web site maintenance, social media, distance delivery of meetings	Yes, for web site improvement.
4. Working with the college to construct an educational/meeting facility at Spindletop research farm	No, the department has not addressed this recommendation.

Departmental recommendations for improvement to the research programs	
Recommendation	**Recommendation**
1. Hiring a 50% statistical consultant to advise graduate students and faculty members on statistical design and analysis	Yes, accomplished through the college and the Department of Statistics.
2. Hiring an administrative support assistant focused on 1) grant management and report submission, 2) grant development and consortium coordination.	No, recommendation dropped following review.
3. Developing a core analytical facility that can be used for non-targeted chemical analysis of plant and soil samples and that serves the analytical needs of Kentucky agriculture as well as our research programs. Sample analyses on a cost recovery basis would support this facility. We envision a lab space of 1,000 square feet. The facility should have a faculty director and two full-time technical persons. The initial equipment for the facility includes a GC-MS ($150,000 plus $10,000 for an annual service contract) and an HPLC-MS ($250,000 plus $20,000 per year for a service contract). Initial start-up for the unit would be approximately $500,000 for a 3 year period. Then the unit must generate adequate funds to become self-sustaining. This models the AGTC facility available for molecular genetics analyses.	No, this has not been addressed.
4. Substantially improving our research farm support infrastructure e.g. replacing the dark fire tobacco barn at Princeton, replacing the sample drying facility at Spindletop and adding a field sample processing area, additional storage space at Spindletop including secure fertilizer storage, increasing the farm support staff at Princeton including a mechanic, adopting field plot GPS technology, field scale equipment supporting climate change research	Yes, we focused on equipment and infrastructure improvements.
5. Providing PIs easier budget and account management by showing individual transactions monthly	Partially, some improvement in account summaries.

RECOMMENDATIONS FOR QUALITY ENHANCEMENT - 2017

During and following this periodic review the department desires to discuss and resolve several big questions as we define our needs for quality enhancement.

1. The Department of Plant and Soil Sciences does not administer a standalone undergraduate or graduate degree program. Instead we participate in interdisciplinary programs: Undergraduate - Horticulture, Plant and Soil Sciences, Natural Resources and Environmental Science, Agricultural and Medical Biotechnology, Equine Science and Management; Graduate - Integrated Plant and Soil Sciences. Are we contributing adequately through these programs to help the college attract and successfully graduate our students? How could we best contribute more? Are we managing our graduate program to provide maximum benefits to the students, our research, and our undergraduate teaching? Have the changes implemented based on our 2011 review been successful?

2. Are we efficiently assigning staff, faculty, and infrastructure resources? Do our current staff and infrastructure resources limit our productivity or is our primary limit faculty time? What are our priority infrastructure and support needs? Do our resources and resource assignments limit faculty collaboration or are there ways to utilize our resources to facilitate cooperation? Is our farm organized to provide appropriate opportunities for field based research for everyone? Can we strengthen teaching activities at the farm?

3. Defining future faculty positions: Program diversity and breadth is one of our strengths—yet this diversity and breadth leaves us yearning for greater faculty collaboration. Also, as faculty numbers decrease some areas are left wanting. How do we proceed with defining critical areas for faculty hiring? Six years ago we determined that a vigorous discussion of faculty position proposals at the time of each faculty vacancy was the appropriate way to plan for faculty replacements. Is that still the appropriate path? Do we choose continued breadth or do we concentrate on creating a critical mass of faculty members in specific areas and diminish our breadth? Would targeting specific research areas as strengths enhance our graduate program quality and our collaboration? What metrics should we collect to measure faculty collaboration? How should the department support collaborative research/extension programs? How do we promote more collaboration among faculty with very different research/extension foci to model and enlarge collaboration among the graduate students from different programs?

--For our undergraduate programs we recommend:

1. Increasing enrollment in the HPLS undergraduate program is imperative; our minimum should be 60 students enrolled and 8 students graduating per year. If enrollment does not increase, consider offering our areas of specialization as individualized curricula.
2. To help with undergraduate student recruitment ask every faculty member to create a 30-minute hands-on recruitment activity.
3. Mentoring undergraduate research projects to address our college expectation of providing a unique experience for each undergraduate student, and to support the increasing enrollment in the Agricultural and Medical Biotechnology program.

4. Encouraging student competition teams in order to foster extracurricular learning and student engagement.
5. Emphasizing the undergraduate program assessment process and encouraging faculty participation in the process.
6. Assessing the potential of different aspects of on-line teaching (Echo360 course capture, Camtasia lecture recording, courses with on-line lectures/in person labs, etc.) for alleviating course scheduling conflicts for students, increasing enrollment, and facilitating non-traditional student participation.

--For the IPSS graduate program we recommend:

1. Continuing providing funds for students to attend research conferences.
2. Emphasizing the graduate program assessment process and encouraging faculty participation in the process.
3. Prioritizing graduate student research or extension presentations and publications as metrics for the program.
4. Expanding the shared graduate-student-course instruction initiative with the University of Tennessee.

--For our extension programs we recommend:

1. Increasing collaboration among our extension and research programs through participation in joint research/extension NIFA-AFRI proposals.
2. Upgrading electronic information delivery via smart phones through apps, podcasts, videos and linkages through social media.
3. Focused engagement with ANR agents about their priority needs and incorporating those needs into a coordinated effort to develop agent-training programs.
4. Organizing a planning retreat with agents and specialists to develop a summer intern research/demo track.
5. Providing programmatic support for writing publications and social media posts. For example, an extension associate for each working group (e.g. grain crops, forages, tobacco, turf, weeds etc.) that would assist with first drafts, reviewing, formatting, and images.
6. Agreeing upon a technology suite for electronic communications (e.g. Camtasia for voice over Power Point presentations).

--For our research programs we recommend:

1. Increasing collaboration among our extension and research programs through participation in joint research/extension NIFA-AFRI proposals.
2. Sharing more space, equipment, and technical staff among research programs. Examples: 1) Use S104 AGN and S208 AGN as the first model with S104 dedicated to chemical analysis of water, soils and plants and S208 dedicated to the analysis of structural and physical properties of soils. Programs will donate equipment and share technical support time for those efforts.
   2) Share technical support and equipment for field research at Spindletop farm.
3. Promoting participation in grant writing workshops and other efforts focused on enhancing collaboration.
4. Addressing a facility plan for our spaces.

5. Maximizing the capability of the Grain and Forage Center of Excellence to conduct research on crop management, soil management, pest management and water quality. Improvements and additions to laboratories at the UKREC to help with soil and water analysis, plant sample preparation, soil chemistry, soil testing and related areas are all necessary and important.

--For the department employees we recommend:

1. Supervisory faculty complete UK SuperVision training courses.
2. Creating functional responses to the UK@Work survey to address employee job satisfaction issues.
3. Continually acquainting employees with the many job/life enhancement programs provided by UK.

--For working with the college to address improvements in infrastructure and support we recommend:

1. Prioritizing the cleaning and upgrading of the air distribution system in the Agricultural Science Center building as the first step of a laboratory renovation program for the building.
2. Providing additional support for the grant submission process, such as adding another college grants officer.
3. Constructing an educational meeting facility at Spindletop research farm.
4. Long-term, we see department collaboration being fortified by having our on-campus faculty housed in a new dedicated building instead of having our faculty located in three buildings.

Mission

To improve, through scholarly research, the understanding of plant and soil systems as sustainable resources for human use while preserving and enhancing environmental quality.

To recruit, educate, and graduate top-quality students and serve our broad-based clientele by providing progressive education programs and effectively interacting with partners in the public and private sectors.

To anticipate and effectively respond to societal needs for improved agricultural productivity and for the wise use of natural resources in order to enhance the quality of life.

Vision

The department strives to balance the three mission areas of a land-grant institution: teaching, research and extension. We take seriously our role of responding promptly to agricultural and environmental issues. We address a broad subject matter including the chemistry, physics and biology of plant, soil and environmental systems ranging from the molecular, to the whole plant, to the ecosystem scale. The department works towards sustainable and profitable crop production, renewable resource management, and environmental protection for now and the future.

Our activities in fulfilling this mission contribute directly to the university's strategic plan areas: Undergraduate Student Success, Graduate Education, Diversity and Inclusivity, Research and Scholarship, and Community Engagement. We support the goals enumerated in the CAFE strategic plan: Prepare highly motivated and culturally adaptive graduates; Build and nurture relationships with the people of the Commonwealth and across the world; Recruit, develop, and retain exceptional faculty and staff; Show CAFE commitment to diversity and inclusion; Produce innovative solutions through multidisciplinary collaborations; and Build state-of-the-art facilities equipped with cutting edge technology.

Department Organizational and Administrative Structure

The Department of Plant and Soil Sciences is one of 14 academic departments in the college. Based on faculty size (Appendix A) it is the largest department. The department organizes itself in overlapping groups:

1. Mission areas – teaching, research and extension
2. Broad research areas – Crop Science, Plant Molecular Biology, and Soil Science
3. Commodity/resource committees – corn and soybean, forage, seed, small grain, soil, tobacco, turf, water/environment, and weed

By relating with different subsets of the faculty in these overlapping groups (Appendix B), faculty members see the different needs of most of the programs in the department. This has enabled the department to look at the big picture, resulting in a department supportive of maintaining our faculty needs to meet the traditional demands of crop agriculture and extension, to fill the instructional requirements for multiple programs, and to provide a supportive research environment for each faculty member and each discipline group to

conduct transcendent research. This collegial approach has been an underpinning for the department, and will remain vital in the future.

Administratively the department is organized under a department chair with a business office, departmental coordinators, and a committee structure (Appendix C). Todd Pfeiffer has been the department chair since May 2009. He will be ending his appointment December 2017. The business office support staff consists of six individuals: the budget manager supervising two financial assistants, the HR coordinator supervising an assistant, and a faculty-supervised staff assistant. The coordinator of instruction (Dr. D'Angelo), the extension coordinator (Dr. Smith), and the graduate program coordinator (Dr. Coyne) are faculty members with partial administrative appointments. The department facility coordinators are staff employees with a portion of their time assigned to the department: Spindletop Farm Coordinator, Campus Facilities Coordinator, Equipment Coordinators, and Safety Coordinator. The department advisory committee, composed of the coordinator of instruction, the coordinator of extension, the graduate program coordinating committee, and the promotion and evaluation committee meets monthly during the academic year. The department's staff representative to the college Staff Council, formerly called Staff Links, and the PSS facility coordinators meet with the advisory committee when needed concerning staff and facility issues. The other department committees meet as needed at the discretion of each committee chair.

Initiatives

During the past five years the department has concentrated on strategic initiatives to increase undergraduate student recruiting, improving activities for and quality of the Integrated Plant and Soil Sciences (IPSS) graduate program, improving infrastructure and equipment, telling our story, and targeting faculty position replacements.

Undergraduate recruiting – Our previous department review indicated, "The department may consider an investment in additional marketing and enhanced visibility of the HPLS degree program to attract additional students. The department has suggested that the HPLS degree may be strengthened by addition of a staff member charged with improving recruitment efforts."
Following this the department hired a recruiter (Amber Harris - 2013 followed by Rebecca von Groote - 2015) to establish the 'AgronoME! Impact the planet. Be an agronomist.' campaign and established a $25,000/year budget for recruiting. The position focuses on recruiting for the Horticulture, Plant and Soil Sciences major, the Modern Agronomic Crop Production individualized curriculum, and provides 20% support for recruiting for the Sustainable Agriculture individualized curriculum. The major recruiting activities are presented in Table 1 with the most recent student enrollment presented in Table 2.

Table 1. Summary of HPLS and Modern Agronomic Crop Recruitment Outreach 2013-2017			
Recruitment Activity	**Type**	**Prospective Students Reached**	**Years**
High School Visits	Presentation	Depending on the school, anywhere from 20 to 200, 20-30 visits per year	2013-2017
On Campus Recruitment Events	Tabling and Lunch Meet and Greets	Depending on the event, 25-150 students; 5-7 events per year	2015-2017
Field Day	Hands-On Outreach Activity	50-70 students, 1 event per year	2014, 2017
Individual Prospective Student Meetings	One on One meeting with Prospective Students	15-20 meetings per year	2013-2017
State FFA Conventions	Tabling with information and giveaways	100-200 per event, 1-2 per year	2016-2017
Social Media Presence (Facebook/Twitter)	Electronic Outreach	insufficient analytics	2013-2017
Website Presence	Electronic Outreach	insufficient analytics	2013-2017

Table 2. Incoming student attendance at summer orientation programs 2016 and 2017*		
Program/Track	**Students 2016**	**Students 2017**
HPLS- Hort Ent Management	5	4
HPLS- Turf Management	1	1
HPLS- Science Track	0	2
HPLS- Crops and Livestock	2	0
Modern Agronomic Crop	5	3
HPLS- Not Yet Known	-	1

* Based on current orientation lists, subject to change through August 2017

Improving activities for, and quality of, the IPSS graduate program – Our last review recommended that we combine all seminar series into one departmental seminar to enhance graduate program and departmental integration. We accomplished this and went further to

establish a graduate student symposium held three times each year. We have received funds to help support those symposia: The Donald Sparks Graduate Student Symposium and the Bill Witt Graduate Student Symposium. The department continues to promote the annual Graduate Program Outstanding Alumnus event and to select the Peaslee Outstanding Graduate Student. Likewise, the previous review recommended the graduate students re-establish the graduate student organization. This occurred. The department has provided partial support for student activities, including a trip in 2016 to visit Monsanto and in 2017 to visit agriculture research companies BASF, Bayer, and Syngenta in the North Carolina Research Triangle. Our base graduate research assistantship stipends increased this year to $18,000 for an M.S. student and $21,000 for a Ph.D. student, bringing them in line with assistantships offered by other Plant and Soil Science programs in the southern multistate region. The department allocates $6,000/year to support graduate student travel to present research at national meetings.

Enhancing facility and equipment infrastructure – The department has worked over the past five years to utilize resources to enhance our facility and equipment infrastructure based on proposals solicited for equipment requests and infrastructure improvements. We were fortunate to have significant salary savings and research incentive resources to focus on this goal. Table 3 shows the broad categories to which funds were allocated.

Table 3. Equipment and infrastructure funding allocations.

	12-13	**13-14**	**14-15**	**15-16**	**16-17**
Spindletop facilities	$ 32,000	$ 39,000	$ 74,000	$ 60,000	$ 36,000
Lab requests	$ 64,000	$ 94,000	$ 80,000	$ 76,000	$148,000
Princeton requests	$ 59,000	$ 53,000	$ 59,000	$ 18,000	$ 23,000
Lexington field programs	$ 57,000	$112,000	$ 83,000	$144,000	$ 92,000
Student labs/offices	$ 50,000				
Other	$ 28,000	$ 4,000	$ 9,000		$ 6,000
Total	$290,000	$302,000	$305,000	$298,000	$305,000

Telling our story – Informing our multiple audiences as to what we do is important. Discussions at faculty meetings considered why and how to accomplish this. We work with Agricultural Communications on stories and press releases and highlight our activities on the department Facebook page and web site. On the Facebook page we post monthly program synopses in '101 Words or Less' following the format from the American Society of Agronomy. For example -

AGroNotes 101: March 2016

Poultry production is a $1.2 billion industry covering 43 Kentucky counties. The 3,000 poultry houses in Kentucky generate around 450,000 tons of poultry litter annually, containing approximately $18 million worth of nutrients, when used appropriately. Extension Soils Specialists, Edwin Ritchey and Josh McGrath have been working closely with other researchers and specialists in weed sciences, plant pathology, and agricultural economics to maximize the agronomic and economic potential of this nutrient source while minimizing any potential negative environmental consequences. Spring application of poultry litter to fields requiring nutrient additions can conserve up to one third of the total value contained in the litter.

Faculty replacement – The previous review recommended improved planning in the department concerning future research and extension program foci, including future faculty hires. The discussion with the college administration following that review led to the suggestion that an effective planning strategy was a thorough discussion of departmental needs and priorities at the time of developing each faculty-hiring proposal. We adopted this approach. A vacant faculty position is considered as a general position, not automatically aligned with a department focus from which the vacancy arose. Faculty members create a draft hiring proposal. The multiple hiring proposals are presented and discussed at a faculty meeting followed by a discussion during an advisory committee meeting. The advisory committee recommendation is then discussed further at the next faculty meeting where consensus is reached on how to proceed. Of the 11 faculty positions filled or to be filled since 2012 three have been filled with a focus markedly different from the predecessor in the position.

Previous Program Review

Our last department program review was conducted in 2011-2012. The recommendations from that review follow:

1. The department should develop a strategic planning process that would foster engagement with larger, longer-term issues in order to have guidelines for making the more immediate decisions on where to invest their resources.

2. The entire Department needs to discuss and resolve several major issues facing the Department. The College of Agriculture and the Department of PSS are getting smaller – what areas and/or responsibilities will be given up? Examples of the long-range type of issues that need to be discussed include the undergraduate HPLS curriculum, research foci within the Department given reduced number of faculty, extension foci – given reduction in Extension FTEs. The review committee suggests that the new IPSS graduate program might serve as a mechanism to integrate the various sub-disciplines (crops, soils, and plant biology) within the Department.

3. As part of the above process and discussions (1 and 2 above), the department should develop interdisciplinary research clusters encompassing both research and extension faculty focused on strengths, and informally or formerly designate these clusters as areas of research foci that can be used to recruit graduate students.

4. The department should establish a committee to examine combining all seminar series into one Departmental seminar series to enhance integration within the Department.

5. A proposal to hire an MS or PhD level person, at the College level, to help coordinate large grant submissions and help identify opportunities and build interdisciplinary teams should be made to the College of Agriculture Administration.

6. The faculty and staff should discuss and develop departmental guidelines to facilitate professional development for staff, and to recognize contributions of technical staff to patents and publications.

7. The department chair should consider scheduling administrative staff meetings on a regular basis. (Suggested frequency = monthly)

8. The review committee strongly recommends that the graduate students re-establish the graduate student organization and include faculty advisors in this organization.

9. The review committee recommends that the graduate students have representatives at departmental functions such as faculty meetings, appropriate departmental committees, and faculty search committees.

Our implementation plan reports responding to those recommendations are found in Appendix D.

Department Contributions to Statewide Postsecondary Strategic Agenda

The department contributes directly to achieving the goals of the statewide postsecondary education strategic agenda, specifically:

- Kentucky will be stronger by ensuring that many more individuals complete a postsecondary degree or credential, and that they graduate with the skills and abilities to be productive, engaged citizens.
- Promote academic excellence through improvements in teaching and learning.
- Kentucky will be stronger by training a globally competitive, entrepreneurial workforce; educating an engaged, informed citizenry; improving the health and well-being of families; and producing new research and discoveries that fuel job creation and economic growth.
- Increase basic, applied, and translational research to create new knowledge, accelerate innovation, and promote economic growth.

We are a majority research department; our department–wide faculty distribution of effort in 2015-2016 was 59% research. Our large, diverse department conducts research in many areas. The breadth of research topics and collaborative efforts between basic and applied researchers allows for a unique research perspective, contributing to all aspects of the Stronger by Degrees research goals. Likewise, we are a service/extension focused department; our department-wide faculty distribution of effort was 23% extension and service. As such we extend our research knowledge into the community, providing adult education via our extension specialists, contributing to the economic growth of Kentucky's agriculture sector, and engaging with our citizenry. Our soils extension group also supports K-12 education programs through high school soil judging contests, train-the-trainer workshops for science teachers and technical assistance with demonstration compost projects, vegetable gardens and rain gardens. The department contributes to multiple undergraduate programs in the College of Agriculture, Food and Environment including Agricultural and Medical Biotechnology, Equine Science and Management, Horticulture, Plant and Soil Sciences, Natural Resources and Environmental Sciences, and individualized programs in Sustainable Agriculture and Modern Agronomic Crop Production. We are also a major component of the graduate degree program Interdisciplinary Plant and Soil Sciences. Our department-wide

faculty distribution of effort was 11% instruction. The department promotes improvement in teaching with our formative peer-review of teaching activity.

Unique Programs

A review of CIP codes indicates that no other university in Kentucky has programs offering B.S., M.S., or Ph.D. degrees under the specific CIP codes used by the programs of this department.

Both the Horticulture, Plant and Soil Sciences undergraduate degree program and the Integrated Plant and Soil Sciences graduate degree program are unique at the University of Kentucky. Both are collaborative between the Department of Plant and Soil Sciences and the Department of Horticulture. A merger of the Crop Science, Plant and Soil Science, Plant Physiology, and Soil Science graduate degree programs formed the Integrated Plant and Soil Sciences graduate program. The first students applied to this program in the spring semester of 2012.

We have also developed and implemented joint forage projects with University of Tennessee, Eastern Kentucky University, Western Kentucky University, Berea College, and Asbury University.

Department Resources

Financial Resources

The department is supported by funds provided through the College of Agriculture, Food and Environment. Individual programs in the department also receive funds from external grants, income accounts, and unrestricted gift funds. The total amount of state and federal funds provided to the department for fiscal year 2017 was $7,200,000. Department programs received $2,673,000 in grant funds, $115,000 in endowment funds and held approximately $4,000,000 in income and gift funds. Table 4 presents the department budget from state and federal funds for the past five years. (Budget numbers in the following tables often differ for the same year depending on the date when the numbers were compiled. The budget during the year is fluid as commitments are added, grants begin or end, etc.)

Table 4. Departmental Budget – 5 years
Data from initial budget spreadsheets July of each year

	Teaching	Research	Extension	Graduate student support	Total	%
2012 - 2013						
State	496,542	3,658,798	1,145,457		5,300,797	79%
Federal		737,562	184,780		922342	14%
RCTF	60,318	172,982		243,773	477,073	7%
Total	556,860	4,569,342	1,330,237	243,773	6,700,212	
%	0.08	0.68	0.20	0.04		
2013 - 2014						
State	547,631	3,623,329	1,186,609		5,357,569	78%
Federal		873,548	90,302		963850	14%
RCTF	70,142	238,497		243,773	552,412	8%
Total	617,773	4,735,374	1,276,911	243,773	6,873,831	
%	0.09	0.69	0.19	0.03		
2014 - 2015						
State	465,465	3,717,635	1,267,476		5,450,576	78%
Federal		886,005	92,043		978048	14%
RCTF	73,956	246,601		247,230	567,787	8%
Total	539,421	4,850,241	1,359,519	247,230	6,996,411	
%	0.08	0.69	0.19	0.04		
2015-2016						
State	543,279	3,825,709	1,298,188		5,667,176	78%
Federal		899,776	93,369		993145	14%
RCTF	60,440	267,366		247,230	575,036	8%
Total	603,719	4,992,851	1,391,557	247,230	7,235,357	
%	0.09	0.69	0.19	0.03		

2016-2017						
State	649,122	3,817,512	1,183,215		5,649,849	78%
Federal		886,653	94,149		980802	14%
RCTF	69,432	264,718		247,230	581,380	8%
Total	718,554	4,968,883	1,277,364	247,230	7,212,031	
%	0.10	0.69	0.18	0.03		

In 2016-2017 funds were available in the broad budget categories shown in Table 5.

Table 5. Primary budget categories for 2016-2017					
2016 - 2017	State	Federal	RCTF	Total	%
Faculty salaries (filled)	2,923,951	19,650	298,082	3,241,683	49.4%
Faculty salaries (open)	396,052	0	0	396,052	6.0%
Staff salaries (filled)	1,786,044	396,757	0	2,182,801	33.3%
Staff salaries (open)	8,800	51,466	0	60,266	0.9%
Graduate students (stipends and tuition)	7,788	61,976	227,906	297,670	4.5%
Operating expenses	240,425	143,513	2,175	386,113	5.9%
Total	5,363,060	673,362	528,163	6,564,585	
%	81.7%	10.3%	8.0%		

The utilization of our operating funds during 2016-2017 is presented in Table 6.

Table 6. 2016-2017 utilization of funds for purposes other than salaries or supporting equipment/facility proposals		
Category	Amount	%
Communications (phone, internet, cell phone supplement)	$ 87,724	20.1%
Departmental allowance to programs	$ 190,000	43.4%
In-state extension travel	$ 44,737	10.2%
Copiers	$ 28,369	6.5%
Office supplies	$ 7,241	1.7%
Maintenance and department vehicle	$ 68,450	15.6%
Graduate student travel support	$ 6,000	1.4%
Background checks/visa fees	$ 2,843	0.6%
Parking meters	$ 2,136	0.5%
Total	$ 437,500	

Physical Resources

The Department of Plant and Soil Sciences has faculty located at three centers in Kentucky: the University of Kentucky main campus in Lexington, the UK Research and Education Center in Princeton, and the Robinson Center for Appalachian Resource Sustainability in Quicksand. Farm-based research is conducted at all three locations. The Princeton farm is approximately 1300 acres with 120 acres allocated to Plant and Soil Sciences research, the Lexington area farms consist of approximately 3800 acres with about 800 acres utilized by the department, and the Quicksand farm supports department research on about 40 acres. On-campus department research labs are located in three buildings: Agricultural Science Center, Plant Science Building, and the Kentucky Tobacco Research and Development Center. The department occupies/utilizes approximately 194,000 sq. ft. of building space with 85,000 sq. ft. in farm buildings, 48,000 sq. ft. of laboratories, and 35,000 sq. ft. of greenhouse space including 13,000 sq. ft. on campus plus a small grains research greenhouse, a forage research greenhouse, and three tobacco transplant greenhouses on the Spindletop research farm. Research lab space and farm building space managed by the UKREC is assigned to the five Plant and Soil Sciences faculty located at Princeton including nearly 2,000 sq. ft. laboratory space, 1,500 sq. ft. greenhouse space and 600 sq. ft. office space. The UKREC farm has recently increased by 300 acres with the purchase of an adjoining tract as part of the Grain and Forage Center of Excellence; with acreage to be available in this tract for Plant and Soil Sciences research once the infrastructure is developed and the tract becomes available.

We have extensive IT capacity including approximately 300 desktop/laptop computers, 65 computers + 15 tablets purchased in the past two years. We have 57.9 TB of available space on our main file server, which is in a Synology hybrid RAID with a 1 disk fault tolerance, with 27.9 TB available in a backup server. 336 GB of computing resources are available for intensive modeling. We have a 475 sq. ft. classroom upgraded in 2016 with a Logitech group HD video and audio conferencing system for distance delivery of graduate courses. This classroom has a touchscreen monitor to allow for individuals to interact with use of media, also housing a projector system, white board projector screen, wall plate for remote control of the classroom, and a wall mounted AV rack housing all equipment. This year, following three years of planning, we completed the fiber optic upgrade to the computing capability of the Spindletop farm including wireless connectivity. We upgraded all switches to Cisco gigabit POE switches to allow for a wireless system, this system allowed us to migrate all of the computers to the domain. As a result, we were able to add all of the printers to the print server. We are also in the process of upgrading all phones to VOIP. This replaced our 20 year old DSL connection and alleviated our most severe computing constraint. We connect seminars and faculty meetings to Princeton and Quicksand as requested via a LifeSize videoconferencing system in Cameron Williams auditorium. The system has degraded during its eight-year life, is losing functionality and needs replacing.

Human Capital Resources

The department personnel currently consists of:

July 1, 2017	
Tenure track faculty	42
Non-tenure track faculty	1
Post-retirement faculty	3
Adjunct faculty	9
Full-time staff	46
Student Workers	40
Temporary staff	22
Post-doctoral scholars	7
Research/teaching assistants	32

Our faculty members are listed in Appendix A.

Our demographic profile is shown in Table 7.

Table 7. Personnel diversity for employees in the Department of Plant and Soil Sciences, July 1, 2017.

Program	Number of personnel	Number of Hispanic + non-Caucasian personnel	Number of female personnel
Graduate students	32	6	16
Post-doctoral scholars	7	6	4
University funded staff	46	9	30
Grant funded staff	22	5	7
Faculty	43	5	8

Faculty expertise

Faculty members are recognized for their expertise, being selected for national honors and editorial activities. We contribute to activities in national scientific societies. Faculty editorships, society service and national awards are presented in Appendix E.

Our faculty profile as of June 30, 2016

Plant and Soil Sciences
Faculty Snapshot FY 2016

All PSS Faculty by Title Series		
Title Series	Faculty	Percent
Regular	30	55%
Extension	12	22%
Adjunct	7	13%
Post Retirement	4	2%
Research	1	2%
Special	1	2%
Total	**55**	**95%**

All PSS Faculty by Full Time/Part Time Status		
FT/PT Status	Faculty	Percent
Full Time	44	80%
Part Time	11	20%

Full Time Faculty by Race		
Race	Faculty	Percent
Asian	3	7%
Hispanic	1	2%
More than one race	1	2%
White	39	89%

Full Time Faculty by Assignment Period		
Assignment Period	Faculty	Percent
12 month	42	95%
9 month	2	5%

Full Time Faculty by Gender		
Gender	Faculty	Percent
Female	8	18%
Male	36	82%

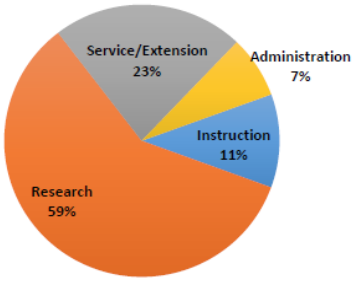
Full Time Faculty by Rank		
Rank	Faculty	Percent
Professor	24	55%
Associate	11	25%
Assistant	9	20%
Total	**44**	**100%**

Full Time Faculty Credentials		
Credentials	Faculty	Percent
Ph.D.	44	100%

Full Time Faculty by Tenure Status		
Tenure Status	Faculty	Percent
Tenured	35	80%
Tenure Track	8	18%
Not Eligible	1	2%

Full Time Faculty by Age		
Age	Faculty	Percent
30-39	3	7%
40-49	14	32%
50-59	13	30%
60-65	11	25%
> 65	3	7%

Average DOE



Full Time Faculty by Years of Service		
Years	Faculty	Percent
< 4	6	14%
4-6	4	9%
7-9	4	9%
10-13	6	14%
14-16	3	7%
17-19	4	9%
20-23	3	7%
24-26	1	2%
27-29	1	2%
30-33	6	14%
34-36	4	9%
> 36	2	5%

Faculty Snapshot 2016/PSS
Data collected from the Faculty Database on 6/30/2016, prepared by Megan Lucy

Similar to the budget data, faculty composition data presented in the following tables depends on the time of year the data were compiled as well as the data set used (for example, Table 7 includes only faculty with a primary appointment in our department on June 30, 2016). Table 8 shows the faculty composition in the years following the last review. For a long-term comparison, historical faculty size data are presented in Appendix F.

Our faculty FTE structure has been relatively constant during the past six years with some fluctuation due to faculty turnover. A small uptick in the percentage extension and instruction with a corresponding decrease in the percentage research occurred.
Table 9 shows the faculty FTE structure during the period from the previous review.

Table 8. Faculty size for the Department of Plant and Soil Sciences 2012-2017. A faculty member who was 100% administration outside the department was not counted. A faculty member with any percentage of extension/instruction/research DOE in the department was counted. So these numbers indicate faculty member count, not faculty FTE. Post-retirement appointments are not reflected in the numbers.

Year*	2012	2013	2014	2015	2016	2017
Adjunct	6	9	8	6	9	9
Extension	10	10	12	12	11	14
Research/Instruction	28	28	28	30	31	28
Research title	3	1	1	1	1	1
Total	47	49	49	49	52	52
UK funded	38	38	38	38	38	40
Open			3	2	3	2
* July 1, XXXX						

Table 9. Plant and Soil Sciences FTE structure for fiscal years 2012 – 2017, data from June 30 each year. Includes research faculty but not post-retirement appointments.

2012						**2013**					
	Res	Ext	Instr	Adm	Total		Res	Ext	Instr	Adm	Total
Prof.	9.69	4.11	2.45	1.18	17.0	Prof.	10.68	3.77	2.32	1.73	18.5
Assoc.	9.10	2.96	1.29	0.40	13.75	Assoc.	8.62	2.96	1.67	.50	13.75
Assist.	6.64	1.6	0.76	0.0	9.0	Assist.	5.88	1.6	0.52	0.0	8.0
Total	25.0	8.67	4.50	1.58	39.75	Total	25.18	8.33	4.51	2.23	40.25
Percent	63	22	11	4		Percent	63	21	11	5	
2014						**2015**					
	Res	Ext	Instr	Adm	Total		Res	Ext	Instr	Adm	Total
Prof.	9.69	4.00	2.01	2.55	18.25	Prof.	9.51	4.40	2.07	1.95	17.93
Assoc.	7.17	2.94	1.42	.2	11.73	Assoc.	7.13	2.96	1.46	.2	11.75
Assist.	4.05	2.65	0.55		7.25	Assist.	4.74	2.40	.86	0.0	8.0
Total	20.91	9.59	3.98	2.75	37.23	Total	21.38	9.76	4.39	2.15	37.68
Percent	56	26	11	7		Percent	56	26	12	6	
2016						**2017**					
	Res	Ext	Instr	Adm	Total		Res	Ext	Instr	Adm	Total
Prof.	9.34	3.36	2.19	1.50	16.39	Prof.	8.95	4.96	1.79	1.65	16.35
Assoc.	6.62	2.40	1.60	0.38	11.0	Assoc.	5.56	3.20	1.69	0.55	11.00
Assist.	4.95	2.40	0.65	0.0	8.0	Assist.	5.84	1.50	1.66	0.0	9.00
Total	20.91	8.16	4.44	1.88	35.39	Total	20.55	9.66	5.14	2.20	37.35
Percent	59	23	13	5		Percent	55	26	14	6	

Faculty recruiting and development processes are determined by university procedures. Guidance in following those procedures is provided from the college by the office of the Assistant Dean for Academic Administration. That office posts online information and

procedures for faculty administration, and the department follows those procedures. Our faculty search committees include a faculty member from outside the department and also include a county agriculture agent in the case of faculty search committees for the extension title series.

The department utilizes a formal mentoring committee system for enhancing the required annual performance reviews, as well as the 2- and 4-year reviews of progress, to assist in the development of assistant professors.

During the past three years the department has seen a small number of faculty members leave the department with a nearly equal number of faculty hires. Two of the retirements in 2016-2017 were of long-term college administrators who held tenure in the department. Not shown here as faculty attrition are four faculty members who have assumed partial administrative appointments in the college or university (25%, 30%, 80%, 80% administrative DOE); these appointments reduced their faculty time contributions in the department. All tenure promotions of assistant professors were successful during these three years (as have been all tenure promotions since 2010, eight total).

Faculty attrition and replacement 2014-2017					
	Retirements	Resignations	Hires	Not tenured	Tenured
2014-2015	0	0	1	0	1
2015-2016	1	0	1	0	1
2016-2017	3	1	2	0	2

Rules of Procedure

The Department of Plant and Soil Sciences adheres to the Rules of Procedure as established and approved by the College of Agriculture, Food and Environment on May 27, 2015, found at the following link:
https://administration.ca.uky.edu/sites/administration.ca.uky.edu/files/201_cafe_rop_for_web.pdf
In addition, the Department of Plant and Soil Sciences maintains internal Rules of Procedure, which were approved by the faculty (Rules of Procedure (pdf). These departmental rules of procedure are currently being reviewed by the department, and will be updated for Dean and Provost approval following faculty review.

Postdoctoral Scholars and Graduate Assistants

As of July 1, 2017 the department employs 7 post-doctoral scholars. All earn $47,476, which is the minimum salary set by the university. Individuals may work as post-doctoral scholars for up to five years. Our post-doctoral scholars have prior post-doctoral appointment times ranging from 4 months to 3.9 years. As of July 1, 2017 the department employs 32 research and teaching graduate assistants. Assistantship stipends range from $15,000 to $23,000. Based on an analysis of assistantship stipends at other land grant universities in the southern multi-state region, as well as a calculation of cost-of-living increases since we last changed stipend levels, the department set the minimum M.S. graduate student stipend at $18,000 and the minimum Ph.D. graduate student stipend at $21,000. Faculty members may offer higher stipend levels as necessary to recruit quality students.

January 2017 assistantship analyses report
Data on the cost of living for the schools in the multi-state region indicated that Lexington is near the average for these towns. A calculation of how much the cost of living has increased since 2006, the last time the stipends were raised, based on figures from the U.S. Department of Labor Statistics, indicated that to provide the same purchasing power as $18,000 in 2006, $21,549 is needed today. For $15,000 it is $17,957. Compared to the data available to us, this is similar to the mean PhD and MS stipends for the southeastern region schools.

Our previous stipend amount has been a factor in student recruiting. Several faculty members described their experiences of being unable to recruit a graduate student because our stipends were much lower than at the competing institution.

The committee unanimously recommended that the minimum MS and PhD stipends be raised to $18,000 and $21,000 respectively to keep up with the increase in cost of living over the past decade and put us at the average for the southeastern region schools. In order to give flexibility in recruiting exceptional students and for differences in student expectations among fields, the committee recommended that these minimums could be supplemented by the faculty advisors by up to $2500, unless the funding specifies a higher stipend (e.g., an NSF fellowship specifies a stipend of $32,000).

Table 10. Number of postdoctoral scholars and graduate research and teaching assistants for each of the last five years – these numbers are counted from payroll data; they include grant funded assistants but do not include graduate students supported by other funding sources outside of the payroll, September 1 count in each year.

	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
Post-doctoral Scholars	11	7	12	11	8
Graduate assistants - MS	19	17	18	12	16
Graduate assistants – Ph.D.	33	30	26	27	19

Quality of Collegial Environment

The University of Kentucky is committed to diversity as a vital characteristic of an optimal education and workplace. The University maintains a firm conviction that it must strengthen the diversity of its communities, support free expression, reasoned discourse and diversity of ideas; and take into account a wide range of considerations, including but not limited to, ethnicity, race, disability, and sex, when making personnel and policy decisions. This culture is reinforced by the Dean of the College of Agriculture, Food and Environment in her published message on the college website.

In addition, the College of Agriculture, Food, and Environment prioritizes the implementation of best practices for developing a diverse faculty, staff, and student body through the college strategic plan, and with leadership from of the CAFE Office of Diversity http://diversity.ca.uky.edu/. The college conducts unconscious bias training workshops to

ensure equality in the faculty search process. UK human resources policy and procedure 2.0, https://www.uky.edu/hr/policies/equal-opportunity-discrimination-and-harassment , states that equal opportunities shall be provided for all persons throughout the University in recruitment, appointment, promotion, payment, training, and other employment practices.

The Department of Plant and Soil Sciences is likewise committed to maintaining and enhancing gender/racial/cultural diversity in our faculty, staff, and graduate student bodies. We follow the best practices detailed by the college. Our department employee demographics are shown above in Table 7. Our department has slowly progressed in enhancing the diversity of our faculty. For the nine faculty members hired since July 1, 2012, following our last review, four are female and three are international scholars. Our staff and graduate student bodies are gender diverse as well as internationally/culturally diverse. Our non-exempt technical staff (university funded + grant funded) currently consists of 17 females and 18 males, 4 having an international background. Our office/IT staff consists of 6 females and 2 males. Our exempt staff of scientists and research/extension specialists consists of 7 females and 19 males, 9 having an international background. The department does not have an African-American employee.

Information Resources from Constituent Surveys

In 2015 UK conducted the UK@Work survey. The department's favorable response rate exceeded the university's rate in all categories, generally matching the favorable response rate for the college (Table 12). The department's response to the survey may be viewed at http://administration.ca.uky.edu/ukatworkreports.

Table 12. 2015 UK@Work survey results. UK@Work summary numbers show the percent favorable responses for the university, college, and department (n=39 respondents from the department).

Total favorable score			
Category	University	College	Department
Career Development	59	58	62
Communications	62	69	70
Diversity and Inclusion	67	72	71
Empowerment	67	72	73
Engagement	82	85	88
Leadership	56	63	59
Operating Effectively	57	63	63
Pay and Benefits	58	58	58
Performance Evaluation	73	77	81
Retention	66	70	78
Stress, Balance, Workload	64	71	70
Supervision	78	81	87
University Culture	64	70	65
Work Relationship	69	70	75

The effectiveness or our extension specialists in meeting the needs of county field programs has been assessed every two years by the Associate Dean for Extension through a survey to collect feedback from county extension agents. The results are summarized in Table 13, and are more fully described in Table 36.

Table 13. Feedback on extension specialists from county agricultural agents the past three times the survey was conducted – 2012, 2014, 2016.

Feedback on Extension Specialists by County Agents	Total Number of Responses	Degree of Interaction	Overall Responsiveness	Value of assistance or support	Effectiveness of assistance, program or support
		3=Extensive 2=Moderate 1=Minimal	3=High 2=Moderate 1=Unresponsive	3=High 2=Moderate 1=Low	3=High 2=Moderate 1=Low
2012					
Department Avg.	30	2.24	2.88	2.79	2.82
Department Range	9 - 71	1.8 – 2.3	2.4 – 3.0	2.5 – 3.0	2.4 – 3.0
2014					
Department Avg.	27	2.39	2.93	2.90	2.90
Department Range	10 - 64	1.6 – 2.7	2.7 – 3.0	2.4 – 3.0	2.5 – 3.0
2016					
Department Avg.	14	2.32	2.82	2.83	2.82
Department Range	5 - 28	1.8 – 2.6	2.5 – 3.0	2.5 – 3.0	2.4 – 3.0

Instruction

Undergraduate Programs

During the review period, about 65% of 35-40 total PSS faculty provided instructional leadership and time to teach courses and advise undergraduate students in three interdisciplinary Bachelor of Science programs, including: (i) Horticulture, Plant, and Soil Sciences (HPLS) (ii) Agricultural Biotechnology (ABT), and (iii) Natural Resources and Environmental Sciences (NRE). A list of undergraduate and graduate courses and scheduling is in Appendix G. The average instructional DOE of PSS faculty is 11%.

Typical enrollments in undergraduate courses (PLS≤400 level) are 10-20 students, except for three courses that have higher enrollments (50-80 students) because they either serve as UK Core courses (Plants, Soils, and People, PLS 103 and 104), or as a degree requirement in HPLS, NRE, and several undergraduate majors offered by other departments (Fundamentals of Soil Science, PLS 366).

In addition to regular on-campus lecture and laboratory courses, ***all*** students are required to participate in at least one off-campus, high impact experience, such as an internship (offered as PLS, NRE, ABT 399 courses) or an independent study/research project with a faculty mentor (PLS, NRE, ABT 395). Typically, students fill these requirements in the junior and senior years of their programs.

Instructional infrastructure (e.g. number of classrooms equipped with computer/projection systems, greenhouse classrooms/facilities, etc.) are adequate to meet most current needs. However, scheduling large enrollment courses is difficult due to a lack of larger classrooms in either the Plant Science Building or Agricultural Science Center.

Graduate Programs

There were four graduate programs to which PSS faculty contributed during the review period: Crop Science (MS and PhD), IPSS (MS and PhD), Plant Physiology (PhD), and Soil Science (PhD). Since 2011 IPSS (Integrated Plant and Soil Sciences) has been the graduate program for all new graduate student training. Graduate students enrolled in the Crop Science, Plant Physiology and Soil Science graduate programs as of 2011 will complete their degrees in those programs. When those students have graduated those graduate programs will be closed. During the review period, 74-87% of the 31 instructional faculty had some type of participation in graduate instruction. Six out of 16 non-instructional faculty also contributed to graduate instruction. Typical class sizes ranged from 10-15 for 4xxG courses, 6-10 for 500 to 600-level courses, and <6 for 700-level courses. Several graduate courses are cross-listed with either NRE, EES (Earth and Environmental Sciences), STA (Statistics), or BIO (Biology) programs. Two courses, IPS 610 and IPS 625, are intended for incoming graduate student cohorts to introduce professional communication and writing skills and group collaboration, respectively.

There are no independent classroom facilities for graduate-level laboratory instruction. Most graduate labs exposing students to specialized analytical equipment are taught within existing research lab facilities.

Teaching Effectiveness

Student teaching evaluations are reviewed by the department chair to determine the quality of teaching as seen by the enrolled students. The department chair also assesses teaching quality through informal discussions with students and faculty, and the directors of undergraduate and graduate studies. Newer faculty members might have senior faculty visit their classes. A formative peer faculty review program is in place in which all courses are periodically evaluated. Faculty members might be counseled to use the services of the university's Center for the Enhancement of Learning & Teaching (CELT), as needed. Individual courses can be evaluated by CELT staff to identify course strengths and weaknesses in midterm or end of term reviews. Faculty are encouraged to attend CELT-sponsored pedagogical programs offered periodically.

Credentialing

In terms of faculty credentialing to support core/elective course offerings, the department chair works closely with faculty members to ensure that instructors of record are fully qualified to teach the courses to which they are assigned. At the college level, the assistant director of faculty resources enters all faculty credentials, including terminal degree transcript information, into the university's Faculty Database credentialing module. This module matches the faculty member's terminal degree Classification of Instructional Programs (CIP) code with the CIP identified with the academic program. Each course also has one or more CIPs associated with it. If the CIPs do not match, the assistant director enters what the university calls a "justification." This justification is based on prior academic experience, additional academic degrees, post-doctoral scholar appointments, and other scholarly records that support the faculty member's credentials for teaching a particular course. An example might be a tenured faculty member whose doctoral degree is in plant physiology, but who teaches a course in the Natural Resources and Environmental Sciences program. The degree CIP might not "match" the program and course CIPs, but the faculty member clearly has the knowledge and experience to teach the course. In keeping with the SACSC accreditation standards, the credentials are reviewed by the provost and the Board of Trustees, and the original documents are retained in the faculty member's standard personnel file at the office of the Assistant Dean of Academic Administration. The assistant director checks all courses each term to ensure the faculty members are qualified to teach the courses to which they are assigned.

Program Admission, Enrollment, Credit Hours, and Student Progression

Minimum eligibility requirements for incoming undergraduate students are the same as for the University, i.e. completion of pre-college high school curriculum (as prescribed by the Council on Postsecondary Education) and high school GPA $\geq$ 2.0 (out of 4). Transfer students from other institutions must also have a cumulative GPA $\geq$ 2.0 to be accepted to the University and

Department. Acceptance to the University, however, is highly competitive, so students in the major typically have much higher than the minimum GPA (GPA 3.3-3.8) (Table 14). Since 2012, the average HS GPA of incoming freshman to the program has steadily increased.

Table 14. Average high school GPA and ACT scores of incoming freshmen to the HPLS program.

Year	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Average HS GPA (out of 4)	3.49	3.34	3.54	3.72	3.83
Average ACT (out of 36)	24	22	24	30	27

Minimum qualifications for incoming graduate students are the same as required by the University of Kentucky Graduate School: undergraduate GPA of 2.75 or graduate GPA of 3.0, GRE scores required, international students must have TOEFL score of 79 or IELTS score of 6.5. In addition, the IPSS graduate program requires that all students (non-thesis track excepted) must have an identified thesis or dissertation adviser identified prior to admission. Coursework deficiencies prior to admission are addressed on a remedial basis. Test scores of incoming graduate students have increased during the period since the last review.

Table 15. Average test scores of incoming graduate students to the IPSS program.

	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Admitted		14	25	29	20	18
Verbal GRE rank	42	45	51	57	56	57
Quantitative GRE rank	39	43	55	51	46	55
Analytical GRE rank			93	35	36	53
Grad GPA		3.48	3.78	3.61	3.67	3.76
Undergrad GPA		3.47	3.41	3.3	3.26	3.43
TOEFL		87	92	95		95

The number of students, graduates, and credit hour production in the HPLS program during the review period are summarized in Table 16. There was no consistent change in student numbers during the review period, however the average number of students in the program (45) was considerably less than the previous two review periods (62 students in the 2006-2011 review period and 96 students in the 2001-2005 review period). The program continues to graduate the eight students per year which was the goal in our last strategic plan.

Table 16. Number of students, graduates, and credit hour production in Horticulture, Plant, and Soil Science program.

Year	2011-12	2012-13	2013-14	2014 -15	2015-16
Majors Enrolled	31	43	53	45	55
Number of Graduates	7	8	7	9	14
*Credit Hour Production	2095	2507	2723	2497	2768

*Attempted credit hours generated program (PLS) listed courses.

According to a 2015 USDA report (https://www.purdue.edu/usda/employment/), projected employment opportunities in the agricultural sciences are strong. Our goal is to help meet demand by increasing enrollment in the HPLS program to >60 students. Possible strategies to achieve this goal are revising the curriculum, increasing recruitment at 4H and Career Fairs, and providing more scholarships to incoming students (depending on availability of funds).

The number of students, graduates, and credit hour production in all graduate programs (combined) in which the department participated during the review period are summarized in Table 17. Enrollment is largely controlled by available funding for assistantships, with only 56% of applicants accepted, and available laboratory space. Due to changes in stipend funding and a more competitive research funding environment the long-term trend will be for fewer students admitted on a more selective basis, or greater emphasis on support directed to PhD students.

Table 17. Number of students, graduates, and credit hour production in PSS graduate programs.

Year	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Majors Enrolled	79	85	78	71	70	66
Number of Graduates	12	26	26	18	17	Not available at time of report
*Credit Hour Production	601	577	620	581	599	

*Attempted credit hours generated by the department in department listed courses.

Table 18. Number of graduate student applicants, admitted, and enrolled in PSS graduate programs.

Degree		2013-14	2014-15	2015-16	2016-17	2017-18
MS	Applied	19	25	23	17	14
	Accepted	8	13	14	10	9
	Enrolled	6	11	10	8	6
	Acceptance Rate	42	52	61	59	64
	Yield Rate	75	85	71	80	67
PhD	Applied	14	21	22	16	17
	Accepted	6	12	15	10	9
	Enrolled	4	7	13	10	6
	Acceptance Rate	43	57	68	62	53
	Yield Rate	67	58	87	100	67

Our instructional activity in terms of overall credit hours taught has been stable during this period, with an uptick in contributions to the NRE courses and a decrease in contributions in other prefixes (mostly a decrease in instruction in GEN courses with Wine Appreciation moving from GEN 300 to PLS 389 and a reduction in teaching GEN 100). The department's instructional FTE has increased 14% during this period, but we haven't reached more students in our courses.

Table 19. Instructional FTE and student credit hour per instructional FTE undergraduate and graduate level courses.					
	2012-13	2013-14	2014-15	2015-16	2016-17
Earned credit hours PSS faculty/PLS courses	2072	1808	1965	1899	2026
Earned credit hours PSS faculty/ABT courses	112	230	124	238	123
Earned credit hours PSS faculty/NRE courses	36	36	48	141	189
Earned credit hours PSS faculty/other course prefixes	335	349	236	76	93
Earned credit hours PSS faculty total	2553	2423	2373	2354	2431
Instructional FTE (sum of the instruction DOE of the faculty)	4.51	3.98	4.39	4.44	5.14
Student credit hour per instructional faculty FTE	566	609	540	530	473

The total number of hours required to complete the HPLS program is 87 credits, which do not include credits in UK core courses (33 credits). The total number of credits to complete the program (120 credits) is the minimum required for an undergraduate degree by the University.

The minimum number of graduate credit hours required to complete the MS program is 24, of which 12 or more must be at 600-level or above and 16 must be in regular courses. The minimum number of graduate credit hours required to complete the PhD program is 36, of which 18 hours can be utilized from any approved MS program.

The average time (years) and credits (including UK Core, transfer and developmental credits) to earn an HPLS degree are summarized in Table 20. Actual credits that students earned for the degree was 18-40 credits greater than the 120 credits requirement for the degree. Possible reasons for excess credits are remedial courses (e.g. college algebra, MA 109), elective courses, major changes, and desire to earn a minor/certificate or double major.

Table 20. Average number of years and credits to obtain B.S. HPLS degree.					
Year	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Average actual time to degree (in years)*	4.07	4.40	5.31	3.91	3.88
Average actual credit to degree	138	144	150	160	143

*Time to degree calculation includes only the GRS cohort. These are first time, full time, fall enrollees only.

The average time (years) and credits to earn a graduate degree are summarized in Table 21. The additional credits above the 24 required at the MS level reflect the requirement for full enrollment by international students and remedial or specialty coursework by all students. The number of additional credit hours above the 36 required in the PhD program likewise reflects remedial coursework and the requirement for all international students to be fully enrolled. In addition, all post qualifying exam PhD candidates are required to be enrolled in 2 credits per term until the completion of the degree. Extended times to degree at both the MS and PhD level also reflect part-time status by UK employees taking advantage of the Employee Education Opportunity Program (EEOP) (particularly county extension agents).

Table 21. Average number of years and credits to obtain M.S. or PhD degree.					
Year	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Average actual time to degree (in years) - MS	2.84	2.80	2.44	2.59	2.43
Average actual credit to degree	30	34	31	31	30
Average actual time to degree (in years) - PhD	4.62	5.26	4.89	4.17	4.87
Average actual credit to degree	57	55	51	42	59

Students should strive to earn an MS degree in two years, a PhD degree in five years, and both degrees MS + PhD in 5.5 years.

Program Delivery and Administration

Orientation

All incoming undergraduate transfer and new students to the University and Department are required to attend a one- or two-day "see blue. U Orientation," in which students meet with other students, hear from campus offices and organizations, take math placement exams, meet with HPLS academic advisors to discuss specific programs, plan, and register for classes (PSS faculty, D'Angelo and PSS academic coordinator, Rebecca von Groote). Students' parents are also included in the orientation process. More information about student orientation activities may be found at https://www.uky.edu/seeblueU/content/information.

The department also participates in "Merit Weekend" orientation, which is a "see blue. U Orientation" held in March (before summer registration) for students with exemplary GPA and ACT/SAT scores.

Incoming graduate students attend an orientation program immediately before classes start in the Fall semester. International graduate students attend a mandatory orientation session the week before in conjunction with activities at the International Center. All graduate students who will be serving as TAs attend mandatory TA training and language testing prior to Fall and Spring terms. In addition, the college has its own TA orientation each term.

Advising

Advising in the undergraduate program is coordinated by the designated Directors of Undergraduate studies (Geneve and D'Angelo), who routinely participate in semi-annual advising workshops during orientation periods. Advising in the students' first semester is also greatly facilitated by the academic coordinator of the program (von Groote).

Students with specialty interests are matched with the appropriate faculty advisor e.g. Horticulture (Geneve), Crops and Soils (D'Angelo), Crops and Livestock (Goff), Turfgrass (Munshaw). Students meet with these academic advisors at least once per semester to plan and register for classes.

The department participates in the University of Kentucky Student Alert System (http://www.uky.edu/studentacademicsupport/sites/www.uky.edu.UGE/files/Types_of_Alerts.pdf), which requests course instructors to notify "The Student Alert Team" about students that are habitually late/absent, perform poorly on assignments, display disruptive behavior, etc. The student, course instructor and the student's advisor are notified, and the student should then meet with the advisor and instructor to discuss/resolve the problem. http://www.uky.edu/studentacademicsupport/faculty-resources-0.

With respect to advising quality, a recent exit survey of nine graduating students conducted by the CAFE Dean for Instruction (Dr. Grabau) indicated that HPLS advising quality was exceptional (5 students), good (2), fair (1) and poor (1). Specific details about the strengths and weakness of our current advising system were not provided, but will be used to make innovations and improve advising when they become available.

Graduate students are primarily advised by the research mentor during their first term. Thereafter they are encouraged to form a 3-member *ad hoc* MS committee or 4-member PhD dissertation committee as soon as possible for the purposes of coursework and research advising. Students without a formal advisor in their first term (a rare occurrence, usually with non-thesis students) are advised by the DGS (M.S. Coyne) until a suitable research mentor is identified. Each graduate student is required to submit a 'progress' report annually in March that has been viewed and approved by the research mentor. The report includes a list of academic milestones, record of productivity in the form of a CV, and writing narratives. Students designated as lagging in performance are contact by the DGS to discuss plans for improvement.

Graduate students who are non-compliant with respect to academic performance are alerted by the Graduate School directly, and international students inappropriately enrolled are identified and contacted by the International Center directly.

The quality of advising is not routinely evaluated for the graduate program.

Other Student Services/Programs

The department has an email list-serve of students and maintains an up-to-date Web page (http://agrono-me.ca.uky.edu/) to notify undergraduate and graduate students about the programs, scholarships, internships, job opportunities and highlights student accomplishments (e.g., Dean's List and professional awards).

Most undergraduate students in the major participate in the Horticulture Club (faculty mentor Geneve) and Agronomy Club (faculty mentor Goff and Rebecca von Groote). On a monthly basis, club members meet with representatives from agricultural industry, and determine ways to raise funds to travel abroad and attend scientific conferences. The Agronomy Club, for example, was recently awarded two Barnhart Fund for Excellence Awards to support these activities. Graduate students participate in the IPSS GSA (Graduate Student Association) as well as the campus GSA.

Under the direction of faculty mentors, many students conduct individual research projects to apply knowledge from traditional coursework, and also earn credit in PLS 395. Table 23 details the number of students involved in research as undergraduates. Next year, the CAFE Associate Dean for Research (Rick Bennett) is offering undergraduate students a new opportunity to submit research proposals for grants to support research ideas, in collaboration with faculty members.

Program delivery flexibility

The department has previously offered two distance learning courses, but currently only PLS/PPA/FOR 619 (Plant Biochemistry) is offered via distance learning as a shared course with the University of Tennessee.

The department serves primarily full time, traditional students who are able to attend daytime classes. The demand for evening or distance courses is not sufficient at this time to warrant the creation of these options. In the Fall 2016, 88% of Baccalaureate students, 83% of Master's students, and 87% of Doctoral students were enrolled full time (Table 22). Thus, for the review period the vast majority of courses were offered on a traditional basis.

Table 22. Full time/part time basis for students enrolled in our programs			
Fall 2016 PSS primary major students			
	Full Time	**Part Time**	**Grand Total**
Baccalaureate Degree	36	5	41
Horticulture, Plant and Soil Science	36	5	41
Ph.D. Degree	40	5	45
Crop Science	3		3
Integrated Plant and Soil Sciences	28	4	32
Plant and Soil Science	1		1
Soil Science	2	1	3
Plant Physiology	6		6
M.S. Degree	19	4	23
Integrated Plant and Soil Sciences	19	4	23
Nondegree	7		7
Plant and Soil Science	7		7
Grand Total	102	14	116

Student participation in internship and/or co-op experiences

All students in the HPLS program are required to participate in at least one internship (PLS 399) or independent research project with a faculty mentor (PLS 395). Students typically plan their experience with their mentor in the spring semester, conduct the project over the summer, and obtain a grade for the completed experience by the faculty mentor in the fall. Assignments and deadlines are agreed upon in advance in the form of a Learning Contract, which is submitted for approval by Director of Undergraduate Studies, Department Chair, and CAFE Office of Student Success.

Table 23. Number of students enrolled in PLS 395 (independent research) and PLS 399 (experiential education) courses					
	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017
PLS 395	9	8	21	8	18
PLS 399	5	12	5	11	16

Graduate students have opportunities to gain certification in stream restoration, statistics, and preparation as future faculty. A small number (1-2 per cohort) take advantage of such opportunities. Several national programs offer internship opportunities for graduate students and at least one student (Orlowski) has taken a leave of absence from his academic program to participate in the same.

Student Learning Outcomes (SLO) Assessment - Undergraduate

Between 2011-2014, program SLO's were:

A. Technical Knowledge
   SLO 1. Students will demonstrate proficiency in scientific principles of the plant, soil and environmental sciences and illustrate their interrelatedness.
   SLO 2. Students will apply the basic technical principles of plant production and appraise their environmental and economic sustainability.

B. Professional Skills
   SLO 3. Students will communicate clearly in oral and written formats.
   SLO 4. Given a situation, students will define the problem, retrieve and evaluate information, and propose and evaluate potential solutions.

C. Perspective
   SLO 5. Students will examine the global diversity of our plant and soil resources.

During 2011-2014, all five SLOs were evaluated on an annual basis using the assessment plan provided in Appendix H. Briefly, SLO's 1, 2, and 5 were evaluated based on scores on a senior exit exam that was made up of questions supplied by PSS faculty instructors of key courses (PLS 103/104, 210, 220, 366, 386). The exam was given to seniors that were enrolled in the capstone course ((typically <5 students per year in PLS 490) and was graded by the capstone course instructor (Dr. D. Williams). Scores on the exams higher than 2.8/4 (2011) or 75% (2012-2014) were deemed satisfactory.

SLO's 3 and 4 were evaluated from each senior's performance on projects that they carried out in the capstone course (PLS 490). Performance was evaluated by classmates, three PSS faculty, and Dr. David Williams (instructor of the course).

Table 24. SLO assessment results during 2011-2014.

SLO 1 Knowledge: Students will demonstrate proficiency in scientific principles of the plant, soil and environmental sciences and illustrate their interrelatedness.

	2011-2012	2012-2013	2013-2014	2014-2015
Assessment method	Exit exam	Exit exam	Exit exam	Exit exam
Result	Below expectations (2.4/4)	Met minimum expectation (82.3% correct)	Below expectations (64.9% correct)	Below expectations (58% correct)
Plan to improve	Work with faculty to improve learning		Increase faculty involvement and number of courses used in assessment process	Develop new SLO's and assessment plan

SLO 2 Knowledge: Students will apply the basic technical principles of plant production and appraise their environmental and economic sustainability.				
	2011-2012	2012-2013	2013-2014	2014-2015
Assessment method	Exit exam	Exit exam	Exit exam	Exit exam
Result	Met minimum expectations (2.8/4)	Met minimum expectation (82.3% correct)	Below expectations (64.9% correct)	Below expectations (58% correct)
Plan to improve	Solicit exam questions from faculty to better evaluate SLO		Increase faculty involvement and number of courses used in assessment process	Develop new SLO's and assessment plan

SLO 3 Professional skills: Students will communicate clearly in oral and written formats.				
	2011-2012	2012-2013	2013-2014	2014-2015
Assessment method	Evaluate senior capstone project (PLS 490)	Evaluate senior capstone project (PLS 490)	Evaluate senior capstone project (PLS 490)	Evaluate senior capstone project (PLS 490)
Result	Good oral communication skills (3/4) Poor written communication skills (2.2/4)	Good oral communication skills (3.5/4); Fair written communication skills (3/4)	Very good oral communication skills (3.87/4); Very good written communication skills (3.67/4)	Fair to low oral communication skills (2.96/4); Very good written communication skills (3.63/4)
Plan to improve	Participate in new UK Core program; Increase writing assignments in PLS courses	Increase faculty involvement and number of courses used in assessment process; increase writing assignments in PLS courses; implement new UK Graduate Composition and Communication Requirement	Increase faculty involvement and number of courses used in assessment process	Develop new SLO's and assessment plan

SLO 4 Problem solving: Given a situation, students will define the problem, retrieve and evaluate information, and propose and evaluate potential solutions.				
	2011-2012	2012-2013	2013-2014	2014-2015
Assessment method	Evaluate senior capstone project (PLS 490)	Evaluate senior capstone project (PLS 490)	Evaluate senior capstone project (PLS 490)	Evaluate senior capstone project (PLS 490)
Result	Below expectations	No available data	No available data	No available data
Plan to improve	Participate in new UK Core program; Increase problem solving exercises in PLS 490			Develop new SLO's and assessment plan

SLO 5 Perspective: Students will examine the global diversity of our plant and soil resources.				
	2011-2012	2012-2013	2013-2014	2014-2015
Assessment method	Exit exam	Exit exam	Exit exam	Exit exam
Result	Better than expected (3.1/4)	Surpassed expectation (91.5% correct)	Satisfactory (80.6% correct)	Poor to fair (77% correct)
Plan to improve	Solicit exam questions from faculty to better evaluate SLO	Increase faculty involvement and number of courses used in assessment process, including broad, programmatic discussion of the exam results and methods.	Increase faculty involvement and number of courses used in assessment process, including broad, programmatic discussion of the exam results and methods.	Develop new SLO's and assessment plan

From the results of the assessments, it was evident that there was much room for improvement in both student training and the way that SLO's are assessed. Dr. Williams, who was primarily involved in the assessment process, suggested that both issues could be better resolved by increasing faculty participation and courses in the assessment process. He also strongly emphasized that courses and curriculum be revised to specifically address SLO's and incorporate methods for assessing achievements.

In accordance with Dr. Williams' suggestions, and to meet new University guidelines, a new four-member faculty assessment team was assembled (Directors of Undergraduate Studies: Geneve, D'Angelo; capstone course instructors: Durham, Haramoto) and the SLO's and assessment plan were revised in 2015.

The 2015 revised SLO's are listed below:

SLO 1. Students will acquire and demonstrate proficiency in scientific and technical principles of the plant, soil, and environmental sciences and illustrate their interrelatedness.
SLO 2. Students will communicate clearly in oral and written formats.
SLO 3. Students will demonstrate the critical thinking skills required to define a problem, retrieve and evaluate information, and propose and evaluate potential solutions.
SLO 4. Students will be able to explain and discuss agricultural production from a global perspective.
SLO 5. Students will obtain the foundational skills for lifelong learning.

According to the 2015 assessment plan, which was approved by the Office of University Assessment (https://www.uky.edu/oua/program-level-assessment), SLO's 2 and 3 are to be evaluated during the first evaluation cycle (2015-2016), and SLO's 1, 4, and 5 are to be evaluated in next evaluation cycle (2016-2017).

Table 25 shows the assessment results of SLO's 2 and 3, which were based on evaluations of samples of students work collected from several PLS courses that were previously identified as fulfilling SLO's (referred to as "artifacts"). Artifacts consisted of research reports, project reports, and business plans prepared by juniors and seniors in four upper level courses (a sophomore/junior level Fundamentals of Soil Science (PLS 366), two senior capstone courses with different emphasis topics (PLS 490), and a senior Weeds Management course (PLS 404)). Each member of faculty assessment team evaluated the artifacts using a 4-tiered rubric score sheet, in which scores of 5=exceeds expectations, 3=meets expectations, 1=beginning to meet expectations, and 0=does not meet expectations. The average scores for the SLO 2 and 3 are summarized in Table 25 (example 3.0/5 means average score of 3.0 with maximum of 5).

Table 25. SLO 2 and 3 assessment results during 2015-2016.		
SLO 2 Communication: Students will communicate clearly in oral and written formats.		
	2015-2016	
Assessment method	Artifacts from senior capstone project-Horticulture Enterprise Management option of PLS 490	Artifacts from senior capstone project-Science option of PLS 490
Result	Content: meets expectations (3.0/5) Evidence of support/sources for content: slightly below expectations (2.8/5) Writing proficiency: slightly below expectations (2.7/5)	Content: meets expectations (3.2/5) Evidence of support/sources for content: slightly above expectations (3.4/5) Writing proficiency: meets expectations (3.1/5)
Plan to improve	None planned at this time as additional data with this new assessment plan will be needed before meaningful actions can be taken	None planned at this time as additional data with this new assessment plan will be needed before meaningful actions can be taken

SLO 3 Critical thinking: Students will demonstrate the critical thinking skills required to define a problem, retrieve and evaluate information, and propose and evaluate potential solutions.		
	2015-2016	
Assessment method	Artifacts from fundamental soils course (PLS 366)	Artifacts from weeds management course (PLS 404)
Result	Problem definition: slightly below expectations (2.3/5) Background development: beginning to meet expectations (1.4/5) Objective statement: slightly below expectations (2.4/5) Solution implementation: slightly below expectations (2.7/5) Outcome evaluation: beginning to meet expectations (1.9/5)	Problem definition: meets to exceeds expectations (4.1/5) Background development: meets to exceeds expectations (4.0/5) Objective statement: meets to exceeds expectations (4.3/5) Solution implementation: meets to exceeds expectations (4.5/5) Outcome evaluation: meets to exceeds expectations (4.3/5)
Plan to improve	None planned at this time as additional data with this new assessment plan will be needed before meaningful actions can be taken	None planned at this time as additional data with this new assessment plan will be needed before meaningful actions can be taken

A comparison of 2011-2015 and 2015-2016 assessment results revealed that scores improved considerably after implementing Dr. Williams' suggestions (i.e. increasing number of faculty and courses in the assessment process).

As pointed out by the new assessment team, however, the 2015-2016 assessment results are still preliminary due to the small number student artifacts evaluated (15) and newness of the 2015-2016 assessment plan, artifacts, and rubrics used in the assessments. Results from future assessments will be used to guide changes in courses/curricula.

Student Learning Outcomes (SLO) Assessment - Graduate

Student Learning Outcomes for the graduate programs to which PSS contributes have been consistent during the review period, but have undergone numerous changes in assessment method during the review period because of program consolidation, and dissatisfaction with both the assessment process and its metrics. Consequently, data are fragmentary and results from previous assessment cycles are not reported here. To facilitate assessment and to evaluate students by the same criteria by which faculty are themselves evaluated, the annual progress report was altered to include a merit-based CV in which specific products of scholarly activity could be reported and tabulated. An example of the guidelines for the annual progress report (including rubrics for progress) and the CV are found in Appendix H.

For the purposes of this review, all graduate programs are considered together as are both the MS and PhD programs.

There are four specific learning objectives:

1. **Knowledge**: The student will have acquired an extensive knowledge of the sciences and technology that support research, education, and technological innovation in plant, soil, and environmental sciences.
2. **Skills:** The student will be conversant with the literature, current concepts, and experimental and analytical methods that support research, teaching, and technological innovation in plant, soil, and environmental sciences, and in their application to agriculture and the environment.
3. **Communication:** The student will have acquired skills in critical and analytical thinking and in communication skills that may be applied to research, education, industry, government, and public service.
4. **Professionalism:** The student will have acquired those elements of professionalism necessary for rewarding and developing careers in plant, soil, and environmental sciences in research, education, production agriculture, agribusiness, government, and public service.

The principal assessment tool for all SLOs is the information contained in the CV prepared for the annual progress report and at the termination of each student's degree as a part of the final examination. It specifically documents student demonstration of knowledge, skills, and abilities in terms of papers, projects, and presentations in a manner consistent with the documentation of faculty productivity for the same criteria.

The second assessment tool, specifically related to SLO #3 (Communication) is required presentation at a graded Graduate Student Symposium in which each student's presentation is graded on a competitive basis by a uniform rubric by a faculty pool.

The third assessment tool, applicable only to students in mid-career, is the research mentor evaluation of student progress in terms of the four SLOs (see the rubric included in Appendix H).

The fourth assessment tool, applicable to SLOs 1-3, is the production of a defendable thesis in the case of students in Plan A and a project report for students in Plan B.

The fifth assessment tool, applicable specifically to SLOs 1-2, is the successful final examination.

For the most recent assessment, which focused on SLOs 1 and 2 the most immediate change was an increase in reporting from < 50% to > 90%. 97% of PhD students and 100% of MS students were evaluated as on track or progressing in their programs. Most other specific criteria of assessment were below the benchmarks desired for each program for these SLOs (see below), but represent the starting point for which improvements can be made. This specifically includes greater emphasis on encouraging students to develop and submit more research proposals and seek academic and professional certification. Steps were made to utilize information gleaned from annual experiment station reports to better track student publication and citation rates for SLO 2.

1. **Knowledge**
   - 75% of M.S. students will be rated 'Progressing' or 'On-Track' for annual assessment of Knowledge.
   - 25% of M.S. students will receive additional certification by the time of graduation.
   - 90% of M.S. students will pass their exit examination on the first try.
2. **Skills**
   - 75% of M.S. students will be rated 'Progressing' or 'On-Track' for annual assessment of Skills.
   - 50% of graduating M.S. students will have their work cited one or more times in a 5-year period post-graduation.

Overall the assessment protocols were regarded as 'Exemplary' during the university program assessment review. Although students are generally rated as 'on-track' by their faculty research mentors, in general they are falling short of ideal criteria for success outlined in our assessment program. More data are needed to determine if benchmark goals are unrealistic. The department currently subsidizes multiple students to serve as teaching assistants in introductory courses such as PLS 366 (Introductory Soil Science) to give them instructional experience. Furthermore, as of 2018 the number of college-level funded TAs for the IPSS program will begin to gradually increase to reflect increasing enrollment in undergraduate courses to which the graduate faculty contribute. This will enable greater exposure of students to instructional experience.

Measures of teaching effectiveness and efforts to improve teaching effectiveness

All instructors are evaluated by students each semester using the University Teacher Course Evaluation (TCE) process.

Instructors are recommended to undergo peer review of their teaching pedagogy at least every four years, in which at least two PSS faculty peers observe the instructor's teaching methods during at least three class/lab meeting periods, and summarize their observations and provide constructive comments (written and oral) to the instructor mid semester so as to give the instructor time to implement any improvements during the remainder of the term.

Instructors are also required to submit a teaching portfolio to the Associate Dean for Instruction on a 2-year cycle.

Adherence to educational policies and procedures established through the faculty governance process

The College of Agriculture, Food and Environment, including the Department of Plant and Soil Sciences, adheres to all University Senate rules. The relevant rules, Section IV: Rules Relating to Admission to the University and Section V: Rules Relating to Attending the University, may be found at the following link:
http://www.uky.edu/Faculty/Senate/rules_regulations/index.htm

Evidence of consistent review and monitoring of course substitution, course equivalency credits, and course transfers toward degree completion

Course substitutions requested by students are reviewed by faculty members. Once approved by a faculty member, the Department Chair or Director of Undergraduate Studies signs the course substitution form before it is submitted to the Associate Dean for Instruction, where the request is further vetted. Equivalency credit and course transfers are reviewed by the Director of Undergraduate Studies, with consultation of faculty when the requests are received from the registrar. The decision is forwarded to the registrar.

Degree requirements and vetting of exceptions are reviewed by faculty. When the faculty agrees to change course requirements, a program change proposal is submitted to the college undergraduate curriculum committee for review. After this review and approval by the Associate Dean for Instruction, the proposal is submitted for university approval. Similar procedures are followed for changes in graduate courses and programming. All new courses and initiatives are approved by the Graduate Curriculum committee and follow a prescriptive path through course approval at the university level using the on-line 'CURRICULOG' system.

Evidence of course scheduling and teaching assignment

The PSS faculty offer 30 undergraduate courses (PLS≤400 level) on a regular basis (at least once per year) (Appendix G) so that students can complete the program within 4 years (Table 20). On the occasion when a faculty member is unable to offer a required course (e.g. due to sabbatical leave, retirement, change to administrative appointment, etc.), the department chair requests PSS faculty with expertise in that area to teach the course for one or two semesters until a new faculty can be found to fill the role on a permanent basis.

There are 30 distinct regular courses (>400G), two special topics course (PLS 597, PLS 697), and a seminar series (PLS 772) offered by the graduate faculty in PSS. Twenty-six of the regular courses are offered on a routine basis once a year although several (e.g. PLS 650,

PLS 712) have not been offered recently due to lack of available instructors. With the exception of IPS 610, IPS 625, and PLS 772 there are no required courses in the IPSS graduate program and the composition of coursework is left to the discretion of the student committee to best suit the student's academic training. Consequently, there can be as many different student course plans as there are students in the program.

Course grade distribution and strategies to monitor grade deflation/inflation

Changes in the distribution of grades in PLS 100-200 and 300-400 level courses during the review period are shown in Table 26. At both course levels, a significantly higher percentage of students earned "A" grades than "B", "C" or lower grades. Percentages of "A" plus "B" grades did not change significantly during the review period.

Table 26. Changes in distribution of grades in PLS 100-200 and 300-400 level courses.

	2011-2012		2012-2013		2013-2014		2014-2015		2015-2016	
Grade	PLS 100-200	PLS 300-400	PLS 100-200	PLS 300-400	PLS 100-200	PLS 300-400	PLS 100-200	PLS 300-400	PLS 100-200	PLS 300-400
	----------% of grades----------									
A	40	46	58	39	49	44	56	42	60	55
B	27	32	22	39	24	26	17	28	19	24
C	16	16	10	16	15	20	12	15	9	12
D, E, W	17	7	10	7	11	11	15	15	13	10

Data are not currently available for graduate instruction grade distribution.

Policy Dissemination and transparency

Dissemination and transparency of the aforementioned policies are ensured by posting the policies and evidences on our university senate and college websites. They may be accessed at the following links:

- Governing Regulations (http://www.uky.edu/regs/gr.htm)
- Administrative Regulations (http://www.uky.edu/regs/ar.htm)
- College and Unit Rules and Statements of Evidence (https://www.uky.edu/universitysenate/college-and-unit-rules-and-statements-evidence)
- CAFE Rules of Procedure (https://administration.ca.uky.edu/sites/administration.ca.uky.edu/files/2015_cafe_rop_for_web.pdf)

Program Impact

The Department of Plant and Soil Sciences ensures that the curriculum offered meets the current demands of the field and the job market of our graduates through consistent interaction between our faculty, alumni, and industry stakeholders. These interactions occur around the processes undertaken for research collaboration, extension outreach, curriculum development, program review, and strategic planning. As a large department with a very diverse collection of faculty specializations, we are able to interact with a broad array of colleagues across disciplines, industry stakeholders, colleagues at other institutions, and government agencies. This interaction allows us to remain consistently knowledgeable of current demands and trends among the multiple disciplines in which our students may engage.

For the Graduate Programs, with the exception of the research mentor evaluation of progress related to the SLOs, every method of evaluation is direct. We ask: what have been the products and experience and how much has occurred; is the GPA consistent with minimum Graduate School requirements; how well does the student demonstrate competent communication; has the student passed required final exams and produced a competent thesis; has the student written and submitted at least one manuscript for peer reviewed publication. The faculty in IPSS are research scientists. The graduate programs in IPSS produce research scientists or individuals capable of functioning in that capacity. Our assessment of students mirrors the University of Kentucky's assessment of its research science faculty in terms of research productivity and outputs, and also mirrors the evaluation of research faculty in professional societies in terms of merit for awards and recognition.

Student Recruitment Activities

The undergraduate student recruitment activities are detailed earlier in this document under Initiatives – Undergraduate recruiting.

Graduate student recruitment is generally through word of mouth. At the College level, the department participated in developing keywords for an internet search tool that would direct students to our graduate programs. We are in the process of developing an updated Graduate recruitment brochure. We have also initiated the process to develop 'University Scholars Programs' for all three multi-departmental programs to which the graduate faculty contribute (ABT, HPLS, NRE). The University Scholars Program allows exceptional undergraduate students to complete the final year of undergraduate work and the first year of MS or PhD work simultaneously, and is regarded as a recruitment tool by our Graduate programs for the best students currently enrolled at UK. Beginning in 2017 the IPSS PhD program will receive block grant funding from CAFE to enable greater recruitment of PhD level students. The funding is insufficient to fully fund individual PhD students, so various different approaches are being explored to provide additional funds for these students. Beginning in 2017 student stipends for MS and PhD students were increased to $18,000 and $21,000, respectively to make graduate student support more competitive with our benchmark universities.

Program contributions to undergraduate UK Core

The Department contributes two courses to the UK Core, including PLS 103 (Plants, Soils, and People: A Global Perspective) which meets the Global Dynamics requirement, and PLS 104 (Plants, Soils, and People: A Science Perspective) which meets the Intellectual Inquiry in the Natural, Physical and Mathematical Sciences UK Core requirement. Both courses attract students with diverse majors and have high enrollments (50-80 students).

Below are descriptions of both courses.

PLS 103 PLANTS, SOILS, AND PEOPLE: A GLOBAL PERSPECTIVE. (3 credits)

Only a few things are essential to life, and food is one of them. What people eat is about what they need to be healthy, what they want to eat (personal preference and culture), and what they have available or can afford to eat. Agriculture plays a vital role in human food security. Many experts feel the world is facing a food supply crisis. Knowledge and application of the principles of plant and soil sciences will have a dramatic effect on human food security, now and into the future, both locally and globally. However, these issues will also be impacted by future human population growth, urbanization, consumer preferences, human decisions regarding civic duties, and climate change. Students successfully completing this course will leave with an understanding of the need to sustainably expand the world's food supply, the basic principles of plant and soil science and their application to this problem, and their own potential role in determining our ability to meet this challenge. Students may not receive credit for both this course and PLS 104.

PLS 104 PLANTS, SOILS, AND PEOPLE: A SCIENCE PERSPECTIVE. (3 credits)

An introduction to the looming world food crisis and the scientific basis governing our ability to sustainably meet it. The course explores the biological and environmental constraints on food production, the ways that agricultural science has dealt with these in the past and possible ways for the future, as well as societal and cultural issues, such as population growth, human health, education, and food definitions, that also impact food security. Intended for any student interested in these topics.

As noted above, the department provides at least one full TA line and identifies students to serve as part-time TAs to facilitate instruction in these courses.

Quality Enhancement Plan

The University of Kentucky's Quality Enhancement Plan (QEP) has a primary emphasis on improving student communication skills (e.g., writing, public speaking, etc.). To accomplish this major goal, the University has implemented a new Graduation Composition and Communication Requirement (GCCR), which replaces the former Graduation Writing Requirement (GWR). In addition to attaining proficiency in written communication (i.e., the old GWR), students will also be required to show competence in oral communication and information literacy in their discipline. The Department of Plant and Soil Sciences uses PLS 490 (Topics in Plant and Soil Science-senior capstone course) to accomplish the GCCR.

Here is a description of the PLS 490 course.

PLS 490 TOPICS IN PLANT AND SOIL SCIENCE. (3 credits)

A capstone course for majors in Plant and Soil Science to be taken near the conclusion of the student's academic career. The course provides the student the opportunity to integrate knowledge acquired in previous courses in the plant and soil science and support areas. Emphasis will be placed on problem solving, synthesizing and integrating information, critical thinking, group activities, and written and oral communication. Instructional methods may include formal lectures, laboratories or supervised individual research. The specific nature of the course depends upon the student's Area of Emphasis within the Plant and Soil Science major. All topics offered will be approved by the Undergraduate Education Committee in the Area of Emphasis. Prereq: Senior in Plant and Soil Science.

University Assessment of programs

Assessment in the department takes many forms. The department's faculty members participate in careful evaluation of teaching scores and student comments, engage in peer review in the classroom, and encourage fellow faculty members to participate in CELT, which is the university's center for teaching enhancement. Faculty members with instructional responsibilities are also evaluated on teaching during the performance review process and as part of the promotion and tenure process. The goal of all these efforts is to ensure that departmental faculty are high quality instructors.
The Department contributes two courses to the UK Core (PLS 103, Plants, Soils, and People: A Global Perspective; PLS 104, Plants, Soils, and People: A Science Perspective) and participates in the new UK Core assessment system, which is coordinated by the Office of University Assessment (http://www.uky.edu/ie/). The value of the courses in meeting UK Core Learning outcomes is assessed from an evaluation of students work in the courses every two years by a trained UK Core faculty team using standardized rubrics (available at http://www.uky.edu/ukcore/Evaluation_Rubrics). The results from the graded rubric are reviewed/analyzed by UK Core Education committee, University Assessment Office, and faculty senate, and are shared with faculty and other constituencies for use in planning and budgeting improvements in student learning at the institutional and program levels. The Office of Undergraduate Education, with support from the Office of Assessment, will coordinate any special analysis as requested by the faculty for further investigation. More details about the assessment procedure are available on the web page: http://www.uky.edu/ukcore/sites/www.uky.edu.ukcore/files/UKCAssessmentPlan_Oct2012.pdf.

The first round of evaluations were conducted in Fall 2016 but those results are not currently available.

Graduating student and alumni satisfaction with program

Student and Employer Satisfaction

The College of Agriculture, Food and Environment (CAFE) and the academic departments and multi-disciplinary programs strive to maintain employer satisfaction through extensive

interactions with stakeholder employers through a variety of methods, including advisory boards, on-campus employment fairs, discipline-based accreditation site visits and reports, and involvement in periodic program reviews. The feedback provided from employers through these mechanisms influences curricula and ensures that students receive the course content that leads to successful employment. Collection of feedback from employers who provide undergraduate students with internship and experiential education opportunities is another way that professors and department chairs can interact employers and learn what knowledge and skills the undergraduates need for successful careers. CAFE, by virtue of being a land-grant agricultural college, has close ties with industry and business. This leads to a consistent exchange of information between the disciplines and the employers.

The College of Agriculture, Food and Environment 2015-2020 Strategic Plan Goal 1B is to track the perceptions and assessments of college graduates' preparation to be competitive in a global economy. The college has begun conducting an annual graduating student exit survey as one strategy to achieve this goal. Nine of the eleven plant sciences/horticulture May 2016 baccalaureate graduates responded to the survey. Five of the nine respondents ranked their satisfaction with the advising experience as excellent, and six ranked their satisfaction with the quality of teaching as excellent. These survey results are encouraging and we look forward to using the results to inform our faculty discussions concerning student/employer satisfaction.

Job and graduate school placement

As shown in Table 27 and 28, most HPLS graduates obtained positions from employers in the private and public sectors, which were located primarily in KY.

The department is interested in collecting information concerning post-graduation student success (as measured by job placement outcomes), and will continue involvement in discussions surrounding collection of this information at the College and University level, and/or through collaboration with the Kentucky Center for Education and Workforce Statistics (KCEWS). The college post-graduation survey collects limited information concerning graduate employment outcomes, but the need to protect the privacy of respondents, coupled with the small sample size of students, prevents presentation of specific information concerning their job placements and salaries.

Data collected by university career service offices from around the nation (including UK) indicated that entry-level salaries of recent graduates of Horticulture and Agronomy/Crop Science programs ranges between $12,000 and $44,085 per year (report available at https://students.ca.uky.edu/sites/students.ca.uky.edu/files/salary_survey_2016_-_regional.pdf).

A few HPLS graduates are pursuing higher academic degrees. The post-graduate status of several students is currently unknown.

Table 27. Post-graduation outcomes: status of HPLS graduates – January 2016 summary			
Status	2012-2013 (n=8)	2013-2014 (n=7)	2014-2015 (n=9)
	% of students		
Employed	50	37.5	87.5
Seeking employment	12.5	0	12.5
Furthering education	12.5	12.5	0
Unknown	25	50	0

Table 28. Organizations hiring HPLS graduates between 2012-2015.
Public sector
Ag extension agent at UK (2)
Executive Secretary at Kentucky General Government Cabinet
Research farm technician at UK
Private sector
Landscape manager at Lawns and Landscapes, Lexington
Lab tech at Compliance Advantage Laboratory, KY
Regional Marketing Manager at Atmos Energy, KY
Intern at Alltech, KY
Intern at Walt Disney World, FL
Farm Manager, Lexington KY
Beck's Hybrid, KY
TMK Bakerville,Ohio
Dow Agro, Nebraska
Self-employed
Employed- Owner/Proprietor Varner's Lawn Service, KY
Self-employed at family farm, KY
Retired, small fruit farmer
Stay at home mom, KY
Pursuing higher education
Graduate student at UK (3)
Graduate student at Univ. of Georgia

As presented in Tables 29 and 30, our January 2016 accounting of student employment post-graduation indicated strong post-graduation outcomes for Ph.D. graduates. Post-graduation outcomes for M.S. graduates shows lower percentages of employment plus furthering education than for Ph.D. graduates.

Table 29. Post-graduation outcomes: status of graduate program students, MS (all programs) – January 2016 summary			
Status	2012-2013 (n=15)	2013-2014 (n=14)	2014-2015 (n=10)
	% of students		
Employed	67	64	50
Seeking employment	20	28	40
Furthering education	7	0	10
Unknown	7	7	0

Table 30. Post-graduation outcomes: status of graduate program students, PhD (all programs) – January 2016 summary			
Status	2012-2013 (n=9)	2013-2014 (n=10)	2014-2015 (n=9)
	% of students		
Employed	89	70	100
Seeking employment	0	10	0
Furthering education	11	10	0
Unknown	0	10	0

Research

Major Research Strengths

Our large, diverse department conducts research in many areas. The breadth of research topics and collaborative efforts between basic and applied researchers allows for a unique research perspective. Diversity contributes strongly to innovative thinking. Looking at the same problem from very diverse perspectives develops multiple sound hypotheses and experimental approaches. We look at cropping systems from production, management and utilization perspectives, involving soils, the rhizosphere, traditional and alternative crops, weeds, and their interactions. Limiting air and water pollution and soil degradation through appropriate soil, water, and crop management has been and will remain a departmental focus. We explore the mechanisms, effects, and potential uses of plant-microbe symbiotic interactions, above- and below ground, to improve agricultural sustainability and environmental functioning. We create genetic resources, and design and develop management strategies to help growers adapt to climate change. We investigate plant metabolic pathways and gene expression mechanisms giving us the ability to improve crop biology. We investigate the interaction of nano-materials with the living world and their fate in the environment. We explore how human-climate interactions affect nutrient, water, and energy cycling in natural, agronomic, and restored ecosystems. Integration with the USDA Animal Forage Production Unit promotes depth and breadth in our forage program, fostering a systems-approach to the research conducted. Partnering with the Kentucky Tobacco Research and Development Center and the University of Tennessee creates a diverse tobacco science program sharing scientists and ideas. We are leveraging investments in the Grain and Forage Center of Excellence in Princeton to expand our future research capabilities. Our research strength springs from our diversity, breadth, and cooperation.

Over the past five years the department averaged $3,345,000 in direct research funding, a per faculty member average of $90,000 per year (Table 32). This average includes 2012-2013 in which federal funding support was only 25% of our annual federal funding average across the other four years. The department collaborates in its research. During the five-year period shown in Table 32 the department participated in an annual average of $6,808,000 of collaborative research funding, double the direct funding to the department. The direct funded research is also highly collaborative; for the 77 projects funded in 2016, 32 were sole PI (or one research program), 21 were multiple PIs in the department, and 24 were collaborative with other departments or institutions.

Here we highlight a few current examples of the important issues our research addresses:

Improving agricultural sustainability for KY and beyond:

- Researchers began participating in a major regional project ‘Optimizing cropping systems for resilience to stress’. Significant funding from the Kentucky Soybean Promotion Board, the Kentucky Corn Growers, and the Kentucky Small Grain Growers Association is supporting irrigation research, including the research project ‘Irrigating the Soil to Maximize the Crop’ and the development of an irrigation research field at the West Kentucky Research and Education Center.

- The grain crops program, with heightened visibility since the investment in the Grain and Forage Production Research Center, is addressing the challenges of maximizing crop production while preserving environmental quality in the face of rising population through current projects on breeding for nitrogen use efficiency in winter wheat and maximizing soybean yields with proper nutrient management,
- Researchers are participating in a major regional project 'Using precision technology: on-farm field trials to enable data-intensive fertilizer management'.
- The industrial hemp research program has grown substantially, reflecting Kentucky's unique early-adapter position among US states, in exploring the agronomic and economic potential of this crop. Our industrial hemp agronomic program leads the way in developing production recommendations, evaluating varieties, and identifying challenges and knowledge gaps for US hemp production.
- The use of cover crops has reemerged in cropping systems. Cover crop research and extension projects are evaluating cover crop contributions to soil health and weed management, including the project 'Nitrogen contributions from different cover cropping systems established following full season soybean'. Annual ryegrass as a cover crop has shown promise in breaking down impermeable soil horizons (fragipan layers) found in western KY, along with enhancing row crop yields.
- A new area of emphasis in Agroclimatology and Ag-systems Modeling will project outcomes and responses of crop production to a climate changing due to increased temperatures and altered precipitation patterns.
- Tall fescue, an important cool season forage grass naturally infected with a fungal endophyte, dominates Kentucky pastures. Current projects involve manipulating the grass-fungal endophyte symbioses with an eye towards ecosystem function.
- The tobacco science program leads the push to control the formation of tobacco-specific nitrosamines during production and curing and to breed disease resistant tobacco.
- Inspired by a desire to optimize phosphorus use while preserving water quality in agroecosystems has led to funded projects to investigate the role of the rhizosphere and waste amendments on phosphorus cycling.
- Spurred by the continuing identification of herbicide-resistant weeds in Kentucky and beyond, weed scientists investigate new strategies for weed management and control, critical in light of the competition of these weeds with crops for nutrients, water, and sunlight, and address herbicide stewardship.

Increasing Economic Opportunities for KY and beyond:

- The industrial hemp agronomic research program works closely with local producers and interacts/advises state legislature, US Congress, and industry on the economic potential for industrial hemp.
- Working with Keeneland, the soil physics program helped to identify a race track material which would drain quickly, provide a stable base for races, and sustain the health of horses, as well as horse-racing, a sizable industry in our area.
- Forage specialists worked with organic dairies to 'Develop science-based recommendations to efficiently manage forages, herd health, and productivity' in their organic systems.

- Chia presents a new crop opportunity with potential as an additive in gluten-free pasta and a source of oil high in omega-3 fatty acid. Our patented early flowering chia is the key component to a USDA specialty crop research grant with a Kentucky entrepreneur and to funding from the Kentucky Small Grains Growers Association.

Increasing Scientific Knowledge in KY and beyond:

- Seeds represent a crucial stage in the life cycle of plants. Cooperative research with scientists from China, Japan, Sri Lanka, Taiwan and the United States is helping agriculturalists worldwide understand the ecology, biogeography and evolution of seed dormancy and germination – important plant traits in agronomy and natural resource management.
- Exploring novel uses and environmental consequences of nanotechnology, including projects such as 'Flavonoid Isolation from Intact Plants: A Nanoparticle-Based Approach' and 'Fate and Effects of Agriculturally Relevant Materials (NanoFARM)'.
- Exploring mechanisms controlling important biological functions, such as nitrogen fixation by legume-rhizobia symbiosis ('Host genotype control of strain specific nitrogen fixation'), gene regulation ('Mechanisms of Gene Regulation by the Plant MADS-domain Transcription Factor, AGL15 and Developmental Outcomes'), and RNA function ('CPSF30 at the convergence of cellular signaling and RNA Processing' and 'Alternative polyadenylation and non-stop mRNAs in Arabidopsis'). The latter two projects led to the development of versatile and inexpensive methods for the production of RNA-Seq libraries, which have been adopted by many laboratories in the USA and world.

A much richer enumeration of research foci, publications and funding is provided in Appendix M.

Student involvement in research

Graduate students are active in our research programs. Publications with a graduate student author are summarized in Table 31 and presented in detail in Appendix I. Student publications have increased noticeably during this review period.

Table 31. Summary of publications with a graduate student author 2012-2016*

	2012	2013	2014	2015	2016
Student authored publications (first author)	19 (14)	26 (11)	25 (14)	23 (17)	33 (24)
Graduate students enrolled	77	77	77	71	70
M.S. and Ph.D. degrees awarded	25	26	25	19	17

*Student publications are counted for graduate students advised in the Department of Plant and Soil Sciences while the students enrolled and the degrees awarded include all IPSS students, advised in both the Department of Horticulture and the Department of Plant and Soil Sciences.

Research metrics - grants and contracts, publications, patents and cultivars

Our research productivity based on publication numbers and funding levels is presented in Table 32. While our research FTE has decreased during this period, our total research productivity has not decreased. Productivity per research FTE, especially for publications, has thus increased.

Table 32. Research productivity metrics for Department of Plant and Soil Sciences					
	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Full time faculty	39	40	38	35	35
Research FTE	24.7	25.37	24.0	19.8	20.5
Books and book chapters	9	4	5	4	8
Refereed journal articles	58	77	98	78	87
Other research articles	35	19	14	21	
Books + book chap. + refereed art.	67	81	103	82	95
Publications per research FTE	2.71	3.17	4.29	4.14	4.63
Direct grant awards	$3,785,819	$1,995,353	$4,046,378	$3,624,295	$3,273,208
Grant awards per full time faculty	$97,072	$49,884	$106,484	$103,551	$93,520
Grant awards per research FTE	$153,086	$78,035	$168,599	$183,138	$159,358
Federally competitive grant awards	$1,806,497	$344,708	$1,372,655	$1,218,516	$1,600,182
% of grants federally competitive	48	17	34	34	49
Collaborative grant awards	$7,012,441	$9,172,923	$5,937,603	$4,360,969	$7,553,928
Patents	6	5	5	2	4
Cultivar releases	1	3	2	4	1

Our other research activities are enumerated in appendices: agencies providing funding (Appendix J) list of grants and contracts (Appendix K), cultivars and patents (Appendix L), publications highlighted by each faculty member are listed within the faculty CV's (Appendix M)

Extension/Service

Our extension programs provide timely, factual, pertinent, and unbiased information to our clientele. Extension clientele encompass many diverse people and organizations including extension agents, producers, crop advisors, land owners, agribusiness, and other parties in the Commonwealth and surrounding states. We disseminate information to this clientele in numerous ways including the traditional methods such as meetings, extension publications, field days, and on-farm research and demonstration trials. Electronic dissemination of information includes mobile-friendly websites, blogs, social media posts, and other electronic resources (e.g. Lync/Skype for Business). To support our information base, we conduct and collaborate on applied research trials that test relevant hypotheses and allow us to contribute up-to-date answers to clientele questions. Here we present a summary of our extension programs by focus areas.

Soils

The soils extension group conducts applied research and outreach programming involved in nutrient management, due in large part to competitive funding provided by the USDA NRCS, USDA AFRI, and support from Kentucky wheat, corn and soybean commodity boards. Through research and demonstration projects on producer-owned farms as well as county, regional, state and national meetings, workshops and conferences the group educates and encourages producers to apply the necessary nutrients for economic viability in the most environmentally sound manner that is possible for the producer. Specialists continue to evaluate fertility recommendations in grain and forage crops including sulfur fertility requirements in wheat and alfalfa, nitrogen rates for wheat and enhancement products for nitrogen and phosphorus in corn. Ongoing trials are evaluating how spatial scale influences plant response to phosphorus fertility. As the 7th largest broiler producer in the nation Kentucky accumulates poultry litter, so many Kentucky row crop producers are very interested in the nutrient efficacy and fate of excess nutrients from poultry litter. Applied research projects emphasize the nutrient availability from manure applications regarding timing, application rate as well as placement (broadcast on soil surface vs. a new technique that injects litter into the surface horizon). The fate of nutrients from poultry litter applications are being evaluated via rainfall simulation plot studies with future expansion into edge of field monitoring projects. The information gleaned from this collective of nutrient management work both from an agronomic and environmental impact perspective is incorporated into the University of Kentucky Extension Bulletin AGR-1 and the Kentucky Phosphorus Index, two principal components of the USDA NRCS Nutrient Management Plan required for many agricultural producers in Kentucky. Through CES agent training programs (New Agent Training, Crop Schools and Certified Crop Advisors workshops such as the Kentuckiana Annual CCA Conference) clientele are educated about soil and nutrient management strategies to increase yield with minimal impacts to the environment.

By partnering with extension specialists in 4-H, Agricultural Education, and Horticulture, the soils group plays a critical resource role in the college for extension educational needs. In the urban environment, the soil extension specialists work with audiences that include homeowners, local utilities, and regulatory agencies involved in nutrient management and storm water. Education and outreach programs include lawn and garden soil management

through county CES meetings and Master Gardener training, septic system siting, design, and maintenance for homeowners and regulators, and storm water management around the home. Soils extension specialists are regular instructors for the Master Gardener curriculum in the required Soils course, Water Quality course and optional Compost course. Statewide, the extension group works with Municipal Separate Storm Sewer System permitted communities and helps them meet their EPA regulatory permit requirements. The soils group supports K-12 education programs through high school soil judging contests, train-the-trainer workshops for science teachers and technical assistance with demonstration compost projects, vegetable gardens and rain gardens.

Grain Crops

Grain and oilseed crops are a major driver of Kentucky's economy, especially in western Kentucky where the majority of these crops are produced. Many of our targeted audiences work directly with producers. When we "train the trainers", we are effectively multiplying the information provided. A hands-on agent-training program was developed to target extension agents in the state, many of which were new agents that lacked adequate training. This program involved many specialists that shared their expertise with agents. The number of extension contacts reported by specialists, although substantial in their own right, falls well short of the people impacted through extension activities in our department.

Specialists working in grain crops have developed the KyGrains.info website in cooperation with local commodity boards (Corn, Soybean, and Small Grains). The website is mobile-friendly and houses the Grain Crops Update, a blog that receives about 60,000 views per year. Specialists and researchers working in grain crops use this site to disseminate information regarding current conditions, relevant topics, or general information. Electronic distribution permits clientele to easily access information at their convenience.

Numerous research and demonstration trials provide sought after information for grain crop producers contending with herbicide resistant weeds such as Palmer Amaranth, Waterhemp, Marestail, and Italian Ryegrass. Applied research on these weed species in combination with demonstration plots and educational programs provide producers the best management strategies possible when dealing with the spread and control of these weeds.

When compared to Cooperative Extension recommendations, farmer practices sometimes show a decreased profit due to excessive inputs, incorrect inputs, or improper management decisions. There are several examples where a producer changed a management practice resulting in substantial savings. We often hear about these types of successes after meetings, through survey results, or by talking with individual producers.

An often overlooked service that extension provides to the public is the Plant Disease Diagnostic Laboratory housed in the Plant Pathology department. As the name implies, they diagnose plant diseases in field, horticultural, and other crops. Often a plant is submitted to the lab that is not diseased, rather it is influenced by some other factor. The specialists in the department identify potential causes and solutions for these issues which range from nutrient deficiencies, environmental conditions, herbicide interactions, and weed identification. This free service is a valuable resource to producers in the state and is strongly supported by extension faculty in the Plant and Soil Sciences Department.

Extension faculty working in grain crops have been very successful in obtaining grant funding. Funding sources include Kentucky Soybean Promotion Board, Kentucky Corn Growers, Kentucky Small Grain Growers Association, United Soybean Board, and Kentucky Ag Development Fund. Members from this group, along with others, were instrumental in securing funding for the creation of the Grain Crops and Forage Center of Excellence at Princeton. This grant will allow for needed facilities renovation, expansion of research areas, and providing leadership in the region for grain crop production.

Forages and Hemp

The forage extension program in Kentucky is one of the top forage programs in the country. Over the last five years we have helped to organize and present forage focused information at Master Cattleman, Master Stocker, and Master Grazer programs and have developed and delivered annual programs for Forages at KCA (KY Cattleman's Association Annual Meeting), KY Farm Bureau Forage session, KY Grazing School, Heart of America Grazing Conference, KY Grazing Conference, KY Alfalfa Conference, Pastures Please Equine Program, and the Equine Farm and Facilities Expo. We publish a monthly Forage News newsletter, contribute to the bi-monthly Grazing News, and write for the monthly KY beef magazine Cow Country News. Forage Specialists at UK have a close working relationship with the KY Forage and Grassland Council (KFGC). Through KFGC, we interact with the broad spectrum of groups and associations that relate with forage crops, and we worked closely with county agents to deliver relevant programing for KY producers.

Forage specialists at UK spend a significant portion of our time in consultation with Agriculture and Natural Resource (ANR) county agents answering technical questions, developing written publications, facilitating follow-up lab tests, conducting formal and informal in-service training, setting up demonstration projects, and speaking at county, regional, and statewide field days and evening meetings. Since forages overlap many agricultural disciplines we help to facilitate interaction and collaboration between extension, research, and teaching colleagues across the College of Agriculture, Food and Environment and with other institutions. We facilitate the regular Forage and Grassland discussion group and the Equine Pasture and Forage working group. We have ongoing collaborations with other faculty in Plant and Soil Sciences, Animal Science, Biosystems and Ag Engineering, Horticulture, Ag. Economics, Veterinary Science, and USDA-ARS-FAPRU and regularly consult with Plant Pathology and Entomology. We coordinate forage extension programing with USDA-NRCS and advise Farm Service Agency (FSA) on issues related to emergency assistance programs for forage crops. We have developed and implemented joint forage projects with Univ. of Tennessee, Eastern Kentucky University, Western Kentucky University, Berea College, and Asbury University.

The Forage Extension Group has been active in securing external funding including the recent USDA-NRCS-RCPP Horse Pasture grant and the USDA-OREI Forage Systems for Organic Dairies grant. We have conducted a number of multi-county field level demonstrations and research trials with county agents to show producers "hands-on" examples of how to manage their forage resources better. These include: 1) Field investigations of sulfur deficiency in alfalfa and determination of fertilizer response; 2) Novel endophyte tall fescue demonstrations; 3) Annual forage crop demonstrations; 4) Pasture over-seeding demonstrations; 5) Switchgrass agronomy; 6) Tall fescue stockpiling

demonstrations. We have worked with agents to hold county or regional field days related to these on-farm demonstrations.

Another major program emphasis has been associated with weed control issues in forage crops including presentations at many of the meetings listed previously. On-farm research trials demonstrated benefits of weed control tactics in pastures. Recent publications in this area include a *Weed Technology* journal article on horse nettle and tall ironweed as part of a collaborative research project with weed scientists at the University of Tennessee, an extension publication to increase awareness of good stewardship when using herbicides on pastures and hay fields (AGR-219), and a reprinting of the widely used publication Broadleaf Weeds of Kentucky Pastures (AGR-207).

Overall enthusiasm for the Industrial Hemp Program in Kentucky continues to generate tremendous interest across the state. Approved hemp acreage from the Kentucky Department of Agriculture (KDA) for the 2017 growing season reached 12,800 acres, an increase of almost 3 times the acres approved from 2016. Extension efforts on behalf of the University of Kentucky's College of Agriculture, Food and Environment continue to expand as well. County extension meetings with producers continue to make up a large part of the extension program. In early 2017, UK Cooperative Extension conducted three statewide meetings focused on the regulatory, agronomic, utilization and advocacy components of the hemp industry in Kentucky, highlighted by the serving of "hemp" hotdogs for lunch at all three meetings.

A major Field Day at Spindletop Farm in September will demonstrate and focus on the hemp research program at the University; two national hemp conferences will be held in Lexington in conjunction with this Field Day. Extension personnel serve as advisory members on the boards of directors for the two main hemp industry groups, the Kentucky Hemp Industries Association and the Kentucky Hemp Research Foundation. This contributes strongly to an excellent relationship between the industry and extension. Extension personnel also regularly participate in meetings nationwide with presentations on the Kentucky Program and hemp agronomy in general.

Turf and Tobacco

The turf and tobacco groups are very involved in applied research across a broad spectrum of topics with the majority of funding provided by tobacco, seed, and/or chemical companies. This applied research provides specialists with information on management practices that can result in a better product while striving for sustainability. Applied research focused on conservation tillage in burley tobacco, the effects of high-temperature aggressive fire-curing of dark tobacco on levels of harmful leaf constituents, and seasonal mowing height variations on smooth clover incidence in tall fescue lawns. The information garnered from the applied research resulted in many new and updated extension publications to assist both county agents and producers/managers with information on proper management practices. Further, specialists in both turf and tobacco have partnered with surrounding states to produce multi-state management guides that reach much broader audiences.

Specific hands-on training has been developed and delivered based on our applied research. The US Tobacco Good Agricultural Practices Training that growers must attend each year to help ensure proper methods are being utilized in the field reached over 4,000 tobacco

growers in KY and TN in 2016 alone. In turf, an intensive hands-on course was developed to reach turf professionals who lack formal turf training or those looking for refreshers. The Kentucky Certified Professional Turf Management Workshop is a joint project through UK and the KY Dept. of Agriculture that promotes best management practices and environmental stewardship. To become certified, attendees must score 70% or better on a comprehensive exam offered on-line following completion of the course. Level 1 and 2 workshops are currently offered and a Level 3 workshop is in development.

Turf and tobacco specialists also disseminate information electronically in order to reach more practitioners more quickly. Both groups utilize social media outlets and have produced a number of 'how to' videos uploaded to YouTube including 'Chemical Topping Burley Tobacco', 'Dark Fired Tobacco', and 'Mole Control in Lawns'. These new forms of communication are able to reach different audiences that may not be interested in reading an extension publication, and they provide specialists with the ability to show specific methods/management practices on camera that can then be utilized by the end user. The videos released by UK specialists have been viewed by many thousands of people. Specialists in both of these groups are also using video conferencing technology to reach multiple counties and increase meeting attendance without extensive travel. Further, specific webpages have been developed to provide up-to-date information in one location for agents and practitioners alike.

Turf and tobacco specialists are also very involved in regional and national organizations including the FDA's Tobacco Products Scientific Advisory Committee, Editor in Chief of Tobacco Science Journal, and Sports Turf Managers Association Research Advisory and Education Committees, among several others.

Quantity and quality of outreach

The following four tables present our quantitative metrics and the summary of the qualitative feedback on extension specialist activity by county agricultural agents. These data support the quantity and quality of our extension outreach programs.

Table 33. Numbered extension publications and success stories

	2012	2013	2014	2015	2016
Numbered Extension Publications-New	14	6	14	6	7
Numbered Extension Publications-Revised	1	1	4	2	5
Progress Reports	16	16	15	16	16
Fact Sheets	0	1	2	2	1
Plant and Soil Sciences Research Report	0	3	3	0	0
KERS Success stories	12	20	5	20	19
Counties with on-site research activities	52	82	40	31	

Table 34. Categories and number of direct extension specialist contacts					
	11-12	12-13	13-14	14-15	15-16
African American	286	350	553	438	1011
Asian American	92	52	140	137	79
Hispanic	119	260	314	170	394
Native Americans	0	0	2	0	0
Other	0	144	78	153	65
Total Contacts	22,893	26,025	21,446	38,027	49,279
Agent training participants	483	590	245	690	

Table 35. Activities to enhance extension programming funding					
	2012	2013	2014	2015	2016
Funded grant proposals with extension specialists as Principal Investigators	18	21	15	23	21

Every two years the associate dean for extension requests input from county extension agents regarding their interaction with the college's extension specialists. Agents respond to an on-line survey providing both numerical feedback and written responses. Table 36 shows the numerical feedback from the three surveys conducted since the previous review. The specific and department average ratings show the high satisfaction with our extension specialists and support our belief that we maintain an excellent overall extension program.

Table 36. Feedback on extension specialists by county agents 2012-2016.					
2012 Feedback on Extension Specialists by County Agents		**Degree of Interaction**	**Overall Responsiveness**	**Value of assistance or support**	**Effectiveness of assistance, program or support**
Specialist Name	**Total Number of Responses**	**3=Extensive 2=Moderate 1=Minimal**	**3=High 2=Moderate 1=Unresponsive**	**3=High 2=Moderate 1=Low**	**3=High 2=Moderate 1=Low**
X	9	2.22	3.00	3.00	3.00
X	10	1.80	2.40	2.60	2.60
X	13	2.77	2.62	2.85	2.77
X	17	2.53	2.82	2.53	2.35
X	22	1.82	2.86	2.91	2.68
X	23	2.26	3.00	3.00	3.00
X	33	2.06	2.73	2.61	2.58
X	39	2.23	2.95	2.97	2.92
X	64	2.39	2.89	2.97	2.95

X	71	2.28	2.94	2.96	2.93
Dept.	301	2.24	2.88	2.79	2.82
College		2.01	2.84	2.83	2.80

2014 Feedback on Extension Specialists by County Agents		**Degree of Interaction**	**Overall Responsiveness**	**Value of assistance or support**	**Effectiveness of assistance, program or support**
Specialist Name	**Total Number of Responses**	**3=Extensive 2=Moderate 1=Minimal**	**3=High 2=Moderate 1=Unresponsive**	**3=High 2=Moderate 1=Low**	**3=High 2=Moderate 1=Low**
X	10	2.5	3	3	3
X	10	1.6	3	3	2.9
X	15	2.73	3	2.93	2.93
X	16	2.38	2.94	2.69	2.69
X	16	2.38	3	3	3
X	18	2.44	3	3	2.94
X	30	2.1	2.67	2.4	2.53
X	37	2.65	2.92	3	2.97
X	38	2.61	2.89	2.97	2.95
X	46	2.43	2.93	2.98	2.98
X	64	2.5	2.94	2.97	2.97
Department	300	2.39	2.93	2.90	2.90

2016 Feedback on Extension Specialists by County Agents		Degree of Interaction	Overall Responsiveness	Value of assistance or support	Effectiveness of assistance, program or support
Specialist Name	**Total Number of Responses**	**3=Extensive 2=Moderate 1=Minimal**	**3=High 2=Moderate 1=Unresponsive**	**3=High 2=Moderate 1=Low**	**3=High 2=Moderate 1=Low**
X	5	2.60	3.00	3.00	3.00
X	6	1.83	2.83	2.67	2.67
X	8	2.38	2.63	2.63	2.63
X	10	2.20	2.90	3.00	3.00
X	12	1.92	2.83	2.67	2.67
X	14	2.36	3.00	3.00	2.93
X	16	1.88	2.50	2.50	2.38
X	18	2.39	2.83	2.94	2.94
X	20	2.55	2.85	3.00	3.00
X	28	2.61	2.89	2.82	2.86
Department	137	2.32	2.82	2.83	2.82

Department Service

All faculty members serve on one or more departmental committees (Appendix C), and this committee service supports our departmental activities and improves how our department functions.

Our service to national societies and national scientific publications is presented in Appendix E.

Appendix A. Plant and Soil Sciences faculty list.

2017-2018 Faculty List Plant and Soil Sciences – July 1, 2017				
Post-retirement	**Professor**	**Associate**	**Assistant**	**Adjunct**
Bush, Lowell	Bailey, Andy (25% UT)	D'Angelo, Elisa	Goff, Ben	Aiken, Glen (Prof)
Murdock, Lloyd	Barrett, Mike	Lee, Brad	Haramoto, Erin	Bolster, Carl (joint BAE)
Wagner, George	Baskin, Carol (75% Biology)	Matocha, Chris	Kawashima, Tomokazu	Dinkins, Randy (Assoc)
	Coyne, Mark	McGrath, Josh	Knott, Carrie	Kagan, Isabelle (Assist)
Emeritus	Egli, Dennis	McNear, Dave	Legleiter, Travis	Sikora, Frank (Assoc)
Barnhisel, Richard	Green, JD	Moe, Luke	Ren, Wei	Sistani, Karamat (Prof)
Blevins, Robert	Grove, John (80% CAFE)	Munshaw, Gregg	Salmeron Cortasa, Montseratt	Weintraub, Michael (Assist)
Burton, Harold	Henning, Jimmy	Perry, Sharyn	Tsyusko, Olga (research)	Williamson, Tanja (Assist)
Collins, Glenn	Hildebrand, David	Phillips, Tim	Walker, Eric (75% UT)	Zourakis, Demetrio (Assist)
Davies, Maelor	Hunt, Art	Ritchey, Edwin		
Ditsch, David	Lee, Chad (30% CAFE)	Smalle, Jan		
Dougherty, Charles	McCulley, Rebecca (25% UK TFISE)	Teutsch, Chris		
Frye, Wilbur	Miller, Bob (40% UT)	Unrine, Jason		
Herbek, James	Pearce, Bob			
Hiatt, AJ	Pfeiffer, Todd (chair)			
Karathanasis, Tasios	Smith, Ray			
Lacefield, Garry	VanSanford, Dave			
Martin, Jim	Wendroth, Ole			
Ragland, John	Williams, David (80% CAFE)			

Rasnake, Monroe	Yuan, Ling			
Rice, Harold	Zhu, Hongyan			
Smith, Scott				
Sims, John				
TeKrony, Dennis				
Thom, William				
Wells, Ken				
Witt, William				

Appendix B. Faculty organization in broad categories of activity – July 2017

Faculty composition by areas (0.XX – current level of appointment in the department)					
Crop Science		Soil Science		Plant Biology	
Research/Instruction					
Barrett					
Baskin (.25)		Coyne		Hildebrand	
Egli (.6)		D'Angelo		Hunt	
Goff		Grove (.2)		Kawashima	
Haramoto		Matocha		Moe	
McCulley (.75)		McCulley (.75)		Perry	
Miller (.6)		McNear		Smalle	
Pfeiffer		Ren		Tsyusko	
Phillips		Tsyusko		Unrine	
Ren		Unrine		Yuan	
Salmeron		Wendroth		Zhu	
Van Sanford					
Williams (.2)					
Extension/Research					
Bailey (.75)		Lee, Brad			
Green		McGrath			
Henning		Ritchey			
Knott					
Lee, Chad (.7)					
Legleiter					
Munshaw					
Pearce					
Smith, Ray					
Teutsch					
Walker (.25)					
Post-retirement					
		Murdock (.5)		Bush (.1)	
				Wagner (.5)	
Adjunct					
Aiken		Bolster		Dinkins	
		Sikora		Kagan	
		Sistani			
		Weintraub			
		Williamson			
		Zourarakis			

Commodity/Interest Group					
Grain Crops		Soil/Water Environment		Forages	
Egli		Bolster		Aiken	
Green		Coyne		Bush	
Grove		D'Angelo		Dinkins	
Haramoto		Lee, Brad		Green	
Hildebrand		Matocha		Goff	
Knott		McCulley		Henning	
Lee, Chad		McGrath		Hunt	
Legleiter		McNear		Kagan	
McGrath		Ren		McCulley	
Murdock		Ritchey		McNear	
Pfeiffer		Sistani		Phillips	
Ren		Tsyusko		Smith	
Ritchey		Unrine		Teutsch	
Salmeron		Wendroth		Zhu	
Van Sanford		Williamson			
Wendroth		Zourarakis			

Tobacco		Hemp		Rhizosphere	
Bailey		Bush		Coyne	
Bush		Goff		McCulley	
Miller		Hildebrand		McNear	
Moe		Moe		Moe	
Pearce		Pearce		Weintraub	
Smalle		Yuan			
Wagner		Williams			
Walker					
Yuan					
Turf		Agronomic Soil		Plant Breeding/Genetics	
Munshaw		Coyne		Hildebrand	
		Grove		Miller	
		Matocha		Pfeiffer	
		McGrath		Phillips	
		McNear		VanSanford	
		Murdock		Zhu	
		Pearce			
		Ren			
		Ritchey			
		Sikora			
		Wendroth			

Seed Science		Weed Science			
Baskin		Barrett			
Egli		Green			
Kawashima		Haramoto			
Perry		Legleiter			
Open					
	Critical Zone Pedology				
	Soil Nutrient Management				

Appendix C. Plant and Soil Sciences Committees 2016-2017

Plant and Soil Sciences
2016-2017 Committees and Service Assignments

Coordinator of Instruction	D'Angelo
Coordinator of Extension	R. Smith
Spindletop Farm Coordinator	Slack
Campus Facilities Coordinator	Kenimer
Equipment Coordinators	Bruening/Lawson
Safety Coordinator	Venard

Promotion and Evaluation Committee

(The department's Rules of Procedure state that an individual is appointed for two years and may serve for only four consecutive years on this committee. The current year of service is indicated in parentheses following the name below)

R. Smith	(1)	Matocha	(2)	B. Lee	(3)	Smalle	(4)
Zhu	(1)	McCulley	(2)				

Responsibilities: To assist and advise on faculty evaluation and promotion

Graduate Program Coordinating Committee

Coyne	DGS IPSS and Soil Science representative
Phillips	Crop Science representative
Hunt	Plant Biology representative

Responsibilities:

1. To coordinate graduate programs in Plant and Soil Sciences.
2. To evaluate applications for admission and assistantships.
3. To coordinate an annual graduate student orientation.
4. To assume leadership in recruiting graduate students.
5. To select an outstanding graduate student each year to receive the Peaslee Award. Mark Coyne will chair this effort.

Advisory Committee

Composed of the Graduate Program Coordinating Committee, Coordinators of Instruction and Extension, and the Promotion and Evaluation Committee.

Responsibilities: To advise on policy, procedure, and other matters as requested by the Chair.
Staff Representation: The staff representative to the college Staff Links committee (Christine Tarne) and the PSS facility coordinators will serve on the Advisory Committee when needed in regard to staff and facility issues.

Project Proposal Review

Wendroth (Chair) Karathanasis Miller Smalle Tsyusko

To review Hatch project proposals, enlisting other reviewers as needed.

Seminar

Responsibilities: To coordinate and schedule seminars.

Department/IPSS[†]		Phillips – No-till[‡]	Instruction[§]	Outstanding Alumnus[¶]
Goff, chair	Priyanka Paul*	Pearce, chair	D'Angelo	Munshaw
Moe	Mitchell Richmond*			
Ren	James Bowen*			
[†]Organize department seminars, graduate student symposia and to involve all graduate students and faculty [‡]Organize the Shirley Phillips No-Till Agriculture program [§]Organize the annual seminar focused on instruction [¶]Organize the annual Graduate Program Outstanding Alumnus seminar [*]Student appointed from IPSS				

Social Committee

Cathy Bowers (coordinator), Susan Leopold with faculty and staff located on PSB 4th floor

Responsibilities: To arrange and conduct the annual Holiday Luncheon plus other departmental social activities as appropriate.

Faculty Awards

Responsibilities: To identify and recommend qualified faculty and specialists for professional awards and other recognitions; then identify an individual to assist in preparing the nomination.

Van Sanford (Chair) Bailey Bertsch McCulley Yuan

Outstanding Alumnus

Responsibilities: To choose an alumnus of our graduate programs to receive the "Distinguished Alumnus Award" and to arrange the visit and activities.

Munshaw (Chair) Egli Knott
and Graduate Program Coordinating Committee (Coyne, Hunt, Phillips)

PSSGSA Advisor - Van Sanford

Undergraduate Program Steering Committee

D'Angelo (Chair)	Matocha	Perry
Goff	McNear	von Groote
Haramoto		

Responsibilities:
1. To review and evaluate undergraduate curricula, courses, and student activities in Plant and Soil Sciences.
2. To provide leadership in the development of new undergraduate programs as needed.
3. Coordinate student recruiting activities

Academic Program - Student Learning Outcomes Assessment Group

McNear (chair), D'Angelo, Coyne, Perry

Responsibilities:
To coordinate, review, and evaluate undergraduate and graduate program assessment activities

UK@Work

Goal 1 Committee: Martinez	Moe	Swanson	Whitaker	
Goal 2 Committee: Bowers	Hunt	Kupper	Pearce	Russell

Responsibilities: Gather the department's opinion and develop a plan to meet our UK@Work goals.
Goal 1: Improve the response to Empowerment Statement 6 - 'I am satisfied with the procedures available for resolving faculty and staff complaints.'
Goal 2: Goal 2: Improve the response to Work Relationship Statement 6 - 'Differing opinions are openly discussed in reaching decisions in my department' combined with two statements under communication 'UK does an excellent job of keeping faculty/staff informed about matters affecting us.' as well as 'Sufficient effort is made to get the opinions and thinking of faculty/staff'.

Outreach and Communications

Field Days Coordinator

R. Smith

Responsibilities: Scheduling and coordination for field days. Field day organizers will advise the coordinator concerning plans and schedules.

Department Web Page

L. Williams (Chair)	Bowers	Kawashima	Lauer	Ritchey
	Salmeron	Tsyusko	von Groote	

Responsibility: To review the appearance and utility of the departmental web page and to offer suggestions for its improvement

Plant and Soil Sciences Research Chronicles - Editor

Pearce

AGR-1

Ritchey (Co-Chair)	McGrath (Co-chair)	Grove	Knott	B. Lee
C. Lee	Pearce	Sikora	R. Smith	Strang

Responsibilities: Establish, review, and publish lime and fertilizer recommendations. Maintain data used to establish those recommendations.

Facilities and Safety

Safety Responsibility: As specified in UK Administrative Regulations (AR II-1.1 –14 –181), environmental health and safety is a shared responsibility of all of us: administration, faculty, staff, and students. The activities of the departmental safety committees do not relieve any others of their obligation to assure compliance with all health and safety requirements.

Farm Oversight College Committees
North Farm – Pearce, Slack
Little Farm - Green

Spindletop Facilities:

Slack (Chair)	Hunter	Lawson	Munshaw	P. Perry (KTRDC)	J. Roberts
	Salmeron	Wendroth			

Responsibilities:
1. Oversight of issues related to management of equipment and buildings
2. Recommend allocation of facility resources at Spindletop.

Spindletop Land Use:

Slack (Chair)	Aiken (FAPRU)	Lawson	C. Lee	McGrath	Miller
	Shelton (KTRDC)	VanSanford			

Responsibilities:
1. Oversight of land assignment and use
2. Recommend allocation of land resources at Spindletop.
3. Inform the Chair and Associate Dean for Research of regulated plant testing

Farm Safety Committee:

McGrath (Chair) Allen Cropper Keene Jones Russell Venard

Responsibilities: Oversight of issues related to on-farm safety, confirm certified first aid trained employees, plus conduct an annual worker safety training

Farm Pesticide Use and Oversight:

Green (Chair) Duckworth Haramoto Neal Omielan Zeleznik

Responsibilities: To review and implement pesticide use guidelines, record keeping, and regulatory compliance, and promote our expectations for safe pesticide use.

Laboratory Safety Committee:

Venard (Chair) Hildebrand Kupper Kurepa Unrine Zhu

Responsibilities: Coordination, planning, and review of on-campus laboratory safety issues, oversight of laboratory chemical and waste handling, organize necessary safety trainings, and management of laboratory inspections as necessary.

Autoclave Committee:

Clark (Chair) Freytag (1st floor Ag North) Hartman (3rd floor PSB) Fukushige (4th floor PSB)

Responsibilities: To oversee autoclave maintenance, certification and training in designated areas including required autoclave certifications

Grinding Rooms Committee:

Nelson (chair) Dollarhide Fisher Olson Weinberger

Responsibilities: To oversee maintenance of grinding mills and grinding rooms plus review safety issues and provide training

Greenhouse Committee:

Barrett (chair) Connelley Dinkins (FAPRU) Haramoto Kawashima Martinez Rhodus

Responsibilities: Coordinate greenhouse space assignments, develop facility recommendations, and publicize UK CA greenhouse safety web page

Emergency Response:

Venard (chair) Hildebrand King Law Omielan Rhodes Unrine

Responsibilities: Review Building Emergency Action Plans for AGN, PSB, Spindletop farm. Keep emergency response information up-to-date on the department's web site and in the building locations where we work.

Coordinators of Specific Areas:

Analytical Lab – Matocha and Crutchfield
Computer Labs and Equipment –Lauer and Singleton
Seedhouse – Kenimer
Soils Radioisotope and Molecular Biology Labs – D'Angelo
Graduate Student, Post-Doc, and Visitor Housing:
AG North 1st Floor – Coyne
AG North 2nd Floor - McCulley
PSB 3rd Floor – Hunt
PSB 4th Floor – Hildebrand

Commodity/Resource Groups

Corn and Soybean
C. Lee (Co-chair)
Knott (Co-chair)
Functions and membership provided by inter-departmental Corn and Soybean Science Group

Forage
Phillips (Chair)
Aiken
Dinkins
Goff
Green
Kagan
McCulley
Olson
R. Smith
Zhu

Seed
Hunter* (Chair)
Phillips*
Miller*
Van Sanford*
Kawashima
Geneve
C. Lee
Pfeiffer
*Foundation Seed subcommittee

Small Grain
Van Sanford (Co-chair)
Knott (Co-chair)
Functions and membership provided by inter-departmental Wheat Science Group

Soil
Coyne (Chair)
D'Angelo
Bertsch
Grove
Karathanasis
B. Lee
Matocha
McGrath
McNear
Pearce
Ritchey
Sikora
Unrine
Wendroth

Tobacco
Pearce (Co-chair)
Miller (Co-chair)
Functions and membership provided by inter-departmental Tobacco Technology Task Force

Turf
Munshaw (Chair)
Barrett
Green
Phillips
Potter
Vincelli
Cropper

Water/Environment
B. Lee (Chair)
Bertsch
Ritchey
Tsyusko
D'Angelo
Karathanasis
Unrine
McCulley
Ren
McGrath

Weed
Green (Chair)
Barrett
Slack
C. Lee
Haramoto
Knott
Baile

Group Chairs may add other names and are encouraged to involve faculty from other departments as appropriate.
Responsibilities:

1. To identify research and other needs to address and solve producer problems.
2. To encourage individuals and groups to fulfill the identified needs.
3. To annually review and update production recommendations as appropriate.
4. To continually review the department's technical publications related to the commodity (Fact Sheets, Leaflets, Progress Reports, etc.) and to recommend or to assign responsibilities for preparation or revision of publications.
5. To advise the chair of needs in the commodity or resource area.
6. The Seed Commodity Committee will make recommendations concerning variety release and certification. The Foundation Seed sub-committee will provide oversight to the Foundation Seed Project and advise the Manager and Chair about FSP operations.

Appendix D. Plant and Soil Sciences Implementation Plan Reports responding to recommendations from the 2011-2012 program review

Department of Plant and Soil Sciences

2013-2014 Implementation Plan Report

Recommendation 1 – The department should develop a strategic planning process that would foster engagement with larger, longer-term issues in order to have guidelines for making the more immediate decisions on where to invest their resources.

Assessment method: Determine whether planning has begun

Results: Planning has begun; the advisory committee has suggested metrics to use for measuring department progress and has suggested potential targets for the next strategic plan.

Analysis of results and reflection: The metrics plan has been discussed by the faculty and has returned to the advisory committee for re-evaluation.

Ongoing improvement actions: The potential targets in a strategic plan will be discussed at the January 2015 faculty meeting.

Recommendation 2 – The entire Department needs to discuss and resolve several major issues facing the Department. The College of Agriculture and the Department of PSS are getting smaller – what areas and/or responsibilities will be given up? Examples of the long-range type of issues that need to be discussed include the undergraduate HPLS curriculum, research foci within the Department given reduced number of faculty, and extension foci – given reduction in Extension FTEs. The review committee suggests that the new IPSS graduate program might serve as a mechanism to integrate the various sub-disciplines (crops, soils, and plant biology) within the Department.

Assessment method: Create the next five-year strategic plan

Results: The potential targets in a strategic plant have been proposed by the advisory committee. We have engaged in much discussion of the HPLS program. A Modern Agronomic Crop Production individualized curriculum has been established.

Analysis of results and reflection: Discussions of undergraduate programs have proceeded most quickly because the metrics for tuition division seem the most stable in the budget model proposals.

Ongoing improvement actions: Tie department discussions to the progress in creating the metrics for the budget model.

Recommendation 3 – As part of the above process and discussions (1 and 2 above), the department should develop interdisciplinary research clusters encompassing both research and extension faculty focused on strengths, and informally or formally designate these clusters as areas of research foci that can be used to recruit graduate students.

Assessment method: Count research clusters which recruit graduate students. Analyze GRE scores of students accepted for assistantships.

Results: A forage interest group and a rhizosphere interest group meet monthly. Two graduate students are being co-advised by an extension specialist at Princeton and a soil science researcher at Lexington. One of these is funded by an external grant. GRE scores of students in the IPSS program have not increased yet.

Analysis of results and reflection: We are trying to enhance graduate student quality by providing departmental funding for assistantships to those applicants with the highest GRE scores. The scores of our applicants have not changed; so as we maintain the same number of graduate students on research assistantships, their overall quality measured by GRE scores has not changed.

Ongoing improvement actions: The department is now trying to encourage the specific recruiting of graduate students by promising assistantships to a program one year ahead of enrollment and charging the faculty member with recruiting a high quality student.

Recommendation 4 – The department should establish a committee to examine combining all seminar series into one Departmental seminar series to enhance integration within the Department.

Assessment method: Count the activities established to enhance the graduate program.

Results: The seminar committee was established, one departmental seminar series was established, a graduate student symposium has been held three times each year,

$5000 was allocated to fund external seminar speakers. Funding for the Graduate Program Outstanding Alumnus award and program was continued.

Analysis of results and reflection: Attendance at departmental seminars has increased, particularly among graduate students. Graduate student participation in the Graduate Student Symposia is strong. The symposia have promoted camaraderie among graduate students with different research interests. Graduate students have assumed responsibility for identifying, inviting and hosting seminar speakers during 2013-2014.

Ongoing improvement actions: Continue promoting and improving the graduate student symposia.

Recommendation 5 – The faculty and staff should discuss and develop departmental guidelines to facilitate professional development for staff, and to recognize contributions of technical staff to patents and publications.

Assessment method: Note the number of times staff development in on the agenda for our semi-annual staff meetings.

Results: Staff development was discussed once in 2013, and was not discussed in 2014.

Analysis of results and reflection: This improvement action has been forgotten and needs to be moved back to active consideration.

Ongoing improvement actions: The chair will reinitiate discussions with faculty and staff to increase professional development and recognize technical staff contributions to patents and publications.

Recommendation 6 – The review committee strongly recommends that the graduate students re-establish the graduate student organization and include faculty advisors in this organization.

Assessment method: Note leadership of the graduate student organization

Results: David Van Sanford was appointed faculty advisor for the group. The group was active in 2013-2014 under the leadership of PhD student John Orlovsky.

Analysis of results and reflection: Participation depends on the interests of the graduate students. The department has provided resources for student activities and promotes graduate student activities on the department's Facebook page.

Ongoing improvement actions: The department will continue to support and encourage the participation of graduate students in the graduate student organization.

Department of Plant and Soil Sciences

2014-2015 Implementation Plan Report

Recommendation 1 - The department should develop a strategic planning process that would foster engagement with larger, longer-term issues in order to have guidelines for making the more immediate decisions on where to invest their resources.

Assessment method: Determine whether planning has begun

Results: Planning has begun; the advisory committee suggested metrics to use for measuring department progress and has suggested potential targets for the next strategic plan. The metrics plan was fully discussed by the faculty at the August 2014 faculty meeting and returned to the advisory committee for re-evaluation.

Analysis of results and reflection: Most of our metrics were focused on defining our department in light of a strict metrics based budget model. As the budget model has changed away from a strict metrics based model, the department will revisit the metrics to create accomplishment based metrics that fit our department goals.

Ongoing improvement actions: The potential new metrics for a strategic plan will be discussed at the January 2016 faculty meeting.

Recommendation 2 - The entire Department needs to discuss and resolve several major issues facing the Department. The College of Agriculture and the Department of PSS are getting smaller – what areas and/or responsibilities will be given up?

Examples of the long-range type of issues that need to be discussed include the undergraduate HPLS curriculum, research foci within the Department given reduced number of faculty, extension foci given reduction in Extension FTEs. The review committee suggests that the new IPSS graduate program might serve as a mechanism to integrate the various sub-disciplines (crops, soils, and plant biology) within the Department.

Assessment method: Create the next five-year strategic plan

Results: The potential targets in a strategic plan have been proposed by the advisory committee. We have held much discussion of the HPLS program. A Modern Agronomic Crop Production individualized curriculum has been established. A recruiting position was created and filled to recruit HPLS students. The department, influenced by state stakeholder groups, will maintain as broad an array of extension specialist programs as possible.

Analysis of results and reflection: Discussions of undergraduate programs have proceeded most quickly because our direct costs associated with those programs are lower than the costs associated with the extension and research programs, and the budget model was focused on tuition division. With the reduction in emphasis on a metrics driven budget model, our strategic planning focus will change.

Ongoing improvement actions: The department discussions will focus on exploring new or continued faculty hiring needs. This will continue our discussions of research and extension foci in the department.

Recommendation 3 - As part of the above process and discussions (1 and 2 above), the department should develop interdisciplinary research clusters encompassing both research and extension faculty focused on strengths, and informally or formally designate these clusters as areas of research foci that can be used to recruit graduate students.

Assessment method: Count research clusters which recruit graduate students. Analyze GRE scores of students accepted for assistantships.

Results: A forage interest group and a rhizosphere interest group meet monthly. A grain crops interest group meets weekly. Two graduate students are being co-advised by a grain crops extension specialist at Princeton and a soil science researcher at Lexington. One of these is funded by an external grant. One graduate student is being co-advised by the tobacco extension specialist at Princeton. This student received a graduate school fellowship. GRE scores of students in the IPSS program have increased slightly.

Mean percentile rank of IPSS students with GRE scores			
	Fall 2012 n-13	Fall 2013 n-17	Fall 2014 n-16
GRE verbal rank	42	45	50
GRE quantitative rank	39	43	47

Analysis of results and reflection: We are trying to enhance graduate student quality by providing departmental funding for assistantships to those applicants with the highest GRE scores. As we turnover about 25% of our students each year, the scores of our applicants have changed slightly.

Ongoing improvement actions: The Department is now encouraging specific recruiting of graduate students by promising assistantships to a program one year ahead of enrollment and charging the faculty member with recruiting a high quality student. Two graduate students have been recruited under this plan.

Recommendation 4 - The department should establish a committee to examine combining all seminar series into one departmental seminar series to enhance integration within the Department.

Assessment method: Count the activities established to enhance the graduate program.

Results: The seminar committee was established, one departmental seminar series was established, a graduate student symposium has been held three times each year, and

$5,000 was allocated to fund external seminar speakers. The Department continues to fund the Graduate Program Outstanding Alumnus program and award and to select the Peaslee Outstanding Graduate Student Award each year.

Analysis of results and reflection: This recommendation has been successfully implemented. Attendance at departmental seminars has increased, particularly among graduate students. Graduate student participation in the Graduate Student Symposia is strong. The symposia have promoted camaraderie among graduate students with different research interests. Graduate students have assumed responsibility for identifying, inviting, and hosting seminar speakers during 2014-2015.

Ongoing improvement actions: Continue promoting and improving the graduate student symposia.

Recommendation 5 - The faculty and staff should discuss and develop departmental guidelines to facilitate professional development for staff, and to recognize contributions of technical staff to patents and publications.

Assessment method: Note the number of times staff development is on the agenda for our semi-annual staff meetings.

Results: Staff development was discussed once in 2013-4 and was not discussed in 2014-5.

Analysis of results and reflection: This improvement action has been forgotten. It has not been suggested as an agenda topic by staff for any of our staff meetings the past two years. If it is to move back to active consideration, that will need to come from the department chair.

Ongoing improvement actions: None current

Recommendation 6 - The review committee strongly recommends that the graduate students re-establish the graduate student organization and include faculty advisors in this organization.

Assessment method: Note leadership of the graduate student organization

Results: David Van Sanford was appointed faculty advisor for the group. The group was active in 2014-2015 under the leadership of MS student Gary Gregg and PhD student Mizuki Tateno.

Analysis of results and reflection: Participation depends on the interests of the graduate students. The department has provided resources for student activities and promotes graduate student activities on the department's Facebook page.

Ongoing improvement actions: Encourage the PSS GSA to choose leaders during each fall semester.

Department of Plant and Soil Sciences

2015-2016 Implementation Plan Report

Recommendation 1 - The department should develop a strategic planning process that would foster engagement with larger, longer-term issues in order to have guidelines for making the more immediate decisions on where to invest their resources.

Assessment method: Determine whether planning has begun

Results: Planning has begun; the advisory committee suggested metrics to use for measuring department progress and has suggested potential targets for the next strategic plan. The metrics plan was fully discussed by the faculty and returned to the advisory committee for re-evaluation. It was recommended that we concentrate on our next periodic review (2017-2018) before returning to writing a strategic plan.

Analysis of results and reflection: Most of our metrics were focused on defining our department in light of a strict metrics based budget model. As the budget model has changed away from a strict metrics based model, the department will revisit the metrics to create accomplishment based metrics that fit our department goals.

Ongoing improvement actions: We have begun work on our self-study document for our 2017-2018 periodic program review.

Recommendation 2 - The entire Department needs to discuss and resolve several major issues facing the Department. The College of Agriculture and the Department of PSS are getting smaller – what areas and/or responsibilities will be given up?

Examples of the long-range type of issues that need to be discussed include the undergraduate HPLS curriculum, research foci within the Department given reduced number of faculty, extension foci given reduction in Extension FTEs. The review committee suggests that the new IPSS graduate program might serve as a mechanism to integrate the various sub-disciplines (crops, soils, and plant biology) within the Department.

Assessment method: Create the next five-year strategic plan

Results: The potential targets in a strategic plan have been proposed by the advisory committee. We have held much discussion of the HPLS program. A Modern Agronomic Crop Production individualized curriculum has been established. A recruiting position was created and filled to recruit HPLS students. The department, influenced by state stakeholder groups, will maintain as broad an array of extension specialist programs as possible.

Analysis of results and reflection: Discussions of undergraduate programs have proceeded most quickly because our direct costs associated with those programs are lower than the costs associated with the extension and research programs, and the budget model was focused on tuition division. With the reduction in emphasis on a metrics driven budget model, our strategic planning focus will change.

Ongoing improvement actions: The department discussions will focus on exploring new or continued faculty hiring needs. These were discussed at the January and August 2016 faculty meetings. This continues our discussions of research foci in the department. It was recommended that we concentrate on our next periodic review (2017-2018) before returning to writing a strategic plan.

Recommendation 3 - As part of the above process and discussions (1 and 2 above), the department should develop interdisciplinary research clusters encompassing both research and extension faculty focused on strengths, and informally or formally designate these clusters as areas of research foci that can be used to recruit graduate students.

Assessment method: Count research clusters which recruit graduate students. Analyze GRE scores of students accepted for assistantships.

Results: A forage interest group and a rhizosphere interest group meet monthly. A grain crops interest group meets weekly. Two graduate students are being co-advised by a grain crops extension specialist at Princeton and two soil science researchers at Lexington. One of these is funded by an external grant. One graduate student is being co-advised by the tobacco extension specialist at Princeton. This student received a graduate fellowship. Two students conducting research on industrial hemp are co-advised by a crop scientist and a plant biochemist. GRE scores of students in the IPSS

program have increased slightly through Fall 2014, but the data for Fall 2015 are no longer available to me on the Graduate School web site.

Mean percentile rank of IPSS students with GRE scores			
	Fall 2012 n-13	Fall 2013 n-17	Fall 2014 n-16
GRE verbal rank	42	45	50
GRE quantitative rank	39	43	47

Analysis of results and reflection: We are trying to enhance graduate student quality by providing departmental funding for assistantships to those applicants with the highest GRE scores. As we turnover about 25% of our students each year, the scores of our applicants have changed slightly.

Ongoing improvement actions: The Department is now encouraging specific recruiting of graduate students by promising assistantships to a program one year ahead of enrollment and charging the faculty member with recruiting a high quality student. Four graduate students have been recruited under this plan; two are Ph.D. candidates, one is an M.S. student, and one M.S. student has withdrawn.

Recommendation 4 - The department should establish a committee to examine combining all seminar series into one departmental seminar series to enhance integration within the Department.

Assessment method: Count the activities established to enhance the graduate program.

Results: The seminar committee was established, one departmental seminar series was established, a graduate student symposium has been held three times each year, and $5,000 was allocated to fund external seminar speakers. The Department continues to fund the Graduate Program Outstanding Alumnus program and award and to select the Peaslee Outstanding Graduate Student Award each year.

Analysis of results and reflection: This recommendation has been successfully implemented. Attendance at departmental seminars has increased, particularly among graduate students. Graduate student participation in the Graduate Student Symposia is

strong. The symposia have promoted camaraderie among graduate students with different research interests. Graduate students have assumed responsibility for identifying, inviting, and hosting seminar speakers during 2014-2016.

Ongoing improvement actions: Continue promoting and improving the graduate student symposia.

Recommendation 5 - The faculty and staff should discuss and develop departmental guidelines to facilitate professional development for staff, and to recognize contributions of technical staff to patents and publications.

Assessment method: Note the number of times staff development is on the agenda for our semi-annual staff meetings.

Results: Staff development was discussed once in 2013-14 and was not discussed in 2014-15 or 2015-16. The department created a staff recognition plaque with recognition going back to 1998. The department shows a staff service award ppt slide show each year at a staff meeting and at a faculty meeting to recognize staff receiving service awards.

Analysis of results and reflection: This improvement action has been forgotten. It has not been suggested as an agenda topic by staff for any of our staff meetings the past three years. If it is to move back to active consideration, that will need to come from the department chair.

Ongoing improvement actions: None current

Recommendation 6 - The review committee strongly recommends that the graduate students re-establish the graduate student organization and include faculty advisors in this organization.

Assessment method: Note leadership of the graduate student organization

Results: David Van Sanford was appointed faculty advisor for the group. The group has been active since 2012-2013. In 2015-2016 the group was led by Andrea Sanchez Barrios and William Serson.

Analysis of results and reflection: Participation depends on the interests of the graduate students. The department has provided resources for student activities, including a trip in 2016 to visit Monsanto, and promotes graduate student activities on the department's Facebook page.

Ongoing improvement actions: Encourage the PSS GSA to choose leaders during each fall semester.

Appendix E – Faculty Expertise

Part 1. Faculty serving as editor / on editorial boards of scientific journals 2012-2016.

Part 2. Faculty awards and service in national scientific societies 2012-2016

Faculty member	Journal	Years
Baskin, C	Weed Biology and Management	(2010-present)
Baskin, C	Acta Botanica Yunnanica	(2006-2015)
Baskin, C	Plant Diversity	(2016-present)
Baskin, C	Seed Science Research	(2003-present)
Coyne, M	Applied Soil Ecology	(2005 – present)
Coyne, M	Pedosphere	(2014 – present)
Coyne, M	Egyptian Journal of Microbiology	(2010 – present)
Hildebrand, D	J. American Oil Chemist Society	(2012 – 2016)
Hildebrand, D	J. Biotech & Biocatalysis	(2012 – 2016)
Lee, B	Soil Science Society of America Journal	(2008-2013)
Matocha, C	Soil Science Society of America Journal	(2011-2016)
McCulley, R	Ecology/Ecological Monographs	(2016 – present)
McCulley, R	Journal of Ecology	(2015 – present)
McCulley, R	New Phytologist	(2009 – present)
McGrath, J	Soil Science Society of America Journal	(2013 – present)
McGrath, J	Agronomy Journal	(2012 – 2013)
Ren, W	Journal of Advances in Modeling Earth Systems	2016
Ren, W	Agricultural and Forest Meteorology	2016
Teutsch, C	Forage and Grazinglands	(2012-2015)
Tsyusko, O	Frontiers in Toxicogenomics	(2013 – present)
Unrine, J	Environmental Toxicology and Chemistry	(2014-2016)
Unrine, J	Environmental Science: Nano	(2014-2016)
Unrine, J	Environmental Chemistry	(2012-2016)

Unrine, J	Frontiers in Toxicogenomics	(2012-2016)
Wendroth, O	Soil & Tillage Research	(2013-present)
Wendroth, O	Geoderma	(2013-present)
Wendroth, O	Soil Science Society of America Journal	(2008-2014)
Wendroth, O	Journal of Plant Nutrition and Soil Science	(2000-present)
Wendroth, O	Agriculture	(2011-present)
Williams, D	Applied Turfgrass Science	(2004-2014)
Yuan, L	Planta	current
Yuan, L	Scientific Reports	current
Yuan, L	Frontiers in Plant Sciences	current

Faculty member	Society	Service	Award
Bailey, A	CORESTA (international society for tobacco research)	Chair, sub-group TSNA in air- and fire-cured tobacco, 2007-2015 Weed control section coordinator, sub-group IPM, 2006-present Cooperator, sub-group agrochemical residue field trials, 2012-present	CORESTA Bronze Medal, 2014
Bailey, A	Tobacco Workers Conference (national society for tobacco research)	TWC Conference Chair, 2016 TWC Program Committee, Chair Agronomy, 2014 TWC Program Committee, Vice-chair Agronomy, 2012	
Barrett, M	Weed Science Society of America	Elected Vice-President for the Weed Science Society of America – 2009 (served as President in 2011-2012), served as Past-President 2012-2013.	WSSA Public Service Award. 2017.

Baskin, C			Tianshan Award from the Chairman (Governor) of Xinjiang Provincial Government (China) for contributions of foreign experts to the economic and social welfare of Xinjiang September 2012
Baskin, C			Thomas Poe Cooper Research Award, UK CAFE March 2012
Baskin, C			Weed Science Society of America Honorary Award for meritorious service to the field of weed science, February 2012
Green, J	North Central Weed Science Society	President 2014	
Grove, J	Soil Science Society of America	SSSA Board Member 2016-2019	
Haramoto, E	Southern Cover Crops Council	Secretary 2017	
Knott, C	American Society of Agronomy	Vice-Chair of Applied Soybean Research Community 2016-2017	
Matocha, C	Soil Science Society of America	Soil Mineralogy Division Chair, 2012	
McGrath, J	Nutrient Management and Soil and Plant Analysis Division, Soil Science Society of America	Past Chair (2016) Chair (2015) Chair Elect (2014)	
McGrath, J	Adaptive Nutrient Management Community, American Society of Agronomy	Vice Chair (2012-2014)	

McGrath, J	North American Proficiency Testing (NAPT)	Program Board (2015)	
McGrath, J	American Society of Agronomy	President's Membership Task Force (2014 – 2016)	
McGrath, J	ACS 237	Membership and Identity Committee (2012 – 2014)	
Munshaw , G	Crop Science Society of America	Extension awards committee and chair	
Munshaw, G	Crop Science Society of America	Div. C5 extension committee and chair	
Murdock, L	UK PSS 2013		Distinguished lecture in No- Till Agriculture
Murdock, L	National No-tillage Conference 2016		Research and Education No-Till Innovator Award
Murdock, L	National Assn of Agriculture Agents 2016		Service to American/ World Agriculture Award.
Pfeiffer, T	Crop Science Society of America	Crop Science Teaching Award committee/chair	
Pfeiffer, T	American Society of Agronomy	United Soybean Fellowship committee, ASA Fellow committee	
Ren, W	Ecological Society of America 2016	Conference/session Chair	
Ren, W	Ecological Society of America Asian Ecology Section, 2012		Early Career Ecologist Award, 2012
Ren, W	Sino-Ecologists Association Overseas (Sino-Eco), 2012	Secretary and Treasurer	Appreciation Award for Outstanding Service to Sino-Eco
Ritchey, E	American Society of Agronomy	ACS237 – Membership and Identity Committee (2015-2017)	

Ritchey, E	Tri Societies, in collaboration with NRCS, and Strategic Conservation Solutions	Conservation Innovation Grants Assessment Project (2013)	
Smith, R	American Forage and Grassland Council	President 2014	Medallion Award, Highest Award, 2013.
Smith, R	International Grassland Congress	Chair Continuing Committee 2015-2020	
Smith, R	American Forage and Grassland Council	Co-Chair Program Planning Committee 2017	
Teutsch, C	Crop Science Society of America	Chair of the Robert F Barnes Graduate Student Competition in 2012	
Teutsch, C	Crop Science Society of America	Immediate Past Chair of Forage and Grazinglands Division (C-6) in 2012	
Teutsch, C	Forage Foundation	Board of Directors, 2012-2015	
Teutsch, C	American Forage and Grassland Council	Board of Directors, 2007-2014	
Teutsch, C	American Forage and Grassland Council	Co-Chair Program Planning Committee in 2015-16	Merit Award in 2014
Teutsch, C	American Forage and Grassland Council	Co-Chair Program Planning Committee in 2016-17	Medallion Award in 2015
Tsyusko, O	SETAC - Society of Environmental Toxicology and Chemistry - 2014	Nanotechnology Advisory Group Chair	
Unrine, J	Society of Environmental Toxicology and Chemistry	Nanotechnology Advisory Group Chair	
Wendroth, O	Soil Science Society of America		Outstanding reviewer award for Vadose Zone Journal 2014
Wendroth, O	Soil Science Society of America		Outstanding Associate Editor Award SSSAJ 2012

Appendix F. Historical review of faculty size for the Department of Plant and Soil Sciences (formerly Department of Agronomy) 1964 – 2016.

Faculty size (rounded to nearest whole number) for the Department of Agronomy 1964-1977 from 1978 department review, Table 12. Extension faculty were not listed in table 12 from that review. The 1977 extension faculty number was obtained by counting.

Year	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Adjunct	5	7	8	9	8	7	6	6	6	6	6	6	5	6
Extension														9
Research/Instruction	19	21	28	32	21	21	20	20	29	29	28	28	27	28
Total	24	28	36	41	39	38	36	36	35	35	34	34	32	43

Faculty size in the Department of Agronomy (1964-1992). The extension numbers include extension specialists with MS degrees (for example in 1977 in the table above the department had 9 PhD extension faculty and 5 MS extension specialists) but the research/instruction numbers do not include research specialists with MS degrees. The 1990-91 numbers and the 1992-93 numbers come from the 1993 department review page 13-15. By 1990 all extension faculty had PhD degrees.

Year	1964-65	1969-70	1974-75	1979-80	1985-86	1990-91	1992-93
Adjunct	5	7	6	6	6	6	5
Extension	8	13	15	15	17	15	15
Research/Instruction	19	21*	28	30	35	29	32
Total	32	41*	49	51	58	49	52

*Corrected from typographical error in the original review document

Faculty size for the Department of Plant and Soil Sciences 1997-2017. A faculty member who was 100% administration outside the department was not counted. A faculty member with any percentage of extension/instruction/research DOE in the department was counted. So these numbers indicate faculty member count, not faculty FTE. Post-retirement appointments are not reflected in the numbers.

Year*	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Adjunct	1	1	1	1	1	1	1	3	4	5	5	5	5	5	4
Extension	15	15	15	15	14	15	14	15	14	14	11	11	11	11	10
Research/ Instruction	33	30	29	36	30	32	34	34	35	35	33	32	33	31	31
Research title						1	1					1	2	2	3
Total	49	46	45	52	45	49	50	52	53	54	49	49	51	49	48
UK funded	48	45	44	51	44	47	48	49	49	49	44	43	44	42	41

Faculty size for the Department of Plant and Soil Sciences 1997-2017 - continued.

Year*	2012	2013	2014	2015	2016	2017									
Adjunct	6	9	8	6	9	9									
Extension	10	10	12	12	11	14									
Research/Instruction	28	28	28	30	31	28									
Research title	3	1	1	1	1	1									
Total	47	49	49	49	52	52									
UK funded	38	38	38	38	38	40									
Open			3	2	3	2									
* July 1, XXXX															

Appendix G. Courses offered in the three programs (ABT, NRE, and PLS) in which PSS faculty members teach or team-teach (2016-2017 and 2017-2018 academic years).

Program/Course	Course Title	Credits	Instructor	Offered
Agricultural Biotechnology Program				
ABT 101	INTRODUCTION TO BIOTECHNOLOGY	1		F
ABT 120	GENETICS AND SOCIETY	3		S
ABT 201	SCIENTIFIC METHOD IN BIOTECHNOLOGY	1	Perry	F
ABT 301	WRITING & PRESENTATION IN THE LIFE SCI	2	Yuan	F, S
ABT 360	GENETICS	3		F
ABT 395	INDEPENDENT STUDY IN BIOTECHNOLOGY	1-4	Multiple	F, S
ABT 399	EXPERIENTIAL LEARNING IN BIOTECHNOLOGY	1-6	Multiple	F, S
ABT 460	INTRODUCTION TO MOLECULAR GENETICS	3	Moe	S
ABT 461	INTRODUCTION TO POPULATION GENETICS	3		S
ABT 495	EXPERIMENTAL METHODS IN BIOTECHNOLOGY	4	Moe/Kawashima/ Hunt	F,S
Natural Resources and Environmental Science Program				
NRE 201	NATURAL RESOURCES AND ENVIRONMENTAL SCIENCE	3	McCulley	F
NRE 320	NATURAL RESOURCE AND ENVIRONMENTAL ANALYSIS	3	Multiple	Summer
NRE 455G	WETLAND DELINEATION	3	Karathanasis	F even yr
NRE 470G (cross listed with PLS)	SOIL NUTRIENT MANAGEMENT	3	Grove/McGrath	S

Horticulture, Plant, and Soil Sciences Program				
PLS 103	PLANTS,SOILS&PEOPLE: A GLOBALPERSPECTIVE	3	Multiple	F,S
PLS 104	PLANTS,SOILS&PEOPLE: A SCIENCE PERSPECTIVE	3	D'Angelo, Phillips	F,S
PLS 210	THE LIFE PROCESSES OF PLANTS	3	Baskin, Smalle	F
PLS 220	INTRODUCTION TO PLANT IDENTIFICATION	3	Phillips	F
PLS 366	FUNDAMENTALS OF SOIL SCIENCE	4	McNear, Matocha	F,S
PLS 389	WINE APPRECIATION	3	Barrett	F,S
PLS 395	SPECIAL PROBLEMS IN PLS	1-4	Multiple	F,S
PLS 396	SOIL JUDGING	1-2	Karathanasis	F
PLS 399	EXPER LEARNING IN PLANT AND SOIL SCIENCE	1-6	Williams, Dangelo,	F,S
PLS 404	INTEGRATED WEED MANAGEMT	4	Haramoto	S
PLS 406	ADVANCED SOIL JUDGING	1	Karathanasis	S
PLS 408	TOBACCO	3	Pearce	F even
PLS 412	GRAIN CROPS	3	Lee, C.	S
PLS 455G	WETLAND DELINEATION	3	Karathanasis	F even
PLS 468G	SOIL USE & MANAGEMENT	3	Coyne, Wendroth	F
PLS 470G	SOIL NUTRIENT MANAGEMENT	3	McGrath, Grove	S
PLS 490	TOPICS IN PLANT AND SOIL SCIENCE	3	Haramoto	S
PLS 502	ECOLOGY-ECONOMIC PLANTS	3	Salmeron	F odd yr
PLS 510	FORAGE MANAGEMENT AND UTILIZATION	3	Goff	S
PLS 514	GRASS TAXONOMY AND ID	3	Phillips	S
PLS 515	TURF MANAGEMENT	3	Munshaw	F
PLS 531	FIELD SCHOOLS IN CROP PEST MANAGEMENT	2	Haramoto	F
PLS 566	SOIL MICROBIOLOGY	3	Coyne	S
PLS 567	METHODS IN SOIL MICROBIOLOGY	1	Coyne	S
PLS 573	SOIL MORPHOLOGY & CLASS	3	Karathanasis	F
PLS 575	SOIL PHYSICS	3	Wendroth	F
PLS 576	LAB IN SOIL PHYSICS	1	Wendroth	F
PLS 597	SP TOPICS IN PLANT & SOIL SCI	1-4	Multiple	F, S

PLS 602	PRIN OF YIELD PHYSIOLOGY	3	Salmeron	S odd yr
PLS 609	PLANT BIOCHEMISTRY	3	Hildebrand, Yuan	S
PLS 615	ADVANCED PLANT GENETICS & GENOMICS	3	Zhu	S
PLS 620	PLANT MOLECULAR BIOLOGY	3	Hunt	F
PLS 622	PHYSIOLOGY OF PLANTS I	3	Perry	F
PLS 623	PHYSIOLOGY OF PLANTS II	3	Smalle	S
PLS 642	BIOSYNTHESIS OF NATURAL PRODUCTS	3	Multiple	F
PLS 650	SOIL-PLANT RELATIONSHIPS	3		F
PLS 655	SPATIAL AND TEMPORAL STATISTICS	3	Wendroth	F even
PLS 657	SEED BIOLOGY	3	Perry	S
PLS 660	ADVANCED SOIL BIOLOGY	2	Coyne	F even
PLS 664	PLANT BREEDING I	3	VanSanford	S
PLS 671	SOIL CHEMISTRY	4	Matocha	F even
PLS 676	QUANT INHER IN PLANT POP	3	VanSanford	S
PLS 697	SP TOPICS IN PLANT & SOIL SCI	1-4	Multiple	F, S
PLS 712	ADVANCED SOIL FERTILITY	4	Grove	F
PLS 741	CLAY MINERALOGY	3	Matocha	S
PLS 772	PLANT AND SOIL SCIENCE SEMINARS	1	Multiple	F, S
IPS 610	INTEGRATED TRANS-DISCIPLINARY RESEARCH	2	Van Sanford, Coyne	F
IPS 625	INTEGRATED TRANS-DISCIPLINARY COMMUNICATIONS	1	Van Sanford, Coyne	F

Appendix H. Assessment forms for graduate programs in PSS.

Annual Assessment of Progress and Development for Graduate Students in IPSS
(Due: 30 March 2017)

Page 1 – Program Details (Completed by Student)
Summary Year: 2016-17
Student Name: _____

Date of Start of Graduate Program: _____

Cumulative GPA: _____

Research area/thesis or dissertation title:

Advisory Committee: Date submitted to Graduate School: _____

Member	Option Area	Status (Full/Assoc)	Department
Chair:			

**See Guide to Graduate Studies for committee composition and option area*

Date of most recent advisory committee meeting: _____

Page 2 - Program Milestones (completed by student)

(Leave milestone blank if not applicable or completed)

Milestone	Year-Semester
Started program	
Graduate Level Statistics Course	
Enrolled in IPS 610	
Enrolled in IPS 625	
Enrolled in PLS 772	
Outlined program of study	
Formed advisory committee (formal or *ad hoc*)	
Drafted research proposal	
Graduate Student Symposium	
Completed required classes	
Scheduled qualifying examination	
Passed qualifying examination	
Applied for graduation	
Scheduled final examination	
Submitted research paper(s)	
Scheduled Exit Seminar	

Page 3 – Program Assessment- (Completed by Advisor)

Summary of Annual Progress (completed by advisor or co-advisor) – Check Appropriate Rating for Each Outcome

Outcome	Lagging (1)	Progressing (2)	On track (3)	Advanced (4)
Knowledge				
Skills				
Communication				
Professionalism				

Recommendations/Requirements/Conditions/Censures:

Other issues relevant to progress towards completion of program (e.g. sickness):

Signatures

Advisor/Co-Advisor: _____ Date_____

Student _____ Date_____

DGS: _____ Date_____

DGS Comments:

Due date: **30 March 2017**

Assessment Rubric - Learning Outcome #1: Knowledge

Criteria	Lagging	Progressing	On Track	Advanced
Basic interest in science.	Not interested in science.	Limited interest in science.	Interested in sciences that support field.	Interest in many fields of science.
Knowledge of fields of sciences that contribute to PSSC and CRSC.	Not knowledgeable Inadequate preparation in undergraduate. or graduate courses.	Appropriate at undergraduate but lacking in graduate courses. Probably limited in continuing education	Adequate knowledge from UG and G courses. Would benefit from broader or deeper knowledge of key disciplines.	Excellent comprehension of the fields that encompass PSSC and CRSC.
Knowledge of literature in field	Does not know the literature of the primary journals. Limited to Google search engines.	Familiar with limited number of scientific journals. Weak knowledge of sources outside USA	Familiar with a limited number of relevant journals. Limited international journals.	Knows the primary journals that contribute to the scientific state of the fields that encompass PSS
Knowledge of leading research institutions and leading researchers	Ignorant of leading researchers, groups or institutions.	Familiar with regional but less familiar with USA.	Limited regional, national and international	Familiar with many leading researchers and Institutions in the USA and overseas.
Familiarity with computer technology in the fields of PSS	Computer illiterate.	Limited skills..Able to run software packages under supervision.	Good skills but requires some technical support.	Skilled in application of software in many fields in PSS. Capable of using new software packages
Environmental sciences	Unaware	Limited	Aware	Knowledgeable

Assessment Rubric - Learning Outcome #2: Skills

Criteria	Lagging	Progressing	On Track	Advanced
Quantitative skills	Very limited	Limited skills	Satisfactory	Highly skilled
Laboratory skills general	Inept in lab	Limited to a few routine lab methods	Acceptable skills that should strengthen.	Skilled in current laboratory techniques and instrumentation.
Lab skills in molecular biology	None	Limited to a few routine lab methods	Acceptable skills that should strengthen.	Proficient in techniques and instrumentation,
Field research skills	No interest	Marginal	Adequate	Skilled in present day field research techniques.
Experimental design and analysis	Incapable of designing experiments and in the analysis of data	Limited to data entry and to elementary statistics.	Skilled in the use of at least one stats package and very capable with support of stats consultant	Skilled in design and data analysis. User of SAS and other stats packages
Records &/documentation	Poor	Needs improvement	Adequate	Excellent
Interpretation and critical analysis of research data.	No capacity to interpret and analyze data correctly	Limited ability to analyze and interpret research data.	Capable of interpreting familiar research data but needs help in interpretation.	Highly competent.
Familiarity with sources and capabilities of the internet as	Incapable of using the internet in research	Has some limited internet user skills but Needs	Possesses skills that apply to job with limited	Has good internet skills but does not overuse it. Independent of technical support.

applicable to PSS	applications in PSS.	technical support	technical support.	Not addicted to the internet.

Assessment Rubric –Learning Outcome #3: Communication

Criteria	Lagging	Progressing	On Track	Advanced
Fundamental knowledge of agriculture	Barely familiar with agriculture. Not capable of making a contribution	Limited knowledge of agriculture and application of specific fields to agriculture	Understands agriculture and how to contribute to its development.	Very familiar with agriculture in USA and in the world economy
Originality/innovation	Not likely to be innovative	Some “eureka” potential	Limited innovation in area of specialization. “In the box”	Generates original ideas and concepts. “Out of the box”
Action on ideas	No action likely	Some action	Appropriate action	Acts promptly on ideas
Verbal Communication	Inarticulate	Marginal but will improve slowly with experience	Acceptable but needs to work on presentation skills	Great communicator
Written communication	Marginal unlikely to improve	Marginal may improve	Acceptable will improve	Excellent
Research publications	None	With assistance/supervision	Acceptable minimal supervision	Excellent
Media skills	Few	Requires technical help	Capable of using media as needed	Capable with many media formats
Teaching skills	No potential as college teacher	Limited potential as teacher, may be OK as class or lab TA	Acceptable teacher will improve with experience.	Great teacher candidate in college classes
Grant writing ability	Incapable of writing sound research proposals	Has potential to write sound and successful research proposals as a cooperator and much help from colleagues.	Has potential to write sound and successful research proposals with some assistance from co-investigators	Has potential to write sound research proposals with high probability of success without experienced co-investigators

Assessment Rubric - Learning Outcome #4: Professionalism

Criteria	Lagging	Progressing	On Track	Advanced
Ethics	Some question of ethics.	Marginal	Ethical	Highly ethical
Interpersonal skills	Introverted loner, not a team player, aggressive	Not as extreme but little hope for change	Indications that personality will develop favorably with maturation.	Extroverted gregarious team player aggressive
Attitude and bearing	Makes a bad impression of first contact. No indication of chance of improvement with age and experience.	Indicates some potential for improvement with maturity and experience.	Indicates improvement with maturity and experience.	Makes a very positive impression on first contact that is sustained.
Work habits	Lazy	Not very productive	Productive with moderate output	Dedicated and industrious with high output.
Productivity	Low	Average	Satisfactory	High
Punctuality	Never on time	Fairly punctual	Acceptable punctuality	Punctual
Leadership/mgt potential	No leadership capability	Some leadership ability	Acceptable leadership	Exceptional Spokesperson
Responsibility	Minimal responsibility limited to one's own.	Marginal responsibility	Adequate responsibility	Highly responsible.
Plagiarism	Prone to plagiarism.	Some unintentional plagiarism	Not a problem.	Properly cites others.
Civics	Questionable	OK but needs improvement	Acceptable	Perfect citizen
Maturity	Immature for age	Improving maturity for age.	Age appropriate maturity.	More mature for age
Scientific associations	None and unfamiliar	Familiar no membership	Familiar limited membership	Familiar and multiple memberships

GRADUATE STUDENT PROGRAM ASSESSMENT: 2016-2017

GUIDELINES FOR GRADUATE STUDENT CURRICULUM VITAE
(**Due March 30, 2017**)

Use 1 inch margins all around, 12-point font or more, 5 page maximum, portrait. Use the suggested headings and subheadings. **Include all headings** even if you do not have entries for them. Leave the space below the heading blank if you do not have an entry. New students will have many blank spaces. This is anticipated. You will fill them in as you progress through your program. Include only work completed while you were officially enrolled at UK (except for publications – see below).

NAME

- Current title
- Date appointed or appointed to current position.
- Academic advisor/Research mentor Signature

  _____

RESEARCH

Projects: (list projects on which you have been active during the entire period of your graduate program, or if written notification of approval was received during your graduate program).

Extramural Grants Funded: List investigators, title and sponsor, include years and amounts of funding, indicate whether you are PI, co-PI, or collaborator. Indicate if nationally or regionally competitive and, if you wish, % of submissions funded in the program.

Proposals Submitted: List investigators, title and sponsor, include years and amounts of funding, indicate whether you are PI, co-PI, or collaborator.

TEACHING, ADVISING, and MENTORSHIP

For the entire period of your graduate program, please provide:

A list of courses taught by year and semester, number of students enrolled in each course, and student evaluations for each course if available.

Number of undergraduate students mentored (in any capacity) on research projects, special projects, and other types of individualized activities.

Activities with students outside the classroom including clubs, organizations, and student recruitment.

List of activities to improve teaching and learning. Include workshops attended, professional meetings, symposiums, and any innovative teaching/learning pedagogy implemented.

EXTENSION/OUTREACH

List significant programs, activities, or projects initiated or active during your graduate program to which you contributed. (Activities that are primarily service to the

university or professional societies should be listed under "SERVICE.")

PUBLICATIONS

For non-refereed publications and where space becomes limiting, indicate the number of items published and provide a representative title if space allows.

Refereed journal articles: Earliest to most recent. Give a complete citation. Include only those formally accepted for publication. You may include those articles resulting from research done elsewhere that were accepted or published while you were enrolled as a graduate student at UK.

Extension publications: List numbered series publications, departmental publications, etc. Indicate those that are peer-reviewed.

Books and peer-reviewed book chapters:

Experiment Station bulletins, progress reports:

Other publications: This might include: reports, non-reviewed publications of symposia or proceedings, unnumbered newsletters, electronic formats, etc.

Abstracts:

Publications in review: List only if submitted for external review. Do not list manuscripts in preparation. Include all publication types here. Indicate journal or extension outlet, and in parentheses, date submitted.

OTHER DOCUMENTED ACCOMPLISHMENTS AND CONTRIBUTIONS

(e.g. Varieties and germplasm released: Patents: Computer programs: Videos, Slide Sets: Satellite Programs, Internet Resources: Add other headings as appropriate.)

M**EETINGS, PRESENTATIONS, CONSULTATIONS, ETC.**

Use for extension or research presentations/meetings not documented elsewhere, for example: seminars, workshops, consulting. Distinguish between those meetings in which you presented an oral vs. a poster presentation.

SERVICE AND RECOGNITION

Outreach: Public service as a professional, which is not covered under "EXTENSION."

Awards and honors: List with year received with a separate line for each. Include editorships, review panels, reviewer service, etc. Distinguish between internal (UK) and external awards.

Invited lectures, speeches: Out-of-state or highly significant in-state may be listed here. Field day talks, for example, should be under "Meetings, ..."

Committees, elected positions, office held: Include department, university, national level, commodity groups, state-wide and multi-institutional committees.

PROFESSIONAL DEVELOPMENT

Professional meetings attended, in-service training, professional societies joined.
Certifications received
Student organizations

101 WORD THESIS/DISSERTATION SUMMARY

Provide a 101 word, or fewer, summary describing your research and potential benefits deriving from it.

Below the summary, indicate one of the following:

"I do/do not give permission for my summary and accompanying picture to be featured in Websites associated with departments participating in my graduate program."

NARRATIVE STATEMENTS

Use 1 inch margins all around, 12 point font or larger. You are permitted up to two pages maximum to cover all areas (research, teaching, and extension/outreach). The narrative should be used to put your activities into context. The narrative should include objectives or directions of your study. (What have you learned; what educational and professional choices have you made; what is it all adding up to?) Your accomplishments should be highlighted. Realized impact or projected impact of your work for the benefit of the public should be delineated. Future plans should be touched upon.

Appendix I. Research publications with graduate student authors 2012-2016.

Student	Degree	Program	Degree Year	Publication citation	Year Published
An, Ran	PHD	SOSC	2016	An, R., and L. A. Moe. (2016) Regulation of pyrroloquinoline quinone-dependent glucose dehydrogenase activity in the model rhizosphere-dwelling bacterium pseudomonas putida kt2440. Applied and Environmental Microbiology 82(16):4955-4964. DOI: 10.1128/aem.00813-16.	2016
Bell, Stephen	PHD	PLPH	2014	Bell*, S. A., C. Shen, A. Brown, and A. G. Hunt. (2016) Experimental genome-wide determination of rna polyadenylation in chlamydomonas reinhardtii. Plos One 11(1). DOI: 10.1371/journal.pone.0146107.	2016
Bourguignon, Marie	MS	PSSC	2013	Bourguignon, M., K. Moore, A. Lenssen, S. Archontoulis, B. Goff, and B. Baldwin. (2016) Kenaf productivity and morphology, when grown in Iowa and in Kentucky. Industrial Crops and Products 94:596-609. DOI: 10.1016/j.indcrop.2016.09.044.	2016
Bussard, Jessica	MS	CRSC	2012	Klotz, J. L., G. E. Aiken, *J. R. Bussard, A. P. Foote, D. L. Harmon, B. M. Goff, F. N. Schrick, and J. R. Strickland. (2016) Vasoactivity and vasoconstriction changes in cattle related to time off toxic endophyte-infected tall fescue. Toxins 8(10). DOI: 10.3390/toxins8100271.	2016
Cai, Bin	PHD	PLPH	2012	Cai, B., H. H. Ji, F. F. Fannin, and L. P. Bush. (2016) Contribution of nicotine and nornicotine toward the production of n'-nitrosonornicotine in air-cured tobacco (nicotiana tabacum). Journal of Natural Products 79(4):754-759. DOI: 10.1021/acs.jnatprod.5b00678.	2016

Starnes, Daniel	PHD	IPSS	2016	Collin, B., O. V. Tsyusko, *D. L. Starnes, and J. M. Unrine. (2016) Effect of natural organic matter on dissolution and toxicity of sulfidized silver nanoparticles to caenorhabditis elegans. Environmental Science-Nano 3(4):728-736. DOI: 10.1039/c6en00095a.	2016
Hitz, Katlyn	MS	IPSS	2015	Hitz, Katlyn, Anthony Clark, and David Van Sanford. (2016) Identifying Nitrogen-Use Efficient Soft Red Winter Wheat Lines in High and Low Nitrogen Environments. Field Crops Research 200:1–9. DOI:10.1016/j.fcr.2016.10.001.	2016
Jack, Ann	PHD	PSSC	2007	Law, A. D., C. Fisher, *A. Jack, and L. A. Moe*. (2016) Tobacco, microbes, and carcinogens: Correlation between tobacco cure conditions, tobacco-specific nitrosamine content, and cured leaf microbial community. Microbial Ecology 72(1):120-129. DOI: 10.1007/s00248-016-0754-4.	2016
Judy, Jonathan	PHD	SOSC	2013	Wagner, G., V. Korenkov, *J. D. Judy, and P. M. Bertsch. (2016) Nanoparticles composed of zn and zno inhibit peronospora tabacina spore germination in vitro and p. Tabacina infectivity on tobacco leaves. Nanomaterials 6(3). DOI: 10.3390/nano6030050.	2016
Orlowski, John Gregg, G.L.	PHD MS	CRSC IPSS	2015 2015	Orlowski, J. M., *G. L. Gregg, C. D. Lee, and W. R. Serson. (2016) Early-season lactofen application fails to increase soybean yield under weed-free conditions. Agronomy Journal 108(4):1552-1560. DOI: 10.2134/agronj2015.0589.	2016
Orlowski, John Gregg, G.L.	PHD MS	CRSC IPSS	2015 2015	Orlowski, J. M., *G. L. Gregg, and C. D. Lee. (2016) Early-season lactofen application has limited effect on soybean branch and mainstem yield components. Crop Science 56(1):432-438. DOI: 10.2135/cropsci2015.08.0482.	2016

Orlowski, John	PHD	CRSC	2015	Orlowski, J. M., B. J. Haverkamp, R. G. Laurenz, D. A. Marburger, E. W. Wilson, S. N. Casteel, S. P. Conley, S. L. Naeve, E. D. Nafziger, K. L. Roozeboom, W. J. Ross, K. D. Thelen, and C. D. Lee. (2016) High-input management systems effect on soybean seed yield, yield components, and economic break-even probabilities. Crop Science 56(4):1988-2004. DOI: 10.2135/cropsci2015.10.0620.	2016
Radkov, Atanas	PHD	PLPH	2015	Radkov, A. D., K. McNeill, K. Uda, and L. A. Moe. (2016) D-amino acid catabolism is common among soil-dwelling bacteria. Microbes and Environments 31(2):165-168. DOI: 10.1264/jsme2.ME15126. Serson, W., M. AL-Amery, S. Patel, T. Phillips and D. Hildebrand. Chia, salvia hispanica.:278-287, M. e. al., Eds. Industrial oilseed crops Academic Press, Elsevier.	2016
Radkov, Atanas	PHD	PLPH	2015	Uda, K., K. Abe, Y. Dehara, K. Mizobata, N. Sogawa, Y. Akagi, M. Saigan, *A. D. Radkov, and L. A. Moe. (2016) Distribution and evolution of the serine/aspartate racemase family in invertebrates. Amino Acids 48(2):387-402. DOI: 10.1007/s00726-015-2092-0.	2016
Sarti-Dvorjak, Daniela	PHD	CRSC	2014	Clark, A. J., *D. Sarti-Dvorjak, G. Brown-Guedira, Y. Dong, B. K. Baik, and D. A. Van Sanford*. (2016) Identifying rare fhb-resistant segregants in intransigent backcross and f-2 winter wheat populations. Frontiers in Microbiology 7. DOI: 10.3389/fmicb.2016.00277.	2016
Simmons, Jason	PHD	SOSC	2015	Simmons, J. R., K. R. Sistani, D. H. Pote, E. L. Ritchey, M. Jn-Baptiste, and H. Tewolde. (2016) Corn response and soil nutrient concentration from subsurface application of poultry litter. Agronomy Journal 108(4):1674-1680. DOI: 10.2134/agronj2015.0529.	2016

Slaughter, Lindsey	PHD	SOSC	2016	Slaughter, L. C., A. E. Carlisle, J. A. Nelson, and R. L. McCulley. (2016) Fungal endophyte symbiosis alters nitrogen source of tall fescue host, but not nitrogen fixation in co-occurring red clover. Plant and Soil 405(1-2):243-256. DOI: 10.1007/s11104-015-2510-9.	2016
Slaughter, Lindsey	PHD	SOSC	2016	Slaughter, L. C., and R. L. McCulley. (2016) Aboveground epichloa << coenophiala-grass associations do not affect belowground fungal symbionts or associated plant, soil parameters. Microbial Ecology 72(3):682-691. DOI: 10.1007/s00248-016-0828-3.	2016
Starnes, Daniel Lichtenberg, Stuart Oostveen, Emily	PHD MS MS	IPSS IPSS IPSS	2016 Current 2014	Starnes, D. L., *S. S. Lichtenberg, J. M. Unrine, C. P. Starnes, *E. K. Oostveen, G. V. Lowry, P. M. Bertsch, and O. V. Tsyusko. (2016) Distinct transcriptomic responses of caenorhabditis elegans to pristine and sulfidized silver nanoparticles. Environmental Pollution 213:314-321. DOI: 10.1016/j.envpol.2016.01.020.	2016
Starnes, Daniel	PHD	IPSS	2016	D'Angelo, E., and *D. Starnes. (2016) Desorption kinetics of ciprofloxacin in municipal biosolids determined by diffusion gradient in thin films. Chemosphere 164:215-224. DOI: 10.1016/j.chemosphere.2016.08.101.	2016
Szoboszlay, Marton	PHD	SOSC	2015	Szoboszlay, M., A. White-Monsant, and L. A. Moe. (2016) The effect of root exudate 7,4 '-dihydroxyflavone and naringenin on soil bacterial community structure. Plos One 11(1). DOI: 10.1371/journal.pone.0146555.	2016
Szoboszlay, Marton	PHD	SOSC	2015	Yang, Q. X., R. F. Wang, S. W. Ren, *M. Szoboszlay, and L. A. Moe. (2016) Practical survey on antibiotic-resistant bacterial communities in livestock manure and manure-amended soil. Journal of Environmental Science and Health Part B-Pesticides Food Contaminants and Agricultural Wastes 51(1):14-23. DOI: 10.1080/03601234.2015.1080481.	2016

Williamson, Jessica Flynn, Ernest	PHD MS	IPSS PSSC	2015 2006	*Williamson, J. A., G. E. Aiken, *E. S. Flynn, and M. Barrett. (2016) Animal and pasture responses to grazing management of chemically suppressed tall fescue in mixed pastures. Crop Science 56(5):2861-2869. DOI: 10.2135/cropsci2016.04.0206.	2016
Ma, Liuyin	PHD	PLPH	2013	Ma, L., and A. G. Hunt*. A 3′ race protocol to confirm polyadenylation sites.135-144, G. A. Hunt and Q. Q. Li, Eds. *Polyadenylation in plants: Methods and protocols* Springer New York, New York, NY.	2015
Ma, Liuyin	PHD	PLPH	2013	Pati, P. K., L. Ma, and A. G. Hunt*. Genome-wide determination of poly(a) site choice in plants.159-174, G. A. Hunt and Q. Q. Li, Eds. *Polyadenylation in plants: Methods and protocols* Springer New York, New York, NY.	2015
Al-Amery, Maythem	PHD	CRSC	Current	Al-Amery, M., H. Fukushige, and D. Hildebrand*. Single seed selection for low phytate lines. Journal of the American Oil Chemists Society 92(8):1119-1123. DOI: 10.1007/s11746-015-2681-9.	2015
An, Ran	PHD	SOSC	2016	Allen, H. K., R. An, J. Handelsman, and L. A. Moe*. A response regulator from a soil metagenome enhances resistance to the beta-lactam antibiotic carbenicillin in escherichia coli. Plos One 10(3). DOI: 10.1371/journal.pone.0120094.	2015
Bourguignon, Marie	MS	PSSC	2013	Bourguignon, M., J. A. Nelson, E. Carlisle, H. Ji, R. D. Dinkins, T. D. Phillips, and R. L. McCulley*. Ecophysiological responses of tall fescue genotypes to fungal endophyte infection, elevated temperature, and precipitation. Crop Science 55(6):2895-2909. DOI: 10.2135/cropsci2015.01.0020.	2015

Judy, Jonathan Guo, Jingqi	PHD PHD	PSSC PLPH	2013 2014	Chen, C., J. M. Unrine*, J. D. Judy, R. W. Lewis, J. Guo, D. H. McNear, Jr., and O. V. Tsyusko. Toxicogenomic responses of the model legume medicago truncatula to aged biosolids containing a mixture of nanomaterials (tio2, ag, and zno) from a pilot wastewater treatment plant. Environmental Science & Technology 49(14):8759-8768. DOI: 10.1021/acs.est.5b01211.	2015
Guo, Jingqi	PHD	PLPH	2014	Guo, J., R. L. McCulley, and D. H. McNear*, Jr. Tall fescue cultivar and fungal endophyte combinations influence plant growth and root exudate composition. Frontiers in Plant Science 6. DOI: 10.3389/fpls.2015.00183.	2015
Judy, Jonathan	PHD	SOSC	2013	Judy, J. D., D. H. McNear, Jr., C. Chen, R. W. Lewis, O. V. Tsyusko, P. M. Bertsch*, W. Rao, J. Stegemeier, G. V. Lowry, S. P. McGrath, M. Durenkamp, and J. M. Unrine. Nanomaterials in biosolids inhibit nodulation, shift microbial community composition, and result in increased metal uptake relative to bulk/dissolved metals. Environmental Science & Technology 49(14):8751-8758. DOI: 10.1021/acs.est.5b01208.	2015
Lucas, Shawn	PHD	SOSC	2013	Lucas, S. T., E. M. D'Angelo*, S. DeBolt, and M. A. Williams*. Soil treatment-induced differential gene expression in tomato: Relationships between defense gene expression and soil microbial community composition. Applied Soil Ecology 93:28-39. DOI: 10.1016/j.apsoil.2015.03.008.	2015
Slaughter, Lindsey	MS	SOSC	2014	Slaughter, L. C., M. N. Weintraub, and R. L. McCulley*. Seasonal effects stronger than three-year climate manipulation on grassland soil microbial community. Soil Science Society of America Journal 79(5):1352-1365. DOI: 10.2136/sssaj2014.10.0431.	2015

Sparks, Bret	MS	PSSC	2014	Sparks, B., G. Munshaw*, D. Williams, M. B. Barrett, J., and P. Woosley. Preplant cultivation techniques and planting date effects on white clover establishment into an existing cool-season turfgrass sward. Hortscience 50(4):615-620.	2015
Starnes, Daniel	PHD	IPSS	2016	Starnes, D. L., J. M. Unrine, C. P. Starnes, B. E. Collin, E. K. Oostveen, R. Ma, G. V. Lowry, P. M. Bertsch, and O. V. Tsyusko*. Impact of sulfidation on the bioavailability and toxicity of silver nanoparticles to caenorhabditis elegans. Environmental Pollution 196:239-246. DOI: 10.1016/j.envpol.2014.10.009	2015
Szoboszlay, Marton	PHD	SOSC	2015	Szoboszlay, M., J. Lambers, J. Chappell, J. V. Kupper, L. A. Moe*, and D. H. McNear, Jr. Comparison of root system architecture and rhizosphere microbial communities of balsas teosinte and domesticated corn cultivars. Soil Biology & Biochemistry 80:34-44. DOI: 10.1016/j.soilbio.2014.09.001.	2015
Zou, Congming	PHD	SOSC	2015	Zou, C., R. C. Pearce*, J. H. Grove, and M. S. Coyne. Conservation practices in tobacco production increase large aggregates and associated carbon and nitrogen. Soil Science Society of America Journal 79(6):1760-1770. DOI: 10.2136/sssaj2015.06.0235.	2015
Judy, Jonathan	PHD	SOSC	2013	Judy, J. D., Bertsch, P. M. (ed. Donald Sparks) Bioavailability, Toxicity, and Fate of Manufactured Nanomaterials in Terrestrial Ecosystems: Academic Press.	2014
Yang, Yang	PHD	SOSC	2014	Yang, Y., and O. Wendroth. 2014. State-space approach to analyze field-scale bromide leaching. Geoderma 217-218:161-172. doi: 10.1016/j.geoderma.2013.11.013	2014
Starnes, Daniel	PHD	IPSS	2016	Choi, J., O. Tsyusko, J. Unrine, N. Chatterjee, J.-M. Ahn, X. Yang, L. Thornton, I. Ryde, D. Starnes, and J. Meyer. 2014. A micro-sized model for the in vivo studies of nanoparticle toxicity: What has Caenorhabditis elegans taught us? Environmental Chemistry. 11: 227-246.	2014

Oostveen, Emily	MS	IPSS	2014	Collin, B; Oostveen, E., O. Tsyusko, and J.M. Unrine. 2014. Influence of natural organic matter and surface charge on the toxicity and bioaccumulation of functionalized ceria nanoparticles in Caenorhabditis elegans. Environmental Science and Technology. 48:1280-1289.	2014
Deaton, Michael	PHD	CRSC	2012	Deaton, M.T., and D.W. Williams. 2014. Cultivar Affects Field Emergence, Establishment Rate, and First-Year Traffic Tolerance of Seeded Bermudagrasses in the Transition Zone. Crop Science. 54(1):349-354.	2014
Ghezzi, Jessique	PHD	SOSC	2014	Ghezzi, J.; A.D. Karathanasis, C. Matocha, J. Unrine, and Y.L. Thompson. 2014. Stability of Soil and Biosolid Nanocolloid and Macrocolloid Particles in the Absence and Presence of Arsenic, Selenium, Copper and Lead. Open Journal of Soil Science. 4:246-258. Published online: doi: 10.4236/ojss.2014.47027.	2014
Ghezzi, Jessique	PHD	SOSC	2014	Ghezzi, J.L., A.D. Karathanasis, C.J. Matocha, J. Unrine, and Y.L. Thompson. 2014. Competitive Sorption Behavior of Arsenic, Selenium, Copper and Lead by Soil and Biosolid Nano- and Macrocolloid Particles. Open Journal of Soil Science. 4:293-304. Published online: doi: 10.4236/ojss.2014.49031.	2014
Ghezzi, Jessique	PHD	SOSC	2014	Ghezzi, J.L., A.D. Karathanasis, C.J. Matocha, J. Unrine, and Y.L. Thompson. 2014. Characterization of Environmental Nano-and Macrocolloid Particles Extracted from Selected Soils and Biosolids. Applied and Environmental Soil Science. Published online: doi: 10.1155/2014/506482.	2014
Williamson, Jessica	PHD	IPSS	2015	Goff, B.M., G.E. Aiken, W.W. Witt, J.A. Williamson, E.S. Flynn, and P.L. Burch. 2014. Timing and rate of Chaparral treatment affects tall fescue seedhead development and pasture grass plant densities. Forage and Grazinglands. Published online: doi: 10.2134/FG-2013-0001-RS.	2014

Hall, Sarah	PHD	CRSC	2011	Hall, S.L., R.L. McCulley, R.J. Barney, and T.D. Phillips. 2014. Does fungal endophyte infection improve tall fescue's growth response to fire and water limitation? PLoS ONE. 9(1):e86904. Published online: doi:10.1371/journal.pone.0086904.	2014
Ghezzi, Jessique	PHD	SOSC	2014	Karathanasis, A.D., J.L. Ghezzi, O. Wendroth, C.J. Matocha, J. Unrine, and Y.L. Thompson. 2014. Subsurface transport of As, Se, Cu, and Pb contaminants with soil and biosolid nano- and macro-colloid fractions. Austin Journal of Hydrology. 1(1):13-25.	2014
Lucas, Shawn	PHD	SOSC	2013	Lucas, S.T., E. D'Angelo, and M. Williams. 2014. Improving soil structure by promoting fungal abundance with organic soil amendments. Applied Soil Ecology. 75:13-23.	2014
Li, Qing	MS	IPSS	2014	Murphree, C.A., Q. Li, E.P. Heist, and L.A. Moe. 2014. A multiple antibioticresistant Enterobacter cloacae strain isolated from a bioethanol fermentation facility. Microbes & Environments. 29:322-325.	2014
Bowen, James	PHD	IPSS	Current	Penn, C.J., J.M. McGrath, J. Bowen, and S. Wilson. 2014. Phosphorus Removal Structures: A Management Option for Legacy Phosphorus. Journal of Soil and Water Conservation. 69(2):51A – 56A. Published online: doi: 10.2489/jswc.69.2.51A.	2014
Radkov, Atanas	PHD	PLPH	2015	Radkov, A.D., and L.A. Moe. 2014. Amino acid racemase enzyme assays. Bioprotocol. 4:e1112.	2014
Radkov, Atanas	PHD	PLPH	2015	Radkov, A.D., and L.A. Moe. 2014. Bacterial synthesis of D-amino acids. Applied Microbiology and Biotechnology. 98:5363-5374.	2014
Rathnayake, Sewwandi Judy, Jonathan	MS PHD	PSSC SOSC	2013 2013	Rathnayake, S., J.M. Unrine, J.D. Judy, A.F. Miller, W. Rao, and P.M. Bertsch. 2014. A multitechnique investigation of the pH dependence of phosphate induced transformations of ZnO nanoparticles. Environmental Science and Technology. 48:4757-4764.	2014

Schluttenhofer Craig	PHD	PLPH	2016	Schluttenhofer, C.M., S. Pattanaik, B. Patra, and L. Yuan. 2014. Analyses of Catharanthus roseus and Arabidopsis thaliana WRKY transcription factors reveal involvement in jasmonate signaling. BMC Genomics. 15:502.	2014
Yang, Yang	PHD	SOSC	2014	Schwen, A., J. Backus, Y. Yang, and O. Wendroth. 2014. Characterizing land use impact on multi-tracer displacement and soil structure. Journal of Hydrology. 519:1752-1768.	2014
Simmons, Jason	PHD	SOSC	Current	Sistani, K. R., M. Jn-Baptiste, J.R. Simmons. 2014. Corn Response to Enhanced-Efficiency Nitrogen Fertilizers and Poultry Litter. Agronomy Journal. 106(2):761-770. Published online: doi: 10.2134/agronj2013.0087.	2014
Szoboszlay, Marton	PHD	SOSC	2015	Szoboszlay, M., J. Lambers, J. Chappell, J.V. Kupper, L.A. Moe, and D.H. McNear, Jr. 2015. Comparison of root system architecture and rhizosphere microbial communities of Balsas teosinte and domesticated corn cultivars. Soil Biology and Biochemistry. 80:34-44.	2014
Tang, Fang	PHD	PLPH	2015	Tang, F., S. Yang, J. Liu, M. Gao, and H. Zhu. 2014. Fine mapping of the Rj4 locus, a gene controlling nodulation specificity in soybean. Molecular Breeding. 33:691.	2014
Gaffney, Bobby	PHD	PLPH	2012	Wu, X., B. Gaffney, B, Q.Q. Li, and A.G. Hunt. 2014. Genome-wide determination of poly(A) sites in Medicago truncatula: evolutionary conservation of alternative poly(A) site choice. BMC Genomics. 15:615.	2014
Tang, Fang	PHD	PLPH	2015	Yang, S., F. Tang, and H. Zhu. 2014. Alternative splicing in plant immunity. International Journal of Molecular Sciences. 15:10424.	2014
Yang, Yang	PHD	SOSC	2014	Yang, Y., O. Wendroth, and R.J. Walton. 2014. Field-scale water and Bromide transport during and after simulated rain. Soil Science Society of America Journal. 78:1224-1238.	2014
Yang, Yang	PHD	SOSC	2014	Yang, Y., and O. Wendroth. 2014. State-space approach to analyze field-scale bromide leaching. Geoderma. 217-218:161-172. Published online: doi: 10.1016/j.geoderma.2013.11.013.	2014

Werkman, Joshua	PHD	PLPH	2013	Pattanaik, S., J.R. Werkman, and L. Yuan. 2013. Biomolecular fluorescence complementation as a tool to study interactions of regulatory proteins in plant protoplasts. pp. 185-193. In: L. Yuan, and S. Perry, eds. Plant Transcription Factors: Methods and Protocols. vol. 754, Methods in Molecular Biology. Humana Press, New York.	2013
Johnson, Jennifer	PHD	CRSC	2010	Aiken, G.E., J.L. Klotz, J.M. Johnson, et al. 2013. Postgraze assessment of toxicosis symptoms for steers grazed on toxic endophyte-infected tall fescue pasture. Journal of Animal Science 91(12):5878-5884.	2013
Richmond, Mitchell	PHD	CRSC	Current	Bailey, W.A., T.W. Lax, R.A. Hill, and M.D. Richmond. 2013. Evaluation of herbicide systems for dark fire-cured tobacco. Tobacco Science 50:34-38.	2013
Banerjee, Sagarika	MS	PSSC	2010	Banerjee, S. and E. D'Angelo. 2013. Livestock antibiotic effects on nitrification, denitrification, and microbial community composition in soils. Open Journal of Soil Science 3:203-212. Published online: doi: http://dx.doi.org/10.4236/ojss.2013.35024.	2013
Cai, Bin	PHD	PLPH	2012	Cai, B., A.M. Jack, R.S. Lewis, RE. Dewey, and L.P. Bush. 2013. (R)-nicotine biosynthesis, metabolism and translocation in tobacco as determined by nicotine demethylase mutants. Phytochemistry 95:188-196.	2013
Cropper, Kenneth	PHD	CRSC	2015	Cropper, K.L. and D.W. Williams. 2013. The Effect of Combination Dew Removal and Curative Fungicide Treatments on Dollar Spot Disease of Creeping Bentgrass. International Turfgrass Society Research Journal 12:91-96.	2013
Deaton, Michael	PHD	CRSC	2012	Deaton, M.T. and D.W. Williams. 2013. Temperature Effects on the Speed and Completion of Germination of Nineteen Commercially Available Seeded Bermudagrass (*Cynodon dactylon*) Cultivars. HortTechnology 23(1):82-85.	2013

Deaton, Michael	PHD	CRSC	2012	Deaton, M.T. and D.W. Williams. 2013. Trinexapac-ethyl and Overseeding Effects on Shear Strength of Four Bermudagrass [(Cynodon dactylon L. (Pers.)] Cultivars Grown on Sand-Based System. International Turfgrass Society Research Journal 12:163-168	2013
Dhakal, Prakash	PHD	SOSC	2013	Dhakal, P., C.J. Matocha, F.E. Huggins, and M.M. Vandiviere. 2013. Nitrite reactivity with magnetite. Environmental Science and Technology 47:6206-6213.	2013
Navarro, Martin	MS	IPSS	2012	Grove, J.H., and M.M. Navarro. 2013. The problem is not N deficiency: Active canopy sensors and chlorophyll meters detect P stress in corn and soybean. p. 137-144. In: J.V. Stafford (ed.) Precision Agriculture '13 – Proceedings of the 9th European Conference on Precision Agriculture. Wageningen Academic Publishers, Wageningen, Netherlands. ISBN: 978-90-8686-224-5. Lleida, Spain. 7-11 July.	2013
Johnson, Jennifer	PHD	CRSC	2010	Klotz, J.L., G.E. Aiken, J.M. Johnson, et al. 2013. Antagonism of lateral saphenous vein serotonin receptors from steers grazing endophyte-free, wild-type, or novel endophyte-infected tall fescue. Journal of Animal Science 91(9):4492-4500. Published online: doi: 0.2527/jas.2012-5896.	2013
Werkman, Joshua	PHD	PLPH	2013	Kong, Q., Pattanaik, S., Feller, A., Werkman, J.R., Chai, C., Wang, Y., Grotewold, E., and Ling Yuan. Regulatory switch enforced by basic helix-loop-helix and ACT-domain mediated dimerizations of the maize transcription factor R. Proceeding of National Academy of Sciences U.S.A. 109:E2091-2097.	2013
Kreba, Sleem	PHD	SOSC	2013	Kreba, S.A., O. Wendroth, M.S. Coyne, and R.L. McCulley. 2013. Spatial and temporal patterns of CO2 flux in crop and grass land-use systems. Vadose Zone Journal 12(4). Published online: doi: 10.2136/vzj2013.01.0005.	2013

Li, Yan	PHD	PLPH	2012	Li, Y., J. Kurepa, and J. Smalle. 2013. AXR1 promotes the cytokinin response by facilitating ARR5 proteolysis. The Plant Journal 74:13-24. Published online: doi: http://onlinelibrary.wiley.com/doi/10.1111/tpj.12098/full.	2013
Li, Yan	PHD	PLPH	2012	Kurepa, J., Y. Li, and J. Smalle. 2013. Reversion of the Arabidopsis rpn12a-1 exon-trap mutation by an intragenic suppressor that weakens the chimeric 5' splice site (2013). F1000Research (2)60. Published online: doi: http://f1000research.com/articles/10.12688/f1000research.2-60.v1/doi	2013
Li, Yan	PHD	PLPH	2012	Kurepa, J., Y. Li, and J. Smalle. 2013. Proteasome-dependent proteolysis has a critical role in fine-tuning the feedback inhibition of cytokinin signaling. Plant Signaling & Behavior (8)3. Published online: doi: pii: e23474. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3676517/ [Epub ahead of print]	2013
Niehaus, Thomas	PHD	PLPH	2011	Linscott, K., J. Chappell, and T. Niehaus. 2013. Characterizing Unique Interaction Domains in Sterol Biosynthetic Complexes for the Control of Fungal Pathogens. Federation of American Societies for Experimental Biology Journal 2013;27:803.3.	2013
Schluttenhofer Craig	PHD	PLPH	2016	Patra, B., C. Schluttenhofer, Y.M. Wu, S. Pattanaik, and L. Yuan. 2013. Transcriptional regulation of secondary metabolite biosynthesis in plants. Biochimica Et Biophysica Acta-Gene Regulatory Mechanisms 1829(11):1236-1247. Published online: doi: 10.1016/j.bbagrm.2013.09.006.	2013
Radkov, Atanas	PHD	PLPH	2015	Radkov, A.D. and L.A. Moe. 2013. Amino acid racemization in Pseudomonas putida KT2440. Journal of Bacteriology 195:5016-5024.	2013

Yang, Yang	PHD	SOSC	2014	Schwen, A., Y. Yang and O. Wendroth. 2013. State-space models describe the spatial variability of bromide leaching controlled by land use, irrigation and pedologic characteristics. Vadose Zone Journal. Published online: doi: 10.2136/vzj2012.0196.	2013
Nambuthiri, Susmitha	PHD	SOSC	2010	Wendroth, O., S. Nambuthiri, and R.J. Walton. 2013. Accounting for soil spatial variability in soil water capacitance probe calibration. Vadose Zone Journal 12(2). Published online: doi: 10.2136/vzj2012.0182.	2013
Whitley, Annie Oostveen, Emily	MS MS	IPSS IPSS	2012 2014	Whitley, A.R., C. Levard, E. Oostveen, P.M. Bertsch, C.J. Matocha, F. vd Kammer, and J.M. Unrine. 2013. Behavior of Ag nanoparticles in soil: Effects of particle surface coating, aging and sewage sludge amendment. Environmental Pollution 182:141-149.	2013
Yang, Yang	PHD	SOSC	2014	Yang, Y., O. Wendroth, and R.J. Walton. 2013. Field-scale bromide leaching as affected by land use and rain characteristics. Soil Science Society of America Journal. Published online: doi: 10.2136/sssaj2013.01.0018.	2013
Zheng, Yumei	PHD	PLPH	2011	Zheng, Q., Y. Zheng, and S.E. Perry. 2013. AGAMOUS-Like15 Promotes Somatic Embryogenesis in Arabidopsis thaliana and Glycine max in Part by Control of Ethylene Biosynthesis and Response. Plant Physiology 161:2113-2127.	2013
Zheng, Yumei	PHD	PLPH	2011	Zheng, Q., Y. Zheng, and S.E. Perry. 2013 Decreased *GmAGL15* expression and reduced ethylene synthesis may contribute to reduced somatic embryogenesis in a poorly embryogenic cultivar of *Glycine max.* Plant Signaling & Behavoir 8:e25422.	2013
Goff, Ben	PHD	CRSC	2012	Aiken, G. E., B. Goff*, W. W. Witt, B. Sleugh, I. A. Kagan, P. Burch, and F. N. Schrick. 2012. Steer and plant responses to chemical suppression of seedhead emergence in toxic endophyte-infected tall fescue. Crop Science 52(2): 960-969. Published online: doi: 10.2135/cropsci2011.07.0377.	2012

Cai, Bin	PHD	PLPH	2012	Cai B.*, and L. P. Bush. 2012. Variable nornicotine enantiomeric composition caused by nicotine demethylase CYP82E4 in tobacco leaf. Journal of Agricultural and Food Chemistry. 60(46): 11586−11591. Published online: doi: 10.1021/jf303681u.	2012
Cai, Bin	PHD	PLPH	2012	Cai, B.*, B. Siminszky, J. Chappell, R. E. Dewey, and L. P. Bush. 2012. Enantioselective demethylation of nicotine as a mechanism for variable nornicotine composition in tobacco leaf. The Journal of Biological Chemistry 287(51): 42804–42811. Published online: doi: 10.1074/jbc.M112.413807.	2012
Agostinelli, Andres	MS	CRSC	2009	Agostinelli, A.*, A. J. Clark, G. Brown-Guedira, and D. A. Van Sanford. 2012. Optimizing phenotypic and genotypic selection for Fusarium head blight resistance in wheat. Euphytica 186:115-126. Published online: doi: 10.1007/s10681-011-0499-6.	2012
Goff, Ben	PHD	CRSC	2012	Aiken, G. E., B. Goff*, W. W. Witt, B. Sleugh, I. A. Kagan, P. Burch, and F. N. Schrick. 2012. Steer and plant responses to chemical suppression of seedhead emergence in toxic endophyte-infected tall fescue. Crop Science 52(2): 960-969. Published online: doi: 10.2135/cropsci2011.07.0377.	2012
Goff, Ben	PHD	CRSC	2012	Goff, B.*, G. E. Aiken, W. W. Witt, B. Sleugh, and P. Burch. 2012. Steer consumption and ergovaline recovery from in vitro digested residues of tall fescue seedheads. Crop Science 52(3): 1437	2012
Goff, Ben	PHD	CRSC	2012	Goff, B.*, P. T. Murphy, and K. J. Moore. 2012. Comparison of common lignin methods and modifications on forage and lignocellosic materials. Journal of Science Food and Agriculture 92: 751	2012
Hall, Sarah	PHD	CRSC	2011	Hall, S.*, R. L. McCulley*, and R. J. Barney. 2012. Restoration of native warm season grassland species in a tall fescue pasture using prescribed fire and herbicides. Restoration Ecology 20: 194	2012

Siegrist, Jacob	MS	PSSC	2008	Iqbal, J., J. Siegrist*, J. A. Nelson, and R. L. McCulley*. 2012. Fungal endophyte infection increases carbon sequestration potential of southeastern U.S.A. tall fescue stands. Soil Biology and Biochemistry 44: 81	2012
Jamboonsri, Watchareewan	PhD	PLPH	2010	Jamboonsri, W.*, T. D. Phillips, R. L. Geneve, J. P. Cahill, and D. Hildebrand. 2012. Extending the range of an ancient crop, *Salvia hispanica* L.	2012
Johnson, Jennifer	PHD	CRSC	2010	Johnson, J. M.*, G. E. Aiken, T. D. Phillips, M. Barrett, J. Klotz, and F. Schrick. 2012. Steer and pasture responses for a novel endophyte tall fescue developed for the upper transition zone. Journal of Animal Science 90(7): 2402	2012
Judy, Jonathan	PhD	SOSC	2013	Judy, J.*, T. Prasad, and P. Bertsch. 2012. Pin oak (Quercus palustris) leaf extract mediated synthesis of triangular, polyhedral and spherical gold nanoparticles. Advances in Nanoparticles 1: 79	2012
Judy, Jonathan	PHD	SOSC	2013	Judy, J.*, J. M. Unrine, W. Rao, and P. Bertsch. 2012. Bioaccumulation of gold nanomaterials by Manduca sexta through dietary uptake of surface contaminated plant tissue. Environmental Science and Technology 46: 12672-12678.	2012
Judy, Jonathan	PHD	SOSC	2013	Judy, J., J. M. Unrine, W. Rao, S. Wirick and P. Bertsch. 2012. Bioavailability of gold to plants: Importance of particle size and surface coating. Environmental Science and Technology 46: 8467-8474.	2012
Dhakal, Prakash	PHD	SOSC	2013	Matocha, C., P. Dhakal*, and S. Pyzola 2012. The role of abiotic and coupled biotic/abiotic mineral controlled redox processes in nitrate reduction. Advances in Agronomy 115: 181-214.	2012
Niehaus, Thomas Bell, Stephen	PHD PHD	PLPH PLPH	2011 Current	Niehaus, T.*, S. Kinison, S. Okada, Y. Yeo, S. Bell*, P. Cui, T. Devarenne, and J. Chappell 2012. Functional identification of triterpene methyltransferases from *Botryococcus braunii* race B. The Journal of Biological Chemistry 287: 8163-8173.	2012

Werkman, Joshua	PHD	PLPH	2013	Que, K., S. Pattaniak, A. Feller, J. Werkman*, C. Chai, Y. Wang, E. Grotewold, and L. Yuan. 2012. A regulatory switch enforced by bHLH and ACT domain-mediated dimerization of the maise transcription factor R. Proceeding of National Academy of Sciences, U.S.A. 109: E2091-2097.	2012
Ruffner, Marvin	PHD	CRSC	2012	Ruffner, M. E.*, R. L. McCulley, J. A. Nelson, and T. G. Barnes. 2012. Ecosystem function differs between Old World bluestem invaded and native coastal prairie in South Texas. Biological Invasions 14(7): 1483-1500. Published online: doi: 10.1007/s10530-012-0174-4.	2012
Gaffney, Bobby	PHD	PLPH	2012	Thomas, P. E., X. Wu, M. Liu, B. Gaffney*, G. Ji, Q. Q. Li, and A. G. Hunt*. 2012. Genome-wide control of polyadenylation site choice by CPSF30 in Arabidopsis. Plant Cell 24: 4376-4388.	2012
Tolson, Joshua	PHD	PSSC	2012	Tolson, J. A.*, J. D. Green, W. W. Witt, G. Schwab, and J. Omielan 2012. Integrated Management Strategies Reduced Tall Ironweed (*Vernonia altissima*) Populations and Weed Biomass and Improved Tall Fescue (*Lolium arundinaceum*) Pasture Productivity. Weed Science 60: 106-112.	2012
Tang, Fang	PHD	PLPH	2015	Wang, D., S. Yang, F. Tang*, and H. Zhu*. 2012. Symbiosis specificity in the legume-rhizobial mutualism. Cell Microbiology 4(3): 334-342. Published online: doi: 10.1111/j.1462-5822.2011.01736.x.	2012
Werkman, Joshua	PHD	PLPH	2013	Que, K., S. Pattaniak, A. Feller, J. Werkman*, C. Chai, Y. Wang, E. Grotewold, and L. Yuan. 2012. A regulatory switch enforced by bHLH and ACT domain-mediated dimerization of the maise transcription factor R. Proceeding of National Academy of Sciences, U.S.A. 109: E2091-2097.	2012
Goff, Ben	PHD	CRSC	2012	Goff, B.*, G. E. Aiken, and W. W. Witt. 2012. Effects of grazing inensity and chemical seed suppression on steers grazing tall fescue pastures. Dow Agrosciences Pasture Summit.	2012

Zou, C.	PhD	SOSC	Current	Zou, C.*, Pearce, R.C., J. H. Grove, and M. S. Coyne. 2012. Soil nitrogen mineralization in different tobacco tillage-rotation systems.	2012
Agostinelli, Andres	MS	CRSC	2009	Agostinelli, A.M., A.J. Clark, G. Brown-Guedira and D.A. Van Sanford. 2011. Optimizing phenotypic and genotypic selection for Fusarium head blight resistance in wheat. Euphytica Published online: doi: 10.1007/s10681-011-0499-6.	2012

Appendix J. External grants and contracts aggregated by funding agency, Calendar years 2012 – 2016.

Sponsor	2012	2013	2014	2015	2016
Agricen Sciences			$34,062		
Agricultural Research Service	$166,403	$151,961	$320,891	$65,098	$413,880
Altria Corporate Services Inc	$70,195	$139,640		$89,166	
Altria Corporate Services Inc.			$100,972		
American Snuff Company				$15,400	
Ashland Inc	$9,000				
Ashland Inc.			$30,000		
Auburn University			$26,826		
Bayer CropScience GmbH	$7,000	$10,000	$10,000	$10,000	$10,000
British American Tobacco		$932,458	$129,627		$1,166,766
Burley Tobacco Growers Cooperative Association Inc	$8,000				
Ceres Inc	$55,000	-$40,845			
Concurrent Solutions LLC				$25,000	
Cono SA			$20,000	$7,890	
Consortium for Plant Biotechnology Research Inc	$110,228	$24,694			
Cornell University				$26,862	$27,138
Council for Burley Tobacco		$64,000	$25,000	$90,000	$47,500
Duke University	$137,800	$150,000	$150,000	$150,000	$137,999
Environmental Protection Agency	$79,896				
Kentucky Corn Growers Association	$35,000		$80,775	$78,319	$39,168
Kentucky Small Grain Growers Association	$89,388	$115,062	$155,982	$164,741	$240,217
Kentucky Soybean Promotion Board	$35,000	$172,702	$284,577	$492,521	$268,566
Kentucky Specialty Grains LLC		$8,620			
Koch Agronomic Services LLC			$5,490	$5,042	
KY Corn Growers Association	$35,000		$35,000	$35,000	$35,000
KY Corn Promotion Council	$35,000				

KY Department for Public Health	$40,000		$20,000	$20,000	$20,000
KY Forage and Grasslands Council	$20,000				
KY Governor's Office of Agricultural Policy	$40,000				
KY Science and Technology Co Inc	$143,422			$28,576	$30,000
KY Science and Technology Co Inc.			$29,997		
KY Soybean Promotion Board	$159,997				
KY Transportation Cabinet			$260,348		$300,000
Lexington Fayette Urban County Government			$44,596		
Monsanto Co	$30,950	$41,760	$51,730	$47,460	$51,548
National Fish and Wildlife Foundation				$257,621	
National Institute of Food and Agriculture		$612,015	$100,000	$450,000	$769,136
National Science Foundation	$148,022	$534,963	$466,045	$257,097	
Natural Resources Conservation Service	$75,000	$30,000	$321,955	$4,000	$230,308
Philip Morris International Management SA		$325,000	$325,000	$325,000	$28,641
Purdue University	$30,000	$30,000		$30,000	$282,500
South Dakota State University	$12,500	$28,000	$25,000	$20,000	$48,991
Southern Soybean Research Program			$8,090		
Syngenta Crop Protection		$14,000	$12,500		$50,000
Texas A&M University	$32,000				$12,000
Texas AgriLife Research	$232,210				
University of California Davis	$56,446	$65,676	$53,368	$64,615	
University of Chicago	$47,730	$49,571	$51,511	$59,178	$78,876
University of Minnesota	$140,000	$70,000			
University of Tennessee	$79,901				$476,804
University of Illinois					$16,642
Foundation for Agronomic Research					$70,000
Mendel Biological Solutions LLC					$10,265
Zifora SRL					$135,252
North Central Soybean Research Program					$20,000
Total	**$2,161,08**	**$3,529,27**	**$3,179,34**	**$2,818,58**	**$5,017197**
Grand Total					**$16,705,49**

Appendix K. List (by investigator) of internal and external grants and contracts, 2012-2016.

2016

Bailey, William
Effect of Chloride-containing potassium fertilizer application on dark air-cured tobacco, (3048112729), American Snuff Company, $9,800.00

Bailey, William
Effect of preharvest Debaryomyces hansenii application on nitrite and TSNA in dark tobacco, (3048112731), American Snuff Company, $5,600.00

Barrett, Michael
Sustainable Management of Roadside Vegetation (FY16-17), (3048112914), KY Transportation Cabinet, $300,000.00

Barton, Christopher/Karathanasis, Anastasios
* Evaluation of acidic atmospheric deposition and its influence on soil solution composition in the Daniel Boone National Forest, (3048108882), Forest Service, $7,840.00

Bessin, Ricardo/Dunwell, Winston/Gauthier, Nicole/Knott, Carrie/Lucas, Patricia/Saha, Shubin
* Kentucky IPM Extension and Implementation Program:2014 - 2017, (3048112016), National Institute of Food and Agriculture, $65,000.00

Bruening, William
Performance of Small Grain Varieties in Kentucky, (3048112781), Kentucky Small Grain Growers Association, $20,000.00

Chambers, Orlando/Canete, Socrates/Durbin, Eric/Jack, Anne/Ji, Huihua/Moe, Luke/Shelton, Brent/Yuan, Ling
* Program Income Smokeless Tobacco Reference Product Development, Distribution and Research, (3200000434), Food and Drug Administration, $1.00

Chambers, Orlando/Canete, Socrates/Durbin, Eric/Jack, Anne/Ji, Huihua/Moe, Luke/Shelton, Brent/Yuan, Ling
* Smokeless Tobacco Reference Product Development, Distribution and Research, (3200000431), Food and Drug Administration, $2,999,925.00

Coyne, Mark
Soil Bank Project, (3200000111), Natural Resources Conservation Service, $2.00

Fisher, Colin/Jack, Anne
Development of Pale Yellow Dark Burley, (3048112983), Council for Burley Tobacco, $3,500.00

Fisher, Colin/Jack, Anne/Ji, Huihua
TSNA Accumulation in Controlled Curing Environment, (3048112982), Council for Burley Tobacco, $5,000.00

Fisher, Colin/Jack, Anne/Ji, Huihua
TSNA Accumulation in Controlled Curing Environment, (3048112827), Council for Burley Tobacco, $5,000.00

Fisher, Colin/Ji, Huihua/Pearce, Robert
Topping Height of High Leaf Potential Varieties, (3048112984), Council for Burley Tobacco, $5,000.00
Fisher, Colin/Pearce, Robert
Topping Height of High Leaf Potential Varieties, (3048112826), Council for Burley Tobacco, $10,000.00
Goff, Ben
Field Trial Evaluation of Foliar Applied Microbial Exudate in Grass Grown for Hay Production or Grazing, (3048113051), Mendel Biological Solutions LLC, $10,265.00
Goff, Ben/Haramoto, Erin/Pearce, Robert
Optimizing the Integration of Annual Forages into Tobacco Systems, (3048112981), Council for Burley Tobacco, $5,000.00
Green, Jonathan
USB Multistate Herbicide Resistant Crops and Weeds, (3048112910), Purdue University, $24,586.00
Green, Jonathan/Haramoto, Erin
Investigation of Mixed Population of Palmer Amaranth and Waterhemp with Multiple Herbicide Resistance, (3048113019), Kentucky Soybean Promotion Board, $17,330.00
Hanley, Carol/Bondada, Subbarao/Cooper, Robin/Criswell, Brett/Moe, Luke/Moecher, David/Proffitt, Mary/Schroeder, Margaret/Testa, Stephen/Walcott, Bruce/Webb, Nancy
* STEM PRIDE Year 2 Funding, (3200000611), KY Council on Postsecondary Education, $125,000.00
Haramoto, Erin/Martin, James
SBIR: Leaf-Specific Herbicide Application in the Presence of Crops, (3200000041), Concurrent Solutions LLC, $25,000.00
Haramoto, Erin/Phillips, Timothy
Cover Crop Interseeding to Manage Herbicide-Resistant Weeds, (3200000488), North Carolina State University, $28,641.00
Hildebrand, David
Development of High #3 Soybeans, (3048113020), Kentucky Soybean Promotion Board, $29,470.00
Hildebrand, David
Improved Chia Production & Product Usage, (3048112893), Kentucky Small Grain Growers Association, $23,903.00
Hildebrand, David/Phillips, Timothy
Development of Chia, Salvia Hispanica L., as a Sustainable Oil Source for Renewable Chemical Applications, (3048112085), Cono SA, ($30.00)
Hildebrand, David/Williams, David
KSEF RDE: Increasing the Market Value of Industrial Hemp Seed, (3048112672), KY Science and Technology Co Inc, $28,576.00

Jack, Anne/Fisher, Colin/Ji, Huihua
* The Effects of Cytokinin Application on the Accumulation of Tobacco-specific Nitrosamines, (3048112985), Council for Burley Tobacco, $6,000.00
Jack, Anne/Fisher, Colin/Ji, Huihua
* Sample Preparation for TSNA Analysis, (3048113005), Council for Burley Tobacco, $4,000.00
Jack, Anne/Fisher, Colin/Ji, Huihua
* Evaluation of the Efficacy of HP 400 in Reducing TSNAs - 2016 Field Season, (3048113007), Council for Burley Tobacco, $2,000.00
Jack, Anne/Fisher, Colin/Ji, Huihua
* The Effects of Pre-harvest Quercetin on the Accumulation of Tobacco-specific Nitrosamines, (3048113006), Council for Burley Tobacco, $3,000.00
Jacobsen, Krista/Haramoto, Erin/Phillips, Timothy/Woods, Timothy
* Covers Crops Under Cover: Evaluating Costs, Benefits, and Ecosystem Services of Cover Crops in Year-Round High Tunnel Production Systems, (3200000614), University of Georgia, $237,614.00
Ji, Huihua/Bush, Lowell
* Altria NNK research, (3048112214), Altria Corporate Services Inc, $77,000.00
Knott, Carrie
Improving Soybean Yield in the Double Crop Soybean Production System, (3048112904), North Central Soybean Research Program, $20,000.00
Knott, Carrie
Can wheat yield and grain fill duration be increased by decreasing wheat canopy temperature, (3048112803), Kentucky Small Grain Growers Association, $27,346.00
Knott, Carrie/Grove, J
Improving Soybean Yields with Crop Rotation, (3048112466), Kentucky Soybean Promotion Board, $39,852.00
Lee, Brad
Climate change impacts on soil-water availability under different land management: forest and grasslands in MLRA 120, (3048111841), Natural Resources Conservation Service, $3,998.00
Lee, Chad
Kentucky SO 22 Lee 2016-01-N6-06. SOYBEAN PROP LP, (3048113062), Monsanto Co, $6,048.00
Lee, Chad
Kentucky SO24 Lee 2016-01-B3-03, (3048113060), Monsanto Co, $11,200.00
Lee, Chad
Kentucky SO 23 Lee 2016-01-N6-07. SOYBEAN PROP HP, (3048113063), Monsanto Co, $5,040.00
Lee, Chad/Knott, Carrie
Rye and Barley Management Study, (3048112839), Kentucky Small Grain Growers Association, $10,000.00

Lee, Chad/Knott, Carrie
Inoculating Soybeans to Try to Increase Yield, (3048113052), Kentucky Soybean Promotion Board, $18,000.00
Lehmkuhler, Jeffrey/Amaral-Phillips, Donna/Anderson, Leslie/Bullock, Kevin/Burdine, Kenneth/Burris, Walter/Halich, Gregory/Smith, Samuel
* Kentucky Beef Network VIII Master Education Series, (3048112360), Kentucky Beef Network, $194,622.00
McCulley, Rebecca/Harwood, James/White, Jennifer
Can manipulation of fungal endophyte diversity positively influence tall fescue pasture sustainability and ecosystem functioning?, (3200000462), National Institute of Food and Agriculture, $149,736.00
McGrath, Joshua/Ritchey, Edwin
Using Precision Technology in On-farm Field Trialsto Enable Data Intensive Fertilizer, (3200000594), University of Illinois, $16,642.00
McNear, David/Grove, J/McGrath, Joshua
Rhizosphere Priming Effects on Legacy Organic Phosphorus (Po) in a Winter Wheat/corn Rotation, (3200000600), National Institute of Food and Agriculture, $499,400.00
Miller, Robert
Burley Tobacco Breeding and Genetics, (3048106988), Philip Morris International Management SA, $162,500.00
Miller, Robert
Addition of Blue Mold Resistance to KTTII Burley Tobacco Varieties, (3048112987), Council for Burley Tobacco, $8,000.00
Miller, Robert/Smalle, Jan
Evaluation and Control of Ground Sucker Formation in Burley Tobacco Varieties, (3048112986), Council for Burley Tobacco, $6,000.00
Murdock, Lloyd
Fragipan Remediation small grains, (3048112813), Kentucky Small Grain Growers Association, $25,000.00
Murdock, Lloyd/Grove, J/Matocha, Christopher
Corn Fragipan, (3048112723), Kentucky Corn Growers Association, $25,000.00
Murdock, Lloyd/Karathanasis, Anastasios
Fragipan Remediation 2016 Soybean, (3048112994), Kentucky Soybean Promotion Board, $25,000.00
Nokes, Sue/Crofcheck, Czarena/DeBolt, Seth/Halich, Gregory/Knutson, Barbara/Lee, Chad/Lynn, Bert/Montross, Michael/Rankin, Stephen/Seay, Jeffrey/Smith, Samuel/Stombaugh, Timothy
* On-Farm Biomass Processing: Towards an Integrated High Solids Transporting/Storing/Processing System, (3048109826), National Institute of Food and Agriculture, $13,227.00

Ormsbee, Lindell/Agouridis, Carmen/Edwards, Dwayne/Fryar, Alan/Lee, Brad/Price, Steven/Wang, Yitin/Wei, Yinan
* 104B State Water Resources Research Institute Program 2016 - 2021, (3200000437), US Geological Survey, $92,335.00
Pearce, Robert/Snell, William/Swetnam, Larry
Enhancing Burley Tobacco Produciton Labor Effciency 2016, (3048113033), Council for Burley Tobacco, $10,000.00
Ritchey, Edwin
Planning/Evaluation for UK-REC Wheat Field School, (3048112777), Kentucky Small Grain Growers Association, $5,735.00
Ritchey, Edwin/Bradley, Carl A./Haramoto, Erin
An Integrated Approach to Understand the Dynamics of Poultry Litter Use in Corn and Soybean Production Systems, (3048113015), Kentucky Soybean Promotion Board, $35,000.00
Slack, Charles/Lawson, Sara
Monsanto SO 25, (3048113072), Monsanto Co, $14,560.00
Slack, Charles/Lawson, Sara
Monsanto SO26 , (3048113067), Monsanto Co, $8,400.00
Slack, Charles/Lawson, Sara
Bayer FG72, (3048113071), Bayer CropScience GmbH, $10,000.00
Slack, Charles/Lawson, Sara
Syngenta Soy, (3048113029), Syngenta Crop Protection, $12,000.00
Slack, Charles/Lawson, Sara
Mon 24-01-SO'19, (3048112730), Monsanto Co, $7,000.00
Slack, Charles/Lawson, Sara
Monsanto SO'20, (3048112754), Monsanto Co, $2,100.00
Smith, Samuel
Management Tools to Improve Forage Quality and Persistence of Alfalfa, (3200000322), Cornell University, $26,862.00
Smith, Samuel/Bewley, Jeffrey/Burdine, Kenneth
Develop Science-based Recommendations to Efficiently Manage Forages, Herd Health and Productivity on Organic Dairies in the Southeastern US, (3200000419), University of Tennessee, $476,804.00
Taraba, Joseph/Edwards, Dwayne/Lee, Brad/Sama, Michael
* Phosphorus Runoff Potential and Nitrogen Flux Emissions From Compost Generated in Compost Bedded Dairy Pack Barns, (3200000182), Natural Resources Conservation Service, $75,000.00
Unrine, Jason
Synchortron X-ray microprobe and microspectroscopy research in low temperture geochemistry, (3200000206), University of Chicago, $129,722.00
Unrine, Jason/Tsyusko-Unrine, Olga
NanoFARM (Fate and Effects of Agriculturally Relevant Materials), (3200000226), National Science Foundation, $257,097.00

Unrine, Jason/Tsyusko-Unrine, Olga
Renewal-Center for the Environmental Implications of Nanotechnology, (3048111050), Duke University, $150,000.00
Van Sanford, D
Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties, (3048111385), Agricultural Research Service, $67,005.00
Van Sanford, D
Enhancing Wheat Breeding Through Selection Of Robust Disease Resistant QTL That Function In A Variable Climate, (3200000399), National Institute of Food and Agriculture, $120,000.00
Van Sanford, D
Genomic Selection in Soft Red Winter Wheat, (3048112780), Kentucky Small Grain Growers Association, $10,000.00
Van Sanford, D
Soft Red Winter Wheat Breeding and Variety Development for Kentucky, (3048112779), Kentucky Small Grain Growers Association, $55,000.00
Van Sanford, D
U.S. Wheat and Barley Scab Initiative's Networking and Facilitation Office and Website., (3200000513), Agricultural Research Service, $158,879.00
Wendroth, Ole/Knott, Carrie/Lee, Chad/Murdock, Lloyd/Sama, Michael
DEVELOPING IRRIGATION MANAGEMENT STRATEGIES FOR SOYBEAN PRODUCTION IN HUMID REGIONS OF THE SOUTHERN US, (3048112943), Southern Soybean Research Program, $50,000.00
Wendroth, Ole/Lee, Chad
Irrigating the Soil to Maximize the Crop # An Approach for Wheat to Efficient and Environmentally Sustainable Irrigation Water Management in Kentucky, (3048112766), Kentucky Small Grain Growers Association, $11,660.00
Wendroth, Ole/Lee, Chad
Irrigating the Soil to Maximize the Crop - An Approach for Soybean, (3048112760), Kentucky Soybean Promotion Board, $11,660.00
Wendroth, Ole/Lee, Chad
Irrigating the Soil to Maximize the Crop - An Approach for Corn to Efficient and Environmentally Sustainable Irrigation Water Management in Kentucky, (3048112767), Kentucky Corn Growers Association, $23,319.00
Yang, Shengming/Li, Dandan/Miller, Robert
Marker Design Based on Genotyping by Sequencing for Blue Mold Resistance in Tobacco, (3048113036), Council for Burley Tobacco, $5,000.00
Yokel, Robert/Butterfield, David/Graham, Ursula/Grulke, Eric/Unrine, Jason
* Reconciling Nanoceria's Jekyll and Hyde Reputation Toward Safer Nanotherapy, (3200000086), National Institute of General Medical Sciences, $348,156.00
Yuan, Ling/Williams, David
* KSEF RDE: Developing a Tissue Culture and Gene Transformation Platform for Industrial Hemp, (3048112650), KY Science and Technology Co Inc, $30,000.00

2015

Bailey, William
Triple mutant dark hybrid evaluations, (3048112275), Altria Corporate Services Inc, $42,000.00

Bailey, William
Triple mutant dark hybrid stress test, (3048112276), Altria Corporate Services Inc, $28,000.00

Bailey, William
Conservation tillage evaluation in dark tobacco, (3048111657), Altria Corporate Services Inc, $7,000.00

Bailey, William
Pale yellow double crop curing systems, (3048111658), Altria Corporate Services Inc, $18,000.00

Barrett, Michael
Sustainable Management of Vegetation on Kentucky Highway Rights-of-Way, (3048111755), KY Transportation Cabinet, $130,812.00

Bessin, Ricardo/Dunwell, Winston/Gauthier, Nicole/Knott, Carrie/Lucas, Patricia/Saha, Shubin
* Kentucky IPM Extension and Implementation Program:2014 - 2017, (3048112016), National Institute of Food and Agriculture, $65,000.00

Bruening, William
Performance of Small Grain Varieties in Kentucky, (3048111933), Kentucky Small Grain Growers Association, $9,000.00

Coyne, Mark/Grove, J
Study the Affect of Cover Crops on Soil Health and N Fertilizer Response, (3048112055), Natural Resources Conservation Service, $74,955.00

Crowley, P/McCulley, Rebecca/Sargent, R/Westneat, David/Zeidler-Watters, Kimberly
* Field station planning for the Ecological Research and Education Center, University of Kentucky, (3048111702), National Science Foundation, $25,000.00

Goff, Ben
Enhanced Efficiency Nitrogen Fertilizers on the Production and Nutritive Value of Bermudagrass Pastures, (3048111284), Koch Agronomic Services LLC, $5,042.00

Green, Jonathan/Martin, James
Introducing New Technologies for Managing Herbicide Resistant Weeds, (3048112459), Kentucky Soybean Promotion Board, $13,109.00

Grove, J
PEP-NBT: Product Evaluation Protocol and the Next Big Thing in Corn Production, (3048112484), Kentucky Corn Growers Association, $30,000.00

Grove, J/Bruening, William
PEP-NBT: Product Evaluation Protocol and the Next Big Thing in Wheat Production, (3048111934), Kentucky Small Grain Growers Association, $12,500.00

Grove, J/Ritchey, Edwin
Raising Soybean Yield Potential in Dry Seasons: Increased Rooting Depth and Greater Soil Water Extraction with Deeper Depth to the Fragipan, (3048112461), Kentucky Soybean Promotion Board, $15,000.00
Grove, J/Venard, Claire
PEP-NBT: Product Evaluation Protocol and the Next Big Thing in Soybean Production, (3048112460), Kentucky Soybean Promotion Board, $35,000.00
Hanley, Carol/Cooper, Robin/Criswell, Brett/Garvy, Beth/Moe, Luke/Moecher, David/Proffitt, Mary/Schroeder, Margaret/Testa, Stephen/Walcott, Bruce/Webb, Nancy
* STEM PRIDE: Partnering with Research & Industry to Develop STEM Educators for College and Career Readiness, (3048112388), KY Council on Postsecondary Education, $149,939.00
Hildebrand, David
Improved Chia Production & Product Usage, (3048112002), Kentucky Small Grain Growers Association, $21,318.00
Hildebrand, David
Renewable Lubricants from Plant Oils # Ashland/UKY, (3048112070), Ashland Inc, $30,000.00
Hildebrand, David/Phillips, Timothy
Development of Chia, Salvia Hispanica L., as a Sustainable Oil Source for Renewable Chemical Applications, (3048112085), Cono SA, $27,920.00
Hunt, Arthur
Collaborative Research: CPSF30 at the convergence of cellular signaling and RNA Processing, (3048111913), National Science Foundation, $303,269.00
Hunt, Arthur
KSEF RDE: Posttranscriptional Control of Responses of Plants to Elevated Temperatures, (3048111592), KY Science and Technology Co Inc, $29,997.00
Jack, Anne/Fisher, Colin/Ji, Huihua
* "HP 400" Evaluation of the Efficacy of HP400 in Reducing TSNAs, (3048111654), Council for Burley Tobacco, $4,500.00
Jack, Anne/Fisher, Colin/Ji, Huihua
* "Sample Prep" Sample Preparation for TSNA Analysis, (3048111652), Council for Burley Tobacco, $9,000.00
Jack, Anne/Fisher, Colin/Ji, Huihua/Smalle, Jan
* "Quercetin" The Effects of Pre-Harvest Quercetin Application on the Accumulation of Tobacco-Specific Nitrosamines, (3048111651), Council for Burley Tobacco, $6,300.00
Ji, Huihua/Bush, Lowell
* Altria NNK research, (3048112214), Altria Corporate Services Inc, $77,000.00
Karathanasis, Anastasios
Soil Morphology, (3048111406), KY Department for Public Health, $40,000.00

Knott, Carrie
Applied and Basic Irrigation Research Projects Proposed for UKREC, Princeton, (3048112596), Kentucky Soybean Promotion Board, $32,000.00
Knott, Carrie/Ritchey, Edwin/Van Sanford, D
Effect of plant growth regulator, Palisade 2EC, and different nitrogen rates on wheat growth and yield, (3048111935), Kentucky Small Grain Growers Association, $9,776.00
Lee, Brad
Climate change impacts on soil-water availability under different land management: forest and grasslands in MLRA 120, (3048111841), Natural Resources Conservation Service, $172,000.00
Lee, Brad/Edwards, Dwayne/Grove, J/Ritchey, Edwin
Phosphorus runoff potential in major row crop soils of Kentucky, (3048111949), Natural Resources Conservation Service, $75,000.00
Lee, Chad
2015 Soybean Foliar (SO14) , (3048112638), Monsanto Co, $6,300.00
Lee, Chad
2015-SOYB_OPS LCM USA SO16 , (3048112637), Monsanto Co, $3,780.00
Lee, Chad
2015-SOYB-370 (SO15), (3048112636), Monsanto Co, $3,780.00
Lee, Chad/Knott, Carrie/McGrath, Joshua/Ritchey, Edwin
Determining the Effect of Additional Fertilizer Nitrogen on Irrigated Soybean Yield, (3048112457), Kentucky Soybean Promotion Board, $6,000.00
Lehmkuhler, Jeffrey/Amaral-Phillips, Donna/Anderson, Leslie/Bullock, Kevin/Burdine, Kenneth/Burris, Walter/Halich, Gregory/Smith, Samuel
* Kentucky Beef Network VIII Master Education Series, (3048112360), Kentucky Beef Network, $232,836.00
Martin, James
SO17: Marestail Control in RR2 Xtend System-Midwest, (3048112645), Monsanto Co, $10,500.00
Martin, James/Green, Jonathan
Development of Effective Educationmal Programs to Manage and Mitigate Herbicide Resistant Weeds, (3048111085), Purdue University, $30,000.00
McCulley, Rebecca
Manipulating grass-fungal endophyte symbioses to reduce greenhouse gas emmisions and increase soil carbon sequestration in grasslands of Finland, Spain and the United States, (3048111607), National Institute of Food and Agriculture, $100,000.00
McCulley, Rebecca/Lee, Brad
* Campus Rain Garden Initiative: A Pilot Project for Student Stormwater Education, (3048111189), Lexington Fayette Urban County Government, ($22,298.00)
McCulley, Rebecca/Lee, Brad
* Campus Rain Garden Initiative: A Pilot Project for Student Stormwater Education, (3048111900), Lexington Fayette Urban County Government, $22,298.00

McGrath, Joshua
SAM Initiative: Achieving Subsurface Application of Manures in the Chesapeake Bay Basin, (3048112323), National Fish and Wildlife Foundation, $257,621.00
McNear, David
Influence of microbial-based soil additives on P speciation and availability, (3048111921), Agricen Sciences, $34,062.00
Miller, Robert
Evaluation and Control of Ground Sucker Formation in Burley Tobacco Varieties, (3048111988), Altria Corporate Services Inc, $49,306.00
Miller, Robert
Evaluation and Control of Ground Sucker Formation in Burley Tobacco Varieties, (3048112382), Council for Burley Tobacco, $15,000.00
Miller, Robert
Addition of Blue Mold Resistance to KTTII Burley Tobacco Varieties, (3048112337), Council for Burley Tobacco, $20,000.00
Miller, Robert
Burley Tobacco Breeding and Genetics, (3048106988), Philip Morris International Management SA, $325,000.00
Murdock, Lloyd/Karathanasis, Anastasios
Fragipan Remediation, (3048111944), Kentucky Small Grain Growers Association, $35,000.00
Ormsbee, Lindell/Agouridis, Carmen/Barton, Christopher/Cox, John/Coyne, Mark/Fox, James/Fryar, Alan/Knott, Carrie/Pennell, Kelly/Taraba, Joseph/Zhu, Junfeng
* State Water Institute Fiscal Year 2011-2016, (3048108119), US Geological Survey, $92,335.00
Pearce, Robert/Fisher, Colin
Low Alkaloid Burley Yield Test: Conservation Tillage, (3048111656), Altria Corporate Services Inc, $45,832.00
Pearce, Robert/Snell, William/Swetnam, Larry
Enhancing Burley Tobacco Production Labor Efficiency, (3048112406), Council for Burley Tobacco, $20,000.00
Ritchey, Edwin
Equipment Proposal: SUPPORT OF PLOT COMBINE, (3048112293), Kentucky Soybean Promotion Board, $264,900.00
Ritchey, Edwin/Haramoto, Erin/Hershman, Donald
An Integrated Approach to Understanding the Dynamics of Poultry Litter Use in Corn-soybean Production Systems, (3048112455), Kentucky Soybean Promotion Board, $35,000.00
Ritchey, Edwin/Hershman, Donald/Martin, James
An Integrated Approach to Understand the Agronomic Responses to Poultry Litter Use and Soybean and Corn Production Systems, (3048109298), KY Corn Growers Association, $35,000.00

Slack, Charles/Lawson, Sara
Monsanto 24-04 Service Order 13, (3048112611), Monsanto Co, $7,000.00
Slack, Charles/Lawson, Sara
Bayer Soybean, (3048112594), Bayer CropScience GmbH, $10,000.00
Smalle, Jan
Flavonoid Isolation From Intact Plants: A Nanoparticle-Based Approach, (3048112274), National Institute of Food and Agriculture, $450,000.00
Taraba, Joseph/Coyne, Mark/Reed, Michael
* Proposal to Host Borlaug Fellow from Mexico on Greenhouse Gas (GHG) Emissions from Composting, (3048111904), Foreign Agricultural Service, $24,764.00
Unrine, Jason
Synchrotron X-Ray Microprobe and Microspectroscopy Research at Low Temperature Geochemistry, (3048109477), University of Chicago, $8,332.00
Unrine, Jason
Characterization of Environmental Transformation, Exposure from Sediment, and Toxicity (E-TEST) for ZnO Nanomaterials in Natural Systems, (3048111598), National Science Foundation, $150,632.00
Unrine, Jason/Tsyusko-Unrine, Olga
Renewal-Center for the Environmental Implications of Nanotechnology, (3048111050), Duke University, $150,000.00
Van Sanford, D
U.S. Wheat and Barley Scab Initiative's Networking and Facilitation Office and Website, (3048108107), Agricultural Research Service, $2,139.00
Van Sanford, D
Imrproving Barley and Wheat Germplasm for Changing Environments, (3048107999), University of California Davis, $64,615.00
Van Sanford, D
Development of an AgWeather Website for Kentucky Corn Growers, (3048111819), Kentucky Corn Growers Association, $13,000.00
Van Sanford, D
Soft Red Winter Wheat Breeding and Variety Development for Kentucky, (3048111932), Kentucky Small Grain Growers Association, $39,000.00
Van Sanford, D
Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties, (3048111385), Agricultural Research Service, $61,171.00
Wagner, George/Mihaylova-Kroumova, Antoaneta/Yuan, Ling/Zaitlin, David
A Knockdown-Towards-Mutation Approach for Manipulating the Chemistry of Tobacco, (3048110969), British American Tobacco, $129,627.00
Warner, Richard/Agouridis, Carmen/Barton, Christopher/Unrine, Jason
* Appalachian Research Initiative for Environmental Science (ARIES), (3048108632), Virginia Polytechnic Institute and State University, $50,000.00

Williams, David
Regional Biomass Feedstock Partnership, (3048112491), South Dakota State University, $20,000.00
Yang, Shengming/Li, Dandan/Miller, Robert
Development of User-friendly Markers for Disease Resistance to Potato Virus Y (PVY) and Black Root Rot (BRR) in Burley Tobacco, (3048112383), Council for Burley Tobacco, $15,000.00
Yang, Shengming/Li, Dandan/Miller, Robert
Controlling Endophyte Colonization to Reduce TSNA in Tobacco Leaves, (3048112381), Council for Burley Tobacco, $5,000.00
Zhu, Hongyan
Development of Molecular Markers for Selection Against a Soybean Gene that Restricts Nodulation by the Highly Efficient Nitrogen-fixing Strain USDA 110, (3048112458), Kentucky Soybean Promotion Board, $40,000.00

2014
Barrett, Michael
Sustainable Management of Vegetation on Kentucky Highway Rights-of-Way, (3048111142), KY Transportation Cabinet, $129,536.00
Bessin, Ricardo/Dunwell, Winston/Gauthier, Nicole/Knott, Carrie/Lee, Chad/Lucas, Patricia/Seebold, Kenneth
* Advancing IPM in Kentucky through Extension: 2013-2016, (3048110899), National Institute of Food and Agriculture, $86,500.00
Bruening, William
Performance of Small Grain Varieties in Kentucky, (3048111036), Kentucky Small Grain Growers Association, $9,000.00
Chappell, Joseph/Goklany, Sheba
* Synthetic Crop for Direct Biofuel Production through Re-routing the Photorespiration Intermediates and Engineering Terpenoid Pathways, (3048111047), Texas AgriLife Research, $403,100.00
Fisher, Colin
The effect of temperature and relative humidity on TSNA accumulation during curing of burley tobacco, (3048110903), Council for Burley Tobacco (for profit), $14,000.00
Fisher, Colin/Jack, Anne/Li, Dandan
Development of pale Burley Tobacco, (3048111503), Council for Burley Tobacco, $10,000.00
Goff, Ben
Enhanced Efficiency Nitrogen Fertilizers on the Production and Nutritive Value of Bermudagrass Pastures, (3048111284), Koch Agronomic Services LLC, $5,490.00
Goff, Ben
Resurrecting Perennial Legumes as a Livestock Feeding Strategy:An Improved High-Tannin Birdsfoot Trefoil Cultivar with Trans-Regional Potential, (3048111494), Auburn University, $26,826.00

Grove, J/Ritchey, Edwin
Raising Soybean Yield Potential in Dry Seasons: Increased Rooting Depth and Greater Soil Water Extraction with Deeper Depth to the Fragipan, (3048111335), Kentucky Soybean Promotion Board, $35,000.00
Hildebrand, David
Soybean Oil as a High Value Fuel Cell Energy Source & Lubricant, (3048111334), Kentucky Soybean Promotion Board, $27,841.00
Hildebrand, David
Establishing Salvia Hispanica as a Sustainable Crop for Kentucky Farmers, (3048111127), Kentucky Small Grain Growers Association, $19,842.00
Hildebrand, David
Commercialization of Early Flowering Chia, (3048110920), Kentucky Specialty Grains LLC, $4,000.00
Hunt, Arthur
Alternative polyadenylation and non-stop mRNAs in Arabidopsis, (3048110807), National Science Foundation, $530,446.00
Jack, Anne/Fisher, Colin
* Cytokinin application to reduce TSNAs in burley tobacco, (3048111505), Council for Burley Tobacco, $10,000.00
Jacobsen, Krista/Wendroth, Ole
* Sustainable Nutrient Cycling on Diversified Farms Serving Community Food Systems, (3048110977), National Institute of Food and Agriculture, $495,000.00
Karathanasis, Anastasios
Morphological, Physico-Chemical, and Mineralogical Characterization of Kentucky Soils, (3048110854), Natural Resources Conservation Service, $10,000.00
Karathanasis, Anastasios
Soil Atlas of Kentucky, (3048110853), Natural Resources Conservation Service, $20,000.00
Knott, Carrie/Grove, J
Improving Soybean Yields with Crop Rotation, (3048111343), Kentucky Soybean Promotion Board, $34,928.00
Lawson, Sara/Slack, Charles
Bayer Soybean, (3048111416), Bayer CropScience GmbH, $10,000.00
Lee, Brian/Karathanasis, Anastasios
* Integrating Spatial Educational Experiences (Isee) - Mapping a New Approach to Teaching and Learning Soil Science, (3048111260), Purdue University, $112,500.00
Lee, Chad
Agronomic Maximization of Soybean Yield and Quality, (3048108961), University of Minnesota, $70,000.00
Lee, Chad
Effect of planting date and RM on performance of DroughtGard hybrids under moderate stress or VRI systems, (3048111489), Monsanto Co, $6,720.00

Lee, Chad
Reducing Soybean Stress to Increase Yield, (3048111338), Kentucky Soybean Promotion Board, $40,691.00
Lee, Chad/Russell, Kathleen/Van Sanford, D
Genotype x Envrionment x Management Interactions in Wheat: Year 2, (3048111039), Kentucky Small Grain Growers Association, $6,800.00
Lehmkuhler, Jeffrey/Amaral-Phillips, Donna/Anderson, Leslie/Bullock, Kevin/Burdine, Kenneth/Burris, Walter/Halich, Gregory/Smith, Samuel
* Kentucky Beef Network, (3048110198), KY Beef Network, $241,512.00
Martin, James
Strategies to Confirm and Manage ALS-Resistant Common Chickweed in Wheat in Kentucky (2013-2014), (3048111024), Kentucky Small Grain Growers Association, $8,420.00
Martin, James
Warrant PRE in Soybeans, (3048110848), Monsanto Co, $13,440.00
Martin, James
Evaluation of Residual Properties of MON119096, (3048111449), Monsanto Co, $6,370.00
Martin, James
Roundup Xtend Sustems Recommendations, (3048111444), Monsanto Co, $11,200.00
Martin, James/Green, Jonathan
Development of Effective Educationmal Programs to Manage and Mitigate Herbicide Resistant Weeds, (3048111085), Purdue University, $30,000.00
Martin, James/Green, Jonathan
Developing Control Strategiesfor Glyphosate - Resistant Weeds in Kentucky, (3048111342), Kentucky Soybean Promotion Board, $16,670.00
McCulley, Rebecca
Controls on the Plant-Soil Stoichiometry of Dryland Agroecosystems: A Sabbatical Strengthening Grant, (3048110948), National Institute of Food and Agriculture, $112,015.00
McCulley, Rebecca/Lee, Brad
* Campus Rain Garden Initiative: A Pilot Project for Student Stormwater Education, (3048111189), Lexington Fayette Urban County Government, $22,298.00
Miller, Robert
The Effects of Plant Population on Agronomic Characteristics of Burley Tobacco, (3048111023), Council for Burley Tobacco (for profit), $25,000.00
Miller, Robert
Burley Tobacco Breeding and Genetics, (3048106988), Philip Morris International Management SA, $325,000.00
Murdock, Lloyd/Grove, J/Matocha, Christopher
Fragipan Remediation corn, (3048111148), Kentucky Corn Growers Association, $35,000.00

Murdock, Lloyd/Karathanasis, Anastasios
Fragipan Remediation Soybean, (3048111344), Kentucky Soybean Promotion Board, $35,000.00
Murdock, Lloyd/Karathanasis, Anastasios
Small Grain Fragipan Remediation, (3048111001), Kentucky Small Grain Growers Association, $35,000.00
Phillips, Timothy
Development of Chia in Kentucky, (3048110919), Kentucky Specialty Grains LLC, $4,620.00
Ritchey, Edwin/Hershman, Donald/Martin, James
An Integrated Approach to Understand the Agronomic Responses to Poultry Litter Use and Soybean and Corn Production Systems, (3048109298), KY Corn Growers Association, $35,000.00
Ritchey, Edwin/Hershman, Donald/Martin, James
An Integrated approach to understanding the dynamics of poultry litter use, (3048111336), Kentucky Soybean Promotion Board, $35,000.00
Slack, Charles/Lawson, Sara
RoundupXtend Systems Recommendations, (3048111394), Monsanto Co, $11,200.00
Slack, Charles/Lawson, Sara
MGI herbicide-tolerant soybeans: Evaluation of mesotrione-based weed management programs., (3048111329), Syngenta Crop Protection, $12,500.00
Slack, Charles/Lawson, Sara
Monsanto SO 10, (3048111490), Monsanto Co, $8,960.00
Slack, Charles/Lawson, Sara
Monsanto SO 11, (3048111584), Monsanto Co, $7,280.00
Slack, Charles/Lawson, Sara
Warrant post soybean, (3048110719), Monsanto Co, $6,720.00
Unrine, Jason
Synchrotron X-Ray Microprobe and Microspectroscopy Research at Low Temperature Geochemistry, (3048109477), University of Chicago, $51,511.00
Unrine, Jason/Tsyusko-Unrine, Olga
Renewal-Center for the Environmental Implications of Nanotechnology, (3048111050), Duke University, $150,000.00
Van Sanford, D
Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties, (3048111385), Agricultural Research Service, $68,823.00
Van Sanford, D
Imrproving Barley and Wheat Germplasm for Changing Environments, (3048107999), University of California Davis, $53,368.00
Van Sanford, D
U.S. Wheat and Barley Scab Initiative's Networking and Facilitation Office and Website, (3048108107), Agricultural Research Service, $246,002.00

Van Sanford, D
Development of a Farmer-Friendly AgWeather Website for Kentucky, (3048111430), Kentucky Small Grain Growers Association, $13,000.00
Van Sanford, D
Soft Red Winter Wheat Breeding and Variety Development for Kentucky, (3048111014), Kentucky Small Grain Growers Association, $36,000.00
Venard, Claire
Support for Student Internship with theKentucky Soybean Variety Performance Program (2014), (3048111352), Kentucky Soybean Promotion Board, $8,059.00
Wagner, George
Prospects for using nanoparticles to replace Quadris for control of frogeye leaf spot and blue mold in tobacco cultivation., (3048110888), Council for Burley Tobacco (for profit), $25,000.00
Wagner, George/Mihaylova-Kroumova, Antoaneta/Yuan, Ling
A Knockdown-Towards-Mutation Approach for Manipulating the Chemistry of Tobacco, (3048110969), British American Tobacco, $932,458.00
Warner, Richard/Agouridis, Carmen/Barton, Christopher/Unrine, Jason
* Appalachian Research Initiative for Environmental Science (ARIES), (3048108632), Virginia Polytechnic Institute and State University, $35,000.00
Wendroth, Ole/Knott, Carrie/Lee, Chad/Murdock, Lloyd
Challenges in Soybean Irrigation # Soil and Crop Irrigation Management (SCIM), (3048111436), Southern Soybean Research Program, $8,090.00
Wendroth, Ole/Lee, Chad
Irrigating the Soil to Maximize the Crop - An Approach for Soybean, (3048111360), Kentucky Soybean Promotion Board, $16,388.00
Wendroth, Ole/Lee, Chad
Irrigating the Soil to Maximize the Crop - An Approach for Corn to Efficient and Environmentally Sustainable Irrigation Water Management in Kentucky, (3048111362), Kentucky Corn Growers Association, $32,775.00
Wendroth, Ole/Lee, Chad
Irrigating the Soil to Maximize the Crop - An Approach for Wheat to Efficient and Environmentally Sustainable Irrigation Water Management in Kentucky, (3048111359), Kentucky Small Grain Growers Association, $16,388.00
Williams, David
Evaluation of Miscanthus Species as Feedstock Biofuels, (3048108688), Ceres Inc, $1.00
Williams, David
Regional Biomass Feedstock Partnership, (3048104694), South Dakota State University, $53,000.00

Yang, Shengming
Development of User-friendly Markers for Disease Resistance to Potato Virus Y (PVY) and Black Root Rot (BRR) in Burley Tobacco, (3048111506), Council for Burley Tobacco, $15,000.00
Yuan, Ling/Moe, Luke
* Production of Chemicals in Tobacco Leaves, (3048111120), British American Tobacco, $455,315.00
Zaitlin, David/Miller, Robert
* Utilization of the Arabidopsis FT Gene to Facilitate Rapid Tobacco Variety Development, (3048110890), Council for Burley Tobacco (for profit), $30,000.00
Zhu, Hongyan
Host genetic control of strain-specific nitrogen fixation in the legume-rhizobial symbiosis, (3048111066), National Institute of Food and Agriculture, $500,000.00
Zhu, Hongyan
Genetic improvement of symbiotic nitrogen fixation in soybeans, (3048111337), **Kentucky Soybean Promotion Board, $35,000.00**

2013

Bailey, William
Project 1 - Effect of Excess Heat on TSNA, (3048110355), Altria Corporate Services Inc, $91,000.00
Bailey, William/Pearce, Robert
Conservation tillage management systems for tobacco, (3048110540), Altria Corporate Services Inc, $48,640.00
Barton, Christopher/Karathanasis, Anastasios
* Evaluation of acidic atmospheric deposition and its influence on soil solution composition in the Daniel Boone National Forest, (3048108882), Forest Service, $33,490.00
Bertsch, Paul/Unrine, Jason
Synchrotron X-Ray Microprobe and Microspectroscopy Research at Low Temperature Geochemistry, (3048109477), University of Chicago, $47,730.00
Bertsch, Paul/Unrine, Jason
Center for the Environmental Implications of Nanotechnology (CEIN), (3048105332), Duke University, $137,800.00
Bessin, Ricardo/Coolong, Timothy/Durham, Richard/Johnson, Douglas/Lee, Chad/Lucas, Patricia/Murdock, Lloyd
* IPM in Kentucky: Integrated Development and Delivery, (3048107580), National Institute of Food and Agriculture, $93,645.00
Bruening, William
Performance of Small Grain Varieties in Kentucky, (3048109873), Kentucky Small Grain Growers Association, $8,500.00
Carter, Sara/Slack, Charles
Monsanto 24-14, (3048110481), Monsanto Co, $6,000.00

Carter, Sara/Slack, Charles
Bayer Soybean, (3048110460), Bayer CropScience GmbH, $10,000.00
Carter, Sara/Slack, Charles
Syngenta Soybean, (3048110446), Syngenta Crop Protection, $14,000.00
D'Angelo, Elisa/Agouridis, Carmen/Hower, James/McNear, David/Unrine, Jason/Warner, Richard
Remediation of coal slurry impoundment liquids using a multi-stage constructed treatment wetland system, (3048110449), KY Energy and Environment Cabinet, $61,355.00
Ditsch, David
UK Robinson Center Farmer's Market Shelter, (3048110079), KY Governor's Office of Agricultural Policy, $40,000.00
Grove, J/Ritchey, Edwin
Raising Soybean Yield Potential in Dry Seasons: Increased Rooting Depth and Greater Soil Water Extraction with Deeper Depth to the Fragipan, (3048110343), Kentucky Soybean Promotion Board, $35,000.00
Hildebrand, David
Development of Chia, Salvia hispanica L., as a Sustainable Oil Source for Renewable Chemical Applications, (3048110300), Consortium for Plant Biotechnology Research Inc, $24,694.00
Hildebrand, David
Establishing Salvia hispanica as a Sustainable Grain Crop for KY Farmers, (3048109909), Kentucky Small Grain Growers Association, $10,000.00
Hunt, Arthur
Collaborative Proposal: CPSF30 at the Convergence of RNA Processing, Cellular Signaling and Development in Plants, (3048105143), National Science Foundation, $16,661.00
Karathanasis, Anastasios
Soils Morphology Course, (3048109828), KY Department for Public Health, $40,000.00
Kuhn, Robert/Mansour, Heidi/Salazar, Abraham/Unrine, Jason/Zhan, Chang-Guo
* Construction and assessment of prototype devices to remove aluminium from solutions, (3048108494), Alkymos Inc, $15,000.00
Lee, Brad
2008 Southern Regional Water Resource Project, (3048105666), Texas A&M University, $32,000.00
Lee, Chad
Agronomic Maximization of Soybean Yield and Quality, (3048108961), University of Minnesota, $70,000.00
Lee, Chad
Stressing Soybeans to Increase Yield, (3048110324), Kentucky Soybean Promotion Board, $51,932.00

Lee, Chad/Russell, Kathleen/Van Sanford, D
Genotype x Environment x Management Interactions in Wheat, (3048109876), Kentucky Small Grain Growers Association, $6,800.00
Lehmkuhler, Jeffrey/Amaral-Phillips, Donna/Anderson, Leslie/Bullock, Kevin/Burdine, Kenneth/Burris, Walter/Halich, Gregory/Smith, Samuel
* Kentucky Beef Network, (3048110198), KY Beef Network, $243,735.00
Martin, James
Residual Timing for Marestail Control in Soybean. (Service order no 16), (3048109651), Monsanto Co, $6,950.00
Martin, James
RR2X Soybean Systems Recommendations: Midwest (conventional tillage), (3048110552), Monsanto Co, $9,600.00
Martin, James
Using Wheat as a Tool for Managing Palmer Amaranth, (3048109882), Kentucky Small Grain Growers Association, $5,000.00
Martin, James
Evaluating Marestail Control with Wheat Herbicides, (3048109881), Kentucky Small Grain Growers Association, $3,000.00
Martin, James/Green, Jonathan
Development of Effective Educationmal Programs to Manage and Mitigate Herbicide Resistant Weeds, (3048109968), Purdue University, $30,000.00
Martin, James/Green, Jonathan
Developing Control Strategies for Glyphosate - Resistant Weeds in Kentucky, (3048110334), Kentucky Soybean Promotion Board, $15,770.00
McNeill, S/Halich, Gregory/Lee, Chad/Meyer, Alphonse
* Developing an Organic Corn Enterprise in Kentucky, (3048109754), University of Georgia, $10,000.00
Meyer, Alphonse/Bewley, Jeffrey/Hunter, Jennifer/Isaacs, Steven/Katchova, Ani/Ritchey, Edwin
* KyFarmStart II: A Whole Farm Management Education Program for Beginning Farmers, (3048109667), National Institute of Food and Agriculture, $561,564.00
Miller, Robert
Evaluation of Altria Burley Breedling Lines, (3048108164), Altria Corporate Services Inc, ($22,240.00)
Miller, Robert
Burley Tobacco Breeding and Genetics, (3048106988), Philip Morris International Management SA, $325,000.00
Moe, Luke
KSEF RDE: Bacteria and Bioethanol Fermentation: Characterizing the Impact of Bacterial Contaminants and Bacterial Community Structure on Bioethanol Fermentations Across the US, (3048109480), KY Science and Technology Co Inc, $43,940.00

Mueller, Thomas
GIS and Cloud Computing Tools for Soil and Water Conservation: Grassed Waterways and Nitrogen Fertilizer Recommendations., (3048109590), Natural Resources Conservation Service, $75,000.00
Mueller, Thomas
Methodology for Designing Vegetative Buffers Using GIS and Terrain Analysis, (3048107465), Forest Service, $25,000.00
Murdock, Lloyd/Grove, J/Matocha, Christopher
Corn Growers Fragipan Remediation, (3048110001), Kentucky Corn Growers Association, $35,000.00
Murdock, Lloyd/Karathanasis, Anastasios
Fragipan Remediation, (3048110331), Kentucky Soybean Promotion Board, $35,000.00
Murdock, Lloyd/Karathanasis, Anastasios
Small Grain Fragipan Remediation, (3048109989), Kentucky Small Grain Growers Association, $13,888.00
Murdock, Lloyd/Karathanasis, Anastasios
Soybean Fragipan Remediation, (3048109996), Kentucky Soybean Promotion Board, $35,000.00
Nokes, Sue/Crofcheck, Czarena/DeBolt, Seth/Halich, Gregory/Knutson, Barbara/Lee, Chad/Lynn, Bert/Montross, Michael/Mueller, Thomas/Rankin, Stephen/Seay, Jeffrey/Smith, Samuel/Stombaugh, Timothy
* On-Farm Biomass Processing: Towards an Integrated High Solids Transporting/Storing/Processing System, (3048109826), National Institute of Food and Agriculture, $5,932,786.00
Ritchey, Edwin/Hershman, Donald/Martin, James
An Integrated Approach to Understanding the Dynamics of Poultry Litter Use in Corn-Soybean Production systems, (3048110325), Kentucky Soybean Promotion Board, $35,000.00
Ritchey, Edwin/Hershman, Donald/Martin, James
An Integrated Approach to Understand the Agronomic Responses to Poultry Litter Use and Soybean and Corn Production Systems, (3048109298), KY Corn Growers Association, $35,000.00
Slack, Charles/Carter, Sara
Monsanto Test - Service Order No. 13, (3048109584), Monsanto Co, $8,400.00
Slack, Charles/Carter, Sara
Warrant Soybean tests 2012 - Service Order No. 15, (3048109614), Monsanto Co, $6,000.00
Slack, Charles/Carter, Sara
MON 09-08, (3048110476), Monsanto Co, $6,000.00
Smalle, Jan
KSEF RDE: Stability control of the microtubule-associated protein SPIRAL1 and its role in plant salt stress tolerance, (3048109523), KY Science and Technology Co Inc,

$49,482.00

Smith, Samuel

Multiple Uses for Switchgrass Stands Following Biomass Production, (3048109586), Natural Resources Conservation Service, $75,000.00

Smith, Samuel

Seeded Switchgrass Yield Trial--Annex 1, (3048109418), Ceres Inc, ($26,250.00)

Smith, Samuel/Montross, Michael

Farm Scale Biomass Production for Electricity Gerneration and Community Development, (3048108696), KY Forage and Grasslands Council, $20,000.00

Unrine, Jason/Bertsch, Paul

Synchrotron X-Ray Microprobe and Microspectroscopy Research at Low Temperature Geochemistry, (3048109477), University of Chicago, $49,571.00

Van Sanford, D

U.S. Wheat and Barley Scab Initiative's Networking and Facilitation Office and Website, (3048108107), Agricultural Research Service, $134,717.00

Van Sanford, D

Imrproving Barley and Wheat Germplasm for Changing Environments, (3048107999), University of California Davis, $65,676.00

Van Sanford, D

Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties, (3048105647), Agricultural Research Service, $58,632.00

Van Sanford, D

Soft Red Winter Wheat Breeding and Variety Development For Kentucky, (3048109877), Kentucky Small Grain Growers Association, $35,700.00

Warner, Richard/Agouridis, Carmen/Barton, Christopher/Unrine, Jason

* Appalachian Research Initiative for Environmental Science (ARIES), (3048108632), Virginia Polytechnic Institute and State University, $287,350.00

Wendroth, Ole/Egli, Dennis/Lee, Chad/Murdock, Lloyd

Managing Within-Field Variability of Winter Wheat # Upscaling from Transect to Field, (3048109874), Kentucky Small Grain Growers Association, $6,500.00

Williams, David

Evaluation of Miscanthus Species as Feedstock Biofuels, (3048108688), Ceres Inc, ($14,596.00)

Williams, David

Regional Biomass Feedstock Partnership, (3048104694), South Dakota State University, $12,500.00

Witt, William

Management of Troublesome Weeds in Highway Rights of Way, (3046705900), KY Transportation Cabinet, $1.00

Zhu, Hongyan

KSEF RDE: Host genetic control of strain-specific nitrogen fixation in Medicago truncatula, (3048109518), KY Science and Technology Co Inc, $50,000.00

2012

Arnold, Susanne/Baron, Andre/Hahn, Ellen/Hopenhayn, Claudia/Huang, Bin/Johnson, Nancy/Mellon, Isabel/Orren, David/Pulliam, Joseph/Sanderson, Wayne/Unrine, Jason

* A population-based case-control study of lung cancer in Appalachian Kentucky: The role of environmental carcinogens, (3048108485), Army Medical Research and Materiel Command, $1,430,000.00

Bailey, William

Princeton, KY Field Yield and Quality Evaluation of Burley RNAi Nicotine Demethylase Lines and Hybrids, (3048108161), Altria Corporate Services Inc, $47,955.00

Barrett, Michael

Regional Biomass Feedstock Partnership - Herbaceous Bioenergy Crop Field Trials, (3048104613), South Dakota State University, $30,000.00

Barton, Christopher/Karathanasis, Anastasios

* Evaluation of acidic atmospheric deposition and its influence on soil solution composition in the Daniel Boone National Forest, (3048108882), Forest Service, $50,267.00

Bertsch, Paul/Unrine, Jason

Center for the Environmental Implications of Nanotechnology (CEIN), (3048105332), Duke University, $110,001.00

Bessin, Ricardo/Johnson, Douglas/Coolong, Timothy/Durham, Richard/Johnson, Douglas/Lee, Chad/Lucas, Patricia/Murdock, Lloyd

* IPM in Kentucky: Integrated Development and Delivery, (3048107580), National Institute of Food and Agriculture, $93,645.00

Bruening, William

Performance of Small Garin Varieties in KY, (3048108668), KY Small Grain Growers Association, $8,000.00

Carter, Sara/Slack, Charles

Bayer Master Agreement-Field Trial, (3048109376), Bayer CropScience GmbH, $7,000.00

Carter, Sara/Slack, Charles

DTS Soybean - Service Order No. 14, (3048109373), Monsanto Co, $9,600.00

Chappell, Joseph

Synthetic Crop for Direct Biofuel Production through Re-routing the Photorespiration Intermediates and Engineering Terpenoid Pathways#, (3048109229), Texas AgriLife Research, $232,210.00

Chappell, Joseph

Engineering High Value Oil Production into Biofuel Crops, (3048107853), National Institute of Food and Agriculture, $785,784.00

Fisher, Colin/Li, Dandan

Introducing the Pale Yellow Gene into Increased Chlorophyll Burley, (3048109230), Burley Tobacco Growers Cooperative Association Inc, $8,000.00

Grove, J/Ritchey, Edwin

Raising Soybean Yield Potential in Dry Seasons: Increased Rooting Depth and Greater Soil Water Extraction with Deeper Depth to the Fragipan, (3048109259), KY Soybean Promotion Board, $35,000.00

Hildebrand, David
Further Development of Chia as a New Grain Crop for KY, (3048108731), KY Small Grain Growers Association, $10,000.00
Hildebrand, David
Renewable Lubricant Production, (3048108135), Ashland Inc, $9,000.00
Hildebrand, David
Branch-Chain Fatty Acid Production in Plants, (3048108136), Consortium for Plant Biotechnology Research Inc, $110,228.00
Houtz, Robert/Archbold, Douglas/Bruening, William/Coolong, Timothy/DeBolt, Seth/Dillon, Carl/Grabau, Larry/Halich, Gregory/Hu, Wuyang/Montross, Michael/Pfeiffer, T/Schnelle, Rebecca/Seebold, Kenneth/Smith, Samuel/Strang, John/Van Sanford, D/Vincelli, Paul
* New Crop Opportunities, Phase X, (3048106021), Cooperative State Research Education and Extension, $8,413.00
Hunt, Arthur
Collaborative Proposal: CPSF30 at the Convergence of RNA Processing, Cellular Signaling and Development in Plants, (3048105143), National Science Foundation, $6,000.00
Hunt, Arthur/Downie, A
Polyadenylation of Stored mRNA During Seed Germination, (3048108335), KY Science and Technology Co Inc, $46,967.00
Karathanasis, Anastasios
Soil Morphology Training for On-Site Sewage Disposal Systems, (3048108594), KY Cabinet for Health and Family Services, $30,000.00
Karathanasis, Anastasios
Organize and Coordinating the 2012 South Region CSS Conference, (3048108564), Natural Resources Conservation Service, $7,500.00
Kuhn, Robert/Mansour, Heidi/Salazar, Abraham/Unrine, Jason/Zhan, Chang-Guo
* Constructionandassessmentofprototype devices to remove aluminium from solutions, (3048108494), Alkymos Inc, $143,429.00
Lee, Brad
Soil hydrologic Processes and Watershed Dynamics in the Shawnee Hills, Major Land Resource Area 115 & 120, (3048108630), Natural Resources Conservation Service, $39,999.00
Lee, Brad
2008 Southern Regional Water Resource Project, (3048105666), Texas A&M University, $91,339.00
Lee, Chad
Agronomic Maximization of Soybean Yield and Quality, (3048108961), University of Minnesota, $70,000.00
Lee, Chad/Green, Jonathan
Comparing CornSystems in Wide and Narrow Rows (Year 2), (3048109139), KY Corn Promotion Council, $35,000.00
Lee, Chad/Herbek, James/Murdock, Lloyd
Soybean Management Verification Program: 2012, (3048109295), KY Soybean Promotion Board, $62,000.00

Lee, Chad/Herbek, James/Murdock, Lloyd
Soy MVP: Kentucky soybean management verification program 2011, (3048108481), KY Soybean Promotion Board, $51,220.00
Martin, James/Call, Dorothy/Gray, Jesse
Managing Giant Ragweed and Marestail in Wheat, (3048108682), KY Small Grain Growers Association, $6,000.00
Martin, James/Witt, William
Survey of herbicide resistant Palmer amaranth and waterhemp, (3048109326), KY Soybean Promotion Board, $27,997.00
McCulley, Rebecca
Collaborative Research: Do Expected Evolutionary Trade-Offs in Ezyme Activities Manifest at the Level of Microbial Community Function?, (3048107453), National Science Foundation, $215,766.00
McCulley, Rebecca
Collaborative Research: Decomposition in Drylands: Soil Erosion and UV Interactions, (3048105142), National Science Foundation, $31,832.00
McNear, David
Influence of Tall Fescue Cultivar and Endophyte Genotype Combinations on Root System Architecture, Exudate Composition and Soil Biogeochemical Processes, (3048108638), National Institute of Food and Agriculture, $265,507.00
Miller, Robert
Evaluation of Altria Burley Breedling Lines, (3048108164), Altria Corporate Services Inc, $22,240.00
Miller, Robert
Evaluation of Altria Burley Breedling Lines, (3048109464), Altria Corporate Services Inc, $22,240.00
Moe, Luke
Bacteria and Bioethanol Fermentation: Characterizing the Impact of Bacterial Contaminants and Bacterial Community Structure on Bioethanol Fermentations Across the US, (3048108384), KY Science and Technology Co Inc, $46,060.00
Mueller, Thomas
Vision Paper: Development of a Web 2.0 Soil Data Browser for the NRCS, (3048108162), Natural Resources Conservation Service, $25,000.00
Mueller, Thomas
Methodology for Designing Vegetative Buffers Using GIS and Terrain Analysis, (3048107465), Forest Service, $35,000.00
Murdock, Lloyd/Call, Dorothy/Gray, Jesse
IMPROVING NITROGEN APPLICATION TECHNOLOGY UNDER KENTUCKY CONDITIONS, (3048108683), KY Small Grain Growers Association, $5,000.00
Nokes, Sue/Crofcheck, Czarena/DeBolt, Seth/Halich, Gregory/Knutson, Barbara/Lee, Chad/Lynn, Bert/Montross, Michael/Mueller, Thomas/Rankin, Stephen/Seay, Jeffrey/Shearer, Scott/Smith, Samuel/Stombaugh, Timothy
* On-Farm Biomass Processing: Towards an Integrated High Solids Transporting/Storing/Processing System, (3048108243), National Institute of Food and Agriculture, $1,000,000.00

Ormsbee, Lindell/Agouridis, Carmen/Atwood, David/Beck, Ennis/Currens, James/Wendroth, Ole
* State Water Institute Fiscal Year 2011-2012, (3048108119), US Geological Survey, $92,335.00
Perry, Sharyn
Enhancement of Soybean Somatic Embryo Development to Improve Regeneration and Transformation Efficiency, (3048108671), United Soybean Board, $84,548.00
Ritchey, Edwin
Equipment Purchase: The Value of Manure Research in Kentucky., (3048108706), KY Corn Growers Association, $23,000.00
Ritchey, Edwin
Survey of the Tissue Nutrient Status of Winter Wheat in Kentucky, (3048108667), KY Small Grain Growers Association, $4,000.00
Ritchey, Edwin/Hershman, Donald/Martin, James
An Integrated Approach to Understanding the Dynamics of Poultry Litter Use in Corn-Soybean Production Systems, (3048109261), KY Soybean Promotion Board, $35,000.00
Smith, Samuel
Seeded Switchgrass Yield Trial--Annex 1, (3048109418), Ceres Inc, $55,000.00
Smith, Samuel
The Transition to Biofuel Feedstock Production in Kentucky, (3048107461), Eastern KY University, $18,333.00
Smith, Samuel
Biomass Field Trials, (3048104784), Ceres Inc, $9,520.00
Smith, Samuel/Ditsch, David
Restoring imperiled grassland wildlife through grazing innovation in the eastern United States, (3048109263), University of Tennessee, $79,901.00
Smith, Samuel/Montross, Michael
Farm Scale Biomass Production for Electricity Gerneration and Community Development, (3048108696), KY Forage and Grasslands Council, $259,903.00
Unrine, Jason
Development of two-dimensional field flow fractionation techniques for analysis of engineered nanoparticles in soil and sediment pore waters and extracts., (3048109151), Environmental Protection Agency, $79,896.00
Van Sanford, D
U.S. Wheat and Barley Scab Initiative's Networking and Facilitation Office and Website, (3048108107), Agricultural Research Service, $69,903.00
Van Sanford, D
Accelerating the Development of FHB-Resistant Soft Red Winter Wheat Varieties, (3048105647), Agricultural Research Service, $55,112.00
Van Sanford, D
Imrproving Barley and Wheat Germplasm for Changing Environments, (3048107999), University of California Davis, $56,446.00
Van Sanford, D
Soft Red Winter Wheat Breeding and Variety Development For Kentucky, (3048108693), KY Small Grain Growers Association, $34,955.00

Van Sanford, D/McCulley, Rebecca/Russell, Kathleen
Impact of Climate Change of Wheat Production in Kentucky, (3048108684), KY Small Grain Growers Association, $5,000.00
Warner, Richard/Agouridis, Carmen/Barton, Christopher/Unrine, Jason
* Appalachian Research Initiative for Environmental Science (ARIES), (3048108632), Virginia Polytechnic Institute and State University, $408,533.00
Wendroth, Ole/Egli, Dennis/Murdock, Lloyd
Wheat Crop Sensing in Spring: On-Farm Comparison of Uniform, on the go, and prior Scanning, (3048108669), KY Small Grain Growers Association, $6,500.00
Williams, David
Regional Biomass Feedstock Partnership, (3048104694), South Dakota State University, $22,000.00
Williams, David
Evaluation of Miscanthus Species as Feedstock Biofuels, (3048108688), Ceres Inc, $68,110.00
Witt, William
Management of Troublesome Weeds in Highway Rights of Way, (3046705900), KY Transportation Cabinet, $233,464.00
Yuan, Ling
Development of Hyperactive DNA Transposases by Directed Evolution, (3048108325), KY Science and Technology Co Inc, $39,783.00

Appendix L. List of cultivar releases and patents for the past five years (2012-2016)

Cultivars

- David Van Sanford released two wheat cultivars (Pembroke 2014 and Pembroke 2016)
- Robert Miller released four tobacco cultivars (burley cultivars KT 212 LC and KT 215 LC, dark tobacco cultivars KT D14 LC and KT D17 LC)
- Tim Phillips released two forage grass cultivars (festulolium cultivar Kenfest and tall fescue cultivar Lacefield MaxQII)
- Todd Pfeiffer released two sweet sorghum cultivars (KY1810 and KY0238)
- Legacy forage legume cultivar from Dr. Norman Taylor's program (Crimson clover variety KY Pride)

Patents

- Joe Chappell (plant and soil sciences), Shigeru Okada (Tokyo, Japan), Tom Niehaus (plant and soil sciences), and Tim Devarenne (Bryan, TX) received a patent for "Botryoccocus braunii triterpene synthase proteins and nucleic acid molecules, and methods for their use." #7,985,568
- Joe Chappell (plant and soil sciences), Shuiqin Wu (plant and soil sciences), Michel Schalk (Collonges-Sous-Saleve, France), and Athony Clark (West Windsor, NJ) received a patent for "Transformed plants accumulating terpenes." #8,017,835
- David Hildebrand, Suryadevara Rao and John Thoguru (plant and soil sciences) received a patent for "Fungal desaturases and related methods." #8,053,633
- Joseph Chappell (plant and soil sciences) and Kyoungwhan Back (Pukgu, Republic of Korea) received a patent for "Chimeric isoprenoid synthases and uses thereof." #8,106,260
- Ralph E. Dewey (Apex, NC), Balazs Siminszky (formerly plant and soil sciences), Steven W. Bowen (Raleigh, NC), and Lily Gavilano (formerly plant and soil sciences) received a patent for "Alteration of tobacco alkaloid content through modification of specific cytochrome P450 genes." #8,124,851
- Joseph Chappell (plant and soil sciences) and Bryan Greenhagen (Belmont, MA) received a patent for "Sesquiterpene synthase gene and protein." #8,192,950
- George Wagner (plant and soil sciences) and Ryan Shepherd (Berkeley, CA) received a patent for "Utility of phylloplanins as antibiotics, selective fungicides and for enhancing microbial resistance in plants." #8,227,57
- Joseph Chappell (plant and soil sciences) and Lyle F. Ralston (Kirkwood, MO) received a patent for "Cytochrome P450S and uses thereof." #8,263,362
- Joseph Chappell (plant and soil sciences) and Kyoungwhan Back (Kwangju, Republic of Korea) received a patent for "Chimeric isoprenoid synthases and uses thereof." #8,354,504
- David Hildebrand (plant and soil sciences), Runzhi Li (biochemistry) and Tomoko Hatanaka (Kobe, JP) received a patent for "Diacylglycerol acyltransferase sequences and related methods." #8,431,772
- Joseph Chappell (plant and soil sciences) and Lyle F. Ralston (Chesterfield, MO) received a patent for "Cytochrome P450s and uses thereof." #8,445,231

- David Hildebrand (plant and soil sciences), Watchareewan Jamboonsri (Bangkok, TH) and Timothy Phillipps (plant and soil sciences) received a patent for "Early flowering mutant chia and uses thereof." #8,586,831
- Joe Chappell (plant and soil sciences), Shigeru Okada (Tokyo, JP), Tom Niehaus (plant and soil sciences), and Tim Devarenne (Bryan, TX) received a patent for "Botryoccocus braunii triterpene synthase proteins and nucleic acid molecules, and methods for their use." #8,592,180
- Joseph Chappell (plant and soil sciences), Shigera Okada (Tokyo, JP), Scott Kinson and Tom Niehaus (plant and soil sciences) received a patent for "B. braunii, race B gene for a triterpene methyltransferase enzyme and uses thereof." #8,704,040
- Joseph Chappell (plant and soil sciences) and Lyle F. Ralston (Sao Paulo, BR) received a patent for "Cytochrome P450S and uses thereof." #8,722,363
- Joseph Chappell (plant and soil sciences) and Kyoungwhan Back (Pukgu, KR) received a patent for "Chimeric isoprenoid synthases and uses thereof." # 8,741,651
- Joseph Chappell, Bryan Greenhagen received a patent for "Sesquiterpene synthase gene and protein." #8,835,131
- Joe Chappell, Thomas D. Niehaus (plant and soil sciences), Shigeru Okada, (Tokyo, JP), Timothy P. Devarenne (Bryan, TX), and David S. Wyatt (Lexington, KY) received a patent for "Polypeptides, nucleic acid molecules, and methods for synthesis of triterpenes." #8,822,187
- David Hildebrand (plant and soil sciences), Runzhi Li (biochemistry) and Tomoko Hatanaka (Kobe, Japan) received a patent for "Methods for increasing renewable oil production." #9,133,469
- Ralph E. Dewey (Apex, NC), Balaz Siminszky (formerly plant and soil sciences), Steven W. Bowen (Raleigh, NC) and Lily Gavilano (formerly plant and soil sciences) received a patent for "Alteration of tobacco alkaloid content through modification of specific cytochrome P450 genes." #9,187,759
- Ralph E. Dewey (North Carolina State University), Balazs Siminszky (plant & soil sciences), Steven W. Bowen (North Carolina State University), and Lily Gavilano (plant & soil sciences) received two patents for “Alteration of Tobacco Alkaloid Content Through Modification of Specific Cytochrome P450 Genes” #9,228,194, #9,228,195

Appendix M. Faculty CV's

WILLIAM A. BAILEY

Faculty Position

Extension Professor/Dark Tobacco Specialist, Promoted July 1, 2015;
75% Extension, 25% Research; 75% Univ. of Kentucky, 25% Univ. of Tennessee

Educational Background

PhD. Plant Pathology, Physiology, and Weed Science, 2002, Virginia Tech
M.S. Crop Science, 1999, North Carolina State University
B.S. Agronomy, 1997, North Carolina State University

Program Description: The overall focus of my extension and research program is to provide leadership and assistance to county extension agents, tobacco growers, and the overall tobacco industry. The tobacco industry is currently undergoing significant changes with reduced and uncertain contracting volumes, pending government regulation, and increased quality and accountability demands. Traditional extension tobacco programming, including numerous winter tobacco grower meetings, field days, farm visits, and one-on-one grower consultations, are very important components of my tobacco extension program to address current issues. My most significant extension publication has been being co-editor and author/co-author on 8 of the 12 chapters of ID160: Burley and Dark Tobacco Production Guide, which we revise every 2 years and is now considered the premier production reference for burley and dark tobacco in the U.S. and is referenced heavily internationally also. This publication is now one of the primary cornerstones of the industry-supported Good Agricultural Practices (GAP) program. The U.S. Tobacco GAP program was developed through university and industry efforts in response to FDA regulation of tobacco and impending requirements for our industry to show that tobacco growers have learned and use responsible practices regarding crop management, environmental management, and labor management. All tobacco growers that sell tobacco under contract are now required to attend an annual GAP training. I am responsible for providing this training to nearly 2,000 tobacco growers in western Kentucky and north central Tennessee each year.

My research program is primarily field-based, with approximately 40 replicated research trials per year conducted at the UKREC in Princeton KY, Murray State University's west farm in Murray KY, and the Highland Rim REC in Springfield TN. Primary research areas include transplant production, variety development, pesticide efficacy and residue trials, fertility, topping and sucker control, and curing methods for dark fire-cured, dark air-cured, and burley tobacco. Data from most trials conducted at research stations and on-farm are posted as quickly as possible to the dark tobacco website, used in winter tobacco meetings and agent trainings, and used by agents in county-level programming and publications.

RECENT HONORS AND AWARDS:

- 2015 Tobacco Service Award, Wisconsin Leaf Tobacco Dealers & Growers Assoc.

- Conference chair for the 47th Tobacco Workers Conference, 2016
- Elected to represent the Department of Plant & Soil Sciences and the College of Agriculture, Food, and Environment on the University Senate, 2016-2019.
- Selected as tobacco industry representative for U.S. tobacco growers on the Food & Drug Administration's Tobacco Products Scientific Advisory Committee, 2017-2021.

RECENT PUBLICATIONS:

Research: Refereed Journal Articles: 2015-2016 (27 total)

Richmond, M. D., R. C. Pearce, and W. A. Bailey. 2016. Dark fire-cured tobacco response to potassium rate and application method. Tob. Sci. 53:12-15.

Extension Publications: 2015-2016 (24 total numbered extension publications)

2017-2018 Burley and Dark Tobacco Production Guide.

I serve as co-editor and author or co-author on 8 sections of ID-160: 2017-2018 Burley & Dark Tobacco Production Guide, Univ. of KY, Univ. of TN, and Virginia Tech.

GRANT FUNDING FOR RESEARCH AND EXTENSION PROJECTS:

Research Projects Grant Funding:

2015-2016: $417,762 total research funding, $391,762 to my program

Total since 2003: $2,419,185 in total research grant funding; $2,155,385 to my program

Extension Projects Funding:

2015-2016: $59,900 total extension funding, $36,900 to my program

Total since 2003: $398,340 in total extension funding, $197,887 to my program

GRADUATE STUDENTS ADVISED:

Current: Major Advisor

Mitchell Richmond, PhD candidate, will complete degree in 2018

Andrea Keeney, MS candidate, will complete degree in 2018

Served on 4 other MS committees at Univ.of KY, Univ. of TN, and Murray State Univ.

MAJOR EXTENSION ACTIVITIES:

- **Tobacco GAP Training.** Conducted 25 trainings during 2015-2016 in KY and TN for approximately 2,000 tobacco growers annually for Good Agricultural Practices (GAP) certification required by the industry for all tobacco growers.
- **Tobacco Field Days:** Annual field days at HRREC in Springfield TN' at UKREC in Princeton, and at Murray State University in Murray KY. Annual attendance 450.
- **Tennessee-Kentucky Tobacco Expo:** Annual trade show and educational seminars. Assisted Paul Hart, Robertson Co. TN extension agent, with coordination and presented production seminars. Annual attendance approximately 300.
- **Burley and Dark Tobacco Agent Trainings.** Coordinated with Eric Walker, annual trainings for county agents in TN and KY. 2 trainings per year, East TN for east TN/east KY agents and Western KY for agents in central/western KY/TN.

LEADERSHIP AND SERVICE:

International:

CORESTA subgroup TSNA in Air-Cured and Fire-Cured Tobacco (Chair), 2007-2015

CORESTA subgroup IPM (Editor of IPM-Weeds section), 2007 to present

CORESTA subgroup Agrochemical Residue Field Trials (collaborator) 2013 to present

National:

U.S. Food & Drug Administration, Tobacco Products Scientific Advisory Committee, Industry representative for U.S. tobacco growers, 2017-2021
47th Tobacco Workers Conference, Conference Chair 2016

Michael Barrett

Faculty Position
Professor: Weed Science
Research 50%, Instruction 25%, Service 25%

Educational Background
Ph.D. 1980. University of California, Davis
M.S. 1976. University of Connecticut
B.S. 1974. University of Massachusetts, Amherst

Program Description
Research: My research program and activities have been evolving since I stepped down, after 10 years of service, from the position of Department Chair in 2009. I have worked in bioenergy crops, turfgrass weed management, and other areas of weed science plus as a collaborator in a project testing the safety for horses of tall fescue containing a "friendly" endophyte. However, my interests are now focused on herbicide behavior and selectivity in plants. Current projects are development of a 2,4-D tolerant red clover line and the basis for increased atrazine tolerance in switchgrass from the one-leaf to four-leaf stages. A red clover line tolerant to 2,4-D would be an asset in mixed grass-legume pastures and the project is a continuation of work started by Dr. Norm Taylor. Current studies include field trials, laboratory analysis of 2,4-D metabolism, and gene expression determinations in susceptible and tolerant lines before and after 2,4-D treatment. Understanding how switchgrass tolerance to atrazine is achieved and changes could allow development of varieties tolerant to atrazine earlier which would be a great asset in establishment of this crop. I also oversee a research and training project with the KY Transportation Cabinet focused on roadside vegetation management.

Instruction: I have been involved in teaching several courses since 2009 including PLS 404, the undergraduate weed science course, and PLS 103/104, Plants, Soils & People a Global Perspective/Science Perspective. I am proud that I helped modify 103 and104 so that they now serve as UK Core courses. However, for the past four years my teaching focus has been on PLS 389, Wine Appreciation. This is an extremely popular course, enrollment management is a major challenge, that I created in recognition of a need at UK. I have pursued several professional enrichment activities in support of the course and am planning a sabbatical leave for the spring of 2018 related to the course content. My intention, following the sabbatical, is to increase the number of sections offered for PLS 389.

Service: I have served as the Weed Science Society of America (WSSA) Liaison to the EPA-Office of Pesticide Programs (OPP) since May 2013. In this role, I travel to the OPP offices in Arlington, VA approximately 9 times a year and provide training in weed science for the staff, serve as a subject matter expert to OPP, arrange seminars and field tours, and act as sounding board on weed science topics.

Selected Honors and Awards
WSSA Public Service Award. 2017.
Panel member, USDA-AFRI Weedy and Invasive Plants Program. 2014.
Fellow of the Weed Science Society of America. 2009.
Elected Vice-President for the Weed Science Society of America – 2009 (served as President in 2011-2012), served as Past-President 2012-2013.
Kentucky Forage and Grasslands Council Public Service Award. 2006.
WSSA Outstanding Research Award. 2001.
Fellow of the North Central Weed Science Society. 1999.
WSSA Outstanding Young Weed Scientist Award. 1992.

Recent Publications (Career total: 44 refereed publications, 8 book chapters, 1 patent)
-Cropper, K, G. Munshaw and M Barrett. 2017. Optimum Seasonal Mowing Heights for Smooth Crabgrass Reduction in Tall Fescue Lawns. HortTechnology27:73-77.
-Barrett, M., J. Soteres, and D. Shaw. 2016. Carrots and Sticks: Incentives and Regulations for Herbicide Resistance Management and Changing Behavior. Weed Sci. 64 Special Issue:627-640.
-Williamson, J. A., G.E. Aiken, E.S. Flynn, and M. Barrett. 2016. Animal and Pasture Responses to Gazing Management of Chemically Suppressed Tall Fescue in Mixed Pastures. Crop Sci. 56:2861-2869.
-Sparks, B, G Munshaw, D Williams and M Barrett. 2015. Preplant Cultivation Techniques and Planting Date Effects on White Clover Establishment into an Existing Cool-season Turfgrass Sward. HortScience 50: 615-620.
-Munshaw, G, JD Green and M Barrett. 2015. Herbicide Recommendations for Weed Control in Kentucky Bluegrass and Tall Fescue Lawns for Professional Applicators. Agriculture and Natural Resources Publications: 140.
-Gill, JR, SB Payne, SA Staggenborg, GN Odvody, RW Heiniger, B Macoon, K Moore, M Barrett, and WL Rooney. 2014. Yield Results and Stability Analysis from the Sorghum Regional Biomass Feedstock Trial. Bioenerg. Res. 7:1026-1034.

Current Research Grants
-Barrett, M. PI. Dinkins, R., Aiken, G., and Phillips, T., collaborators. Develop a 2,4-D resistant red clover (*Trifolium pretense* L.) line. USDA. 2016-2018. $199,460.
-Barrett, M. PI. Aiken, G., Phillips, T., and McDowell, K., collaborators. Demonstrate that an improved tall fescue variety with a friendly endophyte (AR584) is safe for horses, specifically, late term pregnant mares. USDA. 2013-2018. $120,000.
-Barrett, M. Sustainable vegetation management for Kentucky roadsides. Kentucky Transportation Cabinet. 2015-2018. $300,000.

Graduate students – Currently, 1 Ph.D. 1 research scientist. Previously, 4 post-docs and 18 students as major advisor.

Carol C. Baskin

Faculty Position

Professor, Department of Plant and Soil Sciences, Univ. of Kentucky (25%)
Professor, Department of Biology, Univ. of Kentucky (75%)

Educational Background

B.S., Florida Southern College, 1964
Ph.D., Vanderbilt University, 1968

Program Description

The main focus of my research is seed germination ecology, and the basic question is: what controls the timing of seed germination in nature? I study wild (noncultivated) species, including agricultural weeds. One of my current projects is the evaluation of differences in the temperature requirements for germination of herbaceous species (winter annuals, summer annuals, biennials and perennials), using germination phenology data for 340 species sown in a nonheated (windows open all year) greenhouse at the University of Kentucky from 1969-2013. Next, these data will be used to determine the effects of disruption in winter cold (as related to climate warming) on dormancy break and timing of germination in spring of seeds that require cold (*c*. 0-10°C, wet) stratification for dormancy break to occur.

As I have matured as a scientist, my research efforts have expanded to the world biogeography of seed dormancy. That is, in each of the major vegetation regions on earth, what percentage of the species has seeds with morphological, morphophysiological, physiological, physical and combinational dormancy. The biogeography part of my work involves studying seed dormancy and germination of species from the montane zone of Hawaii, intensive literature surveys along with building databases for each vegetation region and working with seed scientists in other countries, especially China. With an increase in my knowledge of the world biogeography of seed dormancy, I have devoted considerable attention to the origins and evolutionary relationships of the different kinds of dormancy. In collaboration with evolutionary ecologists at Duke and Harvard universities and a theoretical evolutionary ecologist in Spain, a paper was published in 2014 in the *New Phytologist* on the evolution of the different kinds of dormancy. I have now constructed a database on the occurrence of the various kinds of embryos (13 kinds are known) in seeds of all the extant families of seed plants (gymnosperms and angiosperms). The next project with my evolutionary ecologist collaborators is to look at the origins and evolutionary relationships of the 13 kinds of embryos.

Publications

Book

Baskin, C.C. and J.M. Baskin. 2014. Seeds: Ecology, biogeography, and evolution of dormancy and germination. Second edition. Elsevier/ Academic Press, San Diego.

Referred papers (520 total): a few examples follow

-Willis, C., Baskin, C. C., Baskin, J. M., Auld, J., Venable, D., Cavender-Bares, J., Donohue, K., de Casas, R. 2014. The evolution of seed dormancy: Environmental

cues, evolutionary hubs, and diversification of the seed plants. *New Phytologist* 203: 300-309.

-Cao, D., C. C. Baskin, J. M. Baskin, F. Yang and Z. Huang. 2014. Dormancy cycling and persistence of seeds in soil of a cold desert halophyte shrub. *Annals of Botany* 113: 171- 179.

-Lu, J. J., D. Y. Tan, C. C. Baskin and J. M. Baskin. 2016. Effects of germination season on life history traits and on transgenerational plasticity in seed dormancy in a cold desert annual. *Scientific Reports* 6: 25076; doi: 10.1038/srep25076

-Chia, K. A., Sadler, R. Turner, S. R. and Baskin, C. C. 2016. Seasonal conditions required for dormancy break of *Persoonia longifolia* (Protecaeae), a species with a woody indehiscent endocarp. *Annals of Botany* 118: 331-346.

-Zhang, K., J. M. Baskin, C. C. Baskin, X. Yang and Z. Huang. 2017. Effect of seed morph and light level on growth and reproduction of the amphicarpic plant *Amphicarpaea edgeworthii* (Fabaceae). *Scientific Reports* 7: 39886.

-Fogliani, B., Gateblé, G., Villegente, M., Fabre, I., Klein, N., Anger, N., Baskin, C. and Scutt, C. 2017. The morphophysiological dormancy in *Amborella trichopoda* seeds is a pleisiomorphic trait in angiosperms. *Annals of Botany* 119: 581-590.

-Baskin, J. M. and Baskin, C. C. Seed germination in cleistogamous species: theoretical considerations and a literature survey of experimental results. *Seed Science Research* (in press).

-Rubio de Casas, R., Willis, C., Pearse, W., Baskin, C. C., Baskin, J. M., Cavender-Bares, J. Global biogeography of seed dormancy is determined by seasonality and seed size: a case study in the legumes. *New Phytologist* (in press)

Society activities

President, Botanical Society of America, 1998-1999

Invited out-of-country lectures (65 total)

Current Editorial work

Weed Biology and Management
Plant Diversity
Seed Science Research

Lowell Bush

Faculty Position
Philip Morris Professor of Plant Biology, Department Plant and Soil Sciences; Post-retirement Appointment
100% research

Educational Background
Macalester College, BA, biology
Iowa State University, MS and PhD, Plant Physiology, 1964
Post-doc, University of Minnesota, plant pathology, 1964-1965
University of Strathclyde, sabbatical leave with Dr. J. A. D. Jeffreys, Dept. of Pure & Applied Chemistry, 1973 Fulbright Scholar to Agriculture Institute of Ireland, Oak Park Center, 1987

Program Description
The efforts within our research program have emphasized alkaloid metabolism, toxicity and utilization in tobacco and tall fescue and very recently hemp. The pyridine alkaloids of tobacco have had emphasis on nicotine and secondary amine alkaloids for N′-nitrosoamine formation. Perhaps more significant was our work on selecting seed source plants that contained very low levels of nicotine demethylation to nornicotine and subsequent NNN formation during leaf curing. When we demonstrated the success of this selection with commercial varieties the industry completely adopted the use of these selected seed within two growing seasons. This is still the state-of-the-art today. Most recently, we have shown the difference in R- and S-enantiomer accumulation of nicotine, nornicotine and the corresponding R- and S-NNN accumulation in these selected and mutant plants. The more R-NNN accumulation the better as the S-enantiomer has been shown to be more biological activity.
Other alkaloids studied have been in tall fescue and the fungal endophyte/tall fescue association. We have found that the principal group of alkaloids controlled by the plant to have limited effect on rumen function in cattle but greater allelochemical influence in the ecology of rhizosphere and invertebrates. The ergopeptine alkaloids of the endophyte association greatly influence animal response to consumption of the plants. Results of these studies demonstrate that vasoconstriction of blood vessels is caused by ergovaline and that this does not just occur in the extremities but in the body core as well. Serotonin receptors are involved plus altered ruminal function as energy production in the rumen is changed and subsequent animal growth. This work was done in cooperation with PI's in the Department of Animal Science and USDA collaborators.

Present Funding.
PON and NNK formation and accumulation in tobacco. 2015-2017. $221,000. Altria Client Services
Tall fescue characteristics. 2017, $135,000, USDA, ARS, SCA, this is 4th year of a 5 year recurring funding

Selected peer-reviewed publications – selected from over 180 peer-reviewed publications

Aiken, G. Michael D. Flythe, Isabelle Ann Kagan, Huihua Ji, Lowell Bush. 2016. Mitigation of ergot vasoconstriction by clover isoflavones in goats (Capra hircus). Frontiers Veterinary Sci. DOI:10.3389/fvets.2016.00017. Vol 3. Article 17, 10 pages.

Helander, M; Phillips, T; Faeth, S H; Bush, L P; McCulley, R. 2016. Alkaloid Quantities in Endophyte-Infected Tall Fescue are Affected by the Plant-Fungus Combination and Environment. J. Chem Ecology. 42:118-126.

B. Cai, H. Ji., F. Fannin and L. Bush. 2016. Contribution of Nicotine and Nornicotine toward the Production of N'-Nitrosonornicotine in Air-Cured Tobacco (*Nicotiana tabacum*)". J Nat Prod. 79:754-9. doi: 10.1021/acs.jnatprod.5b00678. Epub 2016 Mar 9.

Ji, Huihua, F. Fannin[2] J. Klotz and L. Bush. 2014. Tall fescue seed extraction and partial purification of ergot alkaloids. Front. Chem., Chemical Biology. 11 December 2014 | doi: 10.3389/fchem.2014.00110 (electronic publication)

McCulley, R., L.P. Bush, A.E. Carlisle, H. Ji and J.A. Nelson. 2014. Warming reduces tall fescue abundance but stimulates toxic alkaloid concentrations in transition zone pastures of the U.S. Frontiers in Chemistry, Chemical Biology doi: 10.3389/fchem.2014.00088 (electronic publication)

Foote, A.P., Penner, G.B., Walpole, M.E., Klotz, J.L., Brown, K.R., Bush, L.P., Harmon, D.L. 2014. Acute exposure to ergot alkaloids from endophyte-infected tall fescue does not alter absorptive or barrier function of the isolated ruminal epithelium. Animal. 8:1106-1112.

Foote, A.P., Penner, G.B., Walpole, M.E., Klotz, J.L., Brown, K.R., Bush, L.P., Harmon, D.L. (2014). Acute exposure to ergot alkaloids from endophyte-infected tall fescue does not alter absorptive or barrier function of the isolated ruminal epithelium. Animal. 8:1106-1112

Foote,A.P., N. B. Kristensen,., J. L. Klotz, D. H. Kim, A. F. Koontz, K. R. McLeod, L. P. Bush, F. N. Schrick and D. L. Harmon. 2013. Ergot alkaloids from endophyte-infected tall fescue decrease reticuloruminal epithelial blood flow and volatile fatty acid absorption from the washed reticulorumen. *J Anim Sci* 91:5366-5378

Bin Cai, Anne M. Jack, Ramsey S. Lewis, Ralph E. Dewey, Lowell P. Bush. 2013. (R)-nicotine

biosynthesis, metabolism and translocation in tobacco as determined by nicotine demethylase mutants. Phytochemistry 95:188-196.

MARK S. COYNE

Faculty Position
Professor of Plant and Soil Sciences: Soil Microbiology
37.0% Research, 43.0% Teaching, 20% Administration

Educational Background
PhD 1989 Michigan State University – Crop and Soil Science (Soil Microbiology)
M.S. 1984 University of California, Riverside - Soil and Environmental Science
B.S. 1982 Iowa State University - Agronomy and International Agriculture

Program Description
Research:
I have a program in applied and environmental microbiology investigating nitrogen transformations in soil, soil and water quality, and environmentally sound waste management. At a basic research level I examine the population ecology of autotrophic nitrifiers and their influence on trace gas evolution from soil (Hatch project). I am also examining the effects of nitrogen fixing legumes on C decomposition in pasture environments (SCA FAPRU project). In applied research I am examining the mechanisms for multiple cover crop benefits to soil quality and N availability (USDA CIG project) and the management of land applied composted bedded pack dairy waste (former KWRRI project).

My graduate training program has manifested itself in the Commonwealth at local, regional, and state levels. Because of my recent work in soil health I have been asked to serve on an M.S. committee at Kentucky State University. My collaboration with Biosystems and Agricultural Engineering will develop innovative best management practices for animal waste composting making use of a new compost bedded pack barn facility at UK. My work in crop, pasture, and riparian systems will lead to improved methods for land management to maximize and quantify soil quality. I have also contributed basic research to justify cover crop recommendations for producers.

Teaching
IPS 610– Transdisciplinary Communications in Integrated Plant and Soil Sciences (1 cr); IPS 625 – Transdisciplinary Research in Integrated Plant and Soil Sciences (2 cr); PLS 468G – Soil Use and Management (3 cr); PLS 566 – Soil Microbiology (3 cr); PLS 567 – Methods in Soil Microbiology (1 cr); PLS 660 – Advanced Soil Biology (2 cr).

Advising and Mentoring (Career):
9 Visiting Scientists; 4 Post Docs; 11 PhD; 15 MS; 71 Committees (14 Current); 11 undergraduate advisees in the NRES program.

Administration

I am the DGS of the Integrated Plant and Soil Sciences Graduate Program (IPSS) and two legacy programs. My goal has been to develop an efficient system for applicant review and approval and comply with University requirements for performance reporting

and evaluation. In 2015 and 2016 there were over 60 students enrolled in these three graduate programs.

CURRENT RESEARCH SUPPORT:

Swanson, H. (PI), Dr. Lin Xiang (Co-PI), **M.S. Coyne** et al. (Co-I). National Institute of Environmental Health Sciences Special Emphasis Summer Research Training and Development R25 ES027684-01 "Summer Research in Environmental Health Sciences" $458,634, 1/1/2017 – 12/31/2022

Ritchey, E. (Lead PI), J. McGrath, B. Lee, E. Haramoto, **M. Coyne,** J. Shockley. "Providing a better understanding of cover crop-soil interactions." USDA National Resource Conservation Service, Kentucky Office, State Conservation Innovation Grant program. Project # 69-5C16-16-1103. 10/16-9/17. $75,000.

Grove, J.H. and **M.S. Coyne**. 2014. "Quantifying the N Benefit of Cover Crop Use." $75,000. USDA NRCS Commodity Credit Corporation. 9/1/2014 – 8/31/2017.

Coyne, M.S. 2013. NP 215 Project Plan: *Forage Systems for Sustainable Animal Production in the Mid-South.* Sub-objective: Do More Legumes in Fescue Pastures Affect C Sequestration after Renovation?" USDA-ARS FAPRU SCA $99,860 (Project Start 2013).

PUBLICATIONS

Journal Articles (Most recent + 68 other career publications):

Zou, C., R.C. Pearce, J.H. Grove, and **M. S. Coyne**. 2017. No-tillage culture and nitrogen fertilizer management for burley tobacco production. *Journal of Agricultural Science* 155:599–612.

Riaz, L., T. Mahmood, **M. S. Coyne**, A. Khalid, A. Rashid, M.T. Hayat, A. Gulzar, and M. Amjad. 2017. Physiological and antioxidant responses of wheat seedlings to fluoroquinolone antibiotics." *Chemosphere* 177:250-257.

Zou, C., R. C. Pearce, J. H. Grove, and **M. S. Coyne**. 2017. Laboratory vs. *in situ* resin-core methods to estimate net nitrogen mineralization for comparison of rotation and tillage practices. *Plant Nutrition and Soil Science.* Accepted (02-21-2017).

Book Chapters:

Coyne, M.S. 2017. "Denitrification in soil." In R. Lal and B.A. Stewart (eds.) Advances in Soil Science: Soil Nitrogen Uses and Environmental Impacts. CRC Press, Boca Raton FL. (In press).

Popular Press:

Coyne, M.S. and R. Mikkelsen. 2015. Soil microorganisms contribute to plant nutrition and root health. *Better Crops* 99(1): 18-20.

Invited Presentations:

Gibbs, L., **M.S. Coyne**, and J. Grove. 2017 "Potential Nitrogen Benefits from Cover Crops." Kentucky No-Till and Cover Crop Soil Health Forum, 03/23/2017, Princeton KY.

Coyne, M.S. 2016. "Cover Crops and Soil Biology: What Do We Know?" SARE Cover Crop Conference, Goldsboro NC (7/18-19/2016).

Elisa Marie D'Angelo

Faculty Positions

Assistant Professor, Dept. of Agronomy, Univ. of Kentucky, 1999
Associate Professor, Dept. of Plant Soil Sciences, Univ. of Kentucky, 2005
Position: 73% research, 12% teaching, 15% administration

Educational Background

B.S. University of Central Florida, 1986, Limnology and Chemistry
Ph.D. University of Florida, 1998, Aquatic/Wetland Biogeochemistry and Environmental Engineering Science

Program Description

Research

My research focuses primarily on the fate, transport, and ecological effects of organic and inorganic compounds contained in livestock manure, treated sewage sludge (biosolids), and coal slurry impoundments, in agricultural, wetland, and aquatic ecosystems.

Recently, we implemented new analytical methods and diffusive transport models (e.g. diffusive gradient in thin films and 2D-DIFS) to show that a commonly-prescribed antibiotic, Ciprofloxacin, which is found at elevated concentrations in municipal biosolids, was very slowly released, and would pose minimal risks in biosolid-amended soils, due to strong sorption and slow diffusion in biosolids.

Our work has shown that another commonly-prescribed antibiotic tetracycline, which is used extensively to treat animal and human diseases, was sorbed 20 x less by poultry manure/bedding materials than by biosolids, but that sorption could be increased up to 40 × by treatment with 10% alum that promoted strong metal oxide bridging with the antibiotic.

Our work has demonstrated that several commonly-prescribed livestock antibiotics (roxarsone, virginiamycin, and bacitracin) had no significant effects on microbial community composition, nitrification or denitrification in soils due to extensive sorption and intrinsic resistance/insensitivity of soil microorganisms to these antibiotics.

Future studies are planned to determine Se removal kinetics and mechanisms in anaerobic wood chip bioreactors.

Teaching and Undergraduate Student Advising

- I teach 100 % of the undergraduate course "Plants, Soils, and People: A Science Perspective" in fall semesters. I am planning to teach an upper level undergraduate course "Environmental Sampling and Analysis" in upcoming spring semesters.
-I am the Director of Undergraduate Studies for the Horticulture, Plant, and Soil Science program (≈30 students) and Modern Agriculture Crop Production program (≈7 students).

Graduate Student Advisor (3 in last four years, plus 7 for career)

Research Support (last four years)

- **Elisa M. D'Angelo**. Beneficial Reuse of Residuals and Reclaimed Water: Impact on Soil Ecosystem and Human Health (W-3170). Hatch Multistate project. 2014-2019.
- John H. Grove (PI), **Elisa M. D'Angelo**, Glen E. Aiken (Research Animal Scientist, USDA Agricultural Research Service). Forage Systems for Sustainable Animal Production in the Mid-South. 2014-2017. $146,160 (5%).
- **Elisa M. D'Angelo** (PI), Richard Warner, Jason Unrine**.** Remediation of coal slurry impoundment liquids using a multi-stage constructed treatment wetland system. Department for Energy Development & Independence; 2013-2014; Statewide competition; $61,355 (95% contribution).
- **Elisa M. D'Angelo** (PI) and Jason Unrine. Bioremediation of Se oxyanions and pollution swapping in anaerobic bioreactors using recycled organic substrates. Kentucky Science and Engineering Foundation. 2017-2018. Statewide competition; $50,000 (95% contribution) (pending).

Refereed journal articles/chapters (last two years, plus 34 additional for career)

- Elisa D'Angelo. 2017. Sorption-desorption equilibrium and diffusion of tetracycline in poultry litter and municipal biosolids. Chemosphere (accepted with minor revision).
- **Elisa D'Angelo** and *Daniel Starnes*. 2016. Desorption kinetics of ciprofloxacin in municipal biosolids determined by diffusion gradient in thin films. Chemosphere 164: 215-224.
- *Trent Garrison**, James Hower, **Elisa D'Angelo,** Alan Fryar. 2016. Water and soil quality at two eastern Kentucky (USA) coal fires. Environmental Earth Sciences 75:1-13.
- *Shawn Lucas**, **Elisa D'Angelo**, Seth DeBolt, and Mark Williams. 2015. Soil treatment-induced differential gene expression in tomato: Relationships between defense gene expression and soil microbial community composition. Applied Soil Ecology 93:28-39.

Dennis B. Egli

Faculty Position

Assistant Professor, Department of Agronomy, University of Kentucky. 1969 – 1974
Associate Professor, Department of Agronomy, University of Kentucky, 1974 -1978
Professor, Plant and Soil Sciences Department, University of Kentucky, 1978 to present.

Educational Background

Ph.D. Crop Physiology and Ecology, University of Illinois, 1969.
CIC Traveling Scholar in Climatology, Purdue University, 1967-1968.
M.S. Agronomy, University of Illinois, 1967.
B.S. Agronomy. The Pennsylvania State University, 1965.

Program Description

The primary focus of my research in Crop Physiology is the seed – the seed used to reproduce grain crops (principally soybean and corn) and the seed harvested as economic yield in these crops. My interests in planting seed include the effect of the environment on seed quality (germination and vigor), changes in quality during storage, and the relationship between seed germination and vigor, and performance of the planting seed in the field (primarily seedling emergence).

The capacity of the seed to accumulate dry matter is as fundamental to the production of yield as is the production of assimilate by photosynthesis. It is impossible understand the production of yield at a basic level without involving the growth and development of the seed. My focus was on the genetic and environmental regulation of seed growth rate and duration of seed growth and their involvement in determining yield.

I am also interested in understanding the basis of the variation of yield and yield gaps of corn and soybean among environments that differ in yield potential to better inform our choices of management systems.

I currently hold a 60% appointment under the UK Phased Retirement Program which will end in May of 2018 with my retirement.

Courses Taught

PLS 502. Crop Ecology.
PLS 602 Principles of Yield Physiology.

Awards

Thomas Poe Cooper Research Award, College of Agriculture, 1981.
University of Kentucky Research Foundation Research Award, 1981.
Seed Science Research Award, Crop Science Society of America, 1996.
Crop Science Research Award, Crop Science Society of America, 2006.

Publications

Books

Egli, D. B. 2017. Seed Biology and the Yield of Grain Crops. 2nd ed. CABI.

Referred journal articles (total 165)

Egli, D.B., B. Hamman, and M. Rucker, 2010. Seed vigor and Uniformity of Seedling Emergence in Soybean. Seed Tech. 32:87-95.

Egli, D.B. 2011. Time and the Productivity of Agronomic Crops and Cropping Systems. Agron. J. 103: 743-750.
Egli, D.B., and M. Rucker. 2012. Seed vigor and the Uniformity of Emergence of Corn Seedlings. Crop Sci. 52: 2774-2782.
Egli, D.B. 2012. Timing of Fruit Initiation and Seed Size in Soybean. J. Crop Improvement. 26: 751-766.
Egli, D.B. 2013. The Relationship between the Number of Nodes and Pods in Soybean Communities. Crop Sci. 53: 1668-1676.
Egli, D.B. and J.L. Hatfield. 2014. Yield Gaps and Yield Relationships in Central U.S. Soybean Production Systems. Agron. J. 106: 1-7.
Egli, D.B. and J.L. Hatfield. 2014.Yield and Yield Gaps in Central U.S. Corn productions Systems. Agron. J. 106: 2248-2254.
Egli, D.B. 2015. Pod Set in Soybean: Investigations with SOYPODP, a Whole Plant Model. Agron. J. 107: 349-360.
Egli, D.B. 2015. Is there a Role for Sink Size in Understanding Maize population – Yield Relationships? Crop Sci. 55: 2453-2462.
Minoli, S., D.B. Egli, S. Rolinski, and C. Mueller. ____ Modelling Growing Periods of Grain Crops at the Global Scale. Global Ecology and Biogeog. (Submitted, June 2017).

Ben Goff

Faculty Position
Assistant Professor, University of Kentucky, 2012-Present
Position: 60% research, 40% teaching

Educational Background
B.S. West Virginia University, 2007, Agronomy
M.S. Iowa State University, 2010, Agronomy
Ph.D. University of Kentucky, 2012, Crop Science

Program Description:
Research:
My research program focuses on increasing the utilization of forage legumes in agricultural systems by developing management strategies to improve their persistence in mixtures, optimizing their efficient use of soil nutrients, and identifying "non-traditional" species that may provide greater benefits. Our goal is for this research to lead to the development of sustainable livestock and cropping systems that are profitable to producers

Teaching:
My teaching responsibilities include two undergraduate/graduate courses in forage agronomy (PLS 510: Forage Management/Utilization & GEN 300: Intro into Forage-Livestock Systems/Forage Bowl Team) and two graduate statistics courses (PLS 597: Agricultural Experimental Design & PLS 597: Experiences in Meta-Analysis of Agricultural Data). I am also advisor for undergraduates enrolled in Crops/Livestock and Modern Agronomic Crop Production options of the Horticulture, Plant and Soil Science Major and currently serve as the faculty advisor for the Undergraduate Agronomy Club.

Current Research Support:
- **Goff, B.M**. 2016-2017. Field Trial Evaluation of Foliar Applied Biostimulant in Grass Grown for Hay Production or Grazing. Koch Agronomic Services, LLC. (Nationally Competitive). $10,265. (100%).
- McGrath, J.M., J. Bowen, D. McNear, O. Wendroth, J. Shockley, E. Ritchey, **B.M. Goff**, and M. Sama. 2016-2020. Do critical soil phosphorus concentrations vary in space and if so why? International Plant Nutrition Institute. (Nationally Competitive). $279,784. (1%).
- Dvorak, J.S., M. Sama, J. Jackson, M. Montross, and **B.M. Goff**, 2016-2019. LIDAR and photogrammetry to map alfalfa yield and quality using unmanned aircraft systems. USDA-AFRI (Nationally Competitive). $249,975. (5%)
- **Goff, B.M.,** R.C. Pearce, and E.R. Haramoto. 2016-2018. Optimizing the Integration of Annual Forage into Tobacco Systems. Council for Burley Tobacco/Burley Tobacco Growers Cooperative Association/KTDRC Summit Grant, (State Commodity Grant). $39,862. (100%)

- **Goff, B.M.** 2014-2015. Enhanced efficiency nitrogen fertilizers on the production and nutritive value of bermudagrass pastures. Koch Agronomic Services, LLC. (Nationally Competitive). $10,532. (100%).
- van Santen, E.S., J.W. MacAdam, K.A. Cassida, G.E. Shewmaker, **B.M. Goff**, R.L. Kallenbach, T.C. Griggs, and J.M. Johnson. 2013-2017. Increasing legume grazing for higher beef gain on pastures: an improved high-tannin birdsfoot trefoil cultivar with trans-regional potential. USDA NIFA-AFRI (Nationally Competitive). $402,500. (7%).

Publications:

Book Chapters:

- **Goff. B.M.**, G.D. Lacefield, and S.R. Smith Jr. 2015. Temperate legumes for grasslands: Their importance and current limitations. In: S.K. Mahanta (ed.) World Grasslands: Opportunities and Challenges. Range Management Society of India, Jhansi, India

Refereed Journal Articles:

(Most Recent Plus an Additional Seven Manuscripts)

- Billman, E.D., **B.M. Goff**, B.S. Baldwin, K. Prince, and T.D. Phillips. 2017 Effects of Vegetative Cool-Season Grasses on Forage Removal by Dairy Heifers. Agron. J. (*in press*)
- Bourguignon, M. K.J. Moore, A. Lenssen, S. Archontoulis, **B.M. Goff**, and B. Baldwin. 2016. Kenaf productivity, morphology, and anatomy when grown in Iowa and Kentucky. Ind. Crops. Prod. 94: 596-609.
- Klotz, J.L., G.E. Aiken, J.R. Bussard, A.P. Foote, D.L. Harmon, B.M. Goff, F.N. Schrick, and J.R. Strickland. 2016. Vasoactivity and vasocontriction changes in cattle related to time off toxic endophyte-infected tall fescue. Toxins. 8: 271-290.
- Zheng, Q.† J. Liu†, **B.M. Goff**, R.D. Dinkins, and Hongyan Zhu. 2016. Genetic manipulation of miR156 for improvement of biomass production and forage quality in red clover. Crop Sci. 56: 1199-1205.
- Villalba, J.J., C. Spackman, **B.M. Goff**, J.L. Klotz, T. Griggs, and J.W. MacAdam. 2016. Interaction between tannin-containing legume and endophyte infected tall fescue seed on lambs' feeding behavior and physiology. J. Anim. Sci. 94: 845-857.
- M.D. Flythe, G.E. Aiken, G.L. Gellen, J.L. Klotz, **B.M. Goff**, and K. Andries. 2015. Hops (Humulus lupulus) β-acid as an inhibitor of caprine rumen hyper-ammonia producing bacteria in vitro. Agric. Food Anal. Bacteriol. 5: 29-36.
- Kagan, I.A., **B.M. Goff**, and M.D. Flythe. 2015. Soluble phenolic compounds in different cultivars of red clover and alfalfa, and their implications against proteolysis and ammonia production in ruminants. Nat. Prod. Comm. 10: 1263-1267.
- **Goff, B.M.**, G.E. Aiken, W.W. Witt, P.L. Burch, and F.N. Schrick. 2015. Steer and forage nutritive value responses to grazing intensity and seedhead suppression of tall fescue in mixed pastures. Prof. Anim. Sci. 31:120-129.
- **Goff, B.M.**, G.E. Aiken, W.W. Witt, J.A. Williamson, E.S. Flynn, and P.L. Burch. 2014. Timing and rate of Chaparral treatment affects tall fescue seedhead development and pasture grass plant densities. Online. Forage and Grazinglands. Doi: 10.2134/FG-2013-0001-RS.

JONATHAN D GREEN

Faculty Position

Extension Professor (Weed Scientist), since 1986
100% Extension

Educational Background

Ph.D. Crop Science (Weed Science), Oklahoma State University, 1986
M.S. Crop Science (Weed Science), University of Kentucky, 1983
B.S. Agronomy, University of Kentucky, 1981

Program Description

The primary goals and objectives of my extension program are 1) to develop weed control recommendations for grain and forage crops and disseminate this information using a variety of educational approaches, 2) to investigate specific weed management problems utilizing field research trials including on-farm locations with county extension staff and farm cooperators, and 3) to develop traditional and innovative training programs for extension personnel, agrichemical dealers and applicators, crop consultants, and farm managers.

An increasing presence of herbicide-resistant weeds is greatly impacting crop production decisions and has been identified as a major topic of concern by producers, agriculture agents, and other crop consultants. I have been participating in a multi-state "Take Action" effort funded through the United Soybean Board and other commodity sponsors to develop research and educational programs to manage and mitigate herbicide-resistant weeds such as glyphosate-resistant marestail (horseweed), Palmer amaranth, and waterhemp. I organized two intensive field schools in Lexington and Princeton (2015) to disseminate information on herbicide-resistant weeds and to begin preparing producers, agricultural agents, and crop consultants on new herbicide tolerant crop technology. Furthermore, I continue to host annual field tours to address these topics. Two populations of Palmer amaranth are now being investigated for resistance to multiple herbicide site of action groups.

Another major program emphasis has been associated with weed control issues in forage crops. I have participated in activities, newsletter articles, and presentations at county, area, and state-wide meetings and field days including the Master Grazer program, Pasture Please Equine Program, Kentucky Forage and Grassland Council Field Day, and UK Ag Equine Farm & Facilities Expo. On-farm research trials were conducted to demonstrate benefits of weed control tactics in pastures. In a collaborative research project with weed scientists at the University of Tennessee a journal article on horsenettle and tall ironweed was recently published in *Weed Technology*. I also wrote a new Extension publication to increase awareness of good stewardship when using herbicides on pastures and hay fields (AGR-219).

I also manage the UK Weed Science Herbarium, which functions to assist county Extension offices with proper identification of weedy plants found in grain crops, pastures and other forage crops, home landscapes, and other locations. Approximately 200 plant specimens are received each year by direct mail plus over 300 requests through images sent via E-mail or other electronic communications.

Professional Recognition

Fellow Award. Presented by North Central Weed Science Society (2009)
M. D. Whitekar Award for Excellence in Extension. Presented by Kentucky Association of Extension Professionals (2008)
Distinguished Achievement Award for Service. Presented by North Central Weed Science Society of America (1999)

Current Research Support

JD Green and Erin Haramoto. Investigation of Multiple Herbicide Resistant Palmer Amaranth and Waterhemp. Funded by Kentucky Soybean Promotion Board. April 2016 - March 2018 ($44,750) PI (regionally competitive)

B. Johnson, L. Steckel, M. Loux, **JD Green**, C. Sprague, B. Hartzler, M. Owen, K. Bradley, D. Peterson, J. Gunsolus, A. Hagar, and R. Zollinger. Multi-State Herbicide Resistant Crops and Weeds ($620,480). Sponsored by United Soybean Board. Oct 2015 – Sept 2017 [$49,000 to my program] co-PI

Refereed Journal Articles

[current, plus 9 additional journal articles/book chapters for career]

Phillips, W.P., T.D. Israel, T.C. Mueller, G.R. Armel, D.R. West, **J.D. Green**, and G.N. Rhodes, Jr. 2016. Utility of Aminocyclopyrachlor for Control of Horsenettle (*Solanum carolinense*) and Tall Ironweed (*Veronia gigantean*) in Cool-Season Grass Pastures. Weed Technology. 30(2):472-477.

Extension Publications

[current year, plus 36 additional peer-reviewed numbered extension publications]

AGR-6. **JD Green** and J. R. Martin. Chemical Control of Weeds in Kentucky Farm Crops. Revised annually

Graduate Students

Currently advising 1 MS student; completed degrees 1 PhD and 4 MS students

Extension Activities

Herbicide Resistant Weeds in Grain Crops: Field trials have been conducted past four years (2014-2017) to evaluate/demonstrate various weed management programs for control of glyphosate-resistant marestail and Palmer amaranth in soybeans and corn. An annual herbicide resistance and application stewardship field day has been held for crop producers, extension agents, crop consultants, pesticide applicators, and other ag business personnel. Research results are used to discuss weed management strategies at other invited meetings and field days.

Weed Management in Forage Crops: Activities have included presentations for the Master Grazer Program, developed a new Extension bulletin on “Practicing Good Stewardship When Applying Herbicides for Pasture Weed Control” writing and contributing to newsletter articles, conducting on-farm research trials and presentations at county, area, and state-wide meetings and field days.

Leadership/Service

North Central Weed Society, President (2014)
Weed Science Society of America, Science Policy Committee (2014-2015)

John H. Grove

Faculty Position
Director, UK Research and Education Center
Professor, Plant and Soil Sciences

Educational Background
Ph.D., 1980, University of Georgia; Agronomy
M.S., 1977, Michigan State University; Soil Chemistry/Fertility
B.S., 1975, Michigan State University; Lyman Briggs College/Chemistry

Professional Experience
2015 - present: Director, University of Kentucky Research and Education Center
1981 - present: Assistant, Associate and Full Professor; member of the Graduate Faculty; Dep. of Plant and Soil Sciences, University of Kentucky College of Agriculture, Food and Environment

Research

Graduate Student Programs Directed/Co-Directed to Completion (career)
Impact Summary – 29 Graduate students (14 Ph.D. and 15 M.S.) directed/co-directed to completion. Thirteen are/were in faculty positions, both domestic (6) and international (7).

Research Funding Support (career)
Impact Summary – Dollars awarded, according to competitiveness and investigator contribution:

	Total Award	Principal Investigator	Co-Investigator	Collaborator
Noncompetitive:	*$425,550*	*93.5%*	*4.7%*	*1.8%*
Competitive:	*$6,369,143*	*39.9%*	*40.3%*	*19.8%*
Total:	*$6,794,693*	*43.3%*	*38.1%*	*18.6%*

Research Publications (career)
Impact Summary – 69 refereed journal publications; 7 book chapters; 6 reviewed reports available on the web; 9 refereed conference/symposium papers; 63 not refereed conference proceedings.

Presentations before Professional Audiences Authored/Co-Authored (career)
Note: Does not include invited presentations or presentations accompanied by published proceedings papers.

Presentations by:	*Me or My Students*	*Colleagues*
International Conference/Symposium	*11*	*2*
National Conference/Symposium	*119*	*49*
Regional Conference/Symposium	*26*	*13*
State Conference/Symposium	*13*	*9*
Total Professional Presentations:	*169*	*73*

Instruction

Selected Recent UK/National Teaching Activities

AGR/PLS 712 – Advanced Soil Fertility, plant science graduate students.
AGR/PLS/NRE 470G – Soil Nutrient Management, plant science undergraduate students.
HON 211 – World Food Issues III: Living with Limits, honors undergraduate student

Outreach

Outreach/Extension Publications (career)

Publication Summary – 8 refereed and numbered publications; 24 other refereed reports and newsletter items; 36 not refereed newsletter and blog items; and 11 articles in grower and agribusiness trade publications.

Outreach/Extension Presentations (career)

Impact Summary – 208 presentations of general agronomic and related research information at small group and county meetings, and field days, in the state of Kentucky.

Professional Recognition

Invited Presentations Authored/Co-Authored:

Impact Summary – 90 invited presentations, of which twenty-two (22) were international, twenty-seven (27) were national and forty-one (41) were regional.

Professional Awards (selected):

University of Kentucky Alumni Association 2013 Great Teacher Award. November, 2012.
American Society of Agronomy Division A-4 Award of Excellence in Educational Materials to authors of the “A Comprehensive Guide to Wheat Management in Kentucky”. Nov. 2009.
Cooperative State Research, Education and Extension Service (CSREES). Partnership Award for Mission Integration to members of the Wheat Science Group. Oct. 2007.

ERIN R. HARAMOTO

Faculty Position
Assistant Professor, Department of Plant and Soil Sciences: Weed Science
65% research, 35% teaching

Educational Background
PhD Horticulture, 2014, Michigan State University
MS Plant, Soil, Environmental Science, 2004, University of Maine
BS Biology, 1997, The George Washington University

Program Description
Research: The main objective of my research program is to foster establishment of more integrated weed management systems in Kentucky grain crops. To this end, my research seeks to generate knowledge of weed biology and ecology—identify weak points in the life cycles of our troublesome agricultural weeds and learn how weeds respond to integrated management practices used to induce stress at these vulnerable stages. Such diversified management approaches can help manage existing herbicide-resistant weeds and slow the evolution of new resistant biotypes. Developing these programs not only requires knowledge of weed biology and ecology, but requires application within a systems approach to ensure a holistic understanding of how weed management fits into overall agricultural production goals. Most of my research to do involves the use of cover crops for weed management, including the integration of cover crops with herbicide applications to target troublesome weed issues.

Teaching: I currently teach PLS 404, Integrated Weed Management (4 credits) each spring. This course is offered for graduate credit (PLS 597); in addition to completing course requirements, graduate students meet weekly for a journal club. I also teach PLS 490 (3 credits) each spring, which is the capstone course for students in the crops and livestock option of the Horticulture, Plant, and Soil Sciences major. Lastly, I teach PLS 531, Field School in Crop Pest Management (2 credits), in the fall. This is a field-based course focused on integrated pest management principles, pest identification and management, and the challenges that agronomic crop producers face in implementation of these programs.

Publications: (last two years, plus twelve additional for career)

Knott, C., J. Grove, and E.R. Haramoto. Could winter annual crop choice increase double-crop soybean yield? Submitted to Agronomy Journal, June 2017.

Haramoto, E.R. and D.C. Brainard. 2017. Spatial and temporal variability in Powell amaranth (*Amaranthus powellii*) emergence under strip tillage with cover crop residue. Weed Science 65: 151-163

Brainard, D., A. Bryant, D.C. Noyes, E.R. Haramoto, Z. Szendrei. 2016. Pest-regulating services under conservation agriculture: Insect and weed management tradeoffs in strip-tilled snap beans. Agriculture, Ecosystems, and Environment 235: 142-154.

Research support: (whole dollar amounts given; amount in parentheses is approximate amount coming to my program)

Co-PI (current):

Optimizing cropping systems for resilience to stress: role of maturity group selection and cover crops on yield, weeds, insects, and microbes. USDA-NIFA. 3/17-2/19. $461,187 (20%)

Cover crops under cover: evaluating costs, benefits, and ecosystem services of cover crops in year-round high tunnel production systems. Southern region Sustainable Agriculture Research and Extension. 2/16-2/19. $241,615 (22%)

Nitrogen contributions from different cover cropping systems established following full season soybeans. USDA NRCS, Kentucky Office, State Conservation Innovation Grant program. 10/17-9/18. $75,000 (17%)

Cover crop management for no-till production of burley tobacco. Altria Corp. 4/16-4/18. $19,000 (50%).

Optimizing the integration of annual forages into tobacco systems. Council for Burley Tobacco and Burley Tobacco Co-op. 4/16-4/18. $30,000 (25%)

Investigation of a mixed population of Palmer amaranth and waterhemp in Kentucky with multiple herbicide resistance." Kentucky Soybean Promotion Board. 5/16-6/18. $44,749 (50%)

Lead PI (current):

Optimizing winter cover crops for weed management in soybeans. Kentucky Soybean Promotion Board. 10/16-6/18. $78,086 (100%)

Integrating cover crops and herbicides for marestail management prior to soybean. Kentucky Soybean Promotion Board. 6/17-6/18. $9,764 (75%)

Industry (current and recently completed):

Approximately $17,000 received from industry for herbicide trials

Completed:

Approximately $60,000 to my program from national, regional, and state sources as lead and co PI on completed grants (total awarded $123,000)

Graduate students trained:

Currently advise two MS students, and serve on 1 PhD and 2 MS committees

Service:

- Reviewer for Weed Technology, Weed Science, Weed Research, Soil Tillage and Research, Sustainability, PLOS-one, HortScience, Agronomy Journal (past 2 years, n=12)
- Guest academic editor for PLOS-one
- Plant and Soil Sciences Department and CAFE, UK—serve on six committees, including two search committees and two curriculum committees
- Southern Cover Crops Council
    - Kentucky co-representative, working group
    - Member of the by-laws and multistate project committees
    - Liaison to the Midwest Cover Crops Council
- Active in Weed Science Society of America and North Central Weed Science Society (incoming member of the steering committee; outgoing chair of Weed Biology, Ecology, and Management section)

Jimmy C. Henning

Faculty Position
Extension Professor of Agronomy: Forages
95% Extension, 5% Administration

Educational Background
Ph.D. Agronomy (Major), Ruminant Nutrition (Minor), 1986, University of Kentucky
M.S. Agronomy, 1983, University of Georgia
B.S. Agronomy, 1981, University of Georgia

Program Description
My program can be best described as in a state of transition from 100% administrative responsibilities as Associate Dean of Extension back to my faculty role as a forage extension specialist. My duties since returning to the department on March 1, 2017 have been to provide additional educational and programmatic support to agents and the producers of Kentucky alongside the existing forage team.

My forage extension program accomplishments are ongoing and include revision of forage extension publications, creation of new educational publications, additional publishing in the popular press by renewing a column in the Farmer's Pride, taking an active role in the Kentucky Forage and Grassland Council by helping them to refine their top program priorities, developing a pocket forage ID guide for horse farm owners and managers of the major grasses, facilitating the update of the forages website, and working with agents in forage program development, implementation and evaluation.

My administrative accomplishments include developing the statewide Program Indicator questions for Dairy, Tobacco and for Forages and developing Guides for Authors and Guides for Reviewers for Extension Numbered Publications.

Invited Presentations
2017. UK's journey to reach the Kentucky beef producer. Oklahoma State University, May 8 – 11, 2017. Stillwater, Oklahoma.

David Hildebrand

Faculty Position
Professor, Department of Plant and Soil Sciences, Univ. of Kentucky
Adjunct Nutritional Sciences Graduate program

Educational Background
B.S. in Agronomy, University of Maryland (1977)
B.S. in Chemistry, University of Maryland (1977)
M.S. in Plant Breeding and Genetics, University of Illinois (1980)
Ph.D. in Plant Breeding and Genetics, University of Illinois (1982)

Program Description
Research
My research program emphasizes the general area of plant biochemistry and genetics and the application of biotechnology to crop improvement with particular emphasis on food, lipid and oil quality and new uses of agricultural products. Plant oils tissues are the most important renewable oil source for edible and industrial purposes as well as for nutraceutical and pharmaceutical uses. Oilseed meals are the most important source of protein. We have significantly increased oil and protein yield from soybeans while improving the composition of the oil. We have developed with Tim Phillips new chia varieties that can be produced in KY. We are selecting hemp genotypes with improved seed yield, seed oil content and fatty acid composition and for increased cannabidiol production. We also develop improved methods for chemical analysis of plants and human blood as an indicator of nutritional status

Teaching - BCH/PLS/PPA 609 - Plant Biochemistry – See: http://www.uky.edu/~dhild/biochem/welcome.html

National Service
Associate Editor J. Am. Oil Chem. Soc. 1999 to present.
Associate Editor Biocatalysis and Agricultural Biotechnology 2009 to present.

Graduate Student Advising
Two MS and two Ph.D. students

Current Research Support
D. Hildebrand. Increasing the market value of hemp seeds. $25,992. – July 1, 2015 to Dec. 31, 2017 – KY Science & Technology Co. Regionally competitive.
D. Hildebrand. Improved chia production and product usage. $49,348. – Feb. 1, 2015 to Dec. 31, 2017 – KY Small Grain Growers Association. Regionally competitive.
D. Hildebrand. Renewable lubricant production. $42,000. Oct. 1, 2016 to Dec. 31, 2017. Ashland/Valvoline Inc. Nationally competitive.
D. Hildebrand. Development of high ω3 soybeans. $29,470, April 1, 2016 to March 31, 2017. KY Soy Promotion Board. Regionally competitive.
C. Kumer, T. Phillips & D. Hildebrand**,** Commercialization of Early Flowering Chia. $48,000 ($3,000 to DH), Jan. 1, 2017 to Dec. 31, 2017. USDA/Kentucky Specialty Crop Program. Regionally competitive.
D. Hildebrand and T. Phillips. Development of *Salvia hispanica* L. as a Sustainable Oil Source. $27,890. Sept. 1, 2014 to Dec. 31, 2017 – Cono SA. Nationally competitive.
D. Hildebrand and T. Phillips. Genetic Selection of Hemp with Higher CBD Levels. $135,252. Jan. 1, 2017 to Dec. 31, 2017 – Grain Services. Nationally competitive.

SOME RECENT RESEARCH PUBLICATIONS (out of 160):
Geneve, R.L., D.F. Hildebrand, T.D. Phillips, M. AL-Amery, and S.T. Kester. Seed Germination in the Mucilage Producing Chia (*Salvia hispanica L.*) nutlets. Crop Sci. (in press).

Akinyemi, O., Geza Bruckner, John Johnson, Terry A. Lennie and David Hildebrand. 2017. A Rapid and Simple Method for Fatty Acid Profiling and Determination of ω-3 Index in Red Blood Cells. The Open Nutrition Journal 11:3-13.

Al-Amery, M., H. Fukushige, W. Serson and D. Hildebrand. 2016. DNA analysis for single seed genotyping in soybeans. Journal of Crop Improvement 30: 165-175.

Hatanaka, T., W. Serson, R. Li, P. Armstrong, K. Yu, T. Pfeiffer, X. Li and D. Hildebrand. 2016. Increasing Renewable Oil Production. J. Agric. Food Chem. 64: 7188-7194.

Zou, Y., S. Chintamanani, P. He, H. Fukushige, L. Zhu, D. Hildebrand, X. Tang and J.-M. Zhou. 2016. A gain-of-function mutation in a mechanosensitive ion channel triggers cell death and wound-induced hyperaccumulation of JA in Arabidopsis. Journal of Integrative Plant Biology (JIPB) 58: 600-609.

AL-Amery, Maythem, Watchareewan Jamboonsri, Chad Lee, James Hammond, Tim Phillips and David Hildebrand. 2015. Evaluation of flax as a viable crop again in the south central U.S. J. KY Academy of Sci. 76: 35-42.

Afitlhile, M., K. Duffield; M. Fry and D. Hildebrand. 2015. The toc132toc120 heterozygote mutant of *Arabidopsis thaliana* accumulates reduced levels of hexadecatrienoic acid. Plant Physiology and Biochemistry 96:426-435.

Al-Amery, M., H. Fukushige and D. Hildebrand. 2015. Single seed selection for low phytate soybeans. JAOCS 92:1119-1123.

Schmidt, M., W. Parrott, D. Hildebrand, D.F., R. Berg, A. Cooksey, K. Pendrvis, Y. He, F. McCarthy and E. Herman E.M. 2015. Transgenic soybean seeds accumulating β-carotene exhibit collateral enhancements of high oleate and high-protein content traits. Plant Biotechnology J. 13: 590-600.

SOME RECENT BOOK CHAPTERS (out of 31):

Hayes, D.G. and D. Hildebrand. 2016. Perilla (*Perilla frutescens*). Chapter 11.9 In: Industrial Oilseed Crops, McKeon et al. editors, Academic Press, Elsevier, pp. 328-332.

McKeon, T.A., D.G. Hayes, D.F. Hildebrand and R.J. Weselake. 2016. Introduction to Industrial Oilseed Crops pp. 1-13, Academic Press, Elsevier.

Fukushige, H. and D. Hildebrand. 2016. Hemp (*Cannabis sativa* L.). Chapter 11.3 In: Industrial Oilseed Crops, McKeon et al. editors, Academic Press, Elsevier, pp. 291-299.

Serson, W., M. AL-Amery, S. Patel, T. Phillips and D. Hildebrand. 2016. Chia, *Salvia hispanica.* Chapter 11.1 In: Industrial Oilseed Crops, McKeon et al. editors, Academic Press, Elsevier, pp. 278-287.

McKeon, T.A., D.G. Hayes, D.F. Hildebrand and R.J. Weselake. 2016. Editors Industrial Oilseed Crops book 453 pages, Academic Press, Elsevier.

RECENT PATENTS (out of 15):

Hildebrand, D.F., R. Li and T. Hatanaka. Method for Increasing Renewable Oil Production. US patent # 9,133,469 issued September 15, 2015.

Hildebrand, D.F., W. Jamboonsri and T. Phillips. Early Flowering Chia and Uses Thereof. US Patent No. 8,586,831 issued November 19, 2013.

Hildebrand, D.F., R. Li and T. Hatanaka. Diacylglycerol Acyltransferase Sequences and Related Methods. US Patent No. 8,431,772 issued April 30, 2013.

Arthur G. Hunt

Faculty Positions

Assistant Professor, Dept. of Agronomy, Univ. of Kentucky, 1985
Associate Professor, Dept. of Plant Soil Sciences, Univ. of Kentucky, 1990
Professor, Dept. of Plant Soil Sciences, Univ. of Kentucky, 1996
Position: 85% research, 15% teaching

Education Background and Training

B.S. University of Lowell, 1976, Biological Sciences
Ph.D. Brandeis University, 1982, Biochemistry
Postdoctoral training Rockefeller University, 1982-1985, Plant Molecular Biology

Program Description

My research deals with the mechanisms of mRNA 3' end formation in plants. In the past, my laboratory was among the first to define the novel polyadenylation signal used in plants, and to characterize various plant polyadenylation complex subunits. More recently, my laboratory has focused more extensively on mechanisms and consequences of alternative polyadenylation. We have established an interesting link between calmodulin signaling and alternative polyadenylation, and shown that this link is important for a number of important growth processes in plants. We are currently focusing on a model that holds that alternative polyadenylation in plants contributes globally to gene regulation by shunting transcriptional output into RNA surveillance pathways.

In the course of this research, my laboratory has developed cost-effective methods for preparing libraries for genome-scale transcriptomics (RNA-Seq) studies, and of computational pipelines for RNA-Seq data analysis that are low-cost and accessible to the trainees (postdoctoral, graduate, and undergraduate) in my laboratory. I have made these resources (including unpublished, raw data) available to a consortium of more than 200 schools includes several HCBUs and other minority-serving institutions. I also co-direct the RNA-Seq instructional activities that are parts of workshops held every summer for faculty teams from participating institutions. To date, the RNA-Seq sections of these workshops have involved faculty from 20 undergraduate-focused institutions, who collectively instruct more than 1500 undergraduates in the class and laboratory. My laboratory has also collaborated with numerous other research groups to facilitate genome-scale transcriptomics studies. These groups include other laboratories at the University of Kentucky (12), other institutions in the USA (7), and other countries (6).

Instruction

PLS620 – Plant Molecular Biology (I teach 100% of this course)
ABT495 – Experimental Methods in Biotechnology (I teach ca. 20% of this course

Honors and Awards

University Research Professor, University of Kentucky, May 2016

National Service (selected activities)

NSF review panels, 2006, 2014, and 2015 (four panels all together).
NIH Study Sections, 2001-2003 (2-3 meetings per year)

Current Research Support

NSF IOS-1353354, “Collaborative Research - CPSF30 at the convergence of cellular signaling and RNA Processing”. Sept. 1, 2014 – Aug. 31, 2018; $303,270.

Agricultural Research Service, “ARS/SCA: Impact of a novel growth-enhancing genetic modification on forage legume quality”. 08/01/2013 – 07/31/2017. $119,600.

Agricultural Research Service, “ARS/SCA: Genome-wide analysis of transcription and RNA processing in the endophyte-plant system”. 08/01/2013 – 07/31/2017. $128,800.

NSF MCB-1243849, “Alternative polyadenylation and non-stop mRNAs in Arabidopsis”, Sept. 1, 2013 – Aug. 31, 2017; $522,983.

Refereed journal articles (2016-2017, in addition to 98 additional peer-reviewed research and review articles)

de Lorenzo, L., Sorenson, R, Bailey-Serres, J., and **Hunt, A. G.** (2017) Noncanonical alternative polyadenylation contributes to gene regulation in response to hypoxia. *The Plant Cell*, in press (Accepted for publication May 22, 2017).

Majee, M., Wu, S., Salaita, L., Gingerich, D., Dirk, L. M. A., Chappell J., **Hunt, A. G.,** Vierstra, R., and Downie, A. B. (2017) The Genetic Structure in a misannotated locus positively influencing Arabidopsis Seed Germination is revealed using surrogate splicing. *Plant Gene 10*, 74-85.

Lim, G-H., Shine, M. B., de Lorenzo, L., Yu, K., Navarre, D., **Hunt, A. G**., Lee, J-y., Kachroo, A., and Kachroo, P. (2016). Plasmodesmata localizing proteins regulate transport and signaling during systemic immunity. *Cell Host and Microbe 19*, 541-549.

Chakrabarti, M., Dinkins, R. D., and **Hunt, A. G.** (2016) De novo transcriptome assembly and dynamic spatial gene expression analysis in red clover (*Trifolium pratense*). *The Plant Genome 9*, published online March 11, 2016. doi:10.3835/plantgenome2015.06.0048.

Bell, S. S., Brown, A., Chen, S., and **Hunt, A. G.** (2016) Experimental genome-wide determination of RNA polyadenylation in Chlamydomonas reinhardtii. *PLoS ONE 11*: e0146107.

Tomokazu Kawashima

Faculty Position
Assistant Professor, Dept. of Plant and Soil Sciences, Univ. of Kentucky, 2016
75% Research, 25% teaching

Educational Background
B.S. Biology University of Tsukuba, Japan, 2002
Ph.D. Mol. Cell & Dev. Biology University of California, Los Angeles, 2009

Program Description
Research
Although more than 9 billion people are projected to populate the world by 2050, the world's arable land has decreased since 2010. Unpredictable changes in global climates also cause uncertainty in food production and security. To ensure a sustainable food supply, new strategies are needed to increase food production per unit of land. Studies indicate that early-stage seed development is more sensitive than its subsequent phases to environmental conditions for yield determinants, and endosperm development during the early seed stage is strongly associated with seed size trait. Therefore, we seek to determine growth traits and transcriptional profiles of the early-stage seed grown at different temperatures and investigate their molecular and physiological relationships with the final yield. To achieve this goal, using *Arabidopsis thaliana* and soybean as the crop model, we will: (i) Quantify temperature effects during early-stage seed development on seed growth traits, (ii) Identify the processes occurring during early-stage seed development that are affected by temperatures, (iii) Conduct transcriptional profiling on early-stage seed compartments, and (iv) Establish a real-time live-cell imaging method to visualize cellular dynamics in the liquid endosperm. By integrating molecules, physiology, and environments, we will understand how early-stage soybean seed development is affected by environmental conditions, shedding light on the mechanism of how plants control seed size and number.

Teaching
I will teach PLS103 and ABT495 starting this fall and spring semeter, respectively.

Publications (2016-2017)
Peer reviewed publications,14 in total

K Motomura, **T Kawashima**, F Berger, T Kinoshita, T Higashiyama. A pharmacological study of Arabidopsis cell fusion. *J. Cell Sci.* (in revision)

Y Kimata, T Higaki, **T Kawashima**, D Kurihara, Y Sato, T Yamada, S Hasezawa, F Berger, T Higashiyama, M Ueda. The zygote polarizes in a tip-growing manner after disorganization of egg cell polarity upon fertilization in Arabidopsis. *Proc. Natl Acad. Sci. U.S.A.* 113:14157-14162 (2016)

K Motomura, F Berger, **T Kawashima**, T Kinoshita, T Higashiyama, D Maruyama. Fertilization-independent cell-fusion between the synergid and central cell in the polycomb mutant. *Cell Structure and Function* 41:121-125 (2016)

Other publications, 3 in total

D Susaki, D Maruyama, R Yelagandula, F Berger, **T Kawashima.** Live-cell imaging of F-actin dynamics during fertilization in Arabidopsis thaliana*. Methods Mol. Biol.* (in press)

R Yelagandula, A Osakabe, E Axelsson, F Berger, **T Kawashima.** Genome-wide profiling of histone modifications and histone variants in Arabidopsis thaliana and Marhchantia polymorpha. *Methods Mol. Biol.* 1610:93-106 (2017)

Invited Presentations (2016-2017)

2017 Extended comparative genomics to identify agriculturally useful genes. Global Biotechnology Congress 2017, Boston, USA

2016 Evolution of plant sperm motility. Marchantia Workshop, Kyoto, JAPAN

2016 Evolution of male germline development in the green plant lineage. 24th International Congress on Sexual Plant Reproduction, Tucson, USA

2016 Evolution of plant-specific histone variant H2A.M/W in the green plant lineage. 3rd Histone Variant Meeting, Tokyo, JAPAN

Carrie A. Knott

Faculty Positions

Assistant Extension Professor, Department of Plant and Soil Sciences, University of Kentucky, Princeton. Since 2013. 80% Extension, 20% Research

Assistant Professor, School of Plant, Environmental and Soil Sciences, Louisiana State University Agricultural Center, Baton Rouge. 2007 to 2013. 100% Research

Educational Background

Ph.D. Crop Science, 2007, University of Kentucky
M.S. Crop Science, 2002, University of Kentucky
B.S. Agriculture, 2000, Western Kentucky University

Program Description

Profitable and sustainable grain crop production in Kentucky is becoming increasingly challenging as commodity prices decrease. The goal of my program is to develop sustainable and profitable grain crop production practices and to disseminate those practices through educational materials. Much of my extension programming focuses on educating producers, county agents, crop consultants, industry representatives, students and the general public. To reach such a diverse audience I employ many different educational materials, such as presentations, publications, and social media. To date, I have more than 97,600 clientele contacts from these various educational events and materials.

My applied field research directly supports my extension program. Much of my research focuses on increasing the yield and profitability of the double-crop soybean production system. There are many challenges but also many opportunities for the double-crop soybean rotation. To date, one M.S. candidate completed a project that evaluated the effect of different winter annual crops on subsequent double-crop soybean yields. I also have one Ph.D. student devoted to determining whether revised agronomic practices can increase the profitability of the double-crop soybean system. She is specifically investigating whether agronomic practices, such as starter fertilizer and grain harvest timing, can reduce mycotoxin levels in wheat and the impact of earlier double-crop planting date and pesticide management programs on double-crop soybean yield.

Publications

Extension (42 for career)

Knott, C. and C. Lee. 2017. Soybean Production in KY. AGR-130. http://www2.ca.uky.edu/agcomm/pubs/agr/agr130/agr130.pdf.

Knott, C. 2017. Identifying Canola Growth Stages. AGR-227. http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR227/AGR227.pdf.

Knott, C. and C. Lee. 2016. Identifying Soybean Growth Stages. AGR-223. http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR223/AGR223.pdf.

Knott, C. 2016. Identifying Wheat Growth Stages. AGR-224. http://www2.ca.uky.edu/agcomm/pubs/AGR/AGR224/AGR224.pdf.

Knott, C., C. Lee, and E. Ritchey. 2015. Common Agronomic Conversions and Calculations.

Knott, C., D. Johnson, C. Bradley, J. Martin, E. Ritchey, C. Lee, and S. McNeil. 2015. Grain Sorghum (Milo) Production in Kentucky. ID-234. http://www2.ca.uky.edu/agcomm/pubs/ID/ID234/ID234.pdf.

Research (20 for career)

Knott, C., E. Swiggart, J. Grove, and E. Haramoto. 2017. Could winter annual crop choice increase double-crop soybean yield? Agronomy Journal. Submitted June 2017.

McLachlan, K., C. Knott, K. Russell, and C. Lee. 2017. *Bradyrhizobium japonicum* seed inoculants have little effect in a soybean-corn rotation in Kentucky. Crop, Forage & Turfgrass Management. Submitted May 2017.

Knott, C.A., D.A. Van Sanford, E.L. Ritchey, and E. Swiggart. 2015. Wheat yield response and plant structure following increased nitrogen rates and plant growth regulator applications. Crop, Forage &Turfgrass Management. 2(1): 1-7. Doi:10.2134/cftm2015.0202.

National Service

USDA-NIFA grant review panel. Spring 2017.

Vice-Chair of Applied Soybean Research Community of ASA|CSSA|SSSA. Since 2016.

Graduate Students Advised

Current: 2

Career: 5

Courses Developed and Taught

PLS 597-003: Grain Crop Field Training (Summer/Fall 2015 and 2016). 3 Credit Hrs

This course was developed for county agents in response to their requests for a set of "Hands-On" trainings for grain crops. The learning objectives of the class were to: 1) gain and apply knowledge of key grain crop production practices and principles in field settings; 2) confidently communicate agronomic knowledge to clientele; and 3) understand the value of basic agronomic principles, such as growth staging.

Brad D. Lee

Faculty Positions

Assistant Prof., Dept. of Agronomy, Purdue U., 2001-2006
Associate Prof., Dept. of Agronomy, Purdue U., 2006-2008
Associate Extension Prof., Dept. of Plant and Soil Sci., U. of Kentucky 2009 - present
Position: 20% Research: 80% Extension

Educational Background

B.S. Agronomy (Geology minor), 1988, Oklahoma State University
M.S. Agronomy, 1994, Oklahoma State University
PhD. Pedology/Soil Mineralogy, 1999, University of California, Riverside

Program Description

My Kentucky-focused extension and applied research activities address water quality issues associated with stormwater regulated urban communities and row-cropped agricultural fields. Nationally I lend expertise to various communities interested in soils science.

Within the urban sector, I lead an effort to provide expertise and programming to 104 regulated Municipal Separate Storm Sewer System communities to help them meet their regulatory requirements for Minimum Control Measures: 1. Public education and outreach, and 2. Public involvement. At present the bulk of this work involves recruiting CES agent participation, facilitating educational programming between permitted communities and CES agents, and developing a method of data exchange between the centralized UK CES database and the permitted communities. I also support educational programming to CES offices in residential stormwater management, nutrient management and water conservation. For example, with Rick Durham (HORT) and Gregg Munshaw (PSS), we have initiated an urban nutrient management program for homeowners, “No P on my Lawn!” and a Green Certification program for professional nutrient applicators in the lawn and landscape care service industry.

Within the agricultural sector, I focus on water dynamics and nutrient management related to soil health parameters. Recently I coordinated a long-term, multistate study which evaluated the variability of soil hydrologic properties across differing land uses and slope positions in the Shawnee Hills physiographic region of western Kentucky, southern Illinois, southern Indiana. Presently I conduct on-farm applied research in row cropped fields to evaluate nutrient and sediment runoff of existing and proposed USDA NRCS BMPs using a portable rainfall simulator and a recently initiated edge-of-field monitoring project. The results of this collective work are being transferred to county CES agents and subsequently agricultural producers via discussions, presentations, webinars and extension bulletins.

Nationally I partner with the USDA NRCS Soil Survey Division to support their soil investigation initiatives, lend applied soil hydrologic experience to the onsite wastewater community, and provide soils expertise to the forensic science community for the development of standards.

Recent Publications (26 peer-reviewed, 50 ext. bull., 2 policy, 3 book chapters)

Lee, B.D. and J. Kabrick. East and Central Farming and Forest Region and Atlantic Basin Diversified Farming Region: Land Resource Regions N and S. Chapter 12. In: West, L.T., M.J. Singer, and A. Hartemink, eds. *Soils of the USA*, Springer, NY (2016).

Durham, R., S. Saha, J. Strang, M. Williams, S. Wright, R. Bessin, B. Lee, E. Pfeufer. 2016. Home vegetable gardening in Kentucky. University of Kentucky CES Bulletin ID-128.

Lee, B.D., T.N. Williamson, A.S. Crain. Water quality and natural resources in the Green River Basin. In: Lee, B.D. A. Jones, D. Carey, S. McSpirit eds. *Water in Kentucky: Natural History, Communities, and Conservation.* UK Press, Lexington, KY. *In press.*

Recent invited Presentations (24 total)

Lee, B.D. 2016. Soil hydraulic properties: Importance & variability across the landscape. Kentuckiana CCA Training Conference. 11/30. French Lick, IN.

Lee, B.D. 2017. Lawn and gardening our way to hell in a vegetable basket. U. Kansas Geog. Dept. 3/30. Lawrence, KS.

Lee, B.D. 2017. No P on my Lawn! - Engaging urban Kentuckians about nutrient management. Southeast Stormwater Association. 12th Annual Regional Conference. 10/12, Louisville, KY.

Awards

2016	Excellence in Extension Award (poster), ASA
2014	Excellence in Extension Award (publication), ASA
2011	USDA-NIFA Southern Region Project of Excellence: Down-Well Camera Team
2006	Indiana Environmental Health Association President's Commendation
2002	Purdue University, College of Agriculture Dean's Team Award

Professional Certifications

Certified Professional Soil Scientist (CPSS)
Indiana Registered Professional Soil Scientist (RPSS #17)

Selected Professional Memberships & Activities

2014-2018	OSAC for Forensic Science: Chemistry/Instrumental Analysis - Geologic Materials Subgroup, Vice-chair (2017 – present)
2008-2013	Associate Editor – *SSSA Journal*, Pedology Division
2007-2011	Chair – Soil micromorphology committee, SSSA
2011	National Review Panel - NIJ
2010	Chair – Soil Mineralogy Division, SSSA
2008	President – Indiana Association of Professional Soil Classifiers

Chad D. Lee

Faculty Positions

Director, Grain and Forage Center of Excellence
Extension Professor, Grain Crops
August 2016 – present: 50% Extension, 10% Research, 10% Teaching, 30% Administrative

Educational Background

Ph.D. Crop and Soil Sciences, Michigan State University, 2002
M.S. Agronomy, University of Nebraska-Lincoln, 1998
B.S. (cum laude), Agriculture, Berea College, 1996

Publications

Referred Publications

(† graduate student advised by C.D. Lee)

5. Mackey, Grant L. †, John M. Orlowski†, Julie Baniszewski† and **Chad D. Lee**. 2016. Corn Response to Seeding Rate Varies by Hybrid and Environment in Kentucky. Crop Forage Turfgrass Manage. 2: doi:10.2134/cfm2016.0002

4. Orlowski, John†, Gary Gregg†, **Chad Lee** and Will Serson. 2016. Early-season lactofen application fails to increase soybean yield under weed-free conditions. Agronomy. Journal. Posted April 6, 2016. doi: 10.2134/agronj2015.0589

3. Orlowski, John†; Bryson Haverkamp; Randy Laurenz; David Marburger; Eric Wilson; Shaun Casteel; Shawn Conley; Seth Nave; Emerson Nafziger; Kraig Roozeboom; William Ross; Kurt Thelen, and **Chad Lee**. 2016. High-Input Management Systems Effect on Soybean Seed Yield, Yield Components, and Economic Break-even Probabilities. Crop Science. Accepted April 13, 2016. doi: 10.2135/cropsci2015.10.0620

2. Marbuger, David A., Bryson J. Haverkamp, Randall G. Laurenz, John M. Orlowski†, Eric W. Wilson, Shaun N. Casteel, **Chad D. Lee**, Seth L. Naeve, Emerson D. Nafziger, Kraig L. Roozeboom, William J. Ross, Kurt D. Thelen and Shawn P. Conley. 2016. Characterizing Genotype x Management Interactions on Soybean Seed Yield. Crop Science. 56: 786-796.

1. Orlowski, J.M.†, G.L. Gregg† and **C.D. Lee**. 2016. Early-Season Lactofen Application has Limited Effect on Soybean Branch and Mainstem Yield Components. Crop Science. 56: 1: 432-438. doi:10.2135/cropsci2015.08.0482

Peer-Reviewed Extension Publications

3. Knott, C. and C. Lee (2017). Soybean Production in Kentucky. AGR-130. Univ. of Kentucky Coop. Ext. Serv. Lexington. Major Revision.

2. Knott, C. and **C. Lee**. (2016). *Identifying Soybean Growth Stages.* AGR-223. Univ. of Kentucky Coop. Ext. Serv. Lexington. New Publication.
1. **Lee, C.**, C. Knott, C. Bradley, R. Villanueva, J.D. Green. (2016). *Replanting Options for Corn.* ID-195 Univ. of Kentucky Coop. Ext. Serv. Lexington. Revision.

Research

Selected Competitive Grants

Bennett, R., and C. Lee. 2016-2018. Kentucky Agricultural Development Fund. **$15,000,000**. University of Kentucky Grains Center of Excellence. (The university is required to match the grant over 5 years.)

Lee, C.D. and C. Knott. 2016-2017. Updating Rye and Barley Management Guidelines for Kentucky (Year 2). Kentucky Small Grains Growers Association. $12,000 (50%)

Lee, C.D. 2016-2017. Comparing Xtend Soybean System to the Roundup Ready System. Kentucky Soybean Board. $17,435

Teaching

2017- PLS512: Grain and Oilseed Management, 3 credits – Spring 2017

2016 - PLS512: Grain and Oilseed Management, 3 credits – Spring 2016

2017 – Guest Lecture, PLS610, (M. Coyne and D. Van Sanford) “Presenting Scientific Information to the General Public.”

Undergraduate Student Mentoring

Dr. Lee has mentored 18 undergraduate student interns, three of whom were later advised by Dr. Lee on graduate programs. One other is inquiring and two others pursued graduate programs in their home countries. Dr. Lee helped county extension agents provide guidance on two interns working with irrigation. Those two interns are now county agents.

Travis Legleiter

Faculty Position
Assistant Extension Professor: Weed Science - 20% Research: 80% Extension
University of Kentucky, Research and Education Center at Princeton

Educational Background
PhD. Botany and Plant Pathology, 2017, Purdue University.
M.S. Plant, Insect, and Microbial Science, 2008, University of Missouri.
B.S. Plant Science, 2006, University of Missouri.

Program Description
Kentucky farmers are currently at a crossroads of weed management tactics in their row crop acreages. The era of roundup ready crops and inexpensive and reliable glyphosate applications is coming to a close as herbicide resistant weeds continue to emerge across the state. In addition, Kentucky farmers are facing a new learning curve of emerging products, such as dicamba resistant soybean which require a level of stewardship many farmers have not previously encountered.
My Extension and research program at the University of Kentucky Research and Education Center at Princeton will initially focus on answering these current issues that Kentucky farmers face. The research program will include investigations of management tactics for herbicide resistant weeds in Kentucky row crops including but not limited to: common waterhemp, Palmer amaranth, and horseweed. The research program will also investigate stewardship practices to reduce herbicide movement during and after application, such as the use of air induction and pulse width modulation broadcast application technologies
The information gleaned from the research program will directly feed my Extension programing in helping Kentucky farmers learn to effectively manage herbicide resistance while being good stewards of the new herbicide resistant crop technologies. The research program and Extension programing will remain flexible and will ever change as Kentucky farmers demands and questions of weed science change.
My initial research and Extension program will be built on my previous experience at Purdue University in which I was employed as an Program Specialist within the weed science program while obtaining my PhD. The past five years of extension programing at Purdue have primarily focused on Palmer amaranth and common waterhemp management. My PhD dissertation focused on the utilization of synthetic auxin herbicides in soybean to enhance the longevity of the technologies. The experience I gained at Purdue will be used to build my research and Extension Program at the University of Kentucky.

Extension publications:
Terminating Cover Crops: Successful Annual Ryegrass Termination with Herbicides (WS-52W). Travis Legleiter, Bill Johnson and Bryan Young. Dec 2015.

Palmer Amaranth Biology, Identification, and Management (WS-51). Travis Legleiter and Bill Johnson. Published Nov 2012, updated Nov 2013. Approx. 12,000 Copies distributed by Purdue Weed Science at field days and winter talks. Approx. 17,000

Downloads of the digital version from Purdue Education Store.

Terminating Cover Crops: Successful Cover Crop Termination with Herbicides (WS-50W). Travis Legleiter, Bill Johnson, Kevin Gibson, and Thomas N. Jordan. Published Apr. 2012. Approx. 2,500 Downloads from the Purdue Education Store.

Herbicide Site of Action Risk of Resistance. A part of the "Take Action" Series. Lead Author- In Press

Refereed Journal Articles

-Legleiter, T.R., W.G. Johnson. 2016. Herbicide Coverage in Narrow Row Soybean as Influenced by Spray Nozzle Design and Carrier Volume. Crop Prot. 83:1-8.
-Legleiter, T.R., K.W. Bradley. 2009. Evaluation of Herbicide Programs for the Management of Glyphosate-resistant Waterhemp (Amaranthus Rudis) in Maize. Crop Prot. 28:917-922.
-Legleiter, T.R., K.W. Bradley, and R.E. Massey. 2009. Glyphosate-resistant Waterhemp (Amaranthus Rudis) Control and Economic Returns with Herbicide Programs in Soybean. Weed Tech. 23:54-61.
-Legleiter, T.R., K.W. Bradley. 2008. Glyphosate and Multiple Herbicide Resistance in Common Waterhemp (Amaranthus Rudis) Populations from Missouri. Weed Sci. 56:582-587.

Invited Presentations

-Indiana Spray Center Conference. Noblesville, IN; Feb 2015 & Nov 2014. Weed Science Update. 120 Attendees Total
-Pesticide Applicator Certification Regional Workshop. Indianapolis, IN; Aug 2014. Herbicide Mode of Action Chart. 40 Attendees
-Farm Bureau Young Farmers Conference. Indianapolis, IN; Jan 2014. Palmer Amaranth Identification, Biology, and Management. 30 Attendees
-Corn Belt Seed Conference. Indianapolis, IN; Feb 2013. 2,4-D and Dicamba Resistant Crop Stewardship. 25 Attendees
-Top Farmer Conference. Chicago, IL; Jan 2013. Top 5 Weed Resistance Stress Reducers. 60 Attendees

Chris Matocha

Faculty Positions
Assistant Professor, Dep. of Agronomy, Univ. of Kentucky, 2000
Associate Professor, Dep. of Plant Soil Sciences, Univ. of Kentucky, 2006
Position: 69% research, 31% instruction

Education
B.S. Texas A&M University, 1993, Plant and Environmental Soil Science
M.S. Texas A&M University, 1996, Soil Science
Ph.D. University of Delaware, 2000, Plant and Soil Science

Program Description
Research
My research program focuses on solving mechanistic problems related to the cycling of nitrogen and its interaction with other elements in soil such as iron, manganese, and carbon. Interest in nitrogen stems not only from its importance to plants as an essential nutrient but also from a need to protect water supplies from elevated nitrate levels. We have found that nitrogen fertilizer additions can change the nature of the clay minerals by ammonium fixation into reactive clay mineral layers at low rates and biota (plants and microorganisms)-mediated mineral weathering at higher N additions. These findings have implications for plant-available nitrogen and potassium, the latter of which was always greatest in the untreated plots where N fertilizer was not added. Furthermore, organic carbon plays an important role in synthesis of clay minerals.
Another poorly understood aspect of the nitrogen cycle is the fate of nitrate under waterlogged conditions in the field. Poorly crystalline iron minerals, which can be transported via erosion, can also generate iron(II) under waterlogged conditions. The resulting iron(II) is involved in the reduction of nitrate and nitrite in coupled biological-chemical processes. This topic formed the basis of a symposium on iron transformations at the Goldschmidt international conference this past summer in which I was invited to speak. We have shown that iron(II) associated with clay minerals can participate in coupled processes related to transformation of nitrate and nitrite.
By understanding pathways which underpin these cryptic transformations of nitrogen, we hope to improve fertilizer use efficiency.
We have also investigated the role of cover crops such as ryegrass in the amelioration of fragipan soil horizons. We have found that there are slight increases in porosity, suggesting the potential to improve row crop yields on these soil types.

Teaching
I teach PLS 366 (Fundamentals of Soil Science), PLS 671 (Soil Chemistry), and PLS/EES 741 (Clay Mineralogy).

National Service

- Chair, Soil Science Society of America, Soil Mineralogy Division, 2013
- Discussant to represent fundamental soil science groups for the first SSSA cross divisional symposium, ASA-SSSA Annual Meetings, Tampa, FL, 2013
- Associate Editor, Soil Science Society of America Journal, 2011-2016

Graduate Student Advisor

I am currently advising one M.S. graduate student (a total of 7 graduate students for career).

Current Research Support

- C.J. Matocha (PI), L. Murdock (co-PI): Ryegrass Commission, 2017-2018; $10,000
- C.J. Matocha (PI), B. Lee, (co-PI), A.E. Fryar (co-PI), Fate of Heavy Metals at the CATchment, UK Student Sustainability Council, 7/01/2016-11/30/2017; $3,500

Refereed journal articles

(most recent, total of 34 for career)

- R.X. Zhou, K. Basu, H. Hartman, C.J. Matocha, S.K. Sears, H. Vali, M.I. Guzman. (2017). Catalyzed synthesis of zinc clays by prebiotic central metabolites. Scientific Reports 7, 533, 10.1038/s41598-017-00558-1.

-S. Rakshit, C.J. Matocha, M.S. Coyne, and D. Sarkar. (2016). Nitrite reduction by Fe(II) associated with kaolinite. International Journal of Science and Technology, 13, 1329-1334.

- C.J. Matocha, J.H. Grove, A.D. Karathanasis, M. Vandiviere. (2016). Changes in soil mineralogy due to nitrogen fertilization in an agroecosystem. Geoderma, 263 176-184.

-E.A. Rienzi, B. Mijatovic, C.J. Matocha, F.J. Sikora, T.G. Mueller. (2016) Use of spectral data from on-the-go multispectral cameras to monitor soil surface moisture: The partial least square regression for data mining, analysis, and prediction. Chapter 6, pp. XX-XX. IN M.R. Goyal, S. Nambuthri, and R. Koech, eds. *Technological Interventions in management of irrigated agriculture.* Apple Academic Press distributed by CRC Press, Waretown, New Jersey.

Rebecca L. McCulley

Faculty Positions

2013-now	Director, UK Tracy Farmer Institute for Sustainability & the Environment
2016-now	Full Professor, Dept. of Plant & Soil Sciences, University of Kentucky
2012-2016	Associate Professor, Dept. of Plant & Soil Sciences, Univ. of Kentucky
2006-2012	Assistant Professor, Dept. of Plant & Soil Sciences, Univ. of Kentucky

Position: 85% Research, 15% Teaching

Educational Background

Rice University	Biology	BA, 1995
Texas A&M University	Rangeland Ecology & Mgmt.	MS, 1998
Colorado State University	Ecology	PhD, 2002
Duke University	Ecosystem Ecology	Postdoc, 2002-2006

Program Description

Research:

My work explores the ecological factors and processes that control rates of biogeochemical cycling and ecosystem structure and function in grasslands. Recent and ongoing studies include:

- Quantifying the effects of land management and climate change on pasture and grassland biogeochemistry
- Evaluating the effects of fungal endophyte infection on tall fescue pasture structure and function
- Understanding the roles of ultra-violet radiation and soil erosion on aridland litter decomposition and microbial decomposer communities
- Exploring how invasive species alter grassland function

I have garnered >$4million to support these activities, ~$2million of which has been directed solely to my research program.

Teaching:

I taught PLS 103/104: Plants, Soils, & People (an introduction to agriculture, general education/UK Core class) once a year from 2008 – 2013. I also helped develop and teach a 300-level Agroecology class and a 100-level Climate Change and Agriculture class during this time period. In 2015 & 2016, I taught NRE 201: Introduction to Natural Resources and Environmental Sciences, which is limited to Natural Resource and Environmental Science majors. Enrollment in these courses has varied from ~15 to >110 undergraduate students.

Publications – (selected from 2016; 63 refereed journal articles to date; * denotes a student I advised)

Slaughter, L.C.* and R.L. McCulley. **2016*.*** Aboveground *Epichloë coenophiala* – grass associations do not affect belowground fungal symbionts or associated plant, soil parameters. Microbial Ecology 72: 682-691.

Guo, J.*, R.L. McCulley, T.D. Phillips, and D.H. McNear, Jr. **2016.** Fungal endophyte and tall fescue cultivar interact to differentially effect bulk and rhizosphere soil processes governing C and N cycling. Soil Biology & Biochemistry 101:165-174.

Harpole, W.S. + 32 co-authors, including R.L. McCulley. **2016*.*** Addition of multiple limiting resources reduces grassland diversity. Nature 537(7618):93-96.

Rojas, X., J. Guo, J.W. Leff, D.H. McNear Jr., N. Fierer, and R.L. McCulley. **2016**. Infection with a shoot-specific fungal endophyte (*Epichloë*) alters tall fescue soil microbial communities. Microbial Ecology 72:197-206.

Smets, W., J.W. Leff, M.A. Bradford, R.L. McCulley, S. Lebeer, and N. Fierer. **2016**. A method for simultaneous measurement of soil bacterial abundances and community composition via 16S rRNA gene sequencing. Soil Biology & Biochemistry 96:145-151.

Jokela, K.J.*, D.M. Debinski, and R.L. McCulley. **2016**. Effects of non-native grass species and endophyte infection on the development and survival of Tawny-edged skippers (Lepidoptera: Hesperiidae). Environmental Entomology 45(1):142-149.

Active Grants

Three NIFA-AFRI grants totaling $749,722, and one USDA-ARS specific cooperative agreement with the Forage Animal Production Research Unit on campus - $152,896

Graduate Students Advised

Primary advisor of one graduate student at present (Mahtaab Bagherzadeh – MS, expected graduation Aug 2018). I have been the primary advisor of 10 graduate students to date (2 PhD; 8 MS); I have served on 17 additional graduate committees.

Leadership/Service

As Director of the Tracy Farmer Institute for Sustainability and the Environment on our campus, I provide leadership, vision, funding, and organizational assistance for faculty, staff, and students engaged in sustainability and environment-related education, outreach, and research. This is accomplished by the creation and facilitation of a variety of Working Groups on campus, each of which aims to increase the visibility of various sustainability and environmental issues, and by supporting undergraduate internships. We organize and host an annual Sustainability Forum/Showcase. I also helped create and help fund-raise and administer the Sustainability Challenge Grant program, entering it's fourth year and has awarded $500K+ to ~20 projects on and off campus.

Honors and Awards

- Global Research Alliance Senior Scientist, AgResearch, Palmerston North, NZ, 2016.
- Distinguished Alumnus. Graduate Degree Program in Ecology, Colorado State University, 2009.
- Julian Huxley Award - Excellence in Ecology & Evolutionary Biology, Rice Univ. 1995.

Joshua M. McGrath

Faculty Position

Associate Extension Professor, Soil Management Specialist, Year of Appointment: 2014
20% Research and 80% Extension

Educational Background

Ph.D. University of Delaware. 2004. Plant and Soil Sciences
B.A. Johns Hopkins University. 1997. Environmental Earth Sciences.

Program Description

My extension and research program focuses on agricultural productivity and environmental quality as they relate to soil fertility, soil management, and water quality. I work with partners to develop and deliver data-supported soil fertility and soil management recommendations. In addition, we have worked to develop new technologies and tools that support economically and environmentally sustainable production in Kentucky. Major programming areas include manure management with a focus on no-till, precision nutrient management, and cover crops and soil health where they intersect with nutrient management decision making. Major program partners include Kentucky farmers, county extension agents, state commodity groups, NRCS, and other university and ARS researchers in our region.

Research, Scholarly, and Creative Activities

- Extramural Funding 2015-present totaling $5,503,105
- Invited book chapters (total = 5)
- Refereed Journal Articles (2015 – Present = 8, total = 30 samples below)
  - Smith, D., Wilson, R., King, K., Zwonitzer, M., McGrath, J. M., Harmel, D., Haney, R., Johnson, L. Lake Erie, Phosphorus and Microcystin: Is it really the farmer's fault. Journal of Soil and Water Conservation. In press. Accepted 9 March 2017..
  - Fiorellino, N.M.*, J.M. McGrath, P.A. Vadas, C.H. Bolster, and F.J. Coale. 2017. Use of Annual Phosphorus Loss Estimator (APLE) Model to Evaluate a Phosphorus Index. Journal of Environmental Quality. http://dx.doi.org/10.2134/jeq2016.05.0203.
  - Shober, Amy L., A. R. Buda, K. C. Turner, N. M. Fiorellino, A. S. Andres, J. M. McGrath, and J. Thomas Sims. 2017. Assessing coastal plain risk indices for subsurface phosphorus loss. Journal of Environmental Quality. http://dx.doi.org/10.2134/jeq2017.03.0102.
- Extension Publications, Reports, and Monographs (2015 – present = 8, total = 23)
- National invited abstracts (2015 – present = 5, total = 27, samples below)
  - McGrath, J.M. 2016. The Mid-Atlantic Perspective. In Nutrient Management Laws and Regulation: Where We Are and Where We're Going Symposium. ASA-CSSA-SSSA International Annual Meetings. 6-9 November 2016. Phoenix, AZ.
  - McGrath, J.M. 2016. Understanding spatial and temporal variability in phosphorus response. SERA-17 Annual Meeting. 9-10 November 2016. Phoenix, AZ.

- McGrath, J.M. 2016. Status and Future of Real-Time Sensing in Crop Production. American Society of Agricultural and Biological Engineering Annual International Meeting. 17 – 20 August 2016. Orlando, Florida. Invited speaker for Marvin Stone Memorial Symposium.

Teaching and Mentoring

- Primary adviser graduated four M.S. and two Ph.D. students, currently one Ph.D. and two M.S. all but thesis
- Served on the committee of eight M.S. and one Ph.D. student
- Spring 2017 taught Soil Fertility and Nutrient Management

Sample of Major Extension Activities (2015 – present)

- Precision Agriculture Farm Management Software and Field Hardware Training for Kentucky Soybean, Corn, and Wheat Producers. Held January 28-29, 2016 in Princeton, KY and December 15 and 16, 2016 in Owensboro, KY.
- Kentucky "Tobacco Barn" meeting. (March 29 – 30, 2016; December 13 – 14, 201;6 and December 8 and 9, 2015). Hosting annual meeting of research and extension scientists from universities, USDA-ARS, Industry, and IPNI to discuss current issues to develop interdisciplinary, national approach to answering most pressing nutrient management challenges facing producers.
- The World Food Prize. Invited to speak and participate in panel discussion on sustainable nutrient management. October 15, 2015. Des Moines, Iowa.
- Organized "The State of the Science Phosphorus Symposium." January 30, 2015. Wye Mills, MD (available online http://www.phosphorussymposium.com/).
- "Scoop on Poop" Multi-County Extension Programming conducted in cooperation with Dr. Shockley and Dr. Ritchey to inform growers on economic, agronomic, and environmental management of poultry litter. Hosted in McLean and Henderson County in 2016. County Extension Presentations

Sample of Committees, elected positions, office held:

- Field to Market 4R Phosphorus Scientific Experts Roundtable. Invited participant in meeting organized by IPNI, TFI, and Field to Market to prepare national 4R guidelines for phosphorus management and Field To Market Model. 1 – 2 June 2016. Washington DC
- Member Agronomy Society of America and Soil Science Society of America
  - 2015 Chair Nutrient Management and Soil and Plant Analysis Division, Soil Science Society of America
  - Associate Editor, Soil Science Society of America Journal (2013 – present, second term)
  - Multiple committees and task forces
- International Certified Crop Advisor Program, 4R Nutrient Management Specialty (2015) and Precision Agriculture Specialty (2017). Developed Performance Objectives and Proficiency Areas for new CCA Specialties
- Kentucky Certified Crop Advisor Board
- Mid-Atlantic Soil Testing and Plant Analysis Work Group (2006 – present))
- Multistate Research Coordinating Committees and Information Exchange Groups
  - SERA-17, NEC-1312, SERA 6, NEERA 1402, NCERA 180, and NEERA1002

David H. McNear Jr.

Faculty Positions (62% research, 18% teaching, 20% administration)
Assistant Professor of Rhizosphere Science, Univ. of KY, Dep. of Plant & Soil Sci. – *2007-2013*
Associate Professor of Rhizosphere Science, Univ. of KY, Dep. of Plant & Soil Sci. – 2013- present

Educational Background and Training

Ph.D	University of Delaware	Environmental Soil Chemistry	*2006*
M.S.	Pennsylvania State University	Environmental Pollution Control	*2001*
B.S.	Pennsylvania State University	Environmental Pollution Control	*1997*

Program Description

Research- Research in the Rhizosphere Science Laboratory focuses on the biogeochemical processes occurring within the rhizosphere over multiple spatial scales, and assesses the influence of these processes on nutrient cycling, metal tolerance, ecosystem and agroecosystem function and health. The Rhizosphere Science Laboratory is one of the few, if not the only, rhizosphere labs in the United States taking a holistic approach, using fundamental, cutting-edge soil chemical, molecular microbial ecology, and plant genetic methodologies together with conventional lab and greenhouse techniques, to unravel and improve our understanding of the intricate interactions at the plant-soil interface. In the past year I have built two new resources, the *rhizosphere imaging laboratory* and the *agroecosystem mesocosm facility*. The rhizosphere imaging laboratory contains a group of equipment capable of determining root system architecture (RSA) in 2D and 3D for rapid phenotyping of RSA traits, and the 2D distribution of O_2, CO_2, and pH and enzymes in the rhizosphere of growing plants. The new *agroecosystem mesocosm (AEM) facility* is specifically designed for imaging root turnover in managed agroecosystems (minimal till, cover crops). The AEM contains a total of 24, 135 L mesocoms, using two soil types (12 mesocoms each) reconstructed into a profile with two soil horizons in which a rhizotron tube for imaging root growth and decomposition and soil moisture and temperature sensors are placed. ***Teaching -*** Responsibilities for one semester of PLS366 Fundamentals of Soil Science (4 CR) each year consisting of two 75 minute lectures and 3-5 (depending on enrollment), 150 minute lab sections per week. This is a large class comprised of students from a variety of majors and backgrounds including animal science, forestry, natural resource and environmental sciences, turf grass management and landscape architecture. The lab consists of mini-lectures which are used to frame the theoretical concepts of the experiment and an in-house lab experiment or field trip to research plots at the UKY Spindletop Farm. ***Administration -*** I am the Director of Undergraduate Studies for the Natural Resources and Environmental Science (NRES) program. Duties of the NRES DUS include advocating for the program, building relationships with the students, maintaining the academic rigor of the program, advising for freshman, transfers, and readmits, creating advising notes each semester for the NRES advisers, meet with prospective students, review and approve learning contracts for internships and research experiences, curriculum related issues and updates, confirming the course schedule/catalog each semester, and finally serving on the college undergraduate curriculum committee. In addition to my NRES DUS I also designed and wrote the student learning outcomes assessment plant for NRES and am responsible for collating and evaluating all the data and writing the annual SLO report.

Honors and Awards

- UK Teacher Who Made a Difference Award, 2015; National Academy of Sciences Kavli Fellow, 2010-2014; USDA Presidential Early Career Award for Scientists and Engineers (PECASE), 2010; Recipient of the UK Ag Student Council Early Career Teaching Award, 2009

Recent Federal Grants Received (~$4.8 mil total, ~$2.5 mil to my program)

1. **McNear, D.H.** (PI), J. McGrath and J. Grove. 2016-2019. *Rhizosphere priming effects on legacy organic phosphorus (Po) in a winter wheat/corn rotation.* **USDA NIFA AFRI .**… **$499,435**
2. Moe, L. (PI), **D.H. McNear** and S. Debolt. 2011-2015. *Plant-Microbe communication in the Medicago truncatula rhizosphere: functional metagenomics, biochemistry and community analysis.* **USDA NIFA AFRI $452,000**
3. **McNear, D.H.** (PI), 2011-2014. *Influence of tall fescue cultivar and endophyte genotype combinations on root system architecture, exudate composition and soil biogeochemical properties.* **USDA NIFA-AFRI $265,000**
4. **McNear, D. H.** (PI), N. Fierer and R. McCulley. 2008-2013**.** *Understanding endophyte effects on soil processes in tall fescue pastures: from rhizosphere to regional scales.* **USDA-NRI, Soil Processes Program $397,500**

National Lab User Time Grants RECEIVED (equivalent to >$300K)

User time (>3mo.) at the advanced light source (ALS-LBNL), advanced photon source (APS-ANL) and the national synchrotron light source (NSLS) has been awarded to my program for collection of synchrotron x-ray spectroscopy data supporting a variety of research projects.

LEADERSHIP AND SERVICE

- Associate Editor for Rhizosphere Journal
- Director of Undergraduate Studies - Natural Resources and Environmental Sciences

STUDENT & POSTDOC ADVISED

4 PhD students (2 current), 6 MS students (1 current), 5 postdocs (1 current), 9 undergrad researchers (3 current), 2 visiting scholars, 3 high school students (1 current), 33 NRES advisees

RECENT PUBLICATIONS (25 in total):

1. *Guo, J., R.L. McCulley, T. Phillips, and **D.H. McNear Jr.** 2016. Fungal endophyte and tall fescue cultivar interact to differentially effect bulk and rhizosphere soil processes governing C and N cycling. Soil Biology & Biochem. 101:165-174
2. Judy, J.D., J.K. Kirby, M.J. McLaughlin, **D.H McNear**, and P.M. Bertsch. 2016. Symbiosis between nitrogen-fixing bacteria and Medicago truncatula is not significantly affected by silver and silver sulfide nanomaterials. Environ. Pollution. 214, 713-736
3. Rojas, X., J.W. Leff, **D.H. McNear Jr.**, and R.L. McCulley. 2016. Infection with a shoot-specific fungal endophyte (Epichloë) alters tall fescue rhizosphere microbial communities. Microbial Ecology
4. *Ding, N., H. Guo, J.V. Kupper and **D.H. McNear Jr.** 2016. Shoot specific fungal endophytes alter soil phosphorus (P) fractions and potential acid phophotase activity but do not increase P uptake in tall fescue. Plant and Soil, 401(1), 291-305.

Robert D. (Bob) Miller

Faculty Positions
Professor, Dept. of Plant & Soil Sciences, University of KY (60%)
Research Professor, Dept. of Plant Sciences, University of TN (40%)

Educational Background
B.A. Berea College, 1974, Chemistry and Biology
Ph.D. University of Kentucky, 1980, Agronomy

Program Description:
I serve as the Principal Investigator of the Kentucky-Tennessee Tobacco Improvement Initiative (KTTII), which was created by the merger of the University of Kentucky and University of Tennessee tobacco breeding programs in 1999. Responsibilities of the Principal Investigator are apportioned between UK and UT on a 60/40% basis. Because of the unusual dual appointment of the PI and the inordinate amount of travel required to fulfill responsibilities to growers in both States, the tobacco breeding position was created as a Special Title Series Plant Breeding appointment. Teaching and publications in refereed journals are not expectations under the job description for this Special Titles position. KTTII is heavily funded by industry grants, contracts, and gifts. Extramural funding obtained for the 2015-2016 reporting period totaled $1,816,364 (PI $1,312,386; Co-PI $235,000, Co-Investigator $268,978). Since KTTII was initiated in 1999, total external funding has exceeded $10,300,000.

The emphasis of the KTTII breeding program involves variety and germplasm development, applied research to help growers select and integrate appropriate crop varieties into specific farm production practices, and providing unbiased information on performance and quality of tobacco varieties to producers and associated industries. The primary focus of the KTTII research program is the development of tobacco varieties having improved disease resistance, coupled with high yield and quality traits. More recently, a major objective has been breeding for improved plant chemistry traits that reduce overall harm of tobacco products. Since its inception in 1999, KTTII has released eleven burley varieties and six dark varieties. These new releases provide burley and dark tobacco producers with varieties that have a better combination of disease resistance and yield potential than was previously available. As a result of consolidation and increased size of production units that has occurred over the last 10 years, without these disease resistant varieties it would be difficult for producers to maintain crop rotation practices that are a vital part of the management strategies for soil-borne diseases. These KTTII varieties have been readily accepted by tobacco growers in Kentucky and Tennessee. Based on seed sales records, KTTII varieties comprised approximately 85-90% of the US burley crop and 25-30% of the dark crop in 2015 and 2016. These varieties are also planted widely throughout other burley producing countries. As an indication of the international relevance of KTTII, TN 90LC has been chosen as the standard variety to be used in all CORESTA, the primary international tobacco research organization, sponsored tobacco research projects.

Significant Career Awards and Honors:

1. Burley Tobacco Co-op Leadership Award; Burley Tobacco Growers' Co-op, 2013.
2. Hutson School of Agriculture Support Award; Murray State University, 2011.
3. Tennessee Agricultural Experiment Station Research Impact Award; University of Tennessee Institute of Agriculture, 2004.
4. Distinguished Service to Agriculture Award; Murray State University, 2001.
5. Epsilon Sigma Phi State Team Award; University of Tennessee Institute of Agriculture, 1999.
6. J.W. Massengill Award for Distinguished Service to Agriculture; Greene County TN Chamber of Commerce, 1999.
7. Philip Morris USA Award for Distinguished Achievement in Tobacco Science; Tobacco Science Research Conference, 1995.
8. ESCOP-ACOP Leadership Development Program, Washington, D.C. 1995-1996.

Cultivars Released:

Burley: TN 86LC, TN 90LC, TN 97LC, KT 200LC, KT 204LC, KT 206LC, KT 209LC, KT 210LC, KT 212LC, KT 215LC, ms KY 14XL8LC

Dark: OS 802, TN D94, TN D485, TN D950LC, KT D4LC, KT D6LC, KT D8LC, KT D14LC, and KT D17LC

Extramural Funding:

Principal Investigator: 2015-2017 = $2,024,164; Career = $12,479,808
Co-Principal Investigator: 2015-2017 = $262,500; Career = $878,452
Co-Investigator: 2015-2017 = $268,978; Career = $413,605

Publications:

Refereed Journal Articles: 16
Book Chapters: 1
Published Abstracts: 68
Experiment Station Bulletins: 14
Popular Press Articles: 18
Presentations Made at Professional Meetings: 115

Graduate Student Training – Major Advisor

PH.D. Students: 1
M.S. Students: 4

Field Days, Tours, Extension Meetings, and On-Farm Demonstrations:

Made presentations at 80 Experiment Station and County field days
Made presentations at 20 tobacco grower meetings in Tennessee
Made presentations at 64 tobacco meetings and field days in Kentucky, Ohio, Virginia, and North Carolina.
Conducted 40 tobacco tours for extension leaders and industry representatives

Consulting:

Made 34 consulting trips to Central and South America

Luke A. Moe

Faculty Positions
Assistant Professor, Plant and Soil Sciences, Univ. of Kentucky, 2009
Associate Professor, Plant and Soil Sciences, Univ. of Kentucky, 2015
Position: 68% research, 22% teaching, 10% administration (for FY 2017)

Education
B.S. Washington State Univ., Pullman, WA, 1999, Biochemistry
Ph.D. Univ. of Wisconsin, Madison, WI, 2005, Biochemistry

Program Description
Research in the Moe laboratory has been largely focused in the following areas:
- Structure and function of plant-associated microbial communities
- Biology of D-amino acids and amino acid racemization
- Genetics, biochemistry, and ecology of microbial phosphate solubilization
- Non-conventional environmental reservoirs for antibiotic resistance

Since joining the University of Kentucky as an assistant professor in November, 2009, I have established a research group addressing issues in environmental microbiology. We use the tools of genetics, genomics, ecology, and biochemistry to probe the function of microbes in their native environments—these habitats have included soil, fermentation tanks, and aboveground and belowground portions of plants. My research is highly collaborative. I have published work with agronomists, environmental scientists, plant pathologists, and biochemists, and I strive to develop collaborations to explore additional environments and to take advantage of new technologies. My research group has been well-funded at UK (over $1.8 million directly to my group), and I am especially proud of having brought in research funds from a wide variety of sources, including federal agencies, state agencies, and industry. Regarding our funding from industry sources, I have been able to leverage personal relationships and shared research interests to generate significant research funds.

Teaching and administration responsibilities fall within the Agricultural and Medical Biotechnology (ABT) undergraduate program. I teach two courses: ABT 495 (Experimental Techniques in Biotechnology) and ABT 460 (Molecular Genetics). ABT 495 is a 4 credit senior-level lecture plus lab course that I teach every Fall semester (2011 to present) and ABT 460 is a 3 credit lecture course that I teach during the Spring semester of even-numbered years (2012 to present). I am the ABT steering committee chair (2016 to present) which accounts for my 10% administrative role.

Graduate Student Advisor
I currently advise one graduate student (Ben Diaz, MS expected Summer 2017). Additionally, I have graduated 3 PhD students since joining the department in 2009.

Research Support ($1,823,893 total since joining the dept. in 2009)
Currently funded projects include the following:

1. "*Smokeless tobacco reference product development, distribution, and research"* US Food and Drug Administration ($7,394,663 total for five years support, 2016-2021, ~$300,000 to my group directly for research purposes) Orlando Chambers (PI, KTRDC), seven Co-PIs including myself.
2. *"A first look at the tobacco microbiome"* British American Tobacco ($67,500 total for one year duration, 95% to my group, 2016-2017) **Luke Moe (PI)**, Co-investigators Anne Jack, Huihua Ji, Lowell Bush (UK Plant & Soil Sciences and KTRDC)
3. *"Production of chemicals in tobacco leaves*" British American Tobacco ($322,010 for three years duration, 90% to my group, 2016-2019); Ling Yuan (PI, UK Plant & Soil Sciences), **Luke Moe (co-PI)**

Refereed journal articles (n=18 total since joining the dept. in 2009)
*Note: * = graduate student in my lab, underline = postdoc, research staff, or visiting scholar in my lab, † = undergraduate student.* Listed below are publications since 2016.

1. *An R, **Moe LA**. (2016) "Regulation of Pyrroloquinoline Quinone-Dependent Glucose Dehydrogenase Activity in the Model Rhizosphere-Dwelling Bacterium *Pseudomonas putida* KT2440" *Appl Environ Microbiol*. 82(16):4955-64. doi:10.1128/AEM.00813-16.
2. *Radkov AD, †McNeill K, Uda K, **Moe LA**. (2016) "D-Amino Acid Catabolism is Common Among Soil-Dwelling Bacteria" *Microbes Environ*. 31(2):165-8. doi:10.1264/jsme2.ME15126.
3. Law AD, Fisher C, Jack A, **Moe LA**. (2016) "Tobacco, Microbes, and Carcinogens: Correlation Between Tobacco Cure Conditions, Tobacco-Specific Nitrosamine Content, and Cured Leaf Microbial Community" *Microb Ecol*. 72(1):120-9. doi:10.1007/s00248-016-0754-4.
4. *Szoboszlay M, White-Monsant A, **Moe LA**. (2016) "The Effect of Root Exudate 7,4'-Dihydroxyflavone and Naringenin on Soil Bacterial Community Structure" *PLoS One*. 11(1):e0146555. doi:10.1371/journal.pone.0146555.
5. Yang Q, Wang R, Ren S, *Szoboszlay M**, Moe LA**. (2016) "Practical Survey on Antibiotic-Resistant Bacterial Communities in Livestock Manure and Manure-Amended Soil" *J Environ Sci Health B.* 51(1):14-23. doi:10.1080/03601234.2015.1080481.
6. Saleem M, Law AD, **Moe LA**. (2016) "*Nicotiana* Roots Recruit Rare Rhizosphere Taxa as Major Root-Inhabiting Microbes" *Microb Ecol*. 71(2):469-72. doi:10.1007/s00248-015-0672-x.
7. *Li Q, Heist EP, **Moe LA**. (2016) "Bacterial Community Structure and Dynamics During Corn-Based Bioethanol Fermentation" *Microb Ecol*. 71(2):409-21. doi:10.1007/s00248-015-0673-9.
8. Uda K, Abe K, Dehara Y, Mizobata K, Sogawa N, Akagi Y, Saigan M, *Radkov AD, **Moe LA**. (2016) "Distribution and Evolution of the Serine/Aspartate Racemase Family in Invertebrates" *Amino Acids* 48(2):387-402. doi:10.1007/s00726-015-2092-0.

Gregg Munshaw

Faculty Position

Associate Professor and Extension Specialist. 80% Extension, 20% Research. University of Kentucky. 2017-present.
Assistant Professor and Extension Specialist. 80% Extension, 20% Research. University of Kentucky. 2012-2017.
Associate Professor. 90% Teaching, 10% Research. Mississippi State University. 2010-2011.
Assistant Professor. 90% Teaching, 10% Research. Mississippi State University. 2004-2010.

Educational Background

PhD 2003 Virginia Tech
MS 2000 University of Kentucky
BS 1997 University of Kentucky

Program Description

I have two main goals with my extension program. The first is to provide easy to understand answers to homeowner's questions. Homeowners are by far the least educated grass manager. Many homeowners do not understand fertilization, calibration, basic mowing, etc. When homeowners do not understand what they are doing (and actually want to learn), they contact their county agents. I have given several presentations at county meetings to educate homeowners and have focused agent trainings on home lawn management. My extension writing has also been focused on home lawn management so agents and homeowners have answers at their fingertips. The second goal of my extension program is to educate professional turf managers. There are many 'professional' turf managers who earned their title by purchasing a truck and a mower. I am working to help these managers understand what and why they are using the practices that they are. To reach out to this segment of the turf population, we offer the Turf and Ornamental Short Course, the Kentucky Certified Professional Turf Managers workshop, and trainings, demonstrations, and workshops as part of our annual field day.
My research goals are to 1) find sustainable options for reducing lawn inputs while maintaining turfgrass quality; 2) help counties and cities maintain the best quality sports turf with minimal cost; and 3) provide answers to agent's questions through research. I am continuing my research program that is focused on reduced input turf. I currently have four research projects directly focused on this area. The majority of my research activities directly support my extension program. Several of my research studies focus on weed control in home lawns, as these are the majority of the questions I receive from agents. Turfgrass variety testing is the final part of my research program. We are testing several cool-and warm-season turfgrasses at a variety of mowing heights for suitability in Kentucky's climate.

Current Year Extension Publications

- A. Patton, J. Kao-Kniflin, B. Branham, T. Voigt, N. Christians, A. Thoms, J. Hoyle, G. Munshaw, A. Hathaway, T. Nikolai, S. Bauer, B. Fresenburg, X. Xiong, B. Kreuser, C. Thompson, D. Gardner, D. Soldat, P. Koch. Turfgrass Weed Control for Professionals. AGR-225. Published 2-2017.
- G. Munshaw, C. Bigelow, M. Goatley, and B. Fresenburg. Optimizing Bermudagrass Athletic Field Winter Survival in the Transition Zone. AGR-228. Published 5-2017.
- 21 additional peer reviewed extension publications

Current Year Journal Publications

- Cropper, K. L., G. C. Munshaw, J. S. Beasley, and M. Barrett. 2017. Chemical control of *Sorghum halpense* in home lawns across two different mowing heights. Crop Science. Accepted.
- Dickson, K. H., J. C. Sorochan, G. C. Munshaw, and A. W. Thoms. 2017. Comparison of cultivation technologies for use on *Agrostis stolonifera* putting greens. Journal of Testing and Evaluation. Accepted.
- Munshaw, G. C., K. H. Dickson, K. L. Cropper, and J. C. Sorochan. 2017. The effect of fraze mowing on overseed establishment in *Cynodon dactylon* turf. Crop Science. Accepted.
- Cropper, K. L., G. C. Munshaw, and M. Barrett. 2017. Optimum seasonal mowing heights for large crabgrass (Digitaria sanquinalis) reduction. HortTechnology 27:73-77.
- Munshaw G. C., J. S. Beasley, C. Baldwin, J. Q. Moss, K. L. Cropper, H. W. Philley, C. Segars, and B. R. Stewart. 2016. Nitrogen and planting rate effects on Latitude 36 bermudagrass establishment. HortTechnology 28:
- 17 additional journal publications

Additional Productivity

- 10 YouTube videos
- 241 presentations (45 invited out-of-state)
- 1 patented bermudagrass cultivar
- >$1.2 M in grants and gifts
- Currently advising 1 graduate student and have served as chair for 6 additional students
- Involved with several committees with Crop Science Society of America and Sports Turf Managers Association

Lloyd W. Murdock, Jr.

Faculty Position

Present	Retired Director; Post-Retired Research Appointment in PSS
2009-2012, 2015	Director of UK Research and Education Center, Princeton
1969-June 30, 2012	University of Kentucky
	Extension Assistant Professor of Agronomy, 1969-1975
	Extension Associate Professor of Agronomy, 1975-1980
	Extension Professor of Agronomy, 1980-present

Educational Background

B.S. Agriculture, 1963, Oklahoma State University
M.S. Agronomy, 1965, Virginia Tech and State University
Ph.D. Soil Science, 1967, Virginia Tech and State University

Selected Honors and awards received since baccalaureate degree

Fellow, American Society of Agronomy, 2002
Excellence in Publication Award, ASA, 1998, 2001, 2004, 2007, 2009
Excellence in Extension Award, National Assoc. of Wheat Growers, 1998
Association of Kentucky Extension Specialists:
Outstanding Project Award – Wheat Science Group, 1998
Outstanding Extension Program, 1984
Outstanding Extension Specialist, 1983
Outstanding Extension Program - IPM Team, 1979 & Wheat Science 2006
Ky. Small Grain Growers Association:
Distinguished Research Award, 1994
Recipient of Research Tour to Europe, 1996
Distinguished Service Award, Ky. Assoc. of Conservation Districts, 1985
Kentucky 4-H:
Outstanding Dedication and Service, 1997
Meritorious Service Award, 1996
Kentucky CCA Organization – Exemplified Leadership Recognition, 2003
Kentucky Association of Agricultural Agents – Outstanding State Specialist Award, 2004
USDA – CSREES Partnership Integration Award, 2008
S.H. Phillips Distinguished Lecture in No-Till Agriculture – Univ. Kentucky, 2013.
Research and Education No-Till Innovator Award 2016 at National No-Till Conference.
2016 Service to American/World Agriculture Award by National Association of County Agriculture Agents.

International Experience

Served on agricultural design teams or as a consultant to agriculture groups for soil and soil fertility improvements in Thailand, Ecuador and Bangladesh. Received invitations and participated in International Symposiums on minimum tillage in China, Mexico, Bangladesh, England, France and Thailand.

Extension
Spent 45 years as an Extension Soil Specialist working in soil fertility and soil management.

Research
Applied Research program has involved crops such as corn, soybeans, wheat, canola or forages. Listed below are some of the subjects researched:

- Nitrogen inhibitors and additives
- Nitrogen rates and timing
- No-tillage on wheat, corn and soybean
- Erosion on soil productivity
- High yield alfalfa, corn, soybeans and wheat
- Fertilizer requirements for no-till
- Nitrogen sensors as a fertilizer guide

Soil compaction and soil penetrometers
Soybean inoculants
Chlorophyll meter
Water quality
Developed variable rate nitrogen algorithm for wheat using remote sensing
Remediation of the fragipan

I presently lead a team of 4 researchers that are finding a way to remediate the fragipan that is in about 3 million acres of Kentucky's soils. The naturally occurring pan stops water movement and root growth and reduces yields. We have found some possible solutions and are developing them at present. We may be able to increase yields on these soils by 25% which would be expected to increase economic returns to producers by $500,000,000 per year.

Publications
Publications have primarily been directed towards the public and professional recommenders. Most of the publications are summarized below:

Abstracts, Newsletters, News Releases, and others	-	280
University and Extension Publications	-	334
Journals and Published Proceedings	-	122
Book Chapters	-	12
Popular Press Articles	-	455

Robert (Bob) C. Pearce

Faculty Position
Associate Extension Professor of Agronomy: Tobacco Production
20% Research: 80% Extension

Educational Background
PhD. Soil Chemistry, 1994, University of Georgia.
M.S. Soil Science, 1989, University of Kentucky.
B.S. Agronomy, 1987, University of Kentucky.

Program Description

Tobacco growers across Kentucky are struggling to adjust to an uncertain future. Burley tobacco contract volume was cut an estimated 20 to 30% in the spring of 2010, with a large number of growers dropped entirely. Those who remained face growing concerns over impending regulation of the tobacco industry, future contract volumes, and problems with leaf quality (3 of the last 4 curing season have resulted in undesirable leaf quality). My extension and research programs have continued to evolve to keep pace with the rapidly changing tobacco industry in Kentucky. With the high degree of uncertainly, the volume of agent calls, client calls, field visits, and consultations has remained strong, placing significant demands on my time. However I believe that these direct interactions are critical for me to maintain a responsive and relevant extension program in burley tobacco. The tobacco extension team (specialists from different departments with tobacco responsibilities) has had several very successful collaborations in recent years including the Innovative Tobacco Grower Program (ITGP) and the comprehensive Tobacco Production Guide (ID-160). I was the lead coordinator of ITGP at its inception and continue to play a major role in directing this program. I am co-editor on the production guide. Both of these resources were developed with the purpose to rapidly get information on new growing methods into the hands of growers.

The goals of my applied research program have always been closely aligned with the objectives of my Extension programs. Much like the extension program, my research program has also undergone significant changes in the last two years. While I am still active in core areas like no-till tobacco production, and nitrogen fertilizer management, I have increased my efforts in the area of sucker control and management for the reduction of Tobacco Specific Nitrosamines (TSNAs). I am confident that my extension program is currently meeting the needs of county agents and burley tobacco growers in Kentucky and surrounding states. The challenge is to maintain a sufficient applied research program to continue to meet those needs into the future and help tobacco growers' transition to life under FDA regulation of the tobacco industry.

Publications

Book Chapters:

Wendroth, O., E.L. Ritchey, S. Nambuthiri, J.H. Grove, and **R.C. Pearce**. 2011. Spatial variability of soil physical properties. In: Gliński, J., J. Horabik, and J. Lipiec (Eds.), Encyclopedia of Agrophysics. Springer, Heidelberg, Germany. (in press).

Extension publications:

Purschwitz, M. A., **B. C. Pearce**, and K. W. Seebold. 2009. Protect Yourself and Your Workers from Dusts and Molds on Cured Tobacco. UK Cooperative Extension/Health Education through Extension Leadership (HEEL) special publication. http://www.uky.edu/Ag/Tobacco/Pdf/TobaccoMold.pdf

Pearce, B., B. Miller, and E. Ritchey. 2009. The Effects of Variety, Harvest Management, and Curing Environment On Cured Leaf Quality of Burley Tobacco. Tobacco Factsheet #1-09.

Pearce, B., J. Zeleznik, and C. Fisher. 2009. Tobacco Float Media Test 2008. Tobacco Factsheet #2-09.

Wilhoit, J. and **B. Pearce**. 2009. Burley Tobacco Curing Advisory. Tobacco Factsheet #4-09.

Bailey A., G. Palmer, and **B. Pearce**. 2009. Topping, Sucker Control, and Harvest Management for Burley and Dark Tobacco. In *2009-2010 Kentucky Tobacco Production Guide*. ID-160. Ed. K. Seebold and B. Pearce.

Pearce B., P Denton, and A. Bailey. 2009. Introduction. In *2009-2010 Kentucky Tobacco Production Guide*. ID-160. Ed. K. Seebold and B. Pearce.

Pearce, B., P. Denton, A. Bailey, and G. Palmer. 2009. Selecting Burley Tobacco Varieties. In *2009-2010 Kentucky Tobacco Production Guide*. ID-160. Ed. K. Seebold and B. Pearce.

Pearce B., G Palmer, A. Bailey, K. Seebold, and L. Townsend. 2009. Management of Tobacco Float Systems. In *2009-2010 Kentucky Tobacco Production Guide*. ID-160. Ed. K. Seebold and B. Pearce.

Pearce B., and G. Schwab. 2009. Field Selection, Tillage, and Fertilization. In *2009-2010 Kentucky Tobacco Production Guide*. ID-160. Ed. K. Seebold and B. Pearce.

Invited Presentation

2011. The role of soil conservation practices in sustainable leaf tobacco production. 2011 CORESTA Agro-Phyto Congress. Sanitago, Chile Nov. 6-10. 2011.

Sharyn Elaine Perry

Faculty Positions

Assistant Professor, Department of Agronomy, University of Kentucky, 1998
Associate Professor, Department of Plant and Soil Sciences, Univ. of Kentucky, 2004
Co-director of Undergraduate Studies for the Agricultural Biotechnology program, 2009
Positon: 20% Instruction, 70% Research, 10% Administration

Educational Experience

B.S. University of Michigan-Dearborn, 1987, Biochemistry
Ph.D. University of Wisconsin-Madison, 1993, Cellular and Molecular Biology

Program Description

Research - My research program focuses on gene regulation during plant embryo development. This includes zygotic embryogenesis, resulting in seeds, as well as somatic embryogenesis that is an important mechanism of regeneration for plants. Regeneration is an important step for generating transgenic plants for basic or applied research. Somatic embryogenesis is also a model for zygotic processes that are difficult to study because the cells are relatively inaccessible.

The approach that we utilize is to study transcription factors that are involved in embryogenesis. One such factor, called AGAMOUS-Like15 (AGL15) can promote somatic embryogenesis in the model plant Arabidopsis and in the crop *Glycine max*. To understand how it does this, we use a chromatin immunoprecipitation approach combined with transcriptomics to determine direct and indirect targets of AGL15. We found other important embryo transcription factors are direct upregulated targets of AGL15 and extended the regulatory network by looking at targets of these factors. In our work, we found that AGL15 is a dual function transcription factor that directly represses some genes but directly expresses other genes. We are working to determine the mechanisms of this dual functionality by looking at protein-protein and protein-DNA interactions that involve AGL15.

Teaching - I teach 45% of the graduate level course PLS622 each Fall semester, 30% of PLS657 (Seed Biology) Spring semesters of odd numbered years, and the undergraduate course ABT201 (Scientific Method in Biotechnology) each Fall semester.

Administration - I have served as Co-director of Undergraduate Studies for the Agricultural and Medical Biotechnology program from June 2009 to July 2017.

National Service

- NSF review panels – five total (2009, 2011, 2013, 2014, and 2017)
- USDA review panels – four total (2003, 2005, 2006 and 2010)

Graduate Student Advisor

I am currently serving as the major advisor for one graduate student (career total: six Ph.D. students)

Current Research Support

- Sharyn Perry; Mechanisms of Gene Regulation by the Plant MADS-domain Transcription Factor, AGL15 and Developmental Outcomes. NSF-IOS: March 1, 2017 to February 29, 2020; $582,455.
- Sharyn Perry; Investigation of Regulatory Networks to Enhance Plant Regeneration by Somatic Embryogenesis. Kentucky Science & Engineering Foundation: July 1, 2016 to June 30, 2017; $30,000.

Refereed Journal Articles

(Five significant; 34 career total; graduate student, *postdoc*, undergraduate#, *corresponding author)

1. *Qiaolin Zheng*, Yumei Zheng, Huihua Ji, Whitney Burnie# and Sharyn E. Perry***** (2016). Gene Regulation by AGL15 Reveals Hormone Interactions in the Promotion of Somatic Embryogenesis. *Plant Physiology,* **172***,* 2374-2387.

2. Sharyn E. Perry*****, *Qiaolin Zheng* and Yumei Zheng (2016). Transcriptome Analysis Indicates that GmAGAMOUS-Like 15 may Enhance Somatic Embryogenesis by Promoting a Dedifferentiated State. *Plant Signaling & Behavior*, **11**, *article e1197463.*

3. *Qiaolin Zheng* and Sharyn E. Perry***** (2014). Alterations in the Transcriptome of Soybean in Response to Enhanced Somatic Embryogenesis Promoted by Orthologs of AGAMOUS-Like 15 and AGAMOUS-Like 18. *Plant Physiology* **164**, 1365-1377.

4**.** *Fangfang Wang* and Sharyn E. Perry***** (2013). Identification of Direct Targets of FUSCA3, a Key Regulator of Arabidopsis Seed Development. *Plant Physiology* **161**, 1251-1264. – *As of January/February 2017, this* ***highly cited paper*** *received enough citations to place it in the top 1% of the academic field of Plant & Animal Science based on a highly cited threshold for the field and publication year.*

5. Yumei Zheng, Na Ren, *Huai Wang*, Arnold J. Stromberg and Sharyn E. Perry* (2009). Global Identification of Targets of the Arabidopsis MADS Domain Protein AGAMOUS-Like15. *The Plant Cell* **21**, 2563-2577. – *selected for special notice by F1000 Biology.*

Todd Pfeiffer

Faculty Position
Assistant Professor, Department of Agronomy, UK, January 1982- April 1987
Associate Professor, Department of Agronomy, UK, May 1987- June 1994
Professor, Department of Plant and Soil Sciences, UK, July 1994 - present
Position: Department chair (since 2009), plant breeder, 85% administration,
5% research, 10% teaching

Educational Background
B.S. University of Kentucky, 1977, Agronomy
M.S. University of Wisconsin, 1979, Agronomy
Ph.D. University of Wisconsin, 1982, Plant Breeding and Plant Genetics

Program Description
My program is administering the department. I focus on getting the important things completed on time, managing the budget, providing quality faculty/staff evaluations and mentoring, promotions and hiring, and encouraging department morale. I've coordinated searches and hires of 12 faculty positions (including four females and three international scientists who have increased the diversity of our faculty), with two in progress, and have managed the promotion process for 18 faculty member promotions, with three in progress. Promoting department morale requires 'being there' as an important form of support, along with sharing information, recognizing people and their contributions, and listening.

New initiatives in the past two years include:
-Focus on 'How do we tell our story better?' Initiated AgroNotes 101 campaign to publicize faculty and graduate student research achievements through social media.
-Support initiative for graduate course sharing between UK and UT Plant and Soil Sciences. In spring 2016 UK shared Plant Biochemistry with UT. Installed distance delivery technology in 360 PSB to support this activity.
-UK@Work - supported this initiative by creating two staff/faculty committees in the department to conduct internal surveys and address two questions identified by UK@Work.
-Continuing to utilize salary savings for facility and equipment improvements, with the completion of fiber optic computing upgrade at Spindletop Farm a recent success.

I teach an honors program section of our UK Core course PLS 103 Plants, Soils, and People: A Global Perspective.

My small research program currently focuses on breeding sweet sorghum for syrup production, originally as a New Crop Opportunity project to promote alternative enterprises to replace tobacco production.

Research Publications
Refereed journal articles and book chapters (62): Six most cited articles listed

-Pfeiffer, T.W. and D.B. Egli. 1988. Heritability of seed-filling period estimates in soybean. Crop Sci. 28:921-925.
-Fatmi, A., C.G. Poneleit and T.W. Pfeiffer. 1993. Variability of recombination frequencies in the Iowa Stiff Stalk Synthetic (*Zea mays* L.). Theor. App. Gen. 86:859-866.
-Mauro, A.O., T.W. Pfeiffer, and G.B. Collins. 1995. Inheritance of soybean susceptibility to Agrobacterium tumefaciens and its relationship to transformation. Crop Sci. 35:1152-1156.
-Gu, H., A.J. Clark, P.B. de Sa, T.W. Pfeiffer, S. Tolin and S.A. Ghabrial. 2002. Diversity among isolates of Bean Pod Mottle Virus. Phytopathology 92:446-452.
-Li, Dandan, T.W. Pfeiffer, and P.L. Cornelius. 2008. Soybean QTL for yield and yield components associated with *Glycine soja* alleles. Crop Sci. 48: 571-581.
- Pfeiffer, T.W., M.J. Bitzer, J.J. Toy and J. F. Pedersen. 2010. Heterosis in sweet sorghum and selection of a new sweet sorghum hybrid for use in syrup production in Appalachia. Crop Science 50:1788-1794.

Varieties Released

Soybean
-Varieties

Pennyrile	1987	(commodity)
Calhoun	1992	(commodity)
CF 461	1995	(commodity)
CF 492	1995	(commodity)
7499	1998	(commodity)
KY04-ns-309	2009	(black seeded lipoxygenase free food grade)

Sweet Sorghum
-Hybrid

KN Morris	2007	(male-sterile hybrid for syrup production)

-Varieties

KY 1810	2013	(pure line for syrup production)
KY 0238	2013	(pure line for syrup production)

Professional Recognition and Honors

Master Teacher Award, Gamma Sigma Delta Kentucky Chapter, 2009
Named ‘Fellow of the Society’ American Society of Agronomy, 2003

Timothy (Tim) D. Phillips

Faculty Position

Associate Professor, Plant and Soil Sciences: Tall Fescue Genetics and Breeding
65% Research: 35% Teaching

Educational Background

Ph.D. North Carolina State University, 1992, Crop Science (small grains breeding)
M.S. North Carolina State University, 1987, Crop Science (peanut breeding)
B.S. North Carolina State University, 1983, Botany

Program Description

As the forage grass breeder at the University of Kentucky, I have developed a program to produce new grass cultivars for use in the transition zone. The majority of effort has been directed at variety development in endophyte-free and novel-endophyte tall fescue, with minor effort continuing on improvement of orchardgrass, timothy, Kentucky bluegrass, perennial ryegrass, and festulolium. With very little investment in forage breeding by other public breeding programs in the southeastern US, it is crucial that the forage grass breeding program at the University of Kentucky be productive and successful. With the release of 'Lacefield MaxQII' in 2015, farmers now have an improved novel endophyte tall fescue from the University of Kentucky to plant.

Over the past 25 years, I have concentrated my efforts on cultivar development. My goal has been to perform recurrent selection in ~25 populations of endophyte-free and novel endophyte tall fescue each season. My activities in collaboration with Chris Schardl (Plant Pathology) and Randy Dinkins (USDA-ARS-FAPRU) with new novel endophyte tall fescue populations complement my work with AgResearch (NZ). Another area of major activity in my breeding program has been wide hybridization. Tall fescue can be crossed with related species (ryegrasses and other *Festuca* species) to introgress genes to improve agronomic and forage quality traits of tall fescue, and these crosses allow detailed basic research on the genetics of the *Festuca-Lolium* complex, as well as endophyte/alkaloid interactions with these hosts. Other wide crosses include Kentucky bluegrass crossed with Texas bluegrass, with the goal of improving drought tolerance and yield. I recognize the need to release new varieties of forage grasses, so this has become my highest priority.

Graduate student research projects have focused on palatability of forage grass varieties, with breeding efforts to improve leaf softness, persistence, and quality included in these projects.

My efforts in chia production and breeding, in close collaboration with David Hildebrand, have been rewarding and successful, but additional funding is needed to continue or increase efforts in this area. Several publications have resulted from this work as well as international collaborations (Italy, Germany, and Canada).

I continue to enjoy teaching the grass id class (PLS514), plant id (PLS220), and the Plants, Soils, and People class (PLS103 and PLS104).

Publications

Book Chapters:

Serson, William, Maythem Al-Amery, Shreya Patel, **Tim Phillips** and David Hildebrand. 2016. Chia, Salvia hispanica. Chapter In: Industrial Oilseed Crops, McKeon et al. editors, Elsevier Feb. 2016 pp 278-288.

Bochicchio, R., **Philips, T. D**., Lovelli, S., Labella, R., Galgano, F., Di Marisco, A., and Amato, M. (2015). Innovative Crop Productions for Healthy Food: The Case of Chia (*Salvia hispanica* L.). In *The Sustainability of Agro-Food and Natural Resource Systems in the Mediterranean Basin* (pp. 29-45). Springer International Publishing.

Refereed journal publications:

Billman, Eric, Goff, B. M., Baldwin, B., Prince, K. and **Phillips T.D.** 2017. Effects of Vegetative Cool-Season Grasses on Forage Removal by Dairy Cattle. *Agronomy Journal* 109(4): 1-11.

Serson, William, Paul Armstrong, **Timothy Phillips**, Maythem AL-Amery, Jason Unrine Elizabeth Maghirang, Kristine Urschel, and David Hildebrand. 2016. Characterization of *Salvia hispanica* Seed Composition and Development of NIRS Calibrations. Submitted to the *Journal of American Oil Chemists' Society,* September, 2016.

Geneve, R. L., D. F. Hildebrand, **T. D. Phillips**, M. AL-Amery, and S. T. Kester. 2017. Stress Influences Seed Germination in Mucilage-Producing Chia. Crop Sci. 0. doi:10.2135/cropsci2016.08.0703

Guo, J., McCulley, R. L., **Phillips, T.D.**, and McNear, Jr. D. H. 2016. Fungal endophyte and tall fescue cultivar interact to differentially effect bulk and rhizosphere soil processes governing C and N cycling. *Soil Biology and Biochemistry*, 101 (October 2016), pp 165-174.

AL-Amery, M., Jamboonsri, W., Lee, C., Hammond, J., **Phillips, T**., Hildebrand, D. 2016. Evaluation of flax as a viable crop again in the south central US. Accepted, *Journal of the Kentucky Academy of Sciences*.

Saikkonen, K., **T.D. Phillips**, S.H. Faeth, R.L. McCulley, I. Saloniemi, and M. Helander. 2016. Performance of endophyte infected tall fescue in Europe and North America. PLOS ONE 11(6):e0157382. doi: 10.1371/journal.pone.0157382

Helander, M., **T. Phillips**, S.H. Faeth, L.P. Bush, R. McCulley, I. Saloniemi, and K. Saikkonen. 2016. Alkaloid quantities in endophyte-infected tall fescue are affected by the plant-fungus combination and environment. Journal of Chemical Ecology 42(2):118-126. doi:10.1007/s10886-016-0667-1.

Bourguignon, M., Nelson, J. A., Carlisle, E., Ji, H., Dinkins, R. D., **Phillips, T. D.**, & McCulley, R. L. 2015. Ecophysiological Responses of Tall Fescue Genotypes to Fungal Endophyte Infection, Elevated Temperature, and Precipitation. *Crop Science*, *55*(6), 2895-2909.

Extension publications: Co-author on 12 forage variety trial reports the past 2 years.

Invited Presentation:

2017. Roses in Kentucky for Master Gardeners meeting in Owensboro, May 6, 2017.

Wei Ren

Faculty Position

Assistant Professor, Dep. of Plant Soil Sciences, Univ. of Kentucky, 2015
Position: 75% research, 25% teaching

Educational Background

2009	Ph.D.	Ecology	Auburn University
2003	M.S.	Meteorology	Nanjing Institute of Meteorology, China
2000	B.S.	Agricultural Meteorology	Nanjing Institute of Meteorology, China

Program Description

Research: The overall goal of my research group is to understand, assess and predict natural processes and human-caused changes in Earth's ecosystems and climate by using an integrated systems approach employing a combination of numerical models, remote sensing/GIS, and field observations and measurements. Over the past two years since I came to UK, I recognized that many long- and short-term experiments (e.g. till vs. no-till, cover crop diversity, etc.) at UK have resulted in diverse sets of data from the molecular to plot and field scales. However, little progress has been made to synthesize and integrate this data into an agroecosystem modeling framework to examine the regional and watershed-level responses of agroecosystems. The research focus of the lab is therefore driven by the key scientific question: How can we identify climate smart agricultural practices at plot and field scales to regional and watershed scales that are effective at mitigating climate change, protecting soil health, and sustaining land and aquatic systems while also enhancing food production? Our research hypothesis is that climate-smart agricultural management practices may cause diverse or even inconsistent responses of agroecosystems from field to regional and watershed levels, in terms of maintaining ecosystem productivity (crop yield, pasture and wood production), reducing greenhouse gas emissions from agricultural land to the atmosphere, and nutrient leaching and export from land to aquatic systems. To answer the above question and test our hypothesis, we established a set of objectives to systematically and quantitatively investigate the responses of diverse agroecosystems (crop, pasture, and forest) to changes in climate, CO_2, air pollution and human activities (land conversion and smart management practices etc.). To achieve these objectives, I designed a general research plan and related tasks for my research group. Some progress over past two years includes model improvement, data collection and analysis, model-data integration and model simulations.

Teaching:

GEN300-002 Climate Change and Agriculture Co-teach (Spring 2017) (21 students)
PLS 697 Ecosystem Ecology (Fall 2016) (7 students)

- **Society Service**

Conference/session Chair

Convener for the oral session “Agroecosystem Responses to Multiple Global Change Drivers in the Anthropocene”, contributing to the annual Ecological Society of America (ESA) 2016 theme: Novel Ecosystems in the Anthropocene,

- **Panel Service -** Panelist: National Science Foundation: MacroSystems Biology and Early NEON Science FY2017
- **Editorial Service -** Associate Editor of *Journal of Advances in Modeling Earth Systems,* 2016-present. Editorial board member for *Agricultural and Forestry Meteorology,* 2016 - present

Graduate Student Advisor - I am currently advising one graduate student (advisor) in IPSS, and two students in Soil Science and In Horticulture (committee member).

Refereed journal articles (recently, out of the total 59)

- Zhu, X., Zeng, X. Qiu, **W. Ren**, B. Tao etc. High-resolution precipitation downscaling in mountainous areas over China: development and application of an enhanced geostatistical approach. *International Journal of Climatology* (in press)
- Zhang, J., P. An, J. Yang, **W. Ren**, Z. Pan, Z. Dong, G. Han, S. Pan, Y. Pan, H. Tian (2017),. Enhancing soil drought induced by climate change and agricultural practices: Observational and experimental evidence from the semiarid area of northern China, *Agricultural and Forest Meteorology*, 243: 74–83
- **Ren, W**., H.Q. Tian, W. Cai, S.E. Lohrenz, C.S. Hopkinson, W. Huang, J. Yang, B. Tao, S.F. Pan, and R. He (2016), Century-long increasing trend and variability of dissolved organic carbon export from the Mississippi River basin driven by natural and anthropogenic forcing, *Global Biogeochem Cy*, 30(9):1288-1299, DOI: 10.1002/2016GB005395.
- Chen, S., B. Tao, and **W. Ren** (2016), Disaster prevention and reduction in Anthropocene, *Front. Environ. Sci. Eng*, 10(5): 19, DOI: 10.1007/s11783-016-0882-6.
- Tian, H.Q., **W. Ren**, B. Tao, G. Sun, A. Chappelka, X. Wang, S. Pan, J. Yang, J. Liu, B. S. Felzer, J. M. Melillo, and J. Reilly (2016), Climate extremes and ozone pollution: a growing threat to China's food security, *Ecosystem Health and Sustainability*, 2(1), DOI:10.1002/ehs2.1203.
- An, P., **W. Ren**, X. Liu, M. Song, and X. Li (2016), Adjustment and Optimization of the Cropping Systems under Water Constraint, *Sustainability*, 8 (12): 1207, DOI: 10.3390/su8121207.
- Zhang, B., H.Q. Tian**, W. Ren,** B. Tao, C. Lu, J. Yang, K. Banger, and S. Pan (2016), Methane Emissions from global rice fields: Magnitude, spatiotemporal patterns and environmental controls, *Global Biogeochem Cy*,30(9):1246-1263, DOI: 10.1002/2016GB005381.
- Jin, N., B. Tao, **W. Ren,** M. Feng, R. Sun, L. He, W. Zhuang, and Q. Yu (2016), Mapping Irrigated and Rainfed Wheat Areas Using Multi-Temporal Satellite Data, *Remote Sensing*, 8(3), 207, doi:10.3390/rs8030207.

Edwin L. Ritchey

Faculty Position

Associate Extension Professor, Plant and Soil Sciences: Extension Soils Specialist
DOE: 80% Extension: 20% Research

Ph.D., Soil Science, University of Kentucky, 2010
M.S., Plant and Soil Sciences, University of Tennessee-Knoxville, 1999
B.S., Natural Resources Management, University of Tennessee-Martin, 1995

Program Description

The leading commodities in Kentucky, grain crops and poultry, are concentrated in western Kentucky and contribute about $3 billion in combined annual sales. Depressed grain commodity prices for the past three years challenge profitability. Nutrient management decisions that justify reduced inputs improve profitability and favor environmental stewardship. My program supports these practices by providing research-based guidance for soil fertility and soil management recommendations, manure utilization and management, and cover crop use in grain production systems. Our research findings indicate that Kentucky producers can save $10 to $25 per ton of poultry litter ($2.5 to 7.5 million annually) compared with current farmer practices. I have also worked with others to evaluate potential sulfur needs for grain crops and alfalfa production in Kentucky due to clientele and industry interest. To date there is no research-based information that justifies widespread need for supplemental sulfur fertility in Kentucky. My program, working with others, has received $4,768,045 in funded research grants and $506,297 in equipment and gifts since 2010.
Successful extension specialist train the trainers and is an effective information multiplier. I am the UK coordinator and moderator for the annual Kentuckiana CCA Conference, the largest training offered to KY CCA's with Kentucky sponsorship. I am also on the board of directors for the KY CCA program and the current chair of the KY CCA exam committee. Along with others in the college, we developed an educational program called "The Scoop on Poop" that provides detailed information for poultry litter use. This program has focused on best management practices to optimize the nutrients contained in manure along with potential environmental consequences. We have delivered this program to multiple counties in western Kentucky and at regional crop advisor conferences in Indiana (Kentuckiana Certified Crop Advisors Conference) and in Maryland (Mid-Atlantic Crop Management School). I have initiated a "wheat field school", with input from other UK research and extension faculty to provide in-depth, hands-on trainings specific to wheat production in Kentucky. We are currently working to expand this training into corn and soybean production. I have worked closely with KY NRCS to provide trainings and workshops for producers and others on best management practices for cover crop use in Kentucky production systems. I was also involved with the SSARE project "Institutionalizing cover crop research and education in the southeast". This project involved about 13 southeastern institutions that culminated with a two-day conference and field day in North Carolina, followed by the creation of the Southern Cover Crop Council. My program has received $733,287 in funded extension grants to support extension outreach programs and activities.

<u>Publications</u>

Refereed Extension Publications (20 total since 2009)

1. **Ritchey, E.**, L. Murdock, D. Ditsch, J. McGrath, and F. Sikora. 2016. ID-163. *Agricultural lime recommendations based on lime quality*.
2. Knott, C., C. Lee, and **E. Ritchey**. 2016. *Common agronomic conversions and calculations*.
3. Knott, C., **E. Ritchey,** J. Martin, C. Lee, D. Johnson, C. Bradley, and S. McNeill. 2016. ID-234. *Grain sorghum (milo) production in Kentucky.*
4. **Ritchey, E**., D. Ditsch, B. Pearce, J. McGrath, and D. Gehring. 2015. 4BA-08MH. *4-H Land Judging in Kentucky*.
5. **Ritchey, E**., D. Ditsch, B. Pearce, J. McGrath, and D. Gehring. 2015. 4BA-09SE. *Land Judging Score Card*. Accompanies 4-H Land Judging publication.
6. Pearce, B., **E. Ritchey**, and D. Reed. 2015. *Field selection and soil preparation*. In B. Pearce, A. Bailey, E. Walker (ed.) ID-160. 2015-2016 Burley and Dark Tobacco production Guide. UK Cooperative Extension Publication in cooperation with University of Tennessee, Virginia Tech, and North Carolina State University.
7. **Ritchey, E**., B. Pearce, and D. Reed. 2015. *Fertilization*. In B. Pearce, A. Bailey, E. Walker (ed.) ID-160. 2015-2016 Burley and Dark Tobacco production Guide. UK Cooperative Extension Publication in cooperation with University of Tennessee, Virginia Tech, and North Carolina State University.
8. **Ritchey, E**., J. McGrath, and D. Gehring. 2015. AGR-217. *Determining soil texture by feel*. UK Cooperative Extension Publication.

Refereed Research Publications – Journal and CAFE (11 since 2010)

1. Simmons*, J.R., K.R. Sistani, D. Pote, **E.L. Ritchey,** M. Jn-Baptiste, and H. Tewolde. 2016. *Corn response and soil nutrient concentration from subsurface application of poultry litter*. Agron. J. 108: 1674-1680. IF=1.542
2. Knott*, C.A., D. A. Van Sanford, **E.L. Ritchey**, and E. Swiggart. 2016. *Wheat yield response and plant structure following increased nitrogen rates and plant growth regulator applications.* Crop, Forage, and Turfgrass Management.
3. **Ritchey*, E.L**., C. Knott, and L.M. Murdock. 2015. *Potential nitrogen loss from frozen soil nitrogen applications to wheat*. Crop, Forage, and Turfgrass Management. DOI: 10.2134/cftm2014.0054.
4. **Ritchey*, E.L**., D.D. Tyler, M.E. Essington, M.D. Mullen, and A.M. Saxton. 2015. *Nitrogen rate, cover crop, and tillage practice alter soil chemical properties*. Agron. J. 107:1-10. IF=1.542
5. **Ritchey*, E.L**., R.C. Pearce, and J.H. Grove. 2015. *Does surface or subsurface tillage influence burley tobacco yield, leaf temperature, or alkaloid content?* Crop, Forage, and Turfgrass Management. DOI: 10.2134/ctfm2014.0055 (Selected by ASA to be reprinted in Crops & Soils Magazine for continuing education units for CCA's nationally).
6. Cook*, K.L., **E.L. Ritchey**, J.L. Loughrin, M. Haley, K.R. Sistani, and C.H. Bolster. 2015. *Effect of turning frequency and season on composting materials from swine high-rise facilities*. Waste Management 39:86-95. IF=3.157

Montserrat Salmeron Cortasa

Faculty Position
Assistant Professor in Grain Crops Agronomy, Ecology, and Physiology
75% Research, 25% Teaching

Educational Background
PhD, Agronomy, 2011, University of Lleida, Spain.
Agricultural engineering, 2005, University of Lleida, Spain.
Technical Agricultural Engineering, 2002, Escola Superior d'Agricultura de Barcelona, Spain.

Program Description
Research
Grain crops provide more than 60% of the world's calorie intake, directly or indirectly by livestock feed. To meet the needs of an increasing population, crop production must increase substantially in the next years, coupled with a sustainable use of resources. The goal of my research program is to increase the productivity and sustainabiliy of grain crop production systems with an integrated approach that combines agronomic and yield pysiology research with the aid of mechanistic crop simulation models to study complex soil-plant-atmoshphere interactions. The final goal of my program is to develop optimum genotype x environment x management (GxExM) recomendations and user-friendly decission tools for producers that can increase productivity with a sustainable use of light, water, and nutrient resources.
My ongoing research projects focus on: (1) quantifying the yield potential of soybean production in Kentucky under no water and nutrient limitaitions and provide optimum soybean maturity group and planting density recomendations for both rainfed and irrigated conditions, as well as the economic viabilily of irrigation and nitrogen applications at different environments; (2) apply crop simulation models to study the potential of short-season soybean cultivars to increase indirect beneficial effects of cover crops stablished after soybean harvest, as part of a multy-state project comprising locations in Nebraska, Ohio, and Kentucky; (3) to quantify optimum planting densities and nitrogen recommendations for irrigated corn in Kentucky and the potential of short season hybrids to reduce irrigation requirements and increase water and nutrient productivity.
Teaching
My position has two graduate courses assigned that are offered every other year. I will start teaching the graduate courses PLS 502 in the fall of 2017, and PLS602 the next time that is offered. In addition, I teach the undergraduate course PLS103 once per year.

Peer reviewed publications (most recent, 17 total for career)
Salmerón, M, Purcell, LC, Vories ED, Shannon, G. 2016. Simulation of genotype-by-environment interactions on irrigated soybean yields in the US Midsouth. Agricultural systems 150: 120-129.
Popp, MP, Purcell, LC, **Salmerón, M**. 2016. Decision Support Software for Soybean Growers: Analyzing Maturity Group and Planting Date Tradeoffs for the U.S.

Midsouth. Crop, Forage, and Turfgrass Management, 2: doi:10.2134/cftm2016.04.0028

Isla, R, Guillen, M, **Salmerón, M.** 2016. Nitrogen availability effects on gas exchange measurements in field-grown maize (Zea mays L.) under irrigated Mediterranean conditions. Spanish Journal of Agricultural Research, 14(4): e0806. http://dx.doi.org/10.5424/sjar/2016144-9109

Salmerón, M, Purcell, LC. 2016. Simplifying the prediction of phenology with the DSSAT-CROPGRO-Soybean model based on relative maturity group and determinacy. Agricultural Systems, 148: 178-187.

Weeks W, Popp M, **Salmeron M**, Purcell LC, Gbur EE, Bourland FM, Buehring NW, Earnest L, Felix BF, Golden B, Hathcoat D, Lofton J, McClure AT, Miller TD, Neely C, Shannon G, Udeigwe TK, Verbree DA, Vories ED, Wiebold, WJ, Dixon B. 2016. Diversifying soybean production risk using maturity group and planting date choices. Agronomoy Journal, 108: 1917-1929.

Salmerón M, Gbur EE, Bourland FM, Buehring NW, Earnest L, Felix BF, Golden B, Hathcoat D, Lofton J, McClure AT, Miller TD, Neely C, Shannon G, Udeigwe TK, Verbree DA, Vories ED, Wiebold, WJ, Purcell LC. 2016. Yield response to planting date among soybean maturity groups for irrigated production in the US Midsouth. Crop science, 56: 747-759.

Salmerón M, Gbur EE, Bourland FM, Golden BR, Earnest L, Purcell LC. Soybean maturity group choices for maximizing light interception across planting dates in the U.S. Midsouth. 2015. Agronomy Journal, 107: 2132-2142

Van Roekel RJ, Purcell LC, **Salmerón M**. 2015. Physiological and management factors contributing to soybean potential yield. 2015. Field Crops Research, 182: 86-97.

Research projects/grants

Kentucky Soybean Promotion Board # 02-004-018: Quantifying the potential of 100 bu ac^{-1} yield soybean and its profitability for environmental conditions in Kentucky. **Salmerón M**, Shockley J, Lee C, Knott C, Ritchie E, University of Kentucky ($34,888).

USDA-NIFA-AFRI 93910: Optimizing cropping systems for resilience to stress: role of maturity group selection and cover crops on yield, weeds, insects, and microbes. Proctor C, Drewnoski M, Elmore R, Everhart S, McMechan A, Parson J, University of Nebraska; Redfearn D, Werle R, Lindsay L, Ohio State University; Haramoto E, **Salmerón M**, University of Kentucky ($110.640).

KWRRI 2017KY2700B: Optimizing yield and water use efficiency of soybean production in Kentucky – experimental and modeling approach. **Salmerón M**, Morrogh Bernard, University of Kentucky; Williamson, T, U.S. Geological Survey ($10,000).

Jan Smalle

Faculty Positions
Assistant Professor, Dep. of Agronomy, Univ. of Kentucky, 2004
Associate Professor, Dep. of Plant Soil Sciences, Univ. of Kentucky, 2010
Position: 85% research, 15% teaching

Educational Background
B.S. Ghent University, 1987, Plant Biotechnology
Ph.D. Ghent University, 1989, Plant Genetics

Program Description
Research
My research currently contains three areas of interest. First, we study the cytokinin response pathway and how cytokinin controls plant growth. We find that several of the key signal-transduction proteins in this pathway are targeted for cytokinin-regulated and 26S proteasome-dependent degradation. Our main aim is to determine to what extent these protein stability controls contribute to the strength and the duration of the cytokinin response. In addition, we aim to identify the ubiquitin/26S proteasome pathway components that specifically interact with the cytokinin signaling proteins and label them for degradation.
With our second research focus we are developing a method for the isolation of flavonoids from plants by using TiO_2 nanoparticles. This new method has the advantage that it is less laborious compared to traditional flavonoid isolation procedures, and that it does not require the destruction of plant material but allows to reuse tissues or whole plants repeatedly for flavonoid production. Moreover, because these nanoparticles are readily taken up by human cell lines they potentially allow for the screening of large collections of different flavonoid mixes for human health related benefits.
Our third research focus aims to investigate the link between oxidative stress and the accumulation of Tobacco Specific NitrosAmines (TSNAs), the main carcinogens found in tobacco products. In particular, we aim to identify tobacco varieties, transgenic approaches, and treatment regimes that would suppress TSNA accumulation in ripening tobacco leaves.

Teaching
I teach 50% of the undergraduate course PLS/BIO210 and 100% of the graduate course PLS623.

National Service
-NIFA review panel, Summer of 2013.

Graduate Student Advisor
I am currently advising two graduate students.

Current Research Support

- Jan Smalle; Flavonoid Isolation From Intact Plants: A Nanoparticle-Based Approach, NIFA: 2015 – 2019; $450,000
- Jasmina Kurepa, Anne Jack, Jan Smalle, Huihua Ji, Colin Fisher; The antioxidant glutathione as a potential suppressor of TSNA accumulation. British American Tobacco; 2017 – 2019; $154,000 ($82,000 for my program)
- Cytokinin regulation of tobacco growth and ripening", Smalle J.(PI) Kentucky Tobacco Research and Development Center: 2017 – 2018; $30,000

Refereed journal articles

h-index: 27 (Scopus.com)
(most recent, plus 42 additional for career)

1. J. Kurepa, Y. Li and J. Smalle (2014). Cytokinin signaling stabilizes the response activator ARR1. ***The Plant Journal*** 78, 157-168.
2. J. Kurepa, Y. Li, S.E. Perry and J. Smalle (2014). Ectopic expression of the phosphomimic mutant version of Arabidopsis response regulator 1 promotes a constitutive cytokinin response phenotype. ***BMC Plant Biology*** 14: 28.
3. J. Kurepa, R. Nakabayashi, T. Paunesku, M. Suzuki, K. Saito, G.E. Woloschak and J. Smalle (2014). Direct isolation of flavonoids from plants using ultra-small anatase TiO_2 nanoparticles. ***The Plant Journal*** 77, 443-453.
4. T. Shull, J. Kurepa and J. Smalle (2016). Cytokinin signaling promotes differential stability of type-B ARRs. ***Plant Signaling & Behavior.*** 11(4).

Christopher D. Teutsch, PhD

Faculty Position
Associate Extension Professor: Forages
Appointment: 20% Research and 80% Extension

Educational Background
PhD, Agronomy, 2000, University of Kentucky, Lexington. Dissertation title: Soil, plant and animal interactions on reclaimed pastureland in southeastern Kentucky.
MS, Crop Science, 1996, The Ohio State University, Columbus. Thesis title: Banded phosphorus and growth stage effects on alfalfa seedling growth and subsequent productivity after temporary waterlogging.
BS, Crop Science, 1994, The Ohio State University, Columbus. Graduated *summa cum laude.*

Program Description

Grazing systems in the transition area between the temperate northern and subtropical southern United States are based on cool-season grass species that have a bimodal forage distribution. These systems are characterized by abundant forage growth in the spring and fall with limited growth during the summer and winter months. My research and extension programs have focused on developing grazing systems that extend grazing in both the summer and winter.

Summer annual grasses. I have conducted applied research on the production and utilization of a number of different summer annual grasses including the sorghum species and crabgrass. My work with crabgrass has shown that while it is commonly considered a weed, it can provide high quality grazing during the summer months when properly managed. My research has shown that nitrogen fertilization increases both the yield and crude protein concentration of crabgrass and can in some cases accumulate toxic levels of nitrate. I have also conducted research evaluating he relationship between yield and digestibility for newly available brown midrib summer annual grasses. The research from these studies has been shared with clientele through in-service training programs for both industry and extension personnel, producer field days and conferences, and articles in trade publications.

Stockpiling for winter grazing. Stockpiling tall fescue in late summer for winter grazing is one of the most economical ways to extend grazing. My research has evaluated nitrogen fertilization rates, sources, and application timing, along with utilization timing and method. My work indicates that the application of nitrogen fertilizer almost always increases yield, but sometimes those increases are not economical, especially when strong nitrogen cycles exist in pastures, fertilizer prices are high, and hay cost is low. I have also conducted research that has shown that strip grazing stockpiled tall fescue increased the utilization of available forage from 15 to 50%, increasing grazing days from 30 to 100 day/A when stockpile yield was 5000 lb DM/A.

Awards and Recognition (Selected)
2016. Merit Award. Virginia Forage and Grassland Council. Outstanding service to the Virginia Forage and Grassland Council and the Virginia forage and livestock industries.
2015. Medallion Award. American Forage and Grassland Council's highest award

2014. American Forage and Grassland Council's Merit Award.
2011. Outstanding Extension Service Award. Virginia Agribusiness Council, Richmond
2009. Harlan White Distinguished Service Award. Virginia Forage and Grassland Council, Crewe, VA.

Summary of Publications (Career)

Item	Lead author	Co-author	Total
Refereed publications	20	17	37
Peer-reviewed extension publications	10	8	18
Papers or abstracts presented at professional meetings	42	26	68
Totals	72	51	123

List of Refereed Publications (Selected)

Tracy, B.F., K. Albrecht, J. Flores, M. Hall, A. Islam, G. Jones, B. Lamp, J. MacAdam, H. Skinner, **C. Teutsch**. 2016. Evaluation of alfalfa-tall fescue mixtures across multiple environments. Crop Sci. 56:2026–2034.

Ferreira, G., H.D. Behl, E. Hokanson, W.E. Thomason, **C.D. Teutsch**. 2015. The interaction of drought stress and heat stress as determinant of dry matter yield and nutritional composition of maize (*Zea mays* L) whole-plant for silage. Maydica 60.1 - M 6.

Arnaudin, M.E., **C.D. Teutsch**, D.W. Watson, S.A.J. Wildeus, and A.O. Abaye. 2014. Dung beetle (Coleoptera: Scarabaeidae) abundance and diversity in pastures of Virginia. J. Entom. Sci. 49(2):97-109.

Extramural Funding (Career)

Extramural Funding	2000-present
As PI	$895,346
As co-PI	$937,443
Total	$1,832,789

Recent Projects Funded:

2016. Demonstrating conversion of wildtype to novel endophyte fescue pastures for greater livestock performance and better environmental outcomes. USDA-Virginia Natural Resources Conservation Service. $75,000
2014. Developing an Alfalfa Hay Export Market in the Humid Eastern United States. USDA-NIFA. $156,140.
2014. Establishing silvopastures for cross-disciplinary research and capacity building. Virginia Tech CALS Capacity Building Grant. $50,000.

Olga Tsyusko

Faculty Positions

Assistant Research Professor, Dep. of Plant and Soil Sciences, Univ. of Kentucky, 2011
Position: 93% research, 7% teaching

Educational Background

B.S. Uzhgorod National University, Ukraine, 1995, Biology
Ph.D. University of Georgia, Athens, GA, USA, 2004, Toxicology

Program Description

Research

Focus of my current research is on the environmental toxicogenomics, the area which combines approaches and techniques of environmental toxicology, genetics and molecular biology. I am interested in evaluating responses of different organisms (invertebrates and plants) after sub-chronic and chronic exposures to nanomaterials. The nanomaterials are studied in both pristine (as synthesized) and environmentally modified (aged) forms as well as directly in the realistic soil environment. I am a member (Co-PI) of the Center for Environmental Implications of Nanotechnology (CEINT) which brings together researchers from several US Universities (UK, Duke University, Carnegie Mellon University, and Virginia University). For the last two years my research moved towards studying multigenerational effects from the chronic exposure to the metal nanoparticles of a model organism *Caenorhabditis elegans*. Using next generation sequencing approach (DNASeq) we identify germline mutations that can be induced by the exposure over 10 generations as well as investigate whether epigenetic changes can be attributed to the observed nanotoxicity. I also continue working on the NSF NanoFARM (Fate and Effects of Agriculturally Relevant Materials) project which involves collaborations with the colleagues at Carnegie-Mellon University as well as with EU international partners in Aveiro, Portugal and Vienna, Austria. The project is examining fate and toxicity of the nanofertilizers (e.g., $Cu(OH)_2$ nanomaterials) with the focus on multi-generational toxicity and epigenetic effects in *C. elegans.*

Additional area of my research is on plant population genetics studying evolution of breeding system in heterostylous wood-sorrel polyploid plant using DNA fragment analysis. Population genetics analyses are also implemented in my teaching course.

Teaching

I teach PLS 597-001. Special Topics in Plant and Soil Sciences: Population Genetics Laboratory (2 credit hours)

Graduate Students

I am currently advising one graduate Ph.D. student (Anye Wamucho) and serve on the committee of two Ph.D. students.

Current Research Support

- Jason Unrine (PI) and Olga Tsyusko (Co-I). Environmental Fate of Double Stranded RNA-Based Bionanocomposites. NSF-EAGER. 2/1/17-31/1/19. $149.945

- Jason Unrine (PI) and Olga Tsyusko (Co-I). Collaborative Research: NanoFARM (Fate and Effects of Agriculturally Relevant Materials). NSF. 8/01/15-08/01/18. $257,097.
- Center for the Environmental Implications of Nanotechnology. As co-PI (Jason Unrine is PI from UK). Renewal. NSF, U.S. EPA-NCER (subcontract from Duke University). 10/13-9/18. $650,000.

Refereed journal articles
(for 2015-2016, plus 33 additional for career)
- Schultz Carolin L., Anye Wamucho, Olga Tsyusko, Jason Unrine, Alison Crossley, Claus Svendsen and David J. Spurgeon. 2016. Multigenerational exposure to silver ions and silver nanoparticles reveals heightened sensitivity and epigenetic memory in *Caenorhabditis elegans*. *Proceedings of the Royal Society B*: 2015-2911.
- Collin Blanche, Olga Tsyusko, Daniel L Starnes and Jason Unrine*. 2016. Effect of natural organic matter on dissolution and toxicity of sulfidized silver nanoparticles to *Caenorhabditis elegans*. *Environmental Science: Nano 3*: 728-736
- Starnes Daniel L., Stuart S. Lichtenberg, Jason M. Unrine, Catherine P. Starnes, Emily K. Oostveen, Gregory V. Lowry, Paul M. Bertsch, Olga V. Tsyusko*. 2016. Distinct transcriptomic responses of *Caenorhabditis elegans* to pristine and sulfidized silver nanoparticles. *Environmental Pollution* 213: 314-321.
- Weller S.G., Sakai A.K., Gray T., Weber J.J., Tsyusko O.V., Domínguez C.A., Fornoni J., Molina-Freaner F.E. 2016 Variation in heterostylous breeding systems in neighbouring populations of *Oxalis alpina* (Oxalidaceae). *Plant Biology* 18: 104-110.
- Chen, C., Unrine, J.M., Judy, J.D., Lewis, R.W., Guo, J., McNear, D.H., and Tsyusko*, O.V. 2015. Toxicogenomic responses of the model legume *Medicago truncatula* to aged biosolids containing a mixture of nanomaterials (TiO_2, Ag, and ZnO) from a pilot wastewater treatment plant. *Environmental Science & Technology* 49: 8759-8768.
- Judy, J.D., McNear, D.H., Chen, C., Lewis, R.W., Tsyusko, O.V., Bertsch, P.M., Rao, W., Stegemeier, J., Lowry, G.V., McGrath, S.P., et al. 2015. Nanomaterials in biosolids inhibit nodulation, shift microbial community composition, and result in increased metal uptake relative to bulk/dissolved metals. *Environmental Science & Technology* 49: 8751-8758.
- Starnes, D., Unrine, J., Starnes, C., Collin, B., Oostveen, E., Ma, R., Lowry, G., Bertsch, P., Tsyusko*, O., 2015 Impact of sulfidation on the bioavailability and toxicity of silver nanoparticles to *Caenorhadbitis elegans*. *Environmental Pollution* 196: 239-246.
- Stark Karolina, David E. Scott, Olga Tsyusko, Daniel P. Coughlin, and Thomas G. Hinton. 2015. Multi-Level effects of low dose rate ionizing radiation on southern toad, *Anaxyrus* [*Bufo*] *terrestris*. PLoS ONE 10(4): e0125327.

Jason Unrine

Faculty Positions

Research Assistant Professor, Department of Plant and Soil Sciences, 2008
Joint Faculty, Department of Toxicology and Cancer Biology, 2012
Assistant Professor, Department of Plant and Soil Sciences, 2013 (85% research, 15% teaching).
Associate Professor, Department of Plant and Soil Sciences, 2017 (85% research, 15% teaching).

Educational Background

PhD, Toxicology, University of Georgia, 2004
BS, Biology, Antioch College, 1998

Program Description

My research group has investigated the environmental fate, transport and ecotoxicology of trace-elements and engineered nanomaterials, an area that we helped pioneer about a decade ago. Much of our research focuses on the transformations and impacts of trace-elements and nanomaterials in terrestrial and wetland environments. We have developed tools that utilize advanced analytical, imaging and spectroscopic techniques to investigate the environmental transformations, bioavailability, bioaccumulation, trophic transfer and maternal transfer of these contaminants. We relate this information to adverse organismal effects with population level relevance. Current work in this area focuses on fate and effects of nanoscale agrochemicals including, such as fertilizers and pesticides. We are also working to translate what we have learned about the fate and effects of nanomaterials in soils and organisms to develop nano-enabled agrochemicals with reduced environmental impacts and enhanced efficacy. For example, we are developing polymer coated ZnO nanomaterials to enhance Zn nutrition in crops grown in soils where Zn bioavailability is inherently low. We are also developing materials for delivery of double stranded RNA-based pesticides. These are pesticides that work based on RNAi and are highly targeted, aiming to only kill single species. These materials will be used to target pest species that cause widespread crop damage, such as the fall army worm and soybean cyst nematode, which are difficult to manage with conventional pesticides. We are also developing materials for control of disease vectors, such as the yellow fever mosquito, which transmits Zika virus.

A second research front is in the area of human exposure science. We focus on human exposure to trace-elements in support of epidemiology studies being conducted by the UK Markey Cancer Center and Cincinnati Children's Hospital. Kentucky has rates of chronic diseases, such as lung cancer, colorectal cancer and diabetes, that far exceed national averages. Our work helps to determine whether trace-element excesses or deficiencies contribute to these disease states. Current work has found that while widespread exposure to excess trace-elements is not likely occurring, deficiencies in Cr and Se are possibly related to lung cancer incidence in Appalachian Kentucky.

Recent Journal Articles (of >90)

1. Syed, Z.; Alexander, D.; Ali, J.; Unrine, J.; Shoults-Wilson, W. A., Chemosensory cues alter earthworm (Eisenia fetida) avoidance of lead-contaminated soil. *Environmental toxicology and chemistry* **2017,** *36* (4), 999-1004.
2. Spielman-Sun, E.; Lombi, E.; Donner, E.; Howard, D. L.; Unrine, J. M.; Lowry, G. V., Impact of surface charge on cerium oxide nanoparticle uptake and translocation by wheat (Triticum aestivum). *Environmental Science & Technology* **2017**.
3. Lahive, E.; Matzke, M.; Durenkamp, M.; Lawlor, A.; Thacker, S.; Pereira, M.; Spurgeon, D.; Unrine, J.; Svendsen, C.; Lofts, S., Sewage sludge treated with metal nanomaterials inhibits earthworm reproduction more strongly than sludge treated with metal metals in bulk/salt forms. *Environmental Science: Nano* **2017**.
4. Vencalek, B. E.; Laughton, S. N.; Spielman-Sun, E.; Rodrigues, S. M.; Unrine, J. M.; Lowry, G. V.; Gregory, K. B., In Situ Measurement of CuO and Cu(OH)2 Nanoparticle Dissolution Rates in Quiescent Freshwater Mesocosms. *Environmental Science & Technology Letters* **2016,** *3* (10), 375-380.
5. Starnes, D. L.; Lichtenberg, S. S.; Unrine, J. M.; Starnes, C. P.; Oostveen, E. K.; Lowry, G. V.; Bertsch, P. M.; Tsyusko, O. V., Distinct transcriptomic responses of Caenorhabditis elegans to pristine and sulfidized silver nanoparticles. *Environmental Pollution* **2016,** *213*, 314-321.
6. Schultz, C. L.; Wamucho, A.; Tsyusko, O. V.; Unrine, J. M.; Crossley, A.; Svendsen, C.; Spurgeon, D. J., Multigenerational exposure to silver ions and silver nanoparticles reveals heightened sensitivity and epigenetic memory in Caenorhabditis elegans. *P Roy Soc B-Biol Sci* **2016,** *283* (1832), 9.

Current funding

NanoFARM, Fate and Effects of Agriculturally Relevant Materials)- NSF
CEINT, Center for the Environmental Implications of Nanotechnology- NSF
EAGER- Environmental Fate of Double Stranded RNA based Pesticides –NSF
DOM affected Behavior of manufactured nanomaterials-BARD
RNAi methods for Zika virus vector control –NIH
E-Test for ZnO Nanomaterials in Natural Systems – NSF
Reconciling Nanoceria's Jekyl and Hyde Reputation- NIH
Development of coated ZnO nanomaterials for fortification of wheat – USDA (Hatch)
Undergraduate Research Experience in Environmental Health Sciences- NIH
Determination of parameters for rational design of nanoparticle delivery of dsRNA to pests- Syngenta

Current Students and Postdocs

Stuart Lichtenberg, PhD, Integrated Plant and Soil Sciences – RNAi-based pesticides
Zeinah Elhaj Baddar, PhD, Integrated Plant and Soil Sciences- ZnO Nanofertilizers
Jieran Li, PhD, Toxicolgy and Cancer Biology- Trophic Transfer of Nanomaterials
Honore Djieutedjeu, Postdoc, Materials Science- Development of nano-carriers for dsRNA

Courses Taught

PLS/TOX 560 – Ecotoxicology

David A. Van Sanford

Faculty Positions

2011- present: Yost-Lea Professor of Plant and Soil Sciences, University of Kentucky
1993 - present: Professor of Plant and Soil Sciences, University of Kentucky
1987 - 1993: Associate Professor of Agronomy, University of Kentucky
Sep. 1990 - Feb. 1991: Visiting Associate Professor, Dep. of Agronomy, Kansas State University,
1981-1987: Assistant Professor of Agronomy, University of Kentucky
Distribution of Effort: 85% research, 15% teaching

Educational Background

Ph.D., Genetics, 1981, North Carolina State University
M. S., Agronomy, 1978, Colorado State University
B. S., Agronomic Crop Science, 1973, Oregon State University

Program Description

Research: My research program has two primary tracks – 1) development and release of improved wheat cultivars and 2) training graduate students through research projects that focus on genetic questions underpinning our breeding efforts. Both of these tracks are informed by our longstanding focus on developing genetic resistance to Fusarium head blight or scab, a devastating disease of wheat worldwide, and of particular concern in Kentucky where our cropping system favors it. The program has recently released Pembroke 2014 and Pembroke 2016 two wheat cultivars with good scab resistance, high yield potential and early maturity for doublecropping. Most of the project's graduate student training and educational efforts have been related to breeding for scab resistance, though two recent students have also worked on nitrogen use efficiency and three students have worked on some aspect of climate change. I began research to determine how to breed for adaptation/resilience to climate change in 2012.and we continue to carry out active and passive warming studies to quantify genetic variation for adaptation to climate change. I am in the process of incorporating genomic selection into our mainstream breeding plans, and currently have two graduate student studies on genomic selection in concert with ongoing scab resistance efforts underway. When optimized genomic selection could have a transformative effect on the breeding program in terms of efficiency and rate of improvement.

Teaching/Graduate Students: I teach (2/3 responsibility) IPS 625 Transdisciplinary Research in Plant and Soil Sciences in the fall and PSS 664 Plant Breeding and PLS 676 Quantitative Genetics alternate years in the spring. I am currently advising four PhD students.

Positions of National Leadership

-Co-Chair and Director of the Networking and Facilitation Office, *US Wheat and Barley Scab Initiative* 2006 – present: Responsible for all of the USWBSI's administrative and communication activities, including management of $5.05 M research grants program for USDA-ARS. The Director is also the Co-Chair of the USWBSI's Steering Committee and is the primary liaison between the USWBSI and USDA- ARS.

-Chair, *National Wheat Improvement Committee*, Feb. 2000 – March 2005: Developed national legislative agenda for wheat research; led team of researchers and stakeholders to Capitol Hill to seek federal funding to support and enhance wheat research; assembled and provided expert commentary and testimony on issues relating to wheat improvement.

Current/Recent Extramural Funding

-Soft Red Winter Wheat Breeding and Variety Development for Kentucky. Kentucky Small Grain Growers Association. September 1, 2015-Dec. 31, 2017. $ 121,125.
-Genomic Selection in Soft Red Winter Wheat. Kentucky Small Grain Growers Association. September 1, 2015-Dec. 31, 2016. $ 10,000.
-Accelerating the Development of Fusarium Head Blight Resistant Wheat Cultivars. May 1, 1 2015 – April 30, 2017.U.S. Wheat and Barley Scab Initiative. $ 128,176.
-U.S. Wheat & Barley Scab Initiative's Networking and Facilitation Office and Website. U.S. May 1, 2015 – April 30, 2017. U. S. Wheat and Barley Scab Initiative. $416,740.
-Food Security: Enhancing Wheat Breeding Through Selection Of Robust Disease Resistant QTL That Function In A Variable Climate. USDA-NIFA-AFRI. January 2016 – December 2016. $119,631.
-Improving barley and wheat germplasm for changing environments, 2011-2016. USDA-NIFA-AFRI. $ 25 M. PI portion $ 251,934.

Recent Publications

-Russell, K., C. Lee and D. A. Van Sanford. 2017. Interaction of Genetics, Environment and Management in Determining SRW Wheat Yields. Agron. J. (In Press)
-Knott, C. A., D. A. Van Sanford, E. L. Ritchey, and E. Swiggart. 2016. Wheat Yield Response and Plant Structure Following Increased Nitrogen Rates and Plant Growth Regulator Applications. Crop, Forage, & Turfgrass Management 2: doi:10.2134/cftm2015.0202.
-Clark, A. J., D. Sarti-Dvorjak, G. Brown-Guedira, Y. Dong, B.-K. Baik and D. A. Van Sanford. 2016. Identifying rare FHB-resistant transgressive segregants in intransigent backcross and F_2 winter wheat populations. Front. Microbiol. 7:277. doi: 10.3389/fmicb.2016.00277
-Huang, M., A. Cabrera, A. Hoffstetter, C. Griffey, D. A. Van Sanford, J. Costa, A. McKendry, S. Chao, C. Sneller. 2016. Genomic selection for wheat traits and trait stability. Theor. Appl. Genet. (doi:10.1007/s00122-016-2733-z).
-Hitz, K., A. Clark, and D. A. Van Sanford. 2016. Identifying Nitrogen-Use Efficient Soft Red Winter Wheat Lines in High and Low Nitrogen Environments. Field Crops Research 200: 1–9. doi:10.1016/j.fcr.2016.10.001.
-Islam, M. S., G. Brown-Guedira; D. A. Van Sanford; Y. Dong; A. L. McKendry. 2016. Novel QTL associated with the Fusarium head blight resistance in Truman soft red winter wheat. Euphytica 207:571-592 doi:10.1007/s10681-015-1550-9.

George J. Wagner

Faculty Position
Emeritus Professor, Plant and Soil Sciences, Tobacco Biochemistry/Biotechnology

Educational Background
PhD. Biology, 1974, SUNY@Buffalo
M.A. Biology, 1971, SUNY@Buffalo
B.A. Biology, 1970, SUNY@Buffalo

Program Description

Tobacco continues to be an important agricultural crop in Kentucky. In 2009 the Family Smoking Prevention and Tobacco Control Act was signed into law granting the FDA authority to regulate tobacco products and limit additives to tobacco during production and product manufacturing. This has changed the tobacco industry significantly in that additives previously allowed in tobacco production and tobacco product manufacture are now restricted, and will likely be further restricted. It is likely that future restrictions will be placed on residues of synthetic chemicals that are used for pest and pathogen control. Therefore there is a growing need for using natural means when growing the tobacco crop (naturally-derived as opposed to synthetic pest resistance compounds). We have long been engaged in understanding the biochemistry involved in biosynthesis of natural pest and pathogen resistance compounds in tobacco and manipulating their biochemistries to allow greater use of natural pest resistance in tobacco production. Our current studies focus on production of diterpenoid and sugar ester compounds by tobacco trichomes. We have identified some biochemical pathways involved and have manipulated these using gene knockdown technologies. In one case we have knocked down the final step in production of CBT-diols in trichomes. This led to accumulation of substantial CBTols the precursors of CBTdiols. The result was a high level of resistance to aphid infestation in the greenhouse and the field. However, the loss of CBTdiols apparently led to increased susceptibility to angular leaf spot disease. Thus, complex interactions of these trichome-derived chemicals with different pest organisms was revealed. We continue to probe diterpenoid and sugar ester metabolism so as to allow development resistance strategies that will maximize use of natural resistance in tobacco and reduce the need for using synthetic compounds in pest and disease control.

There is growing knowledge about the genetics underlying evolution of natural resistance in plants related to tobacco, particularly tomato. This knowledge suggests how one might accelerate variation in resistance compound evolution to gain new levels of resistance in tobacco. We are applying gene knockdown methods to probe these mechanisms.

Black shank disease is now considered to be the most serious tobacco disease in U.S. tobacco fields. We have found that certain natural, secondary compounds produced by non-cultivated tobacco species might be applied to cultivated tobacco species to provide resistance to this disease in the laboratory. We are now extending these observations in field experiments. These studies may allow pretreatment of transplants

to confer resistance, and/or suggest genetic manipulation strategies for causing their endogenous production in modified plants.

Our goal is to pursue strategies that the farmer might use to respond to the regulations of the FDA as they relate to limitation of the use of exogenous, non-natural chemicals in tobacco production and tobacco product manufacturing.

Publications

Kroumova, A.B., Zaitlin, D., and **Wagner, G.J**. 2016. Natural variability in acyl moieties of sugar esters produced by certain tobacco and other Solanaceae species. Phytochemistry, 130: 130-227

Wagner, G., Korenkov, V., Judy, J.D., Bertsch, P.M. 2016. Nanoparticles composed of Zn and ZnO inhibit *Peronospora tabacina* spore germination in vitro and *P. tabacina* infectivity on tobacco leaves. Nanomaterials 16(3) 50-60

Kroumova, A.B., Artiouchine, I., **Wagner, G.J.** 2016. Use of several natural products from selected *Nicotiana* species to prevent black shank disease in tobaco. Beitrage zur Tabakforschung International 27: 113-125.

Chambers, O., Spence, C.L., **Wagner, G.J.** 2017. Professor Emeritus George Wagner, recipient of the 21st Tobacco Science Research Conference Lifetime Achievement Award. Beitrage zur Tabakforschung International 27: 2-3

Ole Wendroth

Faculty Position
Professor of Soil Physics
20% I, 80% R.

Educational Background
Habilitation (*venia legendi*), Technical University of Berlin, Germany, 2001, Soil Science
PhD (Dr. sc. agr.), University of Goettingen, Germany, 1990
Diploma Degree in Agricultural Sciences/Agronomy and Soil Science, Germany, 1987
Practical Farming Degree after two-year-apprenticeship, Germany, 1982

Program Description
Since the severe drought of 2012, irrigation of corn, soybean and wheat has been intensified in Kentucky. Applying the right amount of water at the right time, and developing a concept for variable rate irrigation are the major challenges in the southeastern United States. We are currently in year 3 of a research project that is funded by the three main crop commodities in Kentucky for a time of three years. Two graduate students work on this project. In this project we work on decision support for irrigation water management. At the same time, we are the coordinating group of scientists from four states (Georgia, Tennessee, Alabama, Kentucky) funded by the SSRP (Southern Soybean Research Program). Currently, we are in year 2, and plan on submitting a proposal for year 3. Scientists involved in this project here at UK are: Ole Wendroth, Mike Sama (BAE), Chad Lee, Carrie Knott, and Lloyd Murdock. A continuation of the proposal will be submitted. With a SB 271 grant, it was possible to install a wireless soil water monitoring network in a farmer's field in Princeton, KY for this irrigation project. We have worked together with 12 undergraduate senior-level students from a senior design class (EE 490) on the development of smart-phone apps for irrigation control.
We have begun to use the Root Zone Water Quality Model (RZWQM) to simulate soil water dynamics, crop growth and greenhouse gas emissions. Currently, we try to optimize the way to input and evaluate measured information. One of my graduate students compares different methods to derive crop evapotranspiration ET_a with special emphasis on errors introduced by the soil profile lower boundary condition.
The Soil Physics program has helped the local horse race industry (Keeneland) to find a new race track material and to identify optimum geotextile materials between the soil material and the underlying gravel.
A student from a local high school (Dunbar) has worked in a junior project on farm and city soils and the impact of neighborhood development on soil quality. She won several awards and participated in science fairs at the national and international level. In her senior project, she now investigates the impact of stones on soil hydraulic properties.

Teaching
PLS 575/576 Soil Physics/Soil Physics Lab in fall of odd-numbered years; PLS 655 Spatial and Temporal Statistics in fall of even-numbered years; PLS 468G Soil Management 50% in fall of 2015 and 2016.

Service (recent activities)

Co-Editor-In-Chief Soil & Tillage Research, Editorial Board member for Geoderma, Journal of Plant Nutrition and Soil Science, Agriculture

Reviewer for SSSA, VZJ, Scientia Agricola, J. Hydrology, Hydrological Processes, Nutrient Cycling in Agroecosystems

ASA: Community leadership "Model applications in Field Research"

SSSA: Board of Directors, representing the Fundamental Soil Science Group 2012-2015, and other committee service; Co-organizer of symposia

International: On-site review of Water Research Center for Agriculture and Mining, CONICYT, FONDAP, Chilean government (2016); written review in 2017

University: Graduate council, 2012-2015
Academic Area Advisory Committee, Extension Title Series

College: Ag Faculty Council Member
Member of Strategic Planning Team 2016-2018

Department: Chair of departmental proposal review committee (since 2015)
Faculty mentor for Carrie Knott, Erin Haramoto, Wei Ren, and Montserrat Salmeron Cortasa
Chair of search committee for Agroclimatology and Ag Systems Modeler
Teaching peer evaluation A. Karathanasis

Extension: Presentations at field days

Awards

2017: University Research Professor (UK)
2017: Heick Soil Science Professor (Department)
2008: Fellow of ASA; 2009 Fellow of SSSA
2014: Outstanding Reviewer Award for Vadose Zone Journal
2013: 2012 Outstanding Associate Editor Award for Soil Sci. Society of America Journal
2011: Western Association of Agricultural Experiment Station Directors 2011 Award for Excellence as Member of the Technical Committee for W-2188 "Characterizing Mass and Energy Transport at Different Vadose Zone Scales"

Invited Presentations

Annual Meeting Canadian Soil Science Society 2017
Latin-American Soil Science Conference 2016, Quito, Ecuador
Austral University, Valdivia, Chile; Public presentation 2017, short courses in Spatial and Temporal Statistics in 2015 and 2017.
Embrapa, Seropedica, Brazil, 2016
University of Rio de Janeiro 2014 short course in spatial and temporal statistics

Publications

112 refereed (21 since 2014); 40 non-refereed (not including abstracts)

Advising

10 graduate students (3+1 co-adv. currently); 16 committee service completed, 9 in progress; 4 external committee services (Austria, Australia, Brazil, Denmark); hosted 15 visiting scientists; advised two high school students

D.W. Williams

Faculty Position

Professor of Agronomy: Hemp production
Director: UK Robinson Center for Appalachian Resource Sustainability (UK-RCARS)
80% Administration; 20% Research

Educational Background

Ph.D. Crop Science, 1996, University of Kentucky
M.S. Crop Science, 1993, University of Kentucky
B.S. Horticulture, 1981, Eastern Kentucky University

Program description

I began research activities with industrial hemp in 2014, and have invested 100% of my research efforts in hemp beginning in 2015. Interest in hemp as a potential commodity crop is extremely broad and diverse. This has presented both opportunities (many interested individuals and entities) and challenges (no background or even basic understanding of commodity agriculture or agronomic research). To date, there have been no federal or state funds available for hemp research. Therefore, all support acquired has been from corporate sources. I feel we have been very successful in supporting our work with a total of $157,735 invested directly in our agronomic program, and also participating in the acquisition of an additional $60,000 for other programs in PSS/KTRDC during 2015/2016.

Our research work is extremely basic. Hemp has not been produced in the U.S. since the 1940s. Even then, the varieties under production were largely derived from USDA breeding efforts within the U.S early in the 20th century mostly utilizing germplasm derived from China. Hemp in the U.S. became illegal in 1970 and all hemp germplasm in the U.S. was consequently destroyed. Therefore, we are now working only with germplasm from other nations across the world. We are investigating the most elementary agronomic parameters in an effort to provide science-based information to Kentucky farmers towards the most efficient production models using highly variable lines. Examples include standard variety trials, manipulating plant densities, planting date x variety interactions, nitrogen fertility, BMPs for harvesting, and post-harvest activities (e.g., retting for fiber; curing for cannabinoids).

I am confident in reporting that the UK agronomic hemp research program literally leads the entire nation. Difficult to directly quantify by standard metrics, this fact is stated again and again by other academic institutions, government entities, and members of the industry. We have had and continue to have direct interaction with members of the U.S. Congress and multiple state legislatures seeking our expertise. We are very often sought out by media from all across the country. We are partnering with the Agronomic Tri-Socieites (ACSESS) and the Hemp Industries Association (HIA) hosting a dual meeting in 2017 in Lexington and at UK; an additional indication of the high regard for our program on a national level. This meeting will bring together the national leaders in hemp science and the hemp industry. Within the next year, we will have additional activities contributing to more standard metrics (competitive funding, refereed publications, etc.) to quantify this claim. Work in 2017 is expanded relative to previous years. It is our direct intention to

acquire nationally competitive funding, publish the results of two-year field studies, and continue to lead the U.S. in agronomic hemp research activities.

Refereed Journal Articles (31 career):

Wei Sun, Steve Lipka, Christopher Schwartz, David Williams, and Fuqian Yang. 2016. Hemp-derived activated carbons for supercapacitors. Carbon. 103: 181-192.

Glen E. Aiken and David W. Williams. 2015. Forage Yield and Nutritive Value of Turf Bermudagrasses Managed to Simulate a Horse Pasture Management Scheme in the U.S. Upper Transition Zone. Crop, Forage, and Turfgrass Management. doi:10.2134/cftm2015.0139.

Bret Sparks, Gregg Munshaw, David Williams, Michael Barrett, Jeff Beasley, and Paul Woosley. 2015. Preplant Cultivation Techniques and Planting Date Effects on White Clover Establishment into an Existing Cool-season Turfgrass Sward. Hort. Sci. 50: 615-620.

Invited Presentations/Service:

2015: Testified three times before the Interim Joint Committee on Agriculture, Kentucky General Assembly.
Invited speaker, Hemp Industries Association 2015 Fall Conference, Lexington, KY. Title: Hemp research in Kentucky.
Invited participant meeting with Senate Majority Leader Mitch McConnell and others in Lexington for a discussion on hemp research.
Hosted multiple visits to our UK hemp research work by members of the Kentucky General Assembly and other Kentucky state agencies.
Lync presentation on hemp concurrently reaching 82 county extension offices.
Many (>25) individual county extension office presentations all across Kentucky.
Advisor to the Board of Directors, Kentucky Hemp Industries Association (KYHIA).
2016: Invited speaker, ASA, CSSA, SSSA Science of Industrial Hemp meeting in Denver, CO.
Provided a report on UK hemp research to the Southern Legislative Conference of The Council of State Governments
Provided a tour of UK hemp research to the Southern Legislative Conference of The Council of State Governments
Testified before the Interim Joint Committee on Agriculture of the Indiana Legislature.
Advisor to the Boards of Directors, KYHIA and Kentucky Industrial Hemp Research Foundation.

Ling Yuan

Faculty Positions

Professor
Harold R. Burton Endowed Professor in Plant Biochemistry, Department of Plant and Soil Sciences, University of Kentucky (since 2012).
Research Director, Kentucky Tobacco Research and Development Center (since 2011).
DOE: 65% Research; 15% instruction; 20% administrative (Research Director, KTRDC).

Educational Background

Ph.D. (Plant biology, biochemistry and molecular biology), University of Texas at Austin, 1989.
B.S. (Biology), Jinan University, Guangzhou, China 1983.

Program Description

Research
My primary research interests are focused on (i) transcriptional, posttranscriptional (e.g. microRNA), and posttranslational (e.g. phosphorylation) regulation of plant secondary metabolic pathways and mechanistic roles of functional domains of transcription factors; (ii) application of novel clean technologies, such as genome editing and intragenic transformation, to engineer plant metabolic pathways.
Teaching
I am responsible for ABT301 class, *Writing and Presentation in Life Science*, in the Fall semesters. The class has a 14-student limit as it strongly emphasizes one-on-one interactions with the students. The goal is to help students understand scientific concepts and how to communicate scientific ideas and approaches to others in both written and oral presentations. In the Spring semesters, I am involved in the team-taught PLS609, *Plant Biochemistry*, with responsibility of teaching the biosynthesis of plant secondary metabolites.

Graduate Student Advisor

I am currently advising two Ph.D. students and one Master student. I graduated four UK Ph.D. students and three international Ph.D. graduate students (join advising).

National Service

- Editorial board member: *Planta*, *Scientific Reports*, *Frontiers in Plant Science*
- Grant review panel member: DOE, 2010; USDA AFRI panels 2011, 2014.
- International reviewer, the Chinese National Science Foundation, 2014-now.

Current Research Support

- Currently PI of six industrial grants for more than $1.5 million (20016-19).
- co-PI and chair of advisory committees of two FDA grants to KTRDC for $15 million.
- PI of FAPRU, USDA grant, “Tall fescue biochemical characterization” ($300,000/2014-18).

- Co-PI of a NSF KYEPSCoR grant, “Powering the Kentucky Bioeconomy for a Sustainable Future” (PI: R. Andrews. $20,000,000. 2014-18. Yuan receives $44,000/year to support a Ph.D student stipend and research supplies)

Refereed journal articles

Representative and selected from approx. 60 total *(bolded names indicate corresponding authors; authors under my supervision: *postdoc/scientist, ** student):*

(1) Shen, EM**, Singh, S*, Ghosh JS*, Patra B*, Paul P**, **Yuan L, Pattanaik S*** (2017) The miRNAome of Catharanthus roseus: identification, expression analysis, and potential roles of microRNAs in regulation of terpenoid indole alkaloid biosynthesis. *Scientific Reports.* 7:43027

(2) Paul P**, Singh S*, Patra B*, Sui X**, **Pattanaik S*, Yuan L.** (2017) A differentially regulated AP2/ERF transcription factor gene cluster acts downstream of a MAP kinase cascade to modulate terpenoid indole alkaloid biosynthesis in *Catharanthus roseus*. *New Phytologist*. 213(3):1107-1123

(3) Xu Z, Cheng K, Li X, Yang J, Xu S, Cao X, Hu X, Xie W, Yuan L, Ambrose M, Chen G, Mi H, **Luo D**. (2016) Transcriptional and Post-transcriptional Modulation of SQU and KEW Activities in the Control of Dorsal-ventral Asymmetric Flower Development in Lotus japonicus. *Molecular Plant*. 9(5):722-736.

(4) Schluttenhofer CM** and **Yuan L** (2015) Regulation of specialized metabolism by WRKY transcription factors. *Plant Physiology.* 167 (2): 295-306.

(5) Yuan L and **Grotewold E** (2015) Metabolic engineering to enhance the value of plants as green factories. *Metabolic Engineering.* 27:83-91

(6) Schluttenhofer CM**, Pattanaik S*, Patra B*, and **Yuan L** (2014) Analyses of Catharanthus roseus and Arabidopsis thaliana WRKY transcription factors reveal involvement in jasmonate signaling. *BMC Genomics* 15:502.

(7) Patra, B*. Pattanaik, S*. and **Ling Yuan** (2013) Ubiquitin protein ligase 3 mediates the proteasomal degradation of GLABROUS3 and ENHANCER OF GLABROUS 3, regulators of trichome development and flavonoid biosynthesis in Arabidopsis. *The Plant Journal* 74:435-437.

(8) Que Kong**, Sitakanta Pattanaik*, Antje Feller, Joshua R. Werkman**, Chenglin Chai, Yongqin Wang, **Erich Grotewold**, and **Ling Yuan** (2012). A regulatory switch enforced by bHLH and ACT domain-mediated dimerization of the maize transcription factor R. *Proceeding of National Academy of Sciences, U.S. A.* 109: E2091-2097

(9) Suttipanta, N**., Pattanaik, S*., Kulshrestha, M., Patra, B*., Singh, S.K*. and **Yuan, L.** (2011) The transcription factor CrWRKY1 positively regulates terpenoid indole alkaloid biosynthesis in *Catharanthus roseus. Plant Physiology* 157: 2081-2093.

Hongyan Zhu

Faculty Positions

2015-present Professor, Department of Plant and Soil Sciences, University of Kentucky
2009-2015 Associate Professor, Dept. of Plant and Soil Sciences, Univ. of Kentucky
2004-2009 Assistant Professor, Dept. of Plant and Soil Sciences, Univ. of Kentucky
Appointment: 85% research, 15% teaching

Educational Background

2001 PhD, Genetics, Texas A&M University, College Station, Texas
1997 MS, Genetics, Kansas State University, Manhattan, Kansas
1991 MS, Plant Breeding and Genetics, Yangzhou University, Yangzhou, China
1988 BS, Agronomy, Yangzhou University, Yangzhou, China

Program Description

Research

My laboratory studies pathogenic and symbiotic plant-microbe interactions, with a special focus on legumes. We employ genetic, genomic, and molecular approaches to clone and characterize biologically important genes that are involved in these processes. For plant disease resistance, our long-term goal is to use the model legume *Medicago truncatula* as a surrogate to isolate disease resistance genes against alfalfa pathogens, with the ultimate goal to develop alfalfa cultivars with genetically improved disease resistance. Research projects associated to symbiotic plant-microbe interactions include: 1) Functional analysis of non-legume orthologs of legume genes that are required for nodulation and mycorrhizal symbioses; 2) Cloning and characterization of soybean and *Medicago* genes that control nodulation specificity; and 3) Identification and cloning of soybean and *Medicago* genes that control strain-specific nitrogen fixation and regulate natural variation in nitrogen fixation efficiency. Beyond studying legume-microbe interactions, we are also working on other research projects which aim to apply genetic and genomics tools to gene discovery and crop improvement.

Teaching

PLS 615: Advanced Plant Genetics and Genomics (3 credits). Genomics is reshaping the life sciences by providing high-throughput tools to decipher the functions of individual genes and to characterize their regulation and interactions. **The last decade has seen tremendous development of genomic resources and technologies in major crops and their models.** The intelligent use of these resources and technological innovations will advance our understanding of genome function, allow for prediction of phenotype from genotype, and thus enhance our ability to improve crop production. This course covers major contemporary areas of genomics, including, but not limited to, genome mapping, genome sequencing, genome annotation, genome-wide association analysis, marker-assisted selection in plant breeding, genome-wide transcriptional profiling, high throughput forward and reverse genetics, DNA methylation and epigenetics, quantitative trait locus analysis, and the basic bioinformatics tools.

Five Significant Publications

1. Yang S, Wang Q, Fedorova E, Liu J, Qin Q, Zheng Q, Price PA, Pan H, Wang D, Griffitts JS, Bisseling T, **Zhu H** (2017) Microsymbiont discrimination mediated by a host-secreted peptide in *Medicago truncatula*. *Proc Natl Acad Sci USA* 114 (26): 6848-6853.

2. Wang Q, Yang S, Liu J, Terecskei K, Ábrahám E, Gombár A, Domonkos Á, Szűcs A, Körmöczi P, Wang T, Fodor L, Mao L, Fei Z, Kondorosi É, Kaló P, Kereszt A, **Zhu H** (2017) Host-secreted antimicrobial peptide enforces symbiotic selectivity in *Medicago truncatula*. *Proc Natl Acad Sci USA*, 114(26): 6854-6859.

3. Tang F, Yang S, Liu J, **Zhu H** (2016) *Rj4*, a gene controlling nodulation specificity in soybeans, encodes a thaumatin-Like protein but not the one previously reported. *Plant Physiology* 170:26-32.

4. Yang S, Tang F, Gao M, Krishnan HB, **Zhu H** (2010) *R* gene-controlled host specificity in the legume-rhizobia symbiosis. *Proc Natl Acad Sci USA* 107:18735-18740.

5. Yang S, Gao M, Xu C, Gao J, Deshpande S, Lin S, Roe B, **Zhu H** (2008) Alfalfa benefits from *Medicago truncatula*: The *RCT1* gene from *M. truncatula* confers broad-spectrum resistance to anthracnose in alfalfa. *Proc Natl Acad Sci USA* 105:12164-12169

Graduate Student Advisor

I am not currently advising graduate students due to a lack of department support.

Current Research Support (Total funds allocated to my research program since my joining the University of Kentucky on September 1st, 2004: $2,261,386)

Hongyan Zhu (PI), 2013-2017, Host genetic control of strain-specific nitrogen fixation in the legume-rhizobial symbiosis, United States Department of Agriculture-Agriculture and Food Research Initiative (USDA-AFRI) Competitive Grants Program, $500,000

Hongyan Zhu (PI), 2013-2017, Develop transgenic forage grasses and legumes to alter biochemical pathways to gain a better understanding of secondary metabolite production and plant persistence. USDA-ARS-Specific Cooperative Agreement, $271,770

Department of Plant and Soil Sciences

College of Agriculture, Food and Environment
University of Kentucky

2017 Periodic Program Review

Review Committee site-visit September 24-26, 2017

Programs Reviewed:

HPLS B.S.
IPSS M.S. and Ph.D.
Crop Science M.S. and Ph.D.
Soil Science Ph.D.
Plant Physiology Ph.D.

Review Report Submitted November 1, 2017 by:

Dr. David W. Horohov, Chair, UK Department of Veterinary Science
Dr. Ronald Turco, Purdue University
Dr. April Ulery, New Mexico State University
Dr. Alan Fryar, UK Department of Earth and Environmental Sciences
Dr. Jason Unrine, UK Department of Plant and Soil Sciences
Dr. Carrie Knott, UK Department of Plant and Soil Sciences
Ms. Yvonne Thompson, UK Department of Plant and Soil Sciences
Mr. Wes Morris, UK Department of Plant and Soil Sciences

Table of Contents

Executive Summary

The Department of Plant and Soil Sciences (PSS) is a highly productive and valued component of the College of Agriculture, Food and Environment (CAFE) and the University of Kentucky (UK). The Department Chair, Dr. Todd Pfeiffer, and the faculty are to be commended for their significant contributions to the teaching, research and extension missions of the college. The overall impression is that the department is excelling in these areas, though there is room for improvement. While most of our recommendations would provide some enhancements to the program, there are a few areas requiring greater attention.

The PSS faculty participate in interdisciplinary undergraduate programs in Horticulture, Plant, and Soil Sciences (HPLS), Agricultural and Medical Biotechnology (ABT), and Natural Resources and Environmental Sciences (NRES). Several courses (e.g. PLS 103, 104 and 366) serve as a degree requirement in HPLS, NRES, and other undergraduate majors offered by different departments. In addition to providing lectures in various ABT courses, PSS faculty have also served in leadership roles in the ABT program. The graduate education program in the department has undergone significant modification since the last review. There were initially three graduate programs to which PSS faculty contributed; Crop Science (MS and PhD), Plant Physiology (PhD), and Soil Science (PhD). The integrated plant and soil science (IPSS) program was created in 2009 to combine these programs. Since 2011, all new graduate students have been enrolled in the IPSS program. Faculty participation in graduate training is high. It should be noted that this department has an overall emphasis in research and extension such that the average instructional DOE of PSS faculty is only 11%. Nevertheless, they value their teaching role, as two-thirds of the faculty actively participate in undergraduate teaching and 87% in graduate teaching.

While their commitment to teaching is clearly one of the strengths of this department, the faculty faces some challenges going forward. The primary concern is the difficulty they have faced trying to reach their undergraduate enrollment goals for HPLS. Despite several initiatives, these numbers remain low. Given factors beyond the control of the faculty, it appears unlikely that they will reach their stated goal of 60 students enrolled in this program. There are also curricular and organizational issues within this degree program that need to be resolved. Although the faculty of PSS have already had multiple discussions addressing some of these issues prior to this review, final resolution remains pending. As noted below, we encourage the faculty, and the incoming chair Dr. Rebecca McCulley, to develop plans to address the future of HPLS.

The research programs of the department are quite successful. The department typically ranks highest when compared to other departments in the college in terms of grant funding totals and per faculty averages. The sources of funding are also quite diverse and include federal, state and industry sources. Indeed, the department has benefitted from significant financial support from state commodity groups. While major emphasis areas can be identified, the question arose during the review as to whether this diversity prevents the attainment of a critical mass in a particular area that could be better exploited. As the department appears to have an effective mechanism for determining the direction of future faculty hires, this does not appear to be a major problem. However, we would encourage the department and the new chair to consider developing a strategic plan for faculty hiring to address this issue. Another concern has to do

with the sources of funds for new faculty start-up packages. The incoming chair is urged to work with the philanthropy office and the Dean to identify sources of funds for this purpose. Lastly, the committee was left with the impression that activity, resources and equipment use on the farm could be improved. As detailed below, no defined process appears to be in place that assures that all faculty have equal access to farm-based resources.

The extension program in this department is quite successful. This is noted both in the responses of agents to a poll conducted at the time of the review, the comments of the faculty, and overall impressions of the review committee. The collaborations between extension and regular title series faculty appear to be real and active. Success in obtaining funding from state commodity groups is indicative of the overall impact of this department and its faculty on Kentucky agriculture. While there was limited interaction with stakeholders during the review, these indirect measures speak well of the effectiveness of the extension effort. While some concerns were expressed given current uncertainty regarding the overall extension program in the college, this particular program deserves continued support and recognition for its efforts. The possibility of developing online or similar courses in support of county agents' efforts to obtain a master's degree was discussed as a possible future opportunity for the department and is part of the college strategic plan.

In summary, the committee found the Department of Plant and Soil Sciences to be performing well in its three primary missions. The leadership of Dr. Pfeiffer has effectively enabled this program to maximize the effectiveness of its teaching, service, and research programs. Faculty indicated that they felt both engaged and informed and their overall focus was on furthering the aims of the department. While some areas for improvement were identified, most of these have already been discussed within the department.

The detailed report of the Committee follows, and is concluded with a list of key recommendations.

Description of Review Committee Membership and Process

Committee membership

Dr. David W. Horohov, Chair, UK Department of Veterinary Science
Dr. Ronald Turco, Purdue University
Dr. April Ulery, New Mexico State University
Dr. Alan Fryar, UK Department of Earth and Environmental Sciences
Dr. Jason Unrine, UK Department of Plant and Soil Sciences
Dr. Carrie Knott, UK Department of Plant and Soil Sciences
Ms. Yvonne Thompson, UK Department of Plant and Soil Sciences
Mr. Wes Morris, UK Department of Plant and Soil Sciences

Review process

- Organizing and planning for this 2017 periodic review began in fall 2016 with the department's advisory committee and the college's Office of the Assistant Dean for Academic Administration. The advisory committee recommended individuals to serve on the review committee. Following approval of the recommendations by Dean Nancy Cox, the Office of the Assistant Dean for Academic Administration composed the review

committee and invited the participants based on those recommendations. In the 2016 fall semester, nine listening sessions were scheduled, six for faculty and three for staff. Within the advisory committee, the initial discussions revolved around the big questions the faculty felt needed to be addressed to move the department forward. Those questions were discussed and refined at the January and May 2017 faculty meetings. Specific recommendations for quality enhancement were discussed and refined at the August 2017 staff and faculty meetings.

- The self-study document was developed by Todd Pfeiffer and the department's 2016-2017 Advisory Committee. Sub-groups contributed to different sections: Research – Rebecca McCulley, Chris Matocha, Jan Smalle, Hongyan Zhu; Instruction – Mark Coyne, Elisa D'Angelo, Art Hunt, Tim Phillips; Extension – Ray Smith, Brad Lee, Gregg Munshaw, Edwin Ritchey; Budget – Christine Tarne.
- The Review Committee met in Lexington from September 24-26, 2017. The committee met with the current PSS chair, Dr. Pfeiffer, the evening of September 24. The committee also met separately with incoming chair Dr. McCulley on September 26.
- The committee met with College of Agriculture, Food and Environment Dean Nancy Cox and Assistant Dean for Academic Administration Lisa Collins on the morning of September 25 to receive their charge and to review the rules and procedures.
- Then, the committee met with the Associate Deans of the College of Agriculture, Food and Environment.
- The committee was then taken on a tour of the research farm, after which, the committee had lunch with staff at the farm.
- The committee then returned to campus to conduct two working days of interviews, from which the department chair was excluded. All groups had been previously scheduled and personally invited to the interviews, which they attended (or not) voluntarily. Groups interviewed were:
    - Farm Staff (lunch after farm tour)
    - Graduate Students and Postdocs
    - Directors of Undergraduate and Graduate Studies and Academic Coordinators for interdepartmental programs
    - Assistant Professors
    - Constituents and Stakeholders (dinner)
    - College Philanthropy Officer (Marci Hicks)
    - Associate and Full Professors
    - Departmental Staff
    - Departmental Advisory Committee
    - Princeton and Grain and Forage Center Directors (in person) and faculty (via Skype)
- Afterwards, the committee met to formulate the preliminary oral report and recommendations.

- The committee then met with the CAFE Dean and Executive Council to provide and discuss the preliminary oral report and recommendations.
- The Committee Chair drafted this report, based on committee input during the site visit, and the report was finalized following e-mail consultations with all committee members.

Brief Statements on Evaluation of Quality and Productivity

Strengths

The PSS Review Committee concluded that the program has considerable strengths, of which the following are examples:

1. The department has experienced considerable success in its extension programs. This was demonstrated both by the attainment of significant financial support provided by various commodity groups and the very positive feedback obtained from county agents during the review.
2. The research programs of the faculty are relevant to the agricultural industry of this state and nationally. Again, this is reflected in the support garnered from commodity groups within the state and faculty competitiveness for other Federal funds.
3. The research productivity of the faculty is high. Publication numbers and active grants by faculty typically lead the college. Faculty also participate in national and international professional society meetings, which contributes to the quality of their graduate program.
4. The sources of funding obtained by the faculty is quite diverse. As noted above, this includes obtaining funding from federal, state and industry sources.
5. The research focus of the department is also quite diverse. Overall faculty research interests can be divided into three broad categories; Crop Science, Soil Science and Plant Biology. While this diversity of research can be considered a strength of the program, it also has its limitations, as noted below in the Challenges section.
6. The department makes multiple and significant contributions to the teaching mission of the college. Here, too, the contributions of the department are quite diverse. As detailed below, this is not without its challenges.
7. The department also shows creativity in its approach to graduate student training. The committee was particularly impressed with the program to send graduate students on trips to various companies engaged in agribusiness. This effort to provide added diversification of the career opportunities for students is highly commendable.
8. The organizational structure and participation of faculty in program governance are commendable given the size and diversity of the department. The faculty are able to contribute to discussions regarding concerns about the curriculum and research programs. While some additional improvement areas were identified, the efforts of the chair and the advisory group in providing leadership were widely appreciated. In general, the department exhibits a high degree of collegiality, especially amongst faculty within different title series.

9. The distribution of faculty amongst the ranks and the process for the recruitment of new faculty were also deemed strengths of the department and speak well of its ability to continue with this tradition of excellence into the future.

Challenges

The PSS faces a number of challenges as well, of which the following are particularly important:

1. The undergraduate HPLS program is in need of revision. As documented in the departmental self-study and expressed repeatedly during the interview process, the HPLS program is facing a number of serious issues. It appears unlikely that the major will ever achieve the enrollment goals the department has set. This appears to be due to an overall decline in the number of high-school students with an interest in production agriculture and a disadvantage in cost and location relative to regional universities. Concerns were also expressed regarding the integration of this program with that of the Horticulture Department in terms of curriculum structure and course content. As such, there is a clear need to develop a new vision for this undergraduate program. Rather than investing more effort (and money) into recruiting, a re-evaluation and possible re-direction of the degree program is needed. This would entail reconsidering current structure and alliances and the possibility of developing alternative approaches.

2. While there are many collaborative efforts in the department, several of the faculty indicated that large scale collaboration to address big picture issues was lacking. This could be related to a failure to connect the diverse interests of the faculty, the organizational culture of the department, and the infrastructure issues outlined above. The diversity of the faculty is actually a strength when addressing the complex agricultural and environmental issues. Sub-optimal collaboration represents a missed opportunity for the department.

3. There appears to be a pressing need to develop a strategy for the management of farm resources. Specific concerns were expressed regarding access to field equipment and plots. While there appears to be a system for the allocation of farm resources in place, this information is not readily available to newer faculty. Since a repeated theme during the interviews and within the self-study document was the goal of developing a culture of collaboration, farm resource management is probably a good place to start this effort.

4. One area that concerned the committee was the current strategy employed for providing start-up packages for new faculty hires. Currently, the department appears reliant upon salary savings generated from open positions. This is a somewhat self-defeating strategy as it sacrifices positions in order to have funds available for other purposes. As it is uncertain how much longer this particular strategy might remain viable at the university level, some consideration should be given to developing alternative approaches. As noted below, this could be a target for future philanthropic efforts.

5. While the graduate students were overall very positive about their experiences, there was vocal dissent regarding the name of the degree program, Integrated Plant and Soil Sciences. Their major complaints were that the name itself does not adequately represent

their individual programs, and that the program is not truly integrated. This latter comment reflects similar concerns regarding the overall integration of the different research groups within the department. Some thought should be given to finding ways to address this overall concern so that the IPSS name will be more meaningful.

6. There was general concern regarding facilities and infrastructure. Repeated reference was made to the inadequacy of laboratory space and suboptimal environmental conditions, particularly in Ag North. While some improvements have been made to modernize lab facilities for teaching, additional work is needed. Repeated comments were made regarding the physical separation of the faculty into three different buildings. This situation is less conducive to spontaneous opportunities for collaboration. As this situation is unlikely to improve within the timeframe of the next review period, we have not added it to the list of recommendations, but we do recognize the significance of this complaint and hope the college will work with the department to improve the situation wherever possible. One possible opportunity discussed was the development of meeting facilities at the farm. The possibility of partnering with other programs in the development of this capability should be considered.

7. A need for staff mentoring and professional development opportunities within the department was identified. Likewise, recognition of individual staff effort was considered insufficient. The department is encouraged to find ways to provide these opportunities as these are also goals of the college's strategic plan.

8. There was concern over the large number of committees in the department, many of which rarely meet. Also, the assistant professors seemed to lack an understanding of the committee structure of the department and the process by which departmental decisions are made.

Recommendations

The Review Committee recommends the following:

1. Develop an overall vision and direction for the HPLS undergraduate degree considering future opportunities that will allow the department to compete successfully for potential students. Plan to engage stakeholders in this process.

2. Explore ways to enhance scientific collaboration and transformative ideas by facilitating faculty interactions, particularly with extension faculty and new faculty hires.

3. Construct a management plan and process for North Farm operations that will allow all faculty to have access to plots, equipment and personnel.

4. Devise a departmental strategy for providing all staff with the opportunity for professional development, including participation in scientific meetings where appropriate.

5. Explore opportunities for developing online courses for Extension Agents interested in pursuing master's degrees.

6. Evaluate departmental committee structure and improve procedural transparency.

7. Continue to evaluate space and equipment needs for the program and develop a long-term strategy for improving these aspects of the program.

8. Work with the office of philanthropy and alumni to develop specific goals and objectives for future philanthropic efforts.

9. Consult with current and past graduate students on ways to improve the overall graduate student experience in the program.

Site-visit Agenda

University of Kentucky
College of Agriculture, Food and Environment

College of Agriculture, Food and Environment
Department of Plant and Soil Sciences
Periodic Program Review
Site Visit Agenda
September 24-26, 2017

Date:	September 24, 2017
Day 1:	Sunday

morning – 5:00pm	Reviewers external to UK travel to Lexington Dr. Ulery arrives at Bluegrass Airport at 4:00 pm. Designated local committee member transports Dr. Ulery to the Hilton hotel in downtown Lexington. Dr. Turco and Dr. Knott drive to Lexington and check in to the Hilton hotel downtown. Hilton Downtown, 369 West Vine Street
6:15 pm	Designated local committee member transports Drs. Ulery, Turco, and Knott from the Hilton hotel to Portofino restaurant at 249 E Main St.
6:30 – 8:00 pm	Review Committee has dinner and working session. Group is joined by Department Chair, Dr. Todd Pfeiffer. A local committee member returns Drs. Ulery, Turco, and Knott to the Hilton hotel.

Date:	September 25, 2017
Day 2:	Monday

7:00 – 8:00 am	Breakfast on own (external guests dine at Hilton and charge meal to room)
8:00 – 8:30 am	Local committee member transports external guests to campus, and drops them off at the E.S. Good Barn, Culton Suite.
8:30 – 9:30 am	Meet with College of Agriculture, Food and Environment Dean Nancy Cox and Assistant Dean for Academic Administration Lisa Collins in the Culton Suite. Committee receives their charge from Dean Cox and Dr. Collins reviews rules and procedures.
9:30 – 10:15 am	Meet with Associate Deans in the Culton Suite Dr. Rick Bennett, Research Dr. Larry Grabau, Instruction Dr. Gary Palmer, Extension Dr. Steve Workman, Administration
10:15 – 11:00 am	Break and transport committee by university bus to Spindletop farm
11:00 – 12:00 pm	Tour of Spindletop farm facilities with Dr. Pfeiffer
12:00 – 1:00 pm	Lunch and discussion with staff at farm stallion barn (Drs. Unrine and Knott recused)
1:00 – 1:45 pm	Break and transport committee to campus, E.S. Good Barn
1:45 – 2:30 pm	Discussion with graduate students and post docs in the Culton Suite or Weldon Suite depending upon number of RSVPs (Drs. Unrine and Knott recused)
2:30 – 3:15 pm	Discussion with DGS, DUSs, and academic coordinator in the Culton Suite
3:15 – 3:30 pm	Break
3:30 – 4:15 pm	Discussion with departmental faculty (assistant professors) in the Culton Suite
4:15 – 4:30 pm	Break
5:00 – 6:30 pm	Discussion with stakeholders and working dinner for all committee members at Bronte Bistro (restaurant inside Joseph Beth Booksellers at Lexington Green, 161 Lexington Green Circle, Lexington, KY 40503

Date:	September 26, 2017
Day 3:	Tuesday

7:00 – 8:00 am	Working breakfast with review committee, E.S. Good Barn, Culton Suite
8:00 – 9:00 am	Departmental facility tour
9:00 – 9:45 am	Discussion with departmental faculty, Weldon Suite
9:45 – 10:00 am	Break
10:00 – 10:45 am	Discussion with departmental staff, Weldon Suite (Drs. Unrine and Knott recused)
10:45 – 11:30 am	Discussion with departmental advisory committee, Weldon Suite
11:30 – 11:45 am	Break
11:45 – 12:45 pm	Lunch and discussion with Drs. Pfeiffer, Grove, and Lee about the UK Grain and Forage Center for Excellence, Weldon Suite
12:45 – 1:30 pm	Discussion with departmental faculty, Weldon Suite (Princeton campus faculty will join by video conference)
1:30 – 3:30 pm	Committee working session, Weldon Suite. Committee joined by Dr. Rebecca McCulley, incoming department chair, 1:45-2:15 pm.
3:30 – 4:30 pm	Committee presents preliminary findings to the Dean and Associate Deans of the College of Agriculture, Food and Environment, Weldon Suite
4:30 pm	Selected local committee member transports external guests to Hilton downtown • Dr. Ulery departs at Bluegrass Airport at 8:17 am on Wednesday September 27. • Dr. Turco travels his in personal vehicle

UK Program Review Implementation Plan

*This **required** form is described as Appendix A in AR II-I.0.6.*

College/Unit: Department of Plant and Soil Sciences **Date:** 4/30/2018

Recommendation/ Suggestion	Source I/E/H*	Accept/ Reject**	Unit Response (resulting goal or objective)	Actions (including needed resources)	Time Line
1. Develop an overall vision and direction for the HPLS undergraduate degree considering future opportunities that will allow the department to compete successfully for potential students. Plan to engage stakeholders in this process.	E	A	Developing an overall vision for our existing undergraduate degree program, and also thinking strategically and creatively about new offerings and partnerships with other units, will help us recruit and educate the next generation of plant and soil scientists.	The department will officially withdraw from HPLS, allowing us to think more broadly and creatively about possibly re-envisioning Modern Agronomic Crop Production (an individualized curriculum) and exploring the opportunity to create new curricula with other units on campus. During this planning process, the Undergraduate Curriculum Committee will engage stakeholders (extension agents, industry partners, entities on campus, and community members) in identifying educational needs and deficits.	1 year
2. Explore ways to enhance scientific collaboration and transformative ideas by facilitating faculty interactions, particularly with extension faculty and new faculty hires.	E	A	Stimulating scientific collaboration amongst us will likely lead to the development of new research thrusts, proposals, funding, and graduate training opportunities.	The chair will hold a departmental retreat with the goal of increasing our interactions and knowledge of each other's scientific interests and expertise. The department will host faculty and staff farm tours (both North farm and Princeton). The Chair and faculty will initiate working groups to brainstorm and pursue new research initiatives.	1 year & long term
3. Construct a management plan and process for North Farm operations that will allow all faculty to have access to plots, equipment, and personnel.	E	A	Clarifying workflows, access protocols, and accountability standards on the North Farm will improve function, efficiency, and the work environment for all of us.	The chair will create a committee, comprised of relevant faculty and staff, to compare our current operational and management systems with those employed by other similar institutional farms. This committee will identify desired and potentially realistic changes for the farm. The committee will generate a list of recommendations that we can use to implement changes as possible moving forward.	long term

4. Devise a departmental strategy for providing all staff with the opportunity for professional development, including participation in scientific meetings where appropriate.	E	A	Providing continued learning and professional development for our staff strengthens technical capacity of our unit.	Faculty will encourage staff members to apply for the new CAFE funding set aside for this purpose, and the chair will allocate department funds to support such requests. The chair will encourage faculty to support staff travel to appropriate meetings and trainings whenever possible.	long term
5. Explore opportunities for developing online courses for Extension Agents interested in pursuing master's degrees.	E	A	Developing online courses will fill a need of extension agents, strengthen our teaching and extension programs, and potentially lead to new collaborations.	Faculty will participate in the larger CAFE discussion on this topic being initiated by Dr. Grabau. Individual faculty will explore online course development (for undergrad and masters programs).	long term
6. Evaluate departmental committee structure and improve procedural transparency.	E	A	Refreshing our departmental committee structures may stimulate new collaboration and ideas. Improving procedural transparency increases trust and reinforces the importance of shared governance.	The chair and faculty will re-evaluate our current committee structure and discuss whether and what changes need to be made. The chair will strive to clarify and make procedures more transparent.	1-year & long term
7. Continue to evaluate space and equipment needs for the program and develop a long-term strategy for improving these aspects of the program.	E	A	Programmatic and departmental needs change over time, requiring reassessment of space and equipment usage and needs. Having a strategy and priority scheme for such changes will better prepare us for possible opportunity in the future.	The Chair and faculty will have on-going discussions about space and equipment needs and opportunities, and brainstorm possible short-term and long-term solutions. We will routinely prioritize needs and submit proposals when possible.	long term
8. Work with the Office of Philanthropy and Alumni to develop specific goals and objectives for future philanthropic efforts.	E	A	Donations are an important source of revenue and might help alleviate or rectify some of the infrastructure and programmatic challenges identified previously.	The chair and faculty will work with the Office of Philanthropy & Alumni to identify goals and objectives for the future.	long term

9. Consult with current and past graduate students on ways to improve the overall graduate student experience in the program.	E	A	Having a vibrant, engaging graduate program will help us recruit high quality students and create a more rewarding educational experience for them and for the involved faculty.	The chair will discuss this recommendation with the current graduate students and faculty involved in graduate student education and conduct an in depth review of the IPSS program. Should necessary changes be identified, the chair and Director of Graduate Studies will work to incorporate them into our graduate program.	1-year & long term

* **Source of Recommendation (I = Internal recommendation; E = External Review Committee recommendation; H = Unit Head recommendation)**

** **Accept/Reject Recommendation (A=Accept; R=Reject)**

Unit Head Signature: Rebecca L McCally **Date:** 07 March 2018

Unit Head Supervisor Signature: Nancy M. Cox 4/30/2018