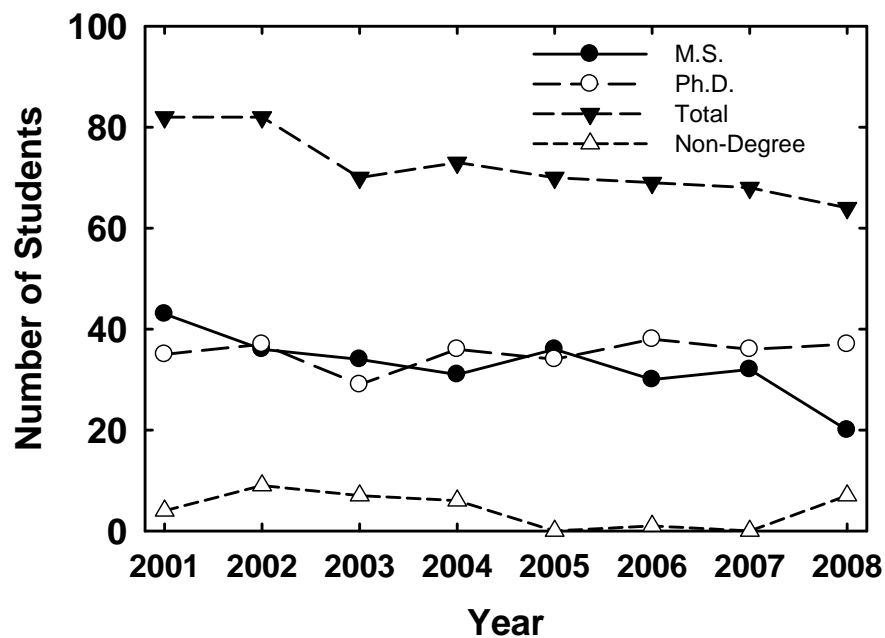


Graduate Education

A. Graduate student overview

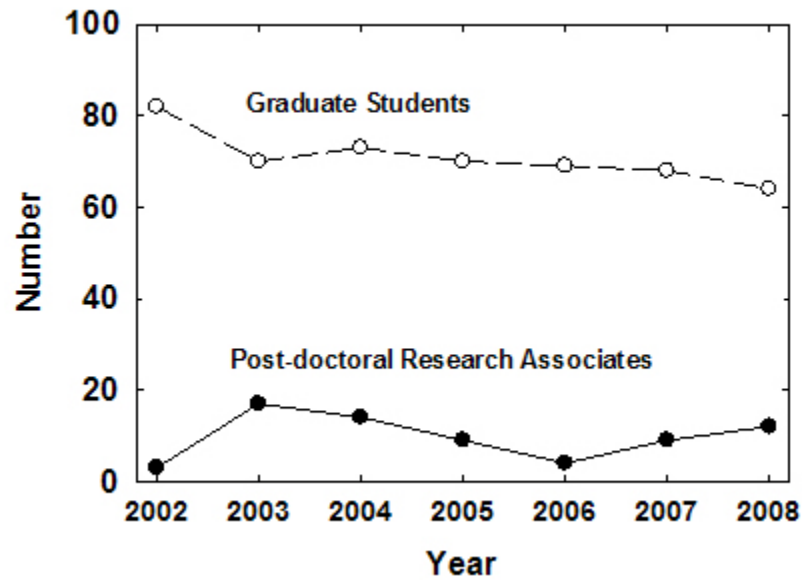
The Department of Agronomy offers M.S. and Ph. D degrees in several areas of crop and soil science, and until recently, student participation has been evenly split between the two degree programs (Figure 3.4). Non-degree student numbers (those awaiting admission because of conditions placed upon them by the Graduate School) also are shown. Total student numbers have declined from 82 in 2001 to 64 in 2008. The number of Ph.D. students has remained relatively constant, whereas the number of M.S. students has declined gradually over time.

Figure 3.4. Trends in the total number of graduate students, and those enrolled in Ph.D., M.S., and non-degree programs in the Department of Agronomy at Purdue University.



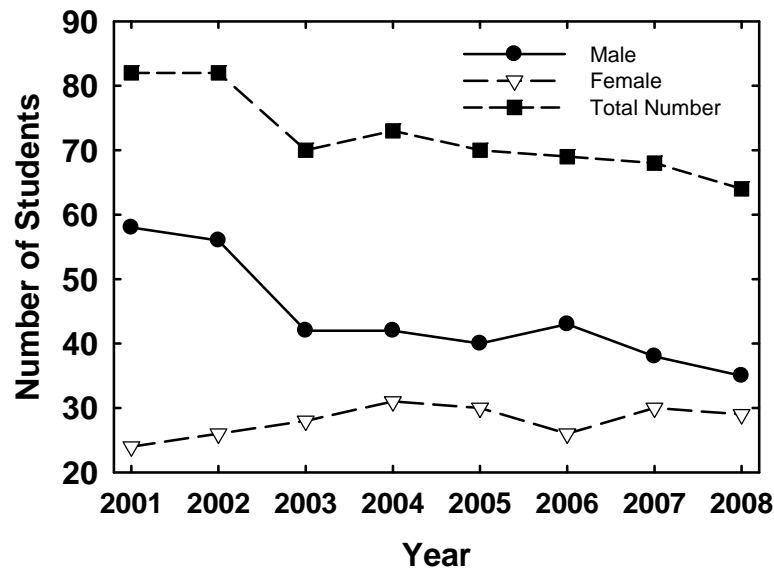
The decline in graduate student numbers has been offset somewhat by increases in the number of post-doctoral research associates (Figure 3.5). Between 2002 and 2008, the number of post-docs has ranged from 3 to 17, with an average of 10 in the department.

Figure 3.5. Trends in the total number of graduate students, and post-doctoral research associates in the Department of Agronomy at Purdue University.



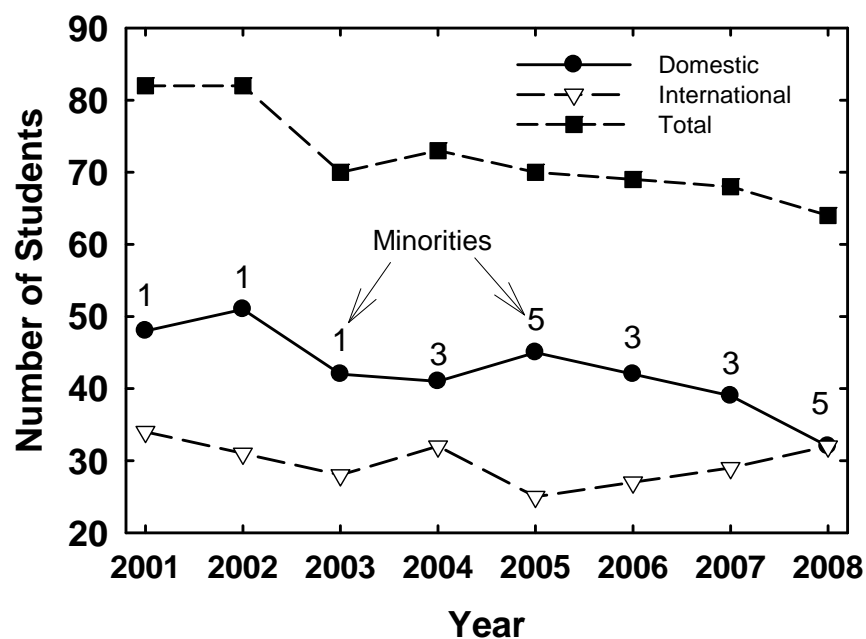
The distribution of graduate students by gender has changed between 2001 and 2008 with an increase in frequency of female graduate students and a concomitant decline in the number of male graduate students (Figure 3.6). In 2008, male graduate students only slightly outnumbered female graduate students (35 men to 29 women).

Figure 3.6. Trends in the total number of graduate students, and distribution of students by gender in the Department of Agronomy at Purdue University.



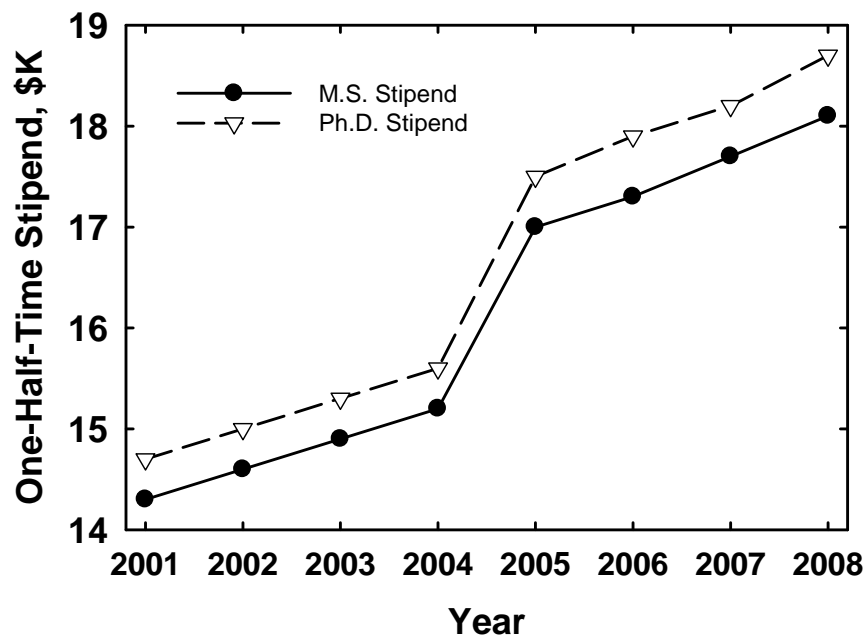
The ratio of domestic to international students declined between 2001 and 2008 such that we now have equal numbers of students from the US and abroad (Figure 3.7). This is an outcome of a reduction in numbers of domestic students rather than an increase in numbers of student from abroad. One stated goal of our 2002 CSREES review was to increase the number of under-represented minorities in our graduate programs. This effort has met with some success. The number of minority students has increased from one in 2001 to an average of four from 2005 to 2008. However, minority students still remain less than 10 percent of our graduate student population.

Figure 3.7. Trends in the total number of graduate students, and distribution of students by origin in the Department of Agronomy at Purdue University. In addition, the number of students classified as under-represented racial minorities is indicated numerically for each year above the data points for domestic students.



Another goal of the 2002 CSREES Review was to increase student stipends. In 2005, stipends were increased approximately \$2,000 in a one-time effort to raise our stipends to the upper 25 percent of those offered by our peer institutions (Figure 3.8). Thus, since 2001 stipends have increased from approximately \$14,500 to approximately \$18,500; an increase of nearly 30 percent. These represent the minimum stipends that must be paid to half-time graduate assistants. Faculty are free to increase stipends above these minimum values as their resources permit.

Figure 3.8. Trends in stipends for M.S. and Ph.D. students in the Department of Agronomy at Purdue University. A one-time increase in 2005 occurred in an effort to make student compensation competitive with peer institutions.



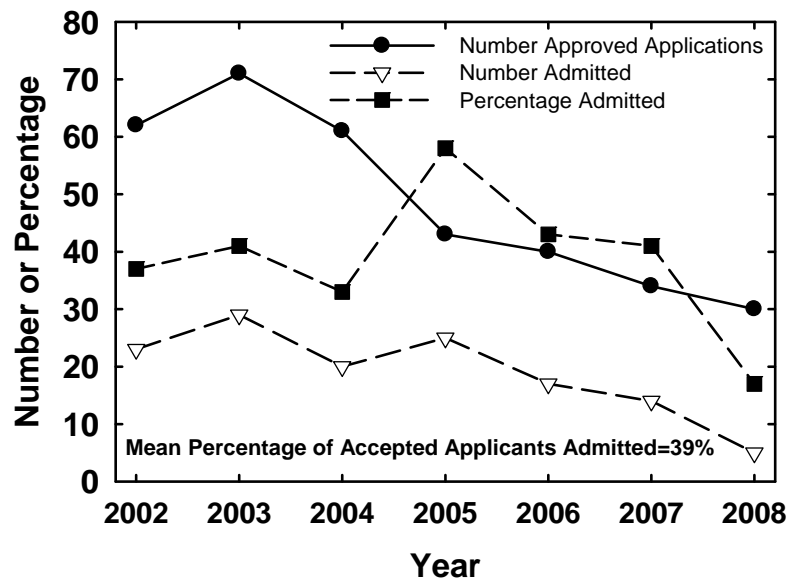
In addition to graduate research assistantships, approximately 4.5 FTE of teaching assistants are used to support graduate students each semester. These TAs generally support the teaching efforts of courses with laboratories or large lecture sections. In addition to assisting with instruction, students improve their teaching skills and portfolio. Over the last two years they have been involved in the following courses:

Table 3.8. Courses TAs are involved with.

AGRY Course	Instructor	TA effort, FTE	Responsibilities
105 Crop Production	Snyder	1/2	Teach lab
210 Turfgrass Culture	Bigelow	1/2	Ass. lecture/ teach lab
255 Soil Science	Van Scoyoc, Graveel	1	Teach lab., Soils Ctr.
305 Seed Analysis	Housley	1/4	Lab setup, grading
320 Genetics	Weil, Szymanski,	1/2	Grading, help sessions
321 Genetics Lab	Koliantz	1/2	Teach lab., grading
365 Soil Fertility	Van Scoyoc, Joern	1/2	Teach lab., lab. set-up
385 Env. Soil Chem.	L. Lee	1/4	Lab. Set-up, Asst. lab.
465/560 Soil Physics	Kladivko	1/4	Teach lab., grading
510/110/310 Turf	Bigelow	1/2	Teach lab., grading
545 Remote Sensing	Crawford	1/2	Teach lab
565 Soil Classific.	Schulze	1/4	Prep lab., Asst. trips
650 Clay Minerology	Schulze	1/4	Asst. lab.

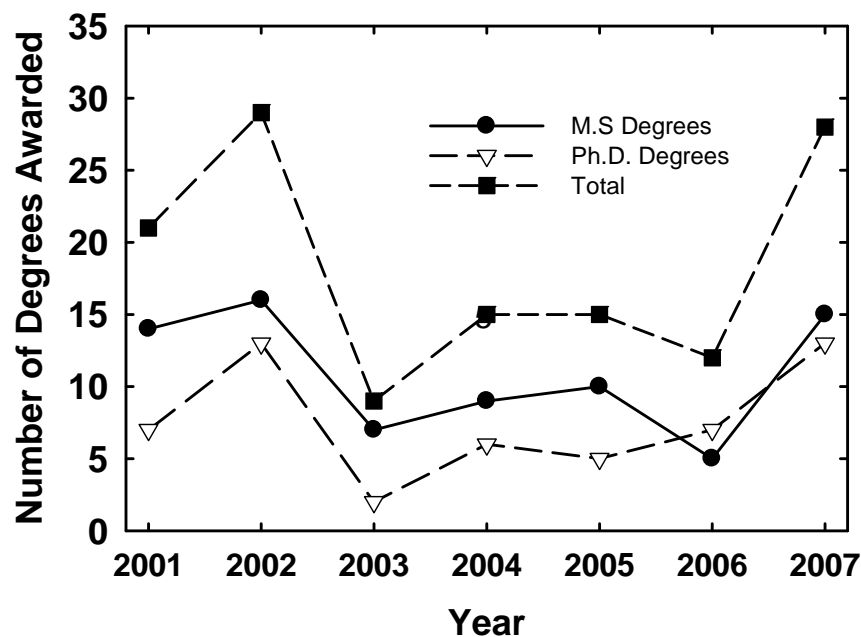
The number of approved applications for graduate study in the Department of Agronomy at Purdue has declined between 2003 and 2008 (Figure 3.9). In 2003, more than 70 students applied for graduate studies in our department and were approved, but by 2008 this number had declined to 30.

Figure 3.9. Trends in approved applications, admissions, and the percentage of approved applications that are admitted in the Department of Agronomy at Purdue University.



The numbers for accepted applications is a relatively accurate estimate of application numbers per year since nearly all applications are accepted or conditionally accepted. The number of admitted students likewise has declined from nearly 30 in 2003 to an all-time low of four in 2008. The low admission values for 2006 to 2008, coupled with relatively unchanged graduation rates each of these years (Figure 3.10), has resulted in the recent decline in graduate student numbers (Figure 3.7). As a result of having fewer students entering the graduate program in recent years, we anticipate a decline in the number of graduate degrees awarded in the coming years. The percentage of approved applicants that are admitted has remained relatively constant (Figure 3.9, approximately 40 percent). The primary reason for approved applicants not being admitted into a program is lack of funding.

Figure 3.10. Trends in total awarded graduate degrees and by M.S. and Ph.D. degree program in the Department of Agronomy at Purdue University.



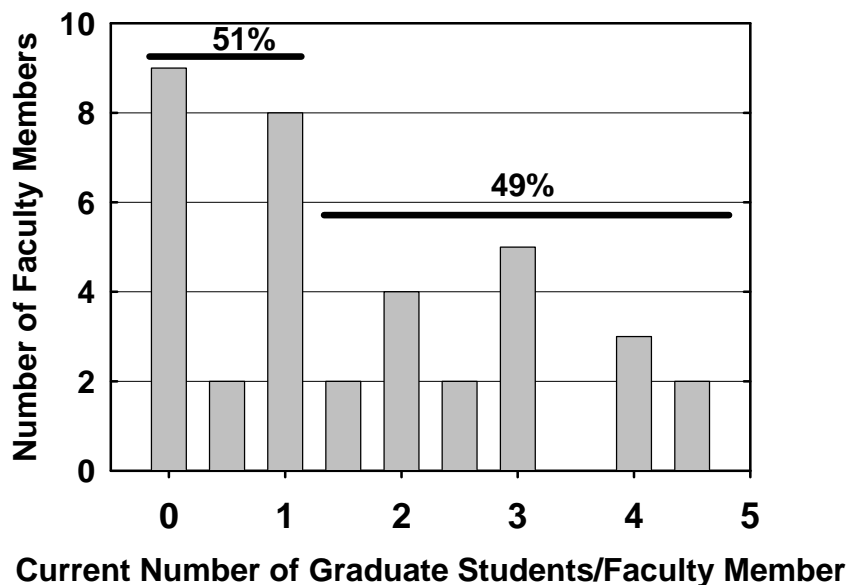
Student satisfaction with the graduate program remains high. A summary of responses to an exit survey conducted with 73 students between June 2001 and October 2008 is provided in Appendix J.1. Students agree (A) or strongly agree (SA) with the majority of questions indicating high levels of satisfaction. Neutral responses (U) or a level of dissatisfaction (D) was noted with certain themes, and in particular career counseling and job seeking skills (Questions D, G, and T). When asked open-ended questions regarding strengths of the graduate program, students often cited the competency/professionalism of their advisor and the quality of instruction in courses. When asked open-ended questions regarding the weaknesses of the graduate program students routinely cited the

need for graduate-level coursework (including physiology, cropping systems, soil fertility, statistics, writing) and the need for greater interaction among research programs. Student concerns regarding limited availability of upper-division graduate courses reflect the sporadic nature of teaching that occurs in the 600-level courses offered by the department (summarized in Appendix J.2). Several courses (AGRY 605, 635, 649, 650, 655) have been successfully offered with some regularity between 2002 and 2007. However, even though they are listed as part of the departmental curriculum most 600-level courses have not been offered or have rarely convened.

B. Faculty overview

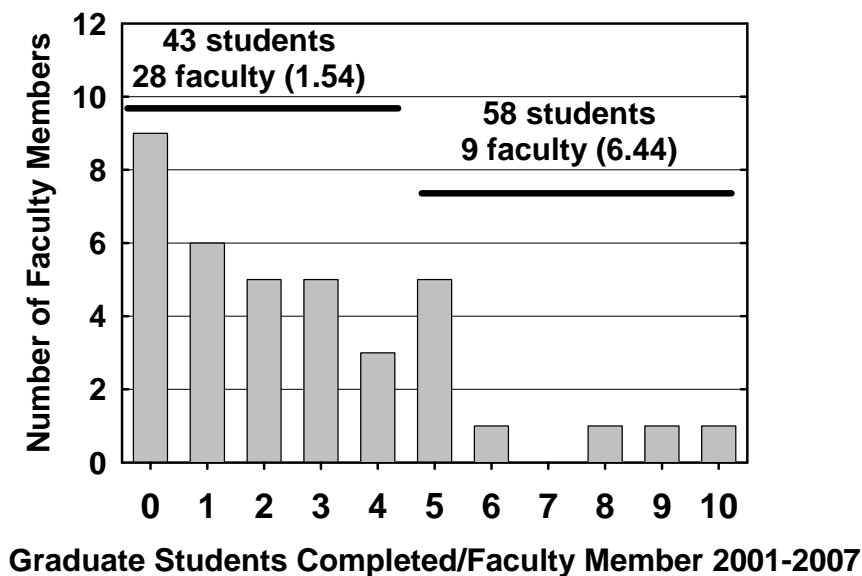
As noted in the CSREES review in 2002, faculty participation in the graduate education program remains uneven. At the current time there is a nearly even split between faculty with one graduate student or less, and those faculty mentoring 1.5 graduate students or more (Figure 3.11).

Figure 3.11. The number of graduate students per faculty member currently in the department. Adjunct faculty (i.e., USDA) and faculty with primary appointments in other departments (i.e., EAS, CIVL) are not included in these data. Co-advising results in partial student numbers assigned to more than one faculty member.



These data suggest that the uneven distribution of effort into graduate education persists in 2008. Determining the numbering of graduate students completed by each faculty agrees with this assessment (Figure 3.12).

Figure 3.12. The number of graduate students completed per faculty member between 2001 and 2007. Adjunct faculty (i.e., USDA) and faculty with primary appointments in other departments (i.e., EAS, CIVL) are not included in these data.



Of the 101 graduate students who completed degrees between 2001 and 2007, nine faculty accounted for 58 students (an average of 6.44 students per faculty member during this time); while the other 28 faculty mentored 43 students to the completion of their degrees during this time (average of 1.54 students per faculty member during this time). Nine faculty did not complete a graduate student during this time interval. However, this includes several recent hires where completing a student was not possible because of time constraints.

C. Program development

Several new graduate program initiatives have been completed since the 2002 CSREES review. The first of these is the creation of an “Integrated BS/MS Program (below).

1. The integrated BS/MS program in the College of Agriculture

- a. **Scope and intent:** The College of Agriculture offers an integrated degree program that will enable outstanding undergraduates to obtain a BS and an MS (thesis) after the successful completion of both degree requirements. The program is designed for outstanding

students who wish to expedite their education in agriculture beyond the undergraduate level. It is designed to meet the educational and professional needs of highly capable and very motivated students. Only Purdue University undergraduate students qualify for the Integrated BS/MS Program.

- b. **Overview:** The entry point into the Integrated BS/MS Program is the second semester of the junior year. Students will be permitted to earn up to nine credits in graduate-level (500- or 600-level) courses during their senior year after being admitted to graduate school that may be included for both the BS degree and the MS plan of study (as per Section IF3 of the revised Policies and Procedures Handbook of the Purdue University Graduate School). Courses which are *required* within the plan of study for the BS degree program cannot be used towards the MS degree. The BS degree will be awarded after the successful completion of the credit hour requirements for this degree in the student's specific BS degree program. After completing the BS degree, students will continue their research and take the remaining coursework on their MS plan of study necessary to meet the 30 credit hour minimum required by the Graduate School for the MS degree. A student may be allowed to advance and expand on the same research area for their undergraduate honors and MS programs. Students are eligible for assistantship and fellowship support after admission to the Graduate School.
- c. **Admission procedure:** Students desiring admission should apply to the Department's Graduate Committee as early as their junior year (Semester 5). The Committee will consider the following criteria for admission into the Integrated BS/MS Program:
 - i. the student's undergraduate GPA (60 or more credits; minimum GPA of 3.5 at the time of enrollment)
 - ii. a formal statement of interest
 - iii. a nomination letter from a faculty member
 - iv. three letters of recommendation
 - v. other criteria as determined by the department

The Department Graduate Committee will extend offers of admission to qualified students before the end of the semester during which they applied. All students are assigned or will select a faculty mentor/advisor upon entering the program. By the end of their first semester in the program, students will constitute their MS committee, and working with their committee, will file an approved "Plan of Study." It is expected that this committee will assist the student in the design and execution of their research that should begin in earnest no later

than the summer after their first semester in the program, typically between the junior and senior years.

2. Ph.D. course and competency requirements

Another initiative that is under way is a modification of the Ph.D. degree requirement to make it competency-based, and reduced the course credit hour requirement. The current state of this effort is summarized below:

- a. The faculty in each of the four disciplinary areas (Earth Systems Science, Cropping Systems, Soil Science, Plant Breeding and Genetics) have identified four or more specialization areas representing those disciplines. Within each specialization area, faculty have articulated expected competencies as well as suggested courses that students should consider to gain expected levels of competency in each area.
- b. There will be a department core in which 12 hours of course credit will be required of all our Ph.D. students. The credit hours will come from the following:

Statistics	6 cr
Ethics	1 cr
Seminar	2 cr
Broadening course*	3 cr

*The broadening course will be selected from courses outside the respective discipline area of the student. *A course taken prior to the PhD can fulfill the broadening requirement if taken for graduate credit.* A list of suggested broadening courses will be developed by the faculty in the respective disciplines and approved by the curriculum committee. *In addition to the above departmental core credit hours, the curriculum committee will recommend to the faculty a procedure for a no-credit requirement for student participation in departmental seminars.*

- c. The student will be required to take a minimum of 18 additional hours of course credit, *consistent with graduate school policy*, beyond the departmental core requirement of 12 hours to satisfy the 30 credit hour requirement for a PhD. *Independent study courses cannot be used to satisfy the 30 credit hour requirement.*
- d. Students will select at least three areas of specialization (in a manner consistent with the guidelines of their chosen discipline area) in which they will demonstrate competency during the preliminary exam.

- e. At least two of these areas of specialization will come from within the student's discipline area.
- f. The preliminary written and oral exam will be conducted by a preliminary exam committee appointed by the departmental examining oversight committee *and with input from the research advisory committee.*
- g. The graduate student prelim exam committee will be composed of at least four faculty with expertise relating to the specialization areas in which the student is to be tested. Normally, no more than two (for students being tested in three specialization areas) or three (for students being tested in four specialization areas) exam committee members will be from the student's advisory committee. At least one of the faculty members on the prelim exam committee for each student will be from outside the student's advisory committee.
- h. The departmental examining oversight committee will select the chair of the student's prelim exam committee with input from members of the prelim exam committee. *The student's academic advisor cannot serve as chair of the preliminary exam committee.*
- i. The chair of the prelim exam committee will convene the committee prior to the written exam to develop a collective approach to the written prelim exam. Following completion of the written exam, the chair of the prelim exam committee will reconvene the committee to discuss the student's performance and to develop a collective approach to the prelim oral exam. *The chair of the preliminary exam committee will communicate the committee assessment of performance to the student and his/her academic advisor prior to the oral exam. Areas of strength and weakness will be discussed.*
- j. At least three members of the prelim exam committee will develop examination questions that evaluate competencies in the student's areas of specialization.
- k. The written and oral prelim exams will be evaluated based upon criteria established by the graduate faculty in the department *and in the graduate school* and implemented by the oversight examining committee. Rubrics established by the Department will be used as part of the evaluation process.
- l. After the prelim written and oral exam, the prelim exam committee chair will schedule a meeting with the student's *advisory committee* to inform and discuss the *preliminary exam* committee's observations

of strengths and weaknesses of the student, and minimally, their justification if the student did not pass the exam.

- m. The graduate student will write a research proposal and present the proposal as a seminar to his/her advisory committee. The timing of the presentation is independent of the preliminary exam but should be conducted within the *first three academic semesters* of a student's program.
- n. The research proposal will be evaluated according to a rubric established by the department and will be expected to meet established departmental standards.
- o. The research proposal seminar is open to all faculty and graduate students.

Definitions:

Discipline area: One of 4 areas of expertise in the graduate program in Agronomy at Purdue. Discipline areas include: Earth Systems Science, Plant Breeding and Genetics, Soil Science, and Cropping Systems.

Specialization area: An area of focus in research and education within a discipline area. Students are expected to gain a high level of understanding and competency in 3 or more specialization areas.

Departmental core: Course requirements for all students in the Ph.D. program in Agronomy.

Discipline core: Courses recommended within a discipline area by the respective faculty to obtain competency in an area of specialization.

Broadening course: A course taken for graduate credit that is outside a student's chosen discipline area and is intended to provide breadth to a student's knowledge base.

Prelim exam: A written and oral examination developed by a prelim exam committee and passed by a PhD student no later than 1 year prior to completion of all Ph.D. requirements.

Prelim exam committee: A committee composed of at least 4 faculty, 1 of which must be outside the student's advisory committee, who are responsible for writing, administering, grading, and assessing a student's competency level in 3 or more areas of specialization.

Advisory committee: A committee of 4 or more faculty providing advice and counsel on the research and plan of study. The advisory committee will consist of four members for Ph.D. candidates with one member outside the Agronomy Department.

3. NRC Accreditation of graduate programs at Purdue University

In preparation for the NRC Accreditation of Graduate Programs at Purdue University, faculty in the College of Agriculture and the Department of Agronomy have participated in creating Learning Outcomes-based M.S. and Ph.D. graduate programs. Five learning outcomes were identified and these included:

Graduate students in the Department of Agronomy at Purdue University will be able to demonstrate the ability to:

- a. Learning Outcome 1: To identify and conduct original research, scholarship, and creative endeavors.
- b. Learning Outcome 2: To effectively communicate in their field of study.
- c. Learning Outcome 3: To think critically, creatively, and to solve problems in their field of study.
- d. Learning Outcome 4: To conduct research in an ethical and responsible manner.
- e. Learning Outcome 5: To demonstrate attributes of professional development consistent with expectations within their field of study.

The Learning Outcomes and associated activities for the Ph.D. program in the Department of Agronomy were approved by the faculty in April 2008. The Learning outcomes and proposed activities associated with achieving these outcomes have been drafted and tentatively approved by the Graduate Committee in the Department of Agronomy. The Learning Outcomes and associated activities for the M.S. program have been drafted and are currently being evaluated by the faculty. Details of the mapping guides can be found in Appendices J.3 and J.4, respectively.

4. Recommendations and questions

We request that the review team consider the following issues that impact the scope and quality of the Graduate Program in the Department of Agronomy at Purdue University.

- a. ***Stated need for more graduate-level course work*** – With significant gaps in our curriculum identified by the graduate students, and with numerous 600-level courses on the books that remain untaught, there is an apparent need to evaluate our graduate course offerings. We

proposed that the faculty conduct a comprehensive review of the curriculum focused on 500- and 600-level course offerings to ensure advanced knowledge is readily available through coursework that meets the needs of graduate students. Coordination of this effort with a simultaneous review of the undergraduate courses (100- to 400-level) courses is recommended so educational objectives and content is provided in a seamless and logical manner.

- b. ***Uneven distribution of graduate advising amongst faculty*** - Several faculty are heavily involved in education of graduate students. However, there is a significant number of faculty who are not participating in graduate education. In order to grow our graduate program, and meet the high demand for our graduates, greater faculty involvement in graduate education is necessary. How do we engage more faculty in the education of graduate students?
- c. ***Declining graduate student enrollment*** - Funding is a clear limitation for most faculty wanting to mentor additional graduate students. Fee remissions and costs associated with graduate education have increased making cost of a graduate student on-par with that of a post-doc. What strategies should be used to increase the number and duration of fellowships and assistantships?