THE UNIVERSITY SYSTEM OF GEORGIA
NEW PROGRAM PROPOSAL

Institution: The University of Georgia

Date: November 7, 2006

School/College/Division/Institute: College of Agricultural and Environmental Sciences

Name of proposed program: Plant Breeding, Genetics & Genomics

Degree: Doctor of Philosophy

Major: Plant Breeding, Genetics & Genomics **CIP Code**

Starting Date: First semester after approval

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PROGRAM DESCRIPTION AND OBJECTIVES (2-page abstract):

Plant Breeding, Genetics, and Genomics (PBGG) is the science of creating new and improved plant varieties that are higher yielding, more disease resistant, more nutritious, or simply of greater ornamental value. As such, a national infrastructure in PBGG is considered essential to ensure food security and to limit the environmental damage caused by traditional agriculture. PBGG is considered now to be a National Area of Emphasis by the USDA.

The value of PBGG to the University of Georgia can be measured by the success of crop and ornamental varieties developed by PBGG faculty and licensed by the University of Georgia Research Foundation (UGARF), including turfgrasses, soybean, alfalfa and other forages, pearl millet, wheat, blueberry, canola, vegetables, muscadine, and numerous ornamental species. Royalties arising from plant varieties provided the University with approximately $3.5 million in FY'05. Royalty revenue in FY'06 exceeded $5 million. The total value of UGA-developed, UGARF-licensed plant varieties marketed in FY'06 approaches $100 million. *Royalties from plant varieties represent approximately two-thirds of the intellectual property income generated annually by UGA.*

Although UGA has more faculty and resources dedicated to PBGG than almost every other Land Grant university in the United States, it lacks a coherent PBGG program. Faculty are spread across three different campuses and different departments. As a result, PBGG faculty have not focused their student training efforts in a coordinated manner that would streamline the student-training process and achieve in-state, national, and international visibility as the premier plant breeding, genetics and genomics institution in the United States.

The objective of the proposed program is to create an interdisciplinary major in Plant Breeding, Genetics and Genomics, which will award a PhD degree. The program is interdisciplinary in the sense that its faculty specialize in different aspects of agriculture (e.g., horticulture or agronomy), and work on crops that have little to do with each other (e.g., turfgrass and peanut). Nevertheless, there are common underlying principles in genetics, breeding strategies, and research tools that are shared by all these faculty. The interdisciplinary approach proposed here, while training students with standard genetics principles and tools, should at the same time give students a much broader appreciation for the flexibility and broad range of applications these principles and tools permit.

Having such a degree would (1) coordinate the teaching and research efforts of faculty from three campuses and separate departments to make more efficient use of resources and promote synergistic interactions between faculty, and (2) raise the state-wide, national and international prominence of PBGG at UGA, resulting in the recruitment of exceptional students and in procurement of additional extramural funding.

At the national level, a shortage of students trained in PBGG has prompted the USDA to name PBGG as a "National Emphasis Area." At present, the number of job opportunities outstrips the number of graduates, and graduates command high starting salaries, even without additional postdoctoral training.

The PBGG degree will be administered as an interdisciplinary major. The participating faculty met several times to develop the curriculum and course of study, which was modeled after that at the University of Wisconsin, long considered one of the top programs in the country. The current course offerings were examined, and new courses created to fill in the gaps.

Courses were placed into "areas," from each of which students would select courses, resulting in a well-rounded program. During these meetings, the faculty also drafted and approved bylaws to govern the administration of the major. The curriculum and the administration details are described later in this proposal.

The development of this major would not require any new faculty to be hired above and beyond those already in place, and those whose hiring has already been projected before the inception of this program. Costs would be incurred to hire a program degree assistant, and provide administrative supplements to the program director and the graduate coordinator.

UGA has traditionally had numerous faculty in the PBGG area. During the last decade, the CAES expanded its research in plant breeding and genetics to include genomics and biotechnology. In cooperation with the Georgia Department of Agriculture and the Georgia Research Alliance, an Eminent Scholar in crop breeding and genomics was recruited. A highly productive, senior-level forage breeder has been employed. Efforts in the breeding of ornamental plants have expanded. An ornamental breeder holds the Dirr Professorship, and the Dooley Professorship in molecular breeding/genomics of horticultural crops has been created. The establishment of a named professorship or an eminent scholar position in turfgrass breeding and genetics is under negotiation with the turf industry. The broad diversity of plant breeding efforts and the expertise in crop genetics, genomics, and biotechnology provide a unique opportunity for the University to better serve the citizens of Georgia through the release of commercially successful varieties and to become an international leader for student training in plant breeding, biotechnology, and applied genomics. *In summary, the issue is not one of insufficient faculty—the issue is to implement a vehicle for the existing faculty to more effectively interact with each other and coordinate their efforts in student training.*

Because of its long history in PBGG, UGA's facilities are outstanding. Field and farm space is available at all three campuses and within the network of Experiment Stations throughout the state. State-of-the-art laboratory facilities exist at the NESPAL (National Environmentally Sound Production Agriculture Laboratory) on the Tifton Campus, and in the CAGT (Center for Applied Genetic Technologies) on the Athens campus. Additional faculty are housed in the Miller Plant Sciences Building on the Athens Campus and in the Redding building on the Griffin Campus. Adequate greenhouse and growth chamber space is available at all three campuses.

The graduate students enrolled in the participating departments already represent a diverse population. Creation of this new major will likely enhance enrollment of students from under-represented groups.

Based on the number of students currently being trained by the participating faculty, we anticipate awarding about 4-5 PhD degrees per year, meaning about 15 students would be enrolled at any given time. These numbers are expected to increase as faculty vacancies are filled and as the national prominence of the program becomes evident.

Students who successfully complete this program would receive a PhD degree in Plant Breeding, Genetics and Genomics from The University of Georgia.

JUSTIFICATION AND NEED FOR THE PROGRAM:

1. **The societal need for graduates prepared by this program.** The world population doubled in the past 40 years, and is projected to increase by 50% over the next 50 years. Agriculture has changed to keep up with the growth in population, and will need to continue to change over the next few decades to continue feeding the growing population. At the same time, agriculture must reduce its environmental footprint– crop production must use less petrochemical inputs and conserve soil and water resources. These past and future challenges to agriculture have been solved by a combination of management techniques and genetic modification of crop plants, collectively known as the Green Revolution. PBGG will remain as a central science to achieve future global food security.[1]

   Today, the sciences of genetics, genomics and biotechnology are being applied to modify crop plants more rapidly and precisely than in the past. New varieties of crop plants are released each year which are higher yielding, higher quality, more disease resistant, or more nutritious than their forebears. The demand for scientists capable of creating new plant varieties surpassed supply a few years ago. The most recent PhD graduates from UGA are now commanding starting salaries in the $80 to $90,000 range, and we get more requests from industry for graduates than we currently can train and supply.[2]

   The USDA has also acknowledged the shortage of students being trained in the PBGG discipline in the US, and has categorized PBGG as a "National Emphasis Area." The following is from their website at http://www.csrees.usda.gov/nea/plants/plants_all.html:

   > **Programs in the Plants, Plant Products National Emphasis Area include:**
   > *Plant Breeding, Genetics & Genomics*: For hundreds of years, traditional plant breeding has generated more productive and nutritious crop plants. Genetics and genomics are now improving the effectiveness and efficiency of plant breeding. The Plant Breeding, Genetics, & Genomics Program focuses on use of these approaches, tools, and resources to improve, protect, and sustain plants for agriculture and the environment.

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[1]Qaim M. 2006.) The role of plant breeding for global food security. *Berichte Uber Landwirtschaft* 84: 198-212.

[2]Morris M., G. Edmeades, and E. Pehu. 2006. Global need for plant breeding capacity: what roles for the public and private sectors? HortScience 41: 30-39.

2. **Demand for the program in the region served by the institution.** Based on the number of students currently being trained by the participating faculty, we anticipate awarding about 4-5 PhD degrees per year, which represents at least 15 students enrolled at any given time. Again, based on current enrollment, most of these students (~75%) are expected to have major professors in Crop and Soil Sciences, and the remainder in Horticulture.

   These numbers are expected to increase as faculty vacancies are filled and as the national prominence of the program becomes evident, and as extramural funding increases. Student demand is greater than the level of available funding for their training, and more students apply to our program than we can accept. Nevertheless, student demand at UGA is not as high as it is at other universities, such as Iowa State, Cornell, University of Wisconsin-Madison, University of Minnesota, and UC-Davis. UGA's lack of a specific major in this area, coupled with the decentralized nature of the available faculty and course work, serve as obstacles to student recruitment. Thus, this major would immediately raise UGA's national and international profile in this discipline, thereby attracting greater numbers of students, more highly qualified students, and the additional extramural funds necessary for their training.

3. **Additional reasons that make the program desirable.** The College of Agricultural and Environmental Sciences (CAES) has faculty with expertise in the various facets of Plant Breeding, Genetics, and Genomics (PBGG). Accordingly, it is not surprising the University of Georgia has conducted highly successful plant breeding programs for decades. Beginning with the development and release of Coastal Bermudagrass in the 1950's, the College of Agricultural and Environmental Sciences (CAES) has developed a world-wide reputation for breeding successful turfgrass varieties. These varieties presently have wide-spread usage on golf courses and athletic fields throughout the southeastern United States and in several foreign countries. More recently, peanut varieties developed on the Tifton Campus have dominated the peanut market in the Southeast. Other UGA plant breeding programs have developed successful varieties licensed by the University of Georgia Research Foundation (UGARF) including soybean, alfalfa and other forages, pearl millet, wheat, blueberry, canola, vegetables, muscadine, and numerous ornamental species. Royalties arising from plant varieties provided the University with approximately $3.5 million in FY'05. Royalty revenue in FY'06 exceeded $5 million. The total value of UGA-developed, UGARF-licensed plant varieties marketed in FY'06 approaches $100 million. Royalties from plant varieties represent approximately two-thirds of the intellectual property income generated annually by the University.

   Currently, there are 16 CAES faculty directly engaged in some aspect of PBGG. Additional faculty housed in Genetics and Plant Biology, who are expected to serve as adjunct members of the PBGG program, will further increase the number of faculty. During the last decade, the CAES has expanded its research in plant breeding and genetics to include genomics and biotechnology. In cooperation with the Georgia Department of Agriculture and the Georgia Research Alliance, an Eminent Scholar in crop breeding and genomics was recruited. A highly productive, senior-level forage breeder has been employed. Efforts in the breeding of

ornamental plants have expanded. An ornamental breeder holds the Dirr Professorship, and the Dooley Professorship has been created, which will have molecular breeding/genomics responsibilities. Discussions are ongoing regarding the establishment of a named professorship or an eminent scholar position in turfgrass breeding. *The net result is that in terms of numbers and national reputation of the faculty in PBGG, UGA is practically unrivaled in the United States*.

The expansion of the PBGG faculty and the broad diversity of plant breeding efforts provide a unique opportunity for UGA to better serve the citizens of Georgia through the release of commercially successful varieties and to become a national and international leader in plant breeding, biotechnology, and applied genomics. This expertise comprises a continuum from the most applied to the most basic research on plants of agricultural importance, and this continuum offers a sound basis for training graduate students in a way that is relevant to today's needs and challenges. Our current teaching programs have simply failed to adequately capitalize on our resources.

A mechanism is absent on campus to coordinate the diverse programs and expertise to maximize the educational and student-training programs. This problem is especially acute because the various faculty are housed at the three UGA campuses (Athens, Tifton, and Griffin) and are located in different departments. Accordingly, the goal of this proposal is an interdisciplinary major in PBGG that would make the maximum and most efficient use of our current resources by facilitating coordination and communication among the relevant faculty. Such an effort should consolidate and enhance UGA's national and international reputation in this field.

A major in PBGG is expected to serve as a focal point to increase coherence and cohesiveness across the Athens, Griffin and Tifton campuses. Firstly, it will provide opportunities for the Griffin and Tifton faculty to teach graduate students in Athens, and facilitate their access to graduate students. One novel course that will be implemented, the Plant Breeding Practicum, will actually ensure graduate students enrolled in the program actually visit each campus and get first-hand experience with the crops being bred on each campus. As specified in the bylaws (included later in this proposal), participating faculty from all three campuses will now have an opportunity to meet as a group on a regular basis.

4. **Reports of advisory committees and consultants.** The national shortage in the ability of US universities to train scientists with the ability to create new varieties of crop plants has been a matter of national concern for some time. Because of the importance to national food security, Iowa State University conducted the first National Plant Breeding Study in 1994. A follow-up study was conducted by other groups in 2001, and again in 2004. The results of these studies are posted at http://www.csrees.usda.gov/nea/plants/part/pbgg_part_study.html, and show a clear decline in resources allocated to PBGG across all Land Grant universities. In response, Michigan State University organized a workshop in 2005 [3] which further

[3]Gepts P., Hancock J. 2006. The future of plant breeding. *Crop Science* 46: 1630-1634.

analyzed the status of PBGG in the United States and outlined future training needs. A follow-up conference, titled "*Plant breeding: A vital capacity for U.S. national goals*" is being hosted in 2007 by North Carolina State University, in collaboration with Cooperative State Research, Education, and Extension Service (CSREES) branch of the USDA. A Plant Breeding Coordinating Committee was established to help coordinate national efforts in Plant Breeding. The full report is at http://cuke.hort.ncsu.edu/gpb/pr/pbccmain.html. The need to increase our ability to train graduate students in the field of PBGG has never been greater or more evident, and UGA has the resources to do so if these are organized properly. We are attaching letters from potential employers (Dr. John Soper, Pioneer-HiBred International and Dr. Glenn Bowers from Syngenta) and from Dr. Ann Marie Thro (USDA National Program Leader for Plant Breeding and Genetics) who were consulted during the process of developing this major.

Despite the decline of programs in Plant Breeding and related disciplines in the USA, Georgia is practically the only program that has experienced growth in terms of faculty who work in an area of PBGG. This was evident from the information provided at the meeting of the USDA-sponsored Plant Breeding Coordinating Committee this past February in North Carolina (http://cuke.hort.ncsu.edu/gpb/pr/pbccposters2007/pbccposters2007.html). Less than half of the Land Grant universities still had programs to report. Of those that did, Georgia's program was among the largest. Thus a well organized program at Georgia has the chance to grow and thrive as other programs disappear. Perhaps the strongest evidence we can provide is in the attached letter from Dr. John Soper from Monsanto—they have enough faith in the PBGG program at Georgia that they are committing two graduate assistantships to help support it.

5. **Public and private institutions in the state offering similar programs.** Due to the land and farm requirements to conduct training and research in PBGG, these programs are only offered by certain Land Grant universities. No other university in Georgia offers training in PBGG. The lack of plant breeding programs in the Southeast has been noted before[4]. This report highlighted North Carolina State University as the main program for plant breeding and associated disciplines in the Southeast. The fact that Georgia was not considered in this report illustrates what a low profile Georgia has, despite having resources comparable to those of NC State. Much more modest programs, lacking the comprehensive faculty at UGA, are at the Universities of Kentucky, Florida and Tennessee. Auburn and Clemson Universities have even smaller programs.

[4]Guner N. and T. C. Wehner. 2003. Survey of U.S. land-grant universities for training of plant breeding students. Crop Sci. 43: 1938-1944.

PROCEDURES USED TO DEVELOP THE PROGRAM

Most of the CAES faculty who actively conduct research and teaching in PBGG met in Macon, GA, on 16 November, 2005, and again on 27 June and 3 October, 2006. During these meetings, the faculty discussed the best way to meet the training and teaching needs of their graduate students.

The result of the discussions was agreement that creation of an interdisciplinary graduate major in Plant Breeding, Genetics and Genomics (PBGG) would be the best way forward. Not only would it focus student training, it would help provide a higher profile for our faculty both on and off campus. A higher profile would in turn help attract more resources and facilitate student recruitment.

Accordingly, two faculty committees were created—one developing bylaws that would guide the conduct of an interdisciplinary graduate degree program, and the other considered curriculum needs. We formulated a program whose bylaws are closely modeled after the interdisciplinary program in Toxicology at UGA, making changes to adapt them to the topic area and the departmental structure within CAES. In addition, the curriculum design borrowed heavily from similar programs in the USA, particularly the Plant Breeding and Plant Genetics Program at the University of Wisconsin-Madison, long considered one of the premier programs in the country. Because the Wisconsin program also has faculty and courses across multiple departments, it is readily adaptable to the situation at the UGA. Additional advice was obtained from seed companies who are major employers of our current graduates, and from the USDA.

During the consultation process with potential employers, these made it clear that they place a high value on professional development (leadership, teamwork, and communication skills) of graduate students, above and beyond their scientific and academic training. We therefore included a section on professional development to encourage students to consider taking courses which do not necessarily contribute to their scientific training, but do contribute to their professional development.

CURRICULUM

Proposed Course of Study for Interdisciplinary Graduate Degrees in Plant Breeding, Genetics, and Genomics

Background:

The first set of students are expected to transfer from either the PhD program in Agronomy or Horticulture. Both of these programs are very similar to most Agronomy or Horticulture majors across the country, in that students are usually expected to complete an MS degree before they can proceed to a PhD degree. Based on the experience at Georgia, approximately one-fourth of the students who obtain a masters do not go on for further study. The remainder continue on to a PhD, either at Georgia or elsewhere. Another common permutation is that students obtain their MS degree at another institution, and then come to Georgia to complete their PhD.

Note that the PhD program in Agronomy here at UGA has very few requirements beyond the hour requirements set by the Graduate School. At some point in their careers, one graduate-level course in statistics is required. In addition, PhD students must each take a 1-hour seminar course. Beyond that, all courses taken are entirely at the discretion of the graduate student and his/her committee, as long as they comply with Graduate School requirements.

The PhD program in Horticulture at UGA is slightly more stringent in terms of its requirements. It differs from its Agronomy counterpart in that a graduate-level chemistry/biochemistry course is also required, and all students are expected to acquire competence in general horticulture and are required to have satisfied proficiency course requirements, even for areas of horticulture irrelevant to PBGG.

The PBGG program will differ significantly from the current UGA Agronomy and Horticulture PhD programs in that it includes a core curriculum to better focus studies and ensure that students acquire the necessary depth of knowledge. While all graduates are expected to be proficient in plant breeding, all will want to emphasize a particular aspect (e.g., nutritional quality, disease resistance, stress resistance, etc.). Thus, the curriculum retains enough flexibility for students to emphasize a breeding aspect of interest.

Program Requirements:

This program will require students to do independent research leading to a dissertation, which must be successfully defended.

Relevant courses have been grouped into 5 different topics. Students must have at least one course from each of the 5 areas. Ultimately, the course of study for each student is determined by the student together with his/her major professor and committee, in keeping with both the standards set by the PBGG coordinating committee (see section on bylaws) and by the Graduate School.

For a Ph.D. degree in PBGG, a minimum of 30 semester hours of course work beyond the M.S. program are required, three hours of which are doctoral dissertation. Of these 30 hours, at least 16 hours must be from 8000- and 9000- level courses, with a minimum of 15 hours required from the Core Curriculum. All students will be expected to have taken an advanced plant breeding course (CRSS (HORT) 8xxx. Advanced Plant Breeding or equivalent; area 1), a course in plant genetics (PBIO 8100 or equivalent; area 2); one course from area 3; one 8000-level statistics course or equivalent (from area 4); and one biochemical/molecular genetics course (from area 5). Two hours of the research-based plant breeding seminar are also required. Students are required to give an exit seminar. Graduate School requirements govern residence, dissertation, examinations, and the composition of the graduate committee.

Existing courses have a course number associated with them. Those that are newly developed are indicated with a 6xxx or 8xxx number. An existing 3-hour course, CRSS 8870, Advanced Plant Genetics, which has not been taught in years due to its overlap with PBIO 8200, will be reconfigured as series of 1-credit-hour modules, numbered as CRSS 8870 through 8873.

1. Plant Breeding
CRSS 6xxx. Plant Breeding Practicum. 3 hours.
HORT 8102. Breeding Ornamental Plants. 1 hour.
CRSS (HORT) 8xxx. Advanced Plant Breeding. 3 hours.
CRSS(PBIO) 8870. Advanced Plant Genetics. 3 hours.
CRSS 8871. Association mapping and diversity analysis. 1 hour.
CRSS 8872. Genome analysis and comparative mapping. 1 hour.
CRSS 8873. Transgenic breeding. 1 hour.
CRSS 8880. Quantitative Aspects of Plant Breeding. 3 hours.

2. Genetics and Cytogenetics
PBIO 8100. Plant Genetics. 4 hours.
CRSS 8890. Plant Cytogenetics: Behavior and Evolution of the Plant Genome. 3 hours.
PBIO 6720-6720L. Plant Variation and Evolution. 4 hours.

3. Plants and Their Environment
PATH 8400. Host-Pathogen Interactions. 3 hours.
PATH 4280/6280-4280L/6280L. Diagnosis and Management of Plant Diseases. 4 hours.
HORT 8150. Plant Growth and Development. 3 hours.

4. Biometry and Bioinformatics
STAT 8090 Statistical Analysis of Genetic Data. 3 hours.
STAT 8200 Design of Experiments for Research Workers. 3 hours.
PBIO(BIOL) 4550/6550. Bioinformatics Applications. 3 hours.
STAT 4640/6640. Statistical Methods in Bioinformatics. II. 3 hours.
BCMB 8140. Advanced Topics in Genomics and Bioinformatics. 3 hours.

5. Biochemical and Molecular Genetics

GENE 8920. Nucleic Acids. 3 hours
GENE 8930 Advanced Molecular Genetics. 3 hours
GENE 8940. Genome Analysis. 2 hours.
(GENE)(PATH)PBIO 4510/6510. Genome Evolution Across the Tree of Life. 3 hours.
BCMB 8010. Advanced Biochemistry and Molecular Biology I. 4 hours.

Professional Development

ALDR 7200 Foundations of Agricultural Leadership. 3 hours.
ALDR 7350 Group, Team, and Organizational Development in Agricultural Organizations. 3 hours
PBIO 8930. Science Writing for General Audiences. 3 hours.
PBIO 8820. Plant Genetics and Molecular Biology Seminar. 1-2 hours. (critical analysis of literature)
CRSS (HORT) 8xxx. PBPG Seminar I. 1 hour. (communication)
CRSS (HORT) 8xxx. PBPG Seminar II. 1 hour. (research)
GENE 8650 Responsible Science 1 hour.
EDHI 9010. Academic Programs in Higher Education. 3 hours.
CRSS 9990. Supervised Teaching Practicum in Crop and Soil Sciences. 1-3 hours.

COURSE DESCRIPTIONS AND PREREQUISITES (From UGA Bulletin)

ALDR 7200. Foundations of Agricultural Leadership. 3 hours.
An interdisciplinary analysis of current issues in the practice of leadership in contemporary and changing society particularly as they affect agricultural organizations and issues. Discussions of leadership theory, roles of leaders, skills for effective leadership, diversity issues, followership, and strategic planning will challenge students to think critically about leadership, enhance personal leadership performance and potential, and prepare for or expand leadership roles, and to become innovative and productive in dealing with challenges facing agricultural organizations today.

ALDR 7350. Group, Team, and Organizational Development in Agricultural Organizations. 3 hours.
Not open to students with credit in ALDR 7300.
An interdisciplinary course on the understanding of groups, teams, and organizations related to agricultural organizations. Theories of group dynamics and applications of problem-solving skills. Team building skills are studied with practical applications. Profit and non-profit agricultural organizations are used as case studies.

BCMB 8010. Advanced Biochemistry and Molecular Biology I. 4 hours.
Prerequisite: BCMB(BIOL)(CHEM) 3100 or BCMB 4010/6010.
Advanced biochemistry and molecular biology stressing thermodynamic principles in biochemistry, structural biology, enzymology, and aspects of metabolism and bioenergetics.

BCMB 8140. Advanced Topics in Genomics and Bioinformatics. 3 hours.
Prerequisite: BCMB 8010.
Contemporary approaches in the genomics of bacteria, archaea and eucarya, including computer applications on the use of various data bases.

CRSS 6xxx. Plant Breeding Practicum. 3 hours. (Maymester)
Prerequisite: CRSS (HORT) 6140 or equivalent.
An overview of plant breeding methodologies, in particular as applied to the crops of Georgia. Non-traditional format: Students will travel to the three campuses (Athens, Griffin, and Tifton), where they will spend one day per crop, learning all the unique features of associated with breeding that particular crop from that crop's breeder.

CRSS(HORT) 8xxx. Advanced Plant Breeding. 3 hours.
Prerequisite: CRSS (HORT) 6140 or equivalent.
An in-depth assessment of the methodologies used for plant breeding and their genetic basis. The course will emphasize the integration of traditional methodologies with the latest genetic and genomic technologies.

CRSS (HORT) 8xxy. PBPG Communication Seminar 1 hour.
Instruction and practice in oral scientific presentations as they relate to the field of plant breeding, genetics, or genomics, with emphasis on effective communications and presentation

techniques. A literature search within a component of plant breeding, genetics or genomics, and a formal seminar on the subject, are required, along with analyses of other seminars presented.

CRSS (HORT) 8xyz. PBPG Research Seminar 1 hour.
Instruction and practice in presenting scientific findings as they relate to the field of plant breeding, genetics, or genomics, with emphasis on effective presentation and interpretation of data from a student's theses or dissertation research. A formal seminar on is required, along with analyses of other seminars presented.

CRSS(PBIO) 8870. Advanced Plant Genetics. 3 hours.
Establishment of the correlation between plant phenotypes and genotypic data, which allows the identification of markers associated with or candidate genes underlying traits of interest.

CRSS 8871. QTL mapping and discovery. 1 hour.
The principles and procedures underlying the establishment of marker-based linkage maps and their application in the establishment of marker-trait associations. The proper applications of commonly used QTL software programs will be examined.

CRSS 8872. Genome analysis and comparative mapping. 1 hour.
Understanding the relationship between different genomes at the structural and functional level.

CRSS 8873. Transgenic breeding. 1 hour.
How transgenic plants are created, the deployment of transgenes in a breeding program, and the various regulations that govern their use.

CRSS 8880. Quantitative Aspects of Plant Breeding. 3 hours.
Prerequisite: [CRSS 4040/6040 and STAT 6220] or permission of department.
Quantitative and population plant genetics and their interrelationship with plant breeding. Genetic and environmental variation and how they relate to selection procedures and choice of type of variety.

CRSS 8890. Plant Cytogenetics: Behavior and Evolution of the Plant Genome. 3 hours. 2 hours lecture and 2 hours lab per week.
Prerequisite: PBIO 8100 or permission of department.
Classical and molecular cytogenetics are integrated to explain the reproductive behavior of angiosperms, the applications of cytogenetics to plant improvement, the study of plant genetics, and the structure and evolution of the plant genome.

CRSS 9990. Supervised Teaching Practicum in Crop and Soil Sciences. 1-3 hours.
Repeatable for maximum 6 hours credit.
Prerequisite: Permission of department.
University-level teaching, including the presentation of lectures and/or laboratory sessions under faculty supervision, at the doctoral level.Non-traditional format: Students lecture in a classroom setting and meet with a faculty supervisor to discuss teaching technique.

EDHI 9010. Academic Programs in Higher Education. 3 hours.
General education and specialization in undergraduate education. Curricular trends, contemporary practices, persistent challenges, and external influences in the development of courses and programs in higher education.

(GENE)(PATH)PBIO 4510/6510. Genome Evolution Across the Tree of Life. 3 hours.
Survey of the wealth of information arising from genomic research conducted on diverse species across the tree of life. Students will explore the evolutionary diversification of genomes in phylogenetically remote organisms and refine critical thinking and technical writing skills through analysis of publications drawn from the recent literature.

GENE 8650. Responsible Science. 1 hour.
Prerequisite: Permission of department.
The course is designed for first year graduate students on how to conduct scientific research responsibly.

GENE 8920. Nucleic Acids. 3 hours. Repeatable for maximum 6 hours credit.
Prerequisite: BCMB 8020 or permission of department.
Structure and function of nucleic acids. The isolation, structure, chemical analysis, hybridization, enzymology, and replication of DNA and RNA, nucleic acids enzymes, protein-nucleic acid interactions and recombinant DNA technology.

GENE 8930. Advanced Molecular Genetics. 3 hours.
Prerequisite: BCMB 8010 or GENE 8920.
The molecular mechanisms of gene action in procaryotes and eucaryotes, including discussions of chromosome structure and replication, mutagenesis and DNA repair, recombination mechanisms, transposition, transcriptions, and translation controls.

GENE 8940. Genome Analysis. 2 hours.
Prerequisite: GENE 4200/6200 or permission of department.
Survey of approaches used in whole genome analyses. Topics include, genome sequence assembly, automated annotation, large-scale expression studies, an introduction to proteomics, SNP and comparative genome analysis. Emphasis will be placed on a critical evaluation of the methods and literature pertaining to whole genome analyses.

HORT 8102. Breeding Ornamental Plants. 1 hour.
Concepts and methods of improving ornamentals, particularly woody and asexually propagated ornamentals. Topics include breeding methods, pollination biology, barriers to obtaining seed set in intra- and interspecific pollinations and methods to overcome these barriers, genetic variation, polyploidy, and inheritance of foliar variegation.Non-traditional format: Course meets for three hours of lecture per week during second five weeks of the semester.

HORT 8150. Plant Growth and Development. 3 hours.
Prerequisite: PBIO 3830-3830L or permission of department.

Growth and development of economic plants. The physiological processes of growth, translocation, growth regulators, juvenility, maturity, senescence. Floral initiation and development of economic plants, with emphasis on the physiological processes of growth, translocation, growth regulators, juvenility, maturity, senescence, floral initiation and development, fruiting, tuber and bulb formation, vernalization, dormancy, rest, and seed germination.

PATH 4280/6280-4280L/6280L. Diagnosis and Management of Plant Diseases. 4 hours. 3 hours lecture and 3 hours lab per week.
Development of fundamental and practical knowledge for identification and management of plant diseases.

PATH 8400. Host-Pathogen Interactions. 3 hours.
Prerequisite: [PATH 3530-3530L and (BCMB 6000 or PBIO (CRSS)(BIOL) 4500/6500)] or permission of department.
Principles of physiology and genetics of parasitism and disease resistance. Emphasis is placed upon how the genetic basis for host-pathogen compatibility and incompatibility is related to structural, physiological, and biochemical responses in diseased plants and to mechanisms of resistance.

PBIO(BIOL) 4550/6550. Bioinformatics Applications. 3 hours. 2 hours lecture and 2 hours lab per week.
Not open to students with credit in PBIO (BIOL) 6550.
Undergraduate prerequisite: PBIO (BIOL) 3020 or BCMB 3600 or BCMB 3600H or GENE (BIOL) 3200.
Graduate prerequisite: BCMB 8140 or PBIO (CRSS)(BIOL) 4500/6500.
The applications and concepts of computational technologies for solving problems in molecular genetics. Current programs and the principles that underlie them will be discussed. Topics include: sequence and structure databases; sequencing; mapping; sequence alignments (dynamic programming); motifs and profiles; phylogeny reconstruction; probabilistic approaches (Markov models).

PBIO 6720-6720L. Plant Variation and Evolution. 4 hours. 2 hours lecture and 4 hours lab per week.
Not open to students with credit in PBIO 6720-6720L.
Prerequisite: GENE(BIOL) 3000.
Variation and evolution in plants, genotypic and phenotypic patterns, genetic diversity, adaptation, breeding systems, polyploidy, hybridization, apomixis, evolutionary data in population genetics and systematics, literature, experimental design, population sampling. Variation analysis, breeding techniques, data presentation, population analysis, molecular evolution.

PBIO 8100. Plant Genetics. 4 hours.
Not open to students with credit in PBIO 8100.
Prerequisite: GENE(BIOL) 3200 or PBIO(CRSS)(BIOL) 4500/6500 or permission of department.
Principles and experimental methods in plant genetics, gene expression, and gene evolution. Topics are interrelated with those of Plant Cellular Biology and Plant Development.

PBIO 8820. Plant Genetics and Molecular Biology Seminar. 1-2 hours. Repeatable for maximum 15 hours credit. 2-4 hours lab per week.
Not open to students with credit in PBIO 8820.
Seminar on current botanical research topics.

PBIO 8930. Science Writing for General Audiences. 3 hours.
Not open to students with credit in PBIO 8930.
Covers basics of good writing and genres of science writing. Includes guest lectures by professional science writers. Students read and discuss science pieces from the popular press, write and critique their own pieces, and pursue special projects. Includes examination of how scientists can better communicate with a general audience.

STAT 4640/6640. Statistical Methods in Bioinformatics II. 3 hours.
Graduate prerequisite: STAT 4630/6630.
Further development of methods for analysis of DNA sequence data. Topics include sequence comparisons, DNA database searches, evolutionary models, phylogenetic tree construction and related topics, as well as relevant topics from probability theory.

STAT 8090. Statistical Analysis of Genetic Data. 3 hours.
Prerequisite: (STAT 4210 or STAT 6220) and STAT 4510/6510.
Common statistical and genetic models appropriate for analyzing genetic data, especially DNA sequence data. Emphasis on fitting models, estimating parameters, and making inferences based on genetic data.

STAT 8200. Design of Experiments for Research Workers. 3 hours.
Prerequisite: STAT 4210 or STAT 6220 or STAT 6320.
Methods for constructing and analyzing designed experiments are considered. Concepts of experimental unit, randomization, blocking, replication, and orthogonal contrasts are introduced. Designs include completely randomized design, randomized complete block design, Latin squares design, split-plot design, repeated measures design, and factorial and fractional factorial designs.

SAMPLE CURRICULUM

The following show an example program of study for Ph.D. students in the proposed degrees. Only academic courses are listed. Graduate students will fulfill appropriate Graduate School requirements for total credit hours each term they are enrolled at the university, as well as general requirements for total credit hours and hours of graduate-only or doctoral-level courses. Research, thesis, and dissertation hours will be taken within the home department of the student's major professor.

Our proposed program was established using models from three outstanding programs in the country from the University of Wisconsin, Cornell University, and Iowa State University. Graduate students in our program would pursue a similar program of study at any of these three institutions. There are no prescribed national standards for plant breeding.

PhD Degree

Year 1		Year 2		Year 3	
Fall	Spring	Fall	Spring	Fall	Spring
PBIO 8100	GENE 8940	BCMB 8101	STAT 8090	HORT 8150	CRSS 8xyz
PATH 8400	CRSS 8xxx	CRSS 8890	CRSS 8880	CRSS 8xxy	
STAT 8200	CRSS 8870	GENE 8940	CRSS 8873		

In addition, CRSS 6xxx (Plant Breeding Practicum) will be taken during Maymester. Students must complete a minimum of 30 semester hours of course work beyond the M.S. degree. Expected time to completion of degree is three years; four if they do not begin with an MS degree. Though students are expected to have an MS degree before they start their PhD program, exceptions are occasionally made, for example, in the case of foreign students who graduate with a 6-year degree rather than the traditional 4-year degree.

ACCREDITATION

There is no accreditation for programs in this field.

CONSISTENCY WITH NATIONAL STANDARDS

There are no formal standards for PBGG. As mentioned previously, this program was primarily modeled after the highly successful program at the University of Wisconsin-Madison. Furthermore, it is consistent with the goals and objectives described by a workshop held at Michigan State University, cited earlier.

STUDENT OUTCOMES ASSOCIATED WITH THE PROGRAM

Student outcomes are consistent with those defined by the USDA when it named PBGG a National Emphasis Area. Namely, graduates from this program should be proficient at "improving the effectiveness and efficiency of plant breeding" by using breeding, genetic and genomic "approaches, tools, and resources to improve, protect, and sustain plants for agriculture and the environment." Corporate employers have also defined other desirable areas of training– namely teamwork and communication skills.

STUDENT FUNDING AND RECRUITMENT

As mentioned previously, most of the students in the PBGG program are students who are currently in, or would have been in, the Agronomy or Horticulture degree program. The vast majority of these students are funded as research assistants on soft dollars brought in by their major professors. In some cases, the department head or graduate coordinator of the major professor's home department may choose to cost-share the research assistantship. In a few cases, the students have scholarship or fellowship funds they have obtained on their own (e.g., an NSF fellowship), or from their government, if a foreign student. No teaching assistantship lines are available for this program, and there is no expectation that they will become available.

In cases where extramural funds are given to the program (e.g., see attached letter from Monsanto), the distribution of the monies will be overseen by the PBGG steering committee. They have the option of using these funds to leverage others, or awarding to PBGG members on a competitive basis.

Recruitment will be greatly facilitated by establishment of the PBGG program as an official entity. Right now, PBGG as a discipline does not stand out in the web sites hosted by the departments of Horticulture or Crop and Soil Sciences (the latter department houses the graduate degrees in Agronomy).

Funds are available in the budget to establish a web site specifically for the PBGG program that would give it in-state, national, and international visibility. Links to it should be available from other web sites, such as that for Crop and Soil Sciences, Horticulture, the College of Agricultural and Environmental Sciences, and the UGA Plant Center. The web site and additional recruiting efforts will be the purview of the PBGG coordinating committee as outlined in the bylaws.

INVENTORY OF FACULTY DIRECTLY INVOLVED

Note: *This is just a listing. The additional information requested for these faculty are found as an addendum at the end of this proposal.*

1. **Roger Boerma** - Distinguished Research Professor of Crop and Soil Sciences, Athens Campus. Dr. Boerma's research concentrates on soybean breeding, genetics, and genomics. Dr. Boerma has several soybean varieties presently being marketed successfully and other cultivars will be released in the next few years. He teaches a 3-hour graduate course (CRSS 8880) entitled, "Quantitative Aspects of Plant Breeding."

2. **Charles Brummer** - Professor of Crop and Soil Sciences, Athens Campus. Dr. Brummer's expertise is in forage breeding and genomics. He teaches an advanced graduate course in plant breeding.

3. **Peng Chee** - Associate Professor of Crop and Soil Sciences, Tifton Campus. Dr. Chee's research responsibilities are in cotton breeding and genomics. He co-teaches a 3-hour course (HORT (CRSS) 4800/6800) entitled "Agricultural Biotechnology."

4. **Patrick Conner** - Associate Professor of Horticulture, Tifton Campus. Dr. Conner is a pecan breeder.

5. **Katrien Devos** - Associate Professor of Crop and Soil Sciences and Plant Biology, Athens Campus. Dr. Devos' expertise is in the area of plant comparative genomics.

6. **Wayne Hanna** - Professor of Crop and Soil Sciences, Tifton Campus. Dr. Hanna's research interests are in the breeding of turfgrasses and pearl millet. Dr. Hanna has numerous successful varieties presently being used on a world-wide basis.

7. **Jerry Johnson** - Professor of Crop and Soil Sciences, Griffin Campus. Dr. Johnson's research expertise is in the breeding of small grains. He has developed several successful varieties of wheat, oat, and barley.

8. **Steve Knapp** - Georgia Research Alliance Eminent Scholar and Professor in Crop and Soil Sciences, Athens Campus. Dr. Knapp's expertise is in oil seeds breeding and genomics.

9. **David Knauft** - Dirr Professor of Horticulture, Athens Campus. Dr. Knauft interests are in ornamental plant breeding and genetics. He teaches a 3-hour course (CRSS 4040/6040), titled "Plant Breeding."

10. **Peggy Ozias-Akins** - Professor of Horticulture, Tifton Campus. Research on peanut and pearl millet genomics and biotechnology. She co-teaches a 3-hour course (HORT (CRSS) 4800/6800) entitled "Agricultural Biotechnology."

11. **Wayne Parrott** - Professor of Crop and Soil Sciences, Athens Campus. Dr. Parrott's

expertise is in row crop biotechnology. He teaches a 3-hour graduate course (CRSS 8890) entitled "Plant Cytogenetics: Behavior and Evolution of Plant Genomes."

12. **Paul Raymer** - Professor of Crop and Soil Sciences, Griffin Campus. Dr. Raymer's responsibilities are in the area of turfgrass breeding, and he will be coordinating the Plant Breeding Practicum course.

13. **Carol Robacker** - Associate Professor of Horticulture, Griffin Campus. Dr. Robacker is an ornamental plant breeder and has released several varieties presently being marketed.

14. **John Ruter** - Professor of Horticulture, Tifton Campus. Dr. Ruter engages in plant breeding and selection of nursery crops for the southeastern United States.

15. **Vince Dooley Distinguished Professor of Ornamental Horticulture**, Athens Campus. This is a newly endowed position, which will be involved in the general area of genomics of ornamental varieties.

16. **Vegetable Breeder** - Athens Campus. This position was recently vacated when the incumbent took became departmental chair at the Ohio State University. It is anticipated this position will be filled in FY'07.

OUTSTANDING PROGRAMS OF THIS NATURE IN OTHER INSTITUTIONS

1. University of Wisconsin, Plant Breeding and Plant Genetics Interdepartmental Program
   Heidi Kaeppler
   Plant Breeding and Plant Genetics Program Chair
   Department of Agronomy
   1575 Linden Drive
   Madison, WI 53706
   Phone 608-262-1390
   Fax 608-262-5217
   Email: hfkaeppl@wisc.edu

The goal of this program is to provide integrated education and research in plant breeding, and accordingly offers MS and PhD degrees in Plant Breeding and Plant Genetics. It includes faculty from eight departments across the university. Between 1995-2000, the program graduated more PhD students in plant breeding than any other program in the country. Their curricular requirements and structure provided the foundation for our proposed program.

Program website: http://www.hort.wisc.edu/pbpg/

2. Cornell University, Department of Plant Breeding and Genetics.
   Mark E. Sorrells
   Chair/Professor
   241 Emerson Hall
   Cornell University
   Ithaca, NY 14853
   Telephone : (607) 255-2180; 255-1665; 255-8092
   Fax: (607) 255-6683
   E-Mail: mes12@cornell.edu

Cornell's Department of Plant Breeding and Genetics is the program in the country offering M.S. and Ph.D. degrees in plant breeding within a single academic department–the rest of the programs in the country are inter-departmental. The department has particular strengths in molecular applications to breeding. It has approximately 40 graduate students in plant breeding, works with many types of plants, and is highly successful in garnering extramural funding for plant breeding and genetic work, in publication of scholarly articles, and in development of new plant varieties. The program has been one of the outstanding in the country for many years. The organization of all plant breeders into an individual department has provided a structure for collaboration that we believe we can create through the development of this interdisciplinary program.

Departmental website: http://plbrgen.cals.cornell.edu/

3. Iowa State University

Dr. Kendall Lamkey
Interim Chair
2101 Agronomy Hall
Iowa State University
Ames, IA 50011
515.294.7636
515.294.3163 Fax
krlamkey@iastate.edu

The ISU Plant Breeding major is housed within the Department of Agronomy, which also houses most of the plant breeding activities on campus. Thus, the Department of Agronomy has a critical mass of well-supported plant breeders to implement a plant breeding major. The plant breeding major enrolls approximately 50 graduate students, focusing primarily on corn, soybeans, forages, and small grains. The coherence of this program has been one of its historic strengths; the proposed UGA program is intended to bring that level of coherence to our programs.

Dr. Fred Jansen
IG Program Chair
253 Bessey Hall
Department of Ecology, Evolution, and Organismal Biology
Iowa State University
Ames, IA 50011-1020 U.S.A.
515.294.4230
515.294.1337 Fax
fjanzen@iastate.edu

In addition, a second major at ISU of relevance to this UGA proposal is the Interdisciplinary Genetics major. ISU has ten interdisciplinary degree programs, and all have been very successful at attracting very high quality graduate students. The IG program has 13 participating departments and currently has 90 students enrolled; a number of plant breeding oriented faculty and students in plant breeding participate in this program. The program has successfully attracted external funding for graduate students and has facilitated research programs across disciplines and departments. This program encompasses a broader view of genetics than the proposed PBGG program, but it demonstrates the synergies that can occur when faculty with similar interests are brought together based on common interests. The structure of the proposed PBGG program at UGA is very similar to that of the highly successful IG program at ISU.

Institute website: http://www.plantsciences.iastate.edu/

INVENTORY OF PERTINENT LIBRARY RESOURCES

The University of Georgia has strong research library resources. It is a member of the Association of Research Libraries and has more than 4.1 million volumes, one of only 36 libraries in the country to reach this level. They subscribe to over 7,000 print journals and provide online access to 35,000 periodicals. Many of these are in areas related to plant breeding and genetics. Major databases, such as CAB Direct, Agricola, BIOSIS, Science Citation Index, and Plant Sciences, are available. The Web of Knowledge is a particularly useful tool to find and access journal articles related to PBGG.

These resources are competitive with those of the institutions listed in the previous section. Current faculty performing research in plant breeding and genetics have found the library holdings adequate for their activities. Given the long history of PBGG at Georgia, the library subscribes to all the major journals in the discipline. On those cases where a journal is not in the UGA collection, it is readily obtainable via interlibrary loan. *It is not anticipated that additional library support will be needed to support the proposed program.*

DESIRED QUALIFICATIONS OF THE STUDENTS WHO WILL BE RECRUITED AND ADMITTED TO THE PROPOSED PROGRAM, INCLUDING ETHNIC POPULATIONS THAT WILL BE TARGETED.

Desired qualifications for students who would be recruited and admitted to the proposed program include appropriate undergraduate background in plant science or related disciplines, along with GPA and GRE scores consistent with requirements for admission to the Graduate School of the University of Georgia and as set by the steering committee of the PBGG program. The program will recruit both domestic and international students and will stress the importance of training students from diverse backgrounds. The CAES hosts a Young Scholars Program each summer, bringing promising students from diverse ethnicities to campus to conduct research. Faculty currently host many of these students in their laboratories and will expand their efforts to participate in this program, providing an avenue for recruitment. In addition, we will pursue funding to recruit and retain diverse students and will recruit at colleges and universities within the southeastern United States with large populations of under-represented students.

FACILITIES

Because of its long history in PBGG, UGA's facilities range from good to outstanding. Sufficient field and farm space is available at all three campuses (Athens, Griffin, and Tifton), and within the network of Experiment Stations that exists throughout the state (Attapulgus, Blairsville, Calhoun, Eatonton, and Plains), thus ensuring access to all the major soil and climatic regions of Georgia.

State-of-the art laboratory facilities exist at the NESPAL (National Environmentally Sound Production Agriculture Laboratory) building on the Tifton Campus, and in the CAGT (Center for Applied Genetic Technologies) on the Athens campus. Additional faculty are housed in the Miller Plant Sciences Building on the Athens Campus and in the Redding building in the Griffin Campus. Adequate greenhouses and growth chamber space are available at all three campus.

A core instrumentation facility for major items of equipment used for graduate student training and research exists in the CAGT. Additional equipment is available at the Tifton and Griffin campuses. All of this equipment requires maintenance and periodic updating. Creation of this new major will neither accelerate nor delay the need for a replacement schedule.

ADMINISTRATION

Bylaws of the interdisciplinary Plant Breeding, Genetics & Genomics program.
These bylaws have been voted upon unanimously by all participating faculty.

Purpose

The interdisciplinary program in Plant Breeding and Plant Genomics (PBGG) is designed to implement and oversee graduate degree programs in PBGG that will focus on the various aspects of plant breeding, plant genetics and plant genomics in the context of plant (crops and ornamentals) improvement. This program promotes interdisciplinary research in PBGG, encourages scholarly activities in PBGG, and applies knowledge of PBGG through workshops, lectures, consultations, and academic instruction.

Faculty

Any official regular or adjunct faculty member of the University of Georgia CAES, regardless of home department, is eligible to apply for membership in the PBGG program. To start the program, the dean of CAES will issue an invitation to faculty interested in the topic area within the college. Those faculty wishing initial consideration should respond with a letter expressing their interest to the dean, who then makes the final selection.

Subsequently, faculty wishing membership should submit a formal letter to the Director, along with a copy of their CV. Members are elected by a majority of the PBGG faculty present at a regular or called meeting.

Members are expected to be active through serving as Major Professors of graduate students in the program, serving as members of graduate student advisory committees, attending PBGG Program faculty meetings, conducting research in the various aspects of plant breeding, plant genetics and plant genomics in the context of plant improvement, attending seminars and programs, and participating in other activities organized by the program. Activity of members will be reviewed every 5 years by the coordinating committee, and inactive members will be asked if they wish to remain members of the PBGG faculty and become involved in its programs. Inactive members may be reinstated at their request and approval by majority vote of the PBGG faculty.

Any official regular or adjunct faculty member of the University of Georgia, other than a faculty member within CAES, is eligible to apply for adjunct membership in the PBGG program. Faculty wishing adjunct membership should submit a formal letter to the Director, along with a copy of their CV. Adjunct members are elected by a majority of the PBGG faculty present at a regular or called meeting, along with any absentee ballots received prior to the start of the meeting.

Adjunct faculty

Adjunct members shall have all the rights and privileges of regular members, but will not be eligible to serve on the coordinating committee or serve as director.

Students
Prospective graduate students will apply for admission to the PBGG program, and must comply with all PBGG requirements as approved by the PBGG Coordinating Committee and faculty. Graduate students will be housed in the academic departments of their major professors and are expected to participate fully in the non-curricular activities of their home departments and of the PBGG program. All Graduate School rules and guidelines apply.

Governance
Director: Following a recommendation from the PBGG faculty, the Director will be appointed by the CAES dean or his/her designated representative and will be responsible for the day-to-day operation of the PBGG program. The Director will supervise any employees and participants in the program who report directly to the Director or to his/her designee. The Director will represent the faculty to the higher administration of the university and will call and chair meetings of the Coordinating Committee and the faculty.

Coordinating committee: To ensure the integrity of the interdisciplinary nature of the program, it will be coordinated by a committee having one representative from each participating academic department (i.e., discipline) within CAES which has at least 3 faculty members participating in the PBGG. The faculty will be selected and appointed to the Coordinating Committee by his/her respective departmental chairperson, following a request to the chair from the Director. The Director may request that the CAES dean or his/her designated representative appoint members-at-large to ensure the coordinating committee has balanced representation of the disciplines represented by the PBGG faculty.

The duties of the coordinating committee include oversight of the budget, monitoring and quality assurance of graduate student performance, approval of graduate fellowships, approval of faculty and student research grants, oversight of the graduate curriculum and graduate admissions standards, the coordination of student recruitment efforts, provide advice to the director on the selection of the Graduate Coordinator, and overall program planning and direction. Any changes to the Bylaws must be approved by the Coordinating Committee before being presented to the faculty for vote.

The Coordinating Committee will review the curriculum requirements periodically. They can recommend changes to the curriculum They will also review changes provided by any regular member of the PBGG program, and determine if they should recommend the change accordingly. Recommended changes must be approved by a majority of the PBGG faculty present at a regular or called meeting.

The Coordinating Committee will review the student admission requirements periodically. They can recommend changes to the standards. They will also review changes provided by any regular member of the PBGG program, and determine if they should recommend the change accordingly. Recommended changes must be approved by a majority of the PBGG faculty present at a regular or called meeting. The date for a regular meeting must be set at least 2 months in advance. Business at called meetings may be conducted via teleconference. An

agenda will be sent out prior to both regular and called meetings.

Graduate Coordinator
The Graduate Coordinator will be nominated by the Coordinating Committee and appointed by the Dean of the Graduate School following a recommendation and approval by the Director and the CAES dean for academic affairs. The Graduate Coordinator handles all student applications to the program and ensures they are handled according the PBGG criteria and comply with all rules and regulations of UGA and the Graduate School. Once a student has been admitted to the program, the Graduate Coordinator will ensure each graduate student has a course of study that meets the requirements of the PBGG program and meets deadlines for examinations, etc., as set by the Graduate School and/or the Coordinating Committee.

Terms of office
All officers (the Director, the Graduate Coordinator, and the members of the Coordinating Committee) will serve 3-year terms and are eligible for one consecutive reappointment. Officers may be asked to server longer terms by the CAES dean or his/her designated representative to ensure continuity.

Meetings
The Coordinating Committee will meet when called by the Director, with at least 2 week's notice. Minutes of each meeting will be kept by the Program Secretary and will be distributed, after approval by the Coordinating Committee, to the faculty.

The PBGG faculty will meet at least once each year, when called by the Director, with at least 2 month's notice. The meetings will focus on research activities, the graduate program, and student performance and standards. Faculty participation will be examined and new members will be elected. Other items can be proposed for discussion at the meeting.

Amendment of the Bylaws
The Coordinating Committee may recommend amendments to the bylaws. These may be amended by a majority vote of the faculty present at a regular or called meeting and approved by the CAES dean or his/her designated representative. Notification must be distributed at least two (2) weeks prior to a regular meeting.

The bylaws should be reviewed at least every 5 years to ensure they remain current and relevant.

In case of conflict with current University, Graduate School, or CAES policies and procedures, the University, Graduate School, or CAES policies and procedures will take precedence over PBGG Program guidelines.

ASSESSMENT
Plant Breeding, Genetics & Genomics
Graduate Student Learning Outcomes Assessment Plan

This interdisciplinary program offers a Doctor of Philosophy (PhD) degree in Plant Breeding, Genetics & Genomics. Graduates with a PhD degree in PBGG should be competitive and well prepared for careers in academia, industry, and government fields. This assessment plan is designed to evaluate the success of our graduate program and to provide guidance towards continuous improvement.

Section 1: *Statement of Student Learning Objectives*
1. Graduates should have a fundamental understanding of the scientific method and be capable of critical thinking.

2. Graduates should have in-depth knowledge in one of the three main components (Breeding, Genetics, or Genomics), while having a working knowledge of the other components, so as to be able to form parts of the interdisciplinary teams which are currently assembled in academia and industry to create new crop varieties.

3. Graduates should have strong communication and technical skills.

4. Graduating PhD students should be able to formulate and conduct original research in an academic or industrial setting and be able to teach courses in their area of specialty.

5. Graduates should participate in professional societies and activities in their profession (e.g., membership and activities in state, regional, and national/international organizations) and win awards and recognition within the University and at regional and national levels.

Section 2: *Learning Assessment Procedures*
The Program will use the following measures to obtain data with which to assess achievement of the student learning objectives:

1. Completion of a Student Performance Evaluation form by each member of a student's Advisory Committee at the Oral Preliminary Exam and at Dissertation defense meetings (Form I).

2. Written record of Exit interviews with the Program Director (Forms II and III).

3. Annual report by the Graduate Coordinator to the Program faculty on number, GPA, and GRE scores of entering graduate students.

4. Survey of supervisors/administrators of graduates one year after graduation (Form IV).

5. Survey of graduate students one year after graduation (Form V).

Section 3: *Use of Assessment Results for Improvement*
Student Performance Evaluations (Form I) will be used to determine if students have mastered the core knowledge in their area of specialization, successfully conducted original research, and developed strong communication and technical skills. The written record on exit interviews with the Program Director (Forms II and III) will guide the Program in improving graduate programs, teaching proficiency, and the friendly atmosphere that is so critical for a first-class graduate program. The annual report by the Graduate Coordinator will be used by the Program to determine if entrance requirements need to be adjusted and if recruiting and retention efforts are satisfactory. The survey of supervisors/administrators, graduate advisors, and graduate students one year after graduation will allow the Program to identify those needed skills that are not currently provided by the programs. The University Review Program also will be used to strengthen areas in the graduate program.

Student Performance Evaluation (Form I)
Graduate Program Assessment
Plant Breeding, Genetics and Genomics Program
University of Georgia

Each member of the Advisory Committee should fill out this form at Oral Preliminary Exams and at Dissertation/Thesis defenses. The forms should be returned to the Graduate Coordinator.

Student Name: _____ Evaluation Date:_____
____Oral Preliminary Exam _____Dissertation Defense _____Thesis Defense

Please rate each area with a scale of 1 to 10. 1 indicates poor preparation; 10 indicates oustanding performance

Knowledge in Specialty Area ..... _____

Knowledge in supporting disciplines _____

Communication Skills
Written ..... _____

Oral ..... _____

One-on-one ..... _____

Research Problem Solving
Ability to organize and define problem ..... _____

Ability to assemble resources ..... _____

Creativity ..... _____

Ability to organize research and carry it through. _____

Ability to evaluate results ..... _____

Comments:

Exit Interview (Form II)
Graduate Program Assessment
Plant Breeding, Genetics and Genomics Program
University of Georgia

Please read the following statements to the graduate student being interviewed: "The following questions are designed to provide the Program with ongoing graduate program assessment data for use by the Program in periodic reviews of our graduate programs. Program assessment is vital in ensuring that we provide relevant and challenging graduate programs in Plant Breeding, Genetics and Genomics. I will ask you several questions about your experiences as a graduate student in this Program. Not all of the questions will be relevant to you and to your career goals. Following this interview, I will give you an optional form (Exit Interview - Form III) in the event you want to add additional, anonymous comments."

Name: _____

Date: _____ Degree:_____

Student Learning Objective 1: Graduates should have a fundamental understanding of the scientific method and be capable of critical thinking.

Questions:
1. Did your graduate experience provide you the necessary background to understand the scientific method?

2. Do you feel that you can use critical thinking to address problems?

Student Learning Objective 2: Graduates should have in-depth knowledge in one of the three main components (Breeding, Genetics, or Genomics), while having a working knowledge of the other components, so as to be able to form parts of the interdisciplinary teams which are currently assembled in academia and industry to create new crop varieties.

Questions:
1. Did the program increase your knowledge of scholarship and new developments in your area of expertise?

2. Do you feel that your program was lacking in a particular area?

Student Learning Objective 3: Graduates should have strong communication and technical skills.

Questions:

1. Did the program increase your communication skills?

2. Did the program increase your technical skills?

Student Learning Objective 4: Graduating PhD students should be able to formulate and conduct original research in an academic or industrial setting and be able to teach courses in their area of specialty.

Questions
1. Did your graduate experience provide you the necessary background to formulate and conduct original research?

2. How well are you prepared to enter an academic position and teach in your area of specialty?

Student Learning Objective 5: Graduates should participate in professional societies and activities in their profession (e.g., membership and activities in state, regional, and national/international organizations) and win awards and recognition within the University and at regional and national levels.

Questions:
1. Did the program increase your knowledge of professional development and professional activities?

2. Do you currently participate in professional societies and activities? Please specify.

Additional Questions
1. Did you encounter specific problems as a graduate student in this Program and, if so, which ones?

2. How might have those problems have been avoided or corrected?

3. Were the faculty, staff, and Program administrators helpful and supportive?

4. Would you choose graduate work in Plant Breeding, Genetics & Genomics if you had to make the choice again? (Please explain your response.)

5. Do you have any suggestions as to how our Program might attract graduate students from under-represented groups and be more sensitive to issues of cultural diversity?

Note: As an alternative, we also have Exit Interview (Form III - Anonymous Responses), depending on student preferences. The questions will be as for Form II, but the preamble is different:

This form is for your use if you did not wish to speak candidly at the Exit Interview, or if you have thought of additional responses or comments that you would like to make. Please return this form to the Graduate Program Assistant, not to the Graduate Coordinator or the Program Director. The responses provided will be used only for internal purposes within the Program and anonymity of responses will be preserved.

Survey of Supervisors/Administrators - 1 Year Postgraduation (Form IV)
Graduate Program Assessment, Plant Breeding, Genetics and Genomics Program
University of Georgia

As part of the assessment of the graduate program in Plant Breeding, Genetics and Genomics at the University of Georgia, we would like to contact your supervisor/administrators in regard to your professional performance. These data will be very instrumental to us as we seek to determine how our graduates are performing in the workplace with the objective of improving our graduate program. If you are willing to participate in this assessment, please fill out the top portion of this form, thereby giving us permission to solicit this information from your supervisor/administrator. Then, ask your supervisor/administrator to complete this form and return it to the address listed below. We appreciate your willingness to help in this effort to improve our graduate programs.

To be completed by the graduate:

Name: _____Degree: _____ Date Degree Received: _____

Position: _____

I give my permission to the Plant Breeding, Genetics and Genomics Program at the University of Georgia to solicit this information which will be used only for the purpose of internal review and assessment of the graduate program.

Signature:_____

To be completed by the supervisor/administrator:
1. Is the individual named above well prepared for the position in which s/he is employed?

2. Is s/he familiar with the latest developments in his area of expertise as they relate to duties in this position?

3. Is this individual contributing significantly to your program or enterprise? Please comment.

4. Are there specific skills, knowledge, or areas of expertise in which s/he excels?

5. Are there specific skills, knowledge, or areas of expertise in which s/he would have benefitted from more preparation?

Please return this form to the Graduate Coordinator, Plant Breeding, Genetics and Genomics Program, 3111 Miller Plant Sciences Bldg, Athens, GA 30602.

Thank you for your assistance to us in this assessment of our graduate program.

Survey of Graduate Students - 1 Year Postgraduation (Form V)
Graduate Program Assessment
Plant Breeding, Genetics and Genomics Program
University of Georgia

The following questions are designed to provide the Plant Breeding, Genetics and Genomics Program with ongoing assessment data for our graduate programs. This information will be used only within the Program, and your responses will be used anonymously in program review and evaluation. Please return this form to the Graduate Coordinator,, Plant Breeding, Genetics and Genomics Program, 3111 Miller Plant Sci. Bldg., Athens, GA 30602. A self-addressed envelope is enclosed for your convenience.

Name and Permanent Address: _____

_____

_____

_____

Today's Date: _____ Degree: _____Date Degree Received: _____

Present Employment or Stage of Education: _____

The assessment is linked to the specific student learning objectives detailed below:

Student Learning Objective 1: Graduates should have a fundamental understanding of the scientific method and be capable of critical thinking

Questions:
1. Did your graduate experience provide you the necessary background to understand the scientific method?

2. Do you feel that you can use critical thinking to address problems?

Student Learning Objective 2: Graduates should have in-depth knowledge in one of the three main components (Breeding, Genetics, or Genomics), while having a working knowledge of the other components, so as to be able to form parts of the interdisciplinary teams which are currently assembled in academia and industry to create new crop varieties.

Questions:
1. Did the program increase your knowledge of scholarship and new developments in your area of expertise?

2. Do you feel that your program was lacking in a particular area?

Student Learning Objective 3: Graduates should have strong communication and technical skills.

Questions:
1. Did the program increase your communication skills?

2. Did the program increase your technical skills?

Student Learning Objective 4: Graduating PhD students should be able to formulate and conduct original research in an academic or industrial setting and be able to teach courses in their area of specialty.

Questions (for PhD students only):
1. Did your graduate experience provide you the necessary background to formulate and conduct original research?

2. How well are you prepared to enter an academic position and teach in your area of specialty?

Student Learning Objective 5: Graduates should participate in professional societies and activities in their profession (e.g., membership and activities in state, regional, and national/international organizations) and win awards and recognition within the University and at regional and national levels.

Questions:
1. Did the program increase your knowledge of professional development and professional activities?

2. Do you currently participate in professional societies and activities? Please specify.

Additional Questions
1. Did you encounter specific problems as a graduate student in this Program and, if so, which ones?

2. How might have those problems have been avoided or corrected?

3. Were the faculty, staff, and Program administrators helpful and supportive?

4. Would you choose graduate work in Plant Breeding, Genetics & Genomics if you had to make the choice again? (Please explain your response.)

5. Do you have any suggestions as to how our Program might attract graduate students from under-represented groups and be more sensitive to issues of cultural diversity?

ACCREDITATION

There is no accreditation for graduate degrees in any area of plant genetics and its related disciplines.

AFFIRMATIVE ACTION IMPACT

The PBGG major is an attractive alternative for students who want a career in biology requiring additional education but are not interested in medical or professional schools. The graduate students enrolled in the participating departments already represent a diverse population. Creation of this new major will not detract, but may enhance, enrollment of students from under-represented groups. Many of the participating faculty receive NSF funding, which requires outreach and recruitment efforts towards under-represented populations. Besides recruitment from national and international sources, we also rely heavily on UGA programs, such as SURP (Summer Undergraduate Research Program) and CURO (Center for Undergraduate Research Opportunities) to help recruit promising undergraduate students.

DEGREE INSCRIPTION

Doctor of Philosophy in Plant Breeding, Genetics & Genomics

FISCAL AND ENROLLMENT IMPACT, AND ESTIMATED BUDGET.
Student enrollment was estimated by considering the number of students currently and historically trained by the faculty joining the PBGG program. This program may be implemented in time for a few of their current students to transfer into the program. However, it is anticipated most of the students in the program will be newly enrolled programs.

We also anticipate a small increase in enrollment once the newly established Vince Dooley Professorship is filled and the recently vacated vegetable breeding position is refilled.

To determine fiscal impact, the EFTs for teaching were primarily based on teaching EFTs of faculty who indicated they will participate in the program from CAES, then adjusted for the proportion of courses they teach related to plant breeding. For the faculty not in our college, the courses taught were added, assuming each was taught once a year, that PBPG students were going to be about 1/3 of the course, and then adjusted accordingly. The total was 2.2 EFT. In all the teaching EFT, there will be no redirection, just use of existing resources.

We next factored in one graduate assistantship contributed by the Georgia Agricultural Experiment Stations, and one staff person to assist the program director and graduate coordinator. The director and graduate coordinator are being assigned 0.1 EFT administrative time each. EFT appointments were converted into dollar amounts by assuming an average of $90,000 salary for faculty and $120,000 for administrators.

A small amount was added for supplies and travel for the administrative staff and for the creation of a Web site and its maintenance. Finally, a 3% annual increase has been added.

Final note: Two degree proposals are being submitted. One for an MS, and one for a PhD. These budgets remain the same, regardless of whether just one or both degrees get implemented. Approval of both degrees rather than one would neither increase or decrease the budget.

I. ENROLLMENT PROJECTIONS (indicate basis for projections in narrative)	FY_07-08_ First Year	FY_08-09__ Second Year	FY_09-10 Third Year
A. Student majors			
1. Shifted from other programs	4	0	0
2. New to institution	10	10	14
TOTAL MAJORS	14	14	14
B. Course sections satisfying program requirements			
1. Previously existing	40	44	44
2. New	4	0	0
TOTAL PROGRAM COURSE SECTIONS	44	44	44
C. Credit hours generated by those courses			
1. Existing enrollments	36	36	36
2. New enrollments	90	90	90
TOTAL CREDIT HOURS	126	126	126
D. Degrees awarded	4 (yr 2)	5 (yr 3)	5 (yr 4)

II. COSTS	EFT	Dollars	EFT	Dollars	EFT	Dollars
A. Personnel--reassigned or existing positions						
1. Faculty	2.2	198,000	2.2	203,940	2.2	210,058
2. Part-time faculty						
3. Graduate assistant	1.0	18,000	1.0	18,500	1.0	19,000
4. Administrators						
5. Support staff						
6. Fringe benefits		52,380		53,949		55,565
7. Other personnel costs						
TOTAL EXISTING PERSONNEL COSTS		268,380		276,389		284,623
B. Personnel--new positions						
1. Faculty						
2. Part-time faculty						
3. Graduate assistant						
4. Administrators	0.2	24,000	0.2	24,700	0.2	25,500
5. Support staff	1.0	24,000	1.0	24,700	1.0	25,500
6. Fringe benefits		9,120		9,394		9,675
7. Other personnel costs						
TOTAL NEW PERSONNEL COSTS		57,120		58,834		60,599
		First Year		Second Year		Third Year

C. Start-up costs (one-time expenses)				
l. Library/learning resources				
2. Equipment (office equip for secretary)	2,000			
3. Other (Web site)	3,000			
D. Physical facilities: construction or major renovation				
TOTAL ONE-TIME COSTS	5,000			
E. Operating costs (recurring costs--base budget)				
1. Supplies/expenses	1,000	1,030	1,060	
2. Travel	1,000	1,030	1,060	
3. Equipment			2,000	
4. Library/learning resources				
5. Other	1,000	1,050	1,100	
TOTAL RECURRING COSTS	3,000	3,090	5,183	
GRAND TOTAL COSTS	328,500	338,313	350,405	

III. REVENUE SOURCES

A. Source of funds			
1. Reallocation of existing funds	328,500	338,313	350,405
2. New student workload	xxxxxxx	xxxxxxx	
3. New tuition			
4. Federal funds			
5. Other grants			
6. Student fees			
7. Other (_____)			
Subtotal			
New state allocation requested			
GRAND TOTAL REVENUES	328,500	338,313	350,405
B. Nature of funds			
1. Base budget	323,500	338,313	348,405
2. One-time funds	5,000		2,000
GRAND TOTAL REVENUES	328,500	338,313	350,405

PIONEER.
A DuPont Company

DuPont Agriculture & Nutrition
Pioneer Crop Genetics Research & Development
Research Center
7300 N.W. 62nd Ave.
P.O. Box 1004
Johnston, IA 50131-1004
(515) 270-3600 Tel
(515) 270-4312 Fax

November 6, 2006

H. Roger Boerma
Distinguished Research Professor & Coordinator
of the Center for Soybean Improvement
Applied Genetic Technologies Center
University of Georgia
111 Riverbend Road
Athens, GA 30602-6810

Roger:

I fully support the idea of creating an interdisciplinary program in Plant Breeding and Genomics at the University of Georgia.

Genomics-related tools are rapidly becoming integrated into plant breeding programs at Pioneer and having a significant impact on our rate of progress toward improving cultivar performance. Having students trained in both plant breeding and genomics applications will be increasingly important as we move into the future. To emphasize this point, we currently view it as imperative that all breeding candidates we consider for PhD level positions have exposure to molecular marker technologies. These tools are routinely used in our breeding programs at Pioneer.

The need for graduates to understand genomics applications to plant breeding will increase with time as we move away from the traditional approach of field testing ever-larger numbers of experimental lines and move into an era of "cultivar design." To succeed in this competitive environment, the best plant breeders will understand the molecular basis of genetics and understand how specific genes and gene combinations/interactions impact field expressed phenotypes such as yield.

As you know, Pioneer is major employer of graduates in the fields of Plant Breeding, Genetics, Biotechnology and Agricultural Sciences. We recognize the strength of the University of Georgia's Plant Breeding curriculum and appreciate your continued efforts to upgrade it with industry needs in mind.

Sincerely,

John F. Soper, PhD
Director, Soybean Research

Pioneer Hi-Bred International, Inc.

Glenn R. Bowers, Ph. D.
Southern Head
Soybean Product Development

Syngenta Seeds, Inc.
778 Craighead 680
Bay, AR 72411
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Tel: (870) 483-7691
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glenn.bowers@syngenta.com

syngenta

November 7, 2006

Dr. H. Roger Boerma
University of Georgia
111 Riverbend Road
Athens, GA 30602-6810

Dear Dr. Boerma

Today, the development of improved cultivars and other types of germplasm for many species of economic importance is conducted by the private sector. In order to fill positions to meet these needs, private industry requires a broad pool of candidates trained in various disciplines. Plant breeders need an understanding of classical genetics, plant breeding, and molecular genetics and genomics. To be successful and to meet their employer's needs, these individuals need to have a strong understanding and firm basis in field trial methodology and agronomy. Too often today, individuals leave graduate school with a narrow view and background. Having strong training in only molecular biology does little to fully prepare someone to be a plant breeder in private industry.

I write this from both long-term and recent experiences. Recently, I was involved in hiring two soybean breeders for Syngenta Seeds. Presently, I am seeking candidates to fill two additional soybean breeding positions. Many of the candidates that I evaluated were too one dimensional in their education.

I am writing in support of the establishment of the proposed course of study for interdisciplinary graduate degrees in Plant Breeding and Plant Genomics at the University of Georgia. I strongly encourage you to develop programs that train tomorrow's plant breeders in a broad spectrum of topics related to understanding how plants reproduce, pass on their genes to subsequent generations, how the genotype interacts with the environment to create a phenotype, the limitations and implications of experimental design and statistical analysis, and other topics related to applied field breeding.

Sincerely,

Glenn R Bowers

Dr. Glenn R. Bowers
Southern Head, Soybean Product Development

MONSANTO

MONSANTO COMPANY
800 NORTH LINDBERGH BLVD.
ST. LOUIS, MISSOURI 63167
http://www.monsanto.com

April 6, 2007

H. Roger Boerma
Distinguished Research Professor & Coordinator
of the Center for Soybean Improvement
Applied Genetic Technologies Center
University of Georgia
111 Riverbend Road
Athens, GA 30602-6810

Dr Boerma,

I am writing this letter in support of the University of Georgia's Ph.D. program in Plant Breeding, Genetics, and Genomics. As a major employer of M.S. and Ph.D. graduates in Plant Breeding, Monsanto is concerned with the dwindling number of Universities that offer quality applied plant breeding programs. Recently we provided the University of Georgia two Monsanto Graduate Fellowships in this area. Monsanto values the UGA graduates in these fields and expects the University of Georgia to continue to provide highly trained plant breeders in the future. We see significant value in the proposed graduate training program including enhanced cooperation across the UGA departmental faculty in Crop & Soil Sciences and Horticulture as well as across the three UGA campuses of Athens, Griffin, and Tifton. The proposed M.S. and Ph.D. programs should provide improved communication and focus among both the graduate students and the faculty working in the plant breeding, genetics and genomics areas. Monsanto strongly supports and encourages the University of Georgia to establish both the M.S. and Ph.D. graduate programs in Plant Breeding, Genetics and Genomics.

Sincerely,

Kevin Matson

Monsanto Fellow
Regional Manager
Southern Soybean Breeding

Thro, Ann Marie, 06:01 AM 10/5/2006, plant breeding education for tomorrow

Subject: plant breeding education for tomorrow
Date: Thu, 5 Oct 2006 06:01:39 -0400
Thread-Topic: plant breeding education for tomorrow
Thread-Index: Acbn+s2weyEMzyenQ3qnCEKyFAyXAQAA9BLwABlodLA=
From: "Thro, Ann Marie" <ATHRO@CSREES.USDA.GOV>
To: "Wayne Parrott" <wparrott@uga.edu>
X-Junkmail-Info:
FROM_NO_LOWER,HTML_50_60,HTML_BACKHAIR_1,HTML_BADTAG_30_40,HTML_MESSAGE,HTML_NONELEMENT_30_40
X-Junkmail-Status: score=81/60, host=puntd2.cc.uga.edu
X-Junkmail-Whitelist: YES (by wparrott@uga.edu at punts4.cc.uga.edu)

To: Wayne Parrott, University of Georgia wparrott@uga.edu, Oct. 5, 2006

Greetings, Dr. Parrott; Greetings, Wayne,

Excellence in teaching, for the development of tomorrow's agricultural science workforce, is viewed as a high priority by CSREES. And attracting the best young scientists into agricultural research-- including plant breeding-- is going to require exciting, well-integrated interdisciplinary graduate programs with top-quality faculty. So you can well imagine that I was interested to learn about the proposed interdisciplinary plant breeding/plant genomics curriculum.

What little data there are on trends in number of students graduating in plant breeding suggest that the number has been declining and, currently, is just breaking even with US replacement needs (Guner and Wehner, 2003; Gepts and Hancock, 2006). Informally, I hear from private-sector employers that they find a shortage of qualified applicants for position openings in plant breeding. They are hiring breeders trained in India, Brazil, Argentina, and China; and competing with Canadian employers for Canadian students.

Similarly, faculty at the handful of universities that still provide comprehensive education and training for plant breeders (Guner and Wehner, 2003) report that that they receive calls from would-be employers asking if there are students near graduation. Most plant breeding students I meet have jobs before they graduate.

Data does exist on plant breeders employed in the public sector, and shows an accelerating decline in public-sector investment in plant breeding through the decade from the early 1990s to 2001 (Frey, 1996; Traxler et al, 2005). The new multi-state Plant Breeding Coordinating Committee (SCC 80) may be able to update this information; in the meantime, it is believed that the public-sector downward trend has continued. The documented downward trend in public sector plant breeding programs suggests that the anecdotal evidence of pro-active industry demand for graduates is accurate.

Public sector breeding programs represent our national capacity to educate future plant breeders, and that capacity is declining. At the same time that our investment for educating plant breeders is lagging, the skills and knowledge required for plant breeding have proliferated (Frey, 2000; Morris et al., 2006; Gepts and Hancock, 2006). Thus the plant breeding education programs we need for tomorrow will be even more sophisticated and complex than the ones that educated us a few decades ago. They must incorporate tested strengths of the past with new disciplines and emerging methods that will form part of the "classical breeding of tomorrow".

I believe that a continued decline in the capacity to train plant breeders must be averted. It would have real and serious implications for our future global leadership in science and technology; for national security preparedness (Bush, 2004); and for the urgent need to meet often-contrasting imperatives of competitiveness and sustainability.

Thro, Ann Marie, 06:01 AM 10/5/2006, plant breeding education for tomorrow

There is simply no scenario for U.S. agriculture that can succeed without plant breeding. We may be able to "coast" for a while, but in the long run we must retain the capacity to develop robust crops that will meet our needs in the circumstances of the future.

Best wishes and thank you for keeping me posted.

Ann Marie Thro
National Program Leader for Plant Breeding and Genetics
Plant and Animal Systems Unit, Cooperative State Research, Education, and Extension Service (CSREES), USDA
Waterfront Center Rm 3462
800 9th Street SW, Washington DC, 20024, USA
tel 1 202 401- 6702 fax - 6898/4888 athro@csrees.usda.gov

P.S. By the way, I thought you might be interested in some of the sources that I've listed. You may be familiar with many of these already:

Bush, G. W. 2004. Defense of United States Agriculture and Food. Homeland Security Presidential Directive / HSPD-9. Jan. 30, 2004. Available on the White House web site, http://www.whitehouse.gov/news/releases/2004/02/20040203-2.html.

Frey, K. J. 2000. National Plant Breeding Study-IV: Future priorities for Plant Breeding. Special Report 102. Iowa Agricultural and Home Economics Experiment Station.

Frey, K. J. 1966. National Plant Breeding Study-I: Human and Financial Resources Devoted to Plant Breeding Research and Development in the United States in 1994. Special Report 98. Iowa Agricultural and Home Economics Experiment Station.

Gepts, P. and J. Hancock. 2006. The future of plant breeding. Crop Sci 46:1630-1634,

Guner, N. and T. C. Wehner. 2003. Survey of U.S. Land-Grant Universities for Training of Plant Breeding Students. Crop Sci. 43:1938–1944.

Michael Morris, Greg Edmeades, and Eija Pehu. 2006. Plant Breeding and the Public Sector: Who Will Train Plant Breeders in the U.S. and around the World? The Global Need for Plant Breeding Capacity. Hort Sci 41(1):30-39

Traxler, G. A. Acquaye, K. J. Frey , A. M. Thro. 2005. Public Plant Breeding Resources in the US: Study Results for the year 2001. Available on the CSREES, USDA web site at: http://www.csrees.usda.gov/nea/plants/in_focus/ptbreeding_if_study.html

The University of Georgia

College of Arts and Sciences
Department of Plant Biology

2502 Plant Sciences
Athens, Georgia 30602-7271

Tel (706) 542-3732
Fax (706) 542-1805

10 October 2006

Dr. David Knauft
Department of Horticulture
1101 Miller Plant Sciences

Dr. Wayne Parrott
Department of Crop and Soil Sciences
CAGT

Dear David and Wayne:

I am pleased to be able to support your new graduate program in Plant Breeding and Plant Genomics. The curriculum you have developed has been well-planned, and we will be happy to have your students taking the Plant Biology courses you list.

Best wishes for the success of your efforts.

Sincerely,

Russell L. Malmberg
Professor and Department Head

The University of Georgia

Department of Statistics

October 4, 2006

Professor Wayne Parrott
Center for Applied Genetic Technologies
111 Riverbend Road
The University of Georgia
Athens, GA 30602-6810

Dear Professor Parrott:

Thank you for the information about the proposed Interdisciplinary Graduate Degree Program in Plant Breeding and Plant Genomics.

I am very glad to see that one course in Statistics is required for both the M.S. degree and the Ph.D. major degree. We hope in fact that some of your students will find it worthwhile to take more than one Statistics course, and I know that some students from the various departments that will partake in this new major already do so.

Looking in from the outside, the establishment of this new interdisciplinary major would seem to make perfect sense. Plant breeding and plant genomics must, especially at a land grant university and in the absence of a medical school, receive a high strategic priority as areas of strength of the University. Some other institutions in a similar situation have understood this. When I was at Iowa State University in the 90s, a tremendous investment was made in their Plant Sciences Institute (http://www.plantsciences.iastate.edu/). It consists of a variety of centers and has proven to be a magnet for interdisciplinary research and training that has also dramatically increased their competitiveness for external funding in the plant sciences. It also has proven to be a great recruiting tool.

I wish you the very best of luck with the new degree programs and hope that, when approved, they will help to further UGA's reputation in the plant sciences and stimulate interaction with other researchers across campus.

Sincerely yours,

John Stufken, Head
Department of Statistics

204 Statistics Building • Athens, Georgia 30602-1952 • Telephone (706) 542-5232
Fax (706) 542-3391 • electronic address: dept@stat.uga.edu

1785
The University of Georgia

College of Agricultural and Environmental Sciences
Department of Horticulture

MEMO

Date: **19 December 2006**

To: **D. Knauft**

From: **D. Bailey** Doug Bailey

Re: **Interdisciplinary Graduate Degrees in Plant Breeding and Plant Genomics**

The University of Georgia houses exceptional expertise in the area of plant breeding and genomics ranging from applied field-based breeding programs to molecular lab-oriented genomics programs. We are a leader in this area in both agronomic and horticultural cropping systems. The proposed interdisciplinary graduate studies program would allow us to offer a comprehensive educational opportunity to both M.S. and Ph.D. candidates that is not available elsewhere. I fully support the program both in principle and in commitment of departmental resources. Please keep me informed as this important initiative develops.

Horticulture Department • 1111 Plant Science Building • Athens, Georgia 30602-7273
Telephone (706) 542-2471 • Fax (706) 542-0624

1. **Name:** H. Roger Boerma
   Rank: Distinguished Research Professor & Coordinator, Center for Soybean Improvement, Center for Applied Genetic Technologies
   Academic discipline: Plant breeding and genomics
   Institutions attended, degrees earned;

Illinois State University	B.S.	1968
University of Illinois	M.S.	1970
University of Illinois	Ph.D.	1973

2. **Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;**
   My responsibilities include: i) development of superior yielding, multiple pest resistant soybean cultivars, ii) development of molecular technologies to improve the efficiency of soybean cultivar development, iii) identification and characterization of useful genetic variation for soybean improvement, iv) training of graduate students and post doctoral fellows in molecular breeding and genetics, v) teaching a graduate course entitled Quantitative Aspects of Molecular Breeding, vi) program implementation for the Center for Soybean Improvement, and vii) coordination of academic research for the Center for Applied Genetic Technologies. I have served as research advisor for postdoctoral scientists and hosted visiting scientists. Odd-numbered years, I teach Quantitative Aspects of Plant Breeding (CRSS 8880, 3 hrs). I have served as both chairman and committee member on numerous graduate advisory committees. The new program will not impact my workload.

3. **Scholarship and publication record for past five years;**

Honors received for academic achievement;

- Named recipient of the 2003 National Council of Commercial Plant Breeders Genetic and Plant Breeding Award
- Elected to the Continuing committee for the World Soybean Research Conference (1998-2004)
- Elected to a Directorship for the Georgia Soybean Association (200-2003)
- Elected to a Directorship for Southern Elite Genetics Association (1998-2002)
- Continuing Committee for the Molecular and Cellular Biology of the Soybean Conference (1998-2004)
- Appointed by President of American Society of Agronomy as co-editor for the monograph - Soybean: Production, Improvement, and Utilization (199-2003)
- Appointed by Chairman of United Soybean Board as co-organizer of the strategic planning workshop for soybean genomics (2003)
- Elected to a 2-year term on the Soybean Genomics Executive Committee (2003-2005)

Publications;

Boerma, H.R., and D.W. Walker. 2005. Discovery and utilization of QTLs for insect resistance in soybean." Genetica (in press).

Fasoula, V.A., and **H.R. Boerma**. 2004. Divergent selection at ultra-low plant density for seed protein and oil content within soybean cultivars. Field Crops Res. (avail. online Nov 2004).

Lee, S.-H., D.R. Walker, P.B Cregan, and **H.R. Boerma**. 2004. "Comparison of four flow cytometric SNP detection assays and their use in plant improvement." Theor. Appl. Genet. (publ. online 17 November).

Lee, G.J., **H.R. Boerma**, M.R. Villagarcia, X. Zhou, T.E. Carter, Jr., Z. Li, and M.O. Gibbs. 2004. A major QTL conditioning salt tolerance in S-100 soybean and descendent cultivars. Theor. Appl. Genet. 109:1610-1619.

Boerma, H.R., and J.E. Specht (ed.). 2004. Soybeans: Improvement, Production, and Uses. 3rd ed. ASA, CSSA, and SSA, Madision WI.

Orf, J.H., B.W. Diers, and **H.R. Boerma**. 2004. Genetic improvement: Conventional and molecular-based strategies. p. 417-450. *In* H.R. Boerma and J.E. Specht (ed.) Soybeans: Improvement, production, and uses. 3rd ed. ASA, CSSA, and SSA, Madision WI.

Fasoula, V.A., D.K. Harris, and **H.R. Boerma**. 2004. Validation and designation of quantitative trait loci for seed protein, seed oil, and seed weight from two soybean populations. Crop Sci. 44:1218-1225.

Hulburt, D.J., **H.R. Boerma**, and J.N. All. 2004. Effect of pubescence tip on soybean resistance to lepidopteran insects. J. Econ. Entomol. 97:621-627.

Ha, B.K., J.B. Bennett, R.S. Hussey, and **H.R. Boerma**. 2004. Pedigree analysis of a major QTL conditioning soybean resistance to southern root-knot nematode. Crop Sci. 44:758-763.

Narvel, J.M., T.E. Carter, Jr., L.R. Jakkula, J. Alvernaz, M.A. Bailey, M.A.R. Mian, S.H. Lee, G.J. Lee, and **H.R. Boerma**. 2004. Registration of NC113 soybean mapping population. Crop Sci. 44:704-706.

Fasoula, V.A., D.K. Harris, M.A. Bailey, D.V. Phillips, and **H.R. Boerma**. 2003. Identification, mapping, and confirmation of a gene in soybean for resistance to bud blight. Crop Sci. 43:1754-1759.

Harris, D.K., **H.R. Boerma**, R.S. Hussey, and S.L. Finnerty. 2003. Additional sources of resistance to two species of root-knot nematode. Crop Sci. 43:1848-1851.

Walker, D.R., **H.R. Boerma**, J.N. All, and W.A. Parrott. 2002. Combining cry1Ac with QTL alleles from PI229358 to improve soybean resistance to lepidopteran pests. Mol. Breed. 9:43-51.

Li, Z., R.F. Wilson, W.E. Rayford, and **H.R. Boerma**. 2002. Molecular mapping genes conditioning reduced palmitic acid content in N87-2122-4 soybean. Crop Sci. 42:373-378.

Walker, D.R., **H.R. Boerma**, J.N. All, and W.A. Parrott. 2002. Transgenic technology for insect resistance: Current achievements and future prospects. p. 38-51. *In* K. Rajasekeran, T.J. Jacks, and J.W. Finley (ed.) Crop Biotechnology. American Chemical Society, Washington, DC.

Narvel, J.M., D.R. Walker, B.G. Rector, J.N. All, W.A. Parrott, and **H.R. Boerma**. 2001. A retrospective DNA marker assessment of the development of insect resistant soybean." Crop Sci. 41:1931-1939.

Lee, S.H., K.Y. Park, H.S. Lee, E.H. Park, and **H.R. Boerma**. 2001. Genetic mapping of QTL conditioning soybean sprout yield and quality. Theor. Appl. Genet. 103:702-709.

Li, Z., L. Jakkula, R.S. Hussey, J.P. Tamulonis, **H.R. Boerma**. 2001. SSR mapping and confirmation of QTL from PI96354 conditioning soybean resistance to southern root-knot nematode. Theor. Appl. Genet. 103:1167-1173.

Narvel, J.M., L.R. Jakkula, D.V. Phillips, T. Wang, S.H. Lee, **H.R. Boerma**. 2001. Molecular mapping and pedigree analysis of Rpx conditioning reaction to bacterial pustule in soybean. J.

Heredity 92:267-270.

4. **Professional activity;**
   American Association for the Advancement of Science
   American Society of Agronomy
   Crop Science Society of America
   Council for Agricultural Science and Technology
   Georgia Chapter of American Society of Agronomy

5. **Expected responsibilities in this program;**
   I expect to continue serving on graduate committees and teaching Quantitative Aspects of Plant Breeding.

1. **Name:** E. Charles Brummer
   Rank: Professor
   Academic discipline: Plant breeding and genomics
   Institutions attended, degrees earned;

Pennsylvania State University	B.S.	1986
University of Georgia	M.S.	1989
University of Georgia	Ph.D.	1993

2. **Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;**
   My workload is 75% research and 25% teaching. My responsibilities include: i) development of superior cultivars of forage and bioenergy crops suitable for hay or pasture, ii) integration of improved breeding methods, including molecular technologies, into the cultivar development process, iii) conducting research on the genetic basis of yield and related traits in alfalfa and other crops, iv) training graduate students and post doctoral fellows in forage breed and genetics, v) teaching graduate and undergraduate courses, and vi) developing sustainable agricultural systems through the incorporation of perennial forage and bioenergy crops. I teach plant breeding and genetics classes and have served on numerous graduate committees as both chairman and committee member. Addition of the new program will not impact my workload.

3. **Scholarship and publication record for past five years;**

Brummer, E.C. 2006. Grazing tolerant alfalfa cultivars have superior persistence under continuous and rotational stocking. Forage and Grazinglands (accepted).

Cruz, V.M.V., R. Luhman, L.F. Marek, C.L. Rife, R.C. Shoemaker, **E.C. Brummer**, and C.A.C. Gardner. 2006. Characterization of flowering time and SSR marker analysis of spring and winter type *Brassica napus* L. germplasm. Euphytica (accepted).

Cruz, V.M.V., J.D. Nason, R. Luhman, L.F. Marek, R.C. Shoemaker, **E.C. Brummer**, and C.A.C. Gardner. 2006. Analysis of bulked and redundant accessions of *Brassica* germplasm using assignment tests of microsatellite markers. Euphytica (accepted).

Cruz, V.M.V., C.L. Rife, J.D. Nason, **E.C. Brummer**, and C.A.C. Gardner. 2006. Measuring the effectiveness of isolation of *Brassica napus* L. accessions during caged germplasm regeneration. Genet. Resources and Crop Evol. (accepted).

Robins, J.G., D. Luth, T.A. Campbell, G.R. Bauchan, C. He, D.R. Viands, J.L. Hansen, and **E.C. Brummer**. 200x. Mapping biomass production in tetraploid alfalfa (*Medicago sativa* L.). Crop Sci. [accepted with revision].

Xiong Y., S. Fei, **E.C. Brummer**, K.J. Moore, R.E. Barker, G. Jung, J. Curley, and S.E. Warnke. 2006. QTL analysis of fiber components and crude protein in an annual × perennial ryegrass interspecific hybrid population. Mol. Breed. (accepted).

Xiong Y., S. Fei, **E.C. Brummer**, R. Arora, R.E. Barker, G. Jung, and S.E. Warnke. 2006. QTL analysis of winter hardiness in an annual × perennial ryegrass interspecific hybrid population. Mol. Breed. (accepted).

Lamb, J.F.S., C.C. Sheaffer, L.H. Rhodes, M. Sulc, D.J. Undersander, and **E.C. Brummer**. 2006. Forage yield and quality of alfalfa cultivars released from the 1940's through the 1990's. Crop Sci. 46:902-909.

Riday, H., and **E.C. Brummer**. 2006. Persistence and yield stability of intersubspecific alfalfa hybrids. Crop Sci. 46:1058-1063.

Robins, J.G., H. Riday, S.J. Helland, and **E.C. Brummer**. 2006. Biomass yield stability in alfalfa. J Iowa Acad. Sci. 111:71-75.

Beuselinck, P.R., **E.C. Brummer**, D.K. Viands, K.H. Asay, R.R. Smith, J.J. Steiner, and D.K. Brauer. 2005. Rhizomatous *Lotus corniculatus*: V. Genotypic and environmental effects on growth. Crop Sci. 45:1736-1740.

Casler, M.D., and **E.C. Brummer**. 2005. Forage yield of smooth bromegrass collections from rural cemeteries. Crop Sci. 45:2510-2516.

Delate, K., E. Holzmueller, D.D. Frederick, C. Mize, and **E.C. Brummer**. 2005. Tree establishment and growth using forage ground covers in an alley-cropped system in Midwestern USA. Agroforestry Systems 65:43-52.

Gepts, P., W.D. Beavis, **E.C. Brummer**, R.C. Shoemaker, H.T. Stalker, N.F. Weeden, and N.D. Young. 2005. Legumes as a model plant family. Genomics for Food and Feed Report of the Cross-Legume Advances Through Genomics Conference. Plant Phys. 137:1228-1235.

Guretzky, J.A., K.J. Moore, **E.C. Brummer**, and C.L. Burras. 2005. Species diversity and functional composition of pastures that vary in landscape position and grazing management. Crop Sci. 45:282-289.

Riday, H., and **E.C. Brummer**. 2005. Heterosis in a broad range of alfalfa germplasm. Crop Sci. 45:8-17.

Riday, H., and **E.C. Brummer**. 2005. Relationships among biomass yield components within and between subspecies of alfalfa. Medicago Genetic Reports Vol. 4. Available at www.medicago-reports.org.

Weishaar, M.A., **E.C. Brummer**, J.J. Volenec, K.J. Moore, and S. Cunningham. 2005. Improving winter hardiness in nondormant alfalfa germplasm. Crop Sci. 45:60-65.

Brummer, E.C. 2004. Genomics research in alfalfa. Crop Sci. 44:1904-1907.

Moore, K.J., T.A. White, R.L. Hintz, P.K. Patrick, and **E.C. Brummer**. 2004. Sequential grazing of cool and warm-season pastures. Agron J 96:1103-1111.

Riday, H., and **E.C. Brummer**. 2004. Morphological variation of *Medicago sativa* subsp. falcata genotypes and their hybrid progeny. Euphytica 138:1-12.

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Guretzky, J.A., K.J. Moore, C.L. Burras, and **E.C. Brummer**. 2004. Distribution of legumes along gradients of slope and soil electrical conductivity in pastures. Agron J. 96:547-555.

Guretzky, J.A., K.J. Moore, A.D. Knapp, and **E.C. Brummer**. 2004. Emergence and survival of legumes seeded into pastures varying in landscape position. Crop Sci. 44:227-233.

Aberle, E.Z., L.R. Gibson, A.D. Knapp, P.M. Dixon, K.J. Moore, **E.C. Brummer**, and R. Hintz. 2003. Optimum planting procedures for eastern gamagrass. Agron. J. 95:1054-1062.

Brueland, B.A., K.R. Harmoney, K.J. Moore, J.R. George, and **E.C. Brummer**. 2003. Developmental morphology of smooth bromegrass growth following spring grazing. Crop Sci. 43:1789-1796.

Casler, M.D., R.E. Barker, **E.C. Brummer**, Y.A. Papadopolous, and L.D. Hoffman. 2003. Selection for orchardgrass seed yield in target vs. non-target environments. Crop Sci. 43:532-538.

Riday, H., **E.C. Brummer**, T.A. Campbell, D. Luth, and P.M. Cazcarro. 2003. Comparisons of genetic and morphological distance with heterosis between *Medicago sativa* subsp. *sativa* and subsp. *falcata*. Euphytica 131:37-45.

Singer, J.W., R.L. Hintz, K.J. Moore, M.H. Wiedenhoeft, and **E.C. Brummer**. 2003. Tall fescue response to nitrogen and harvest date for stockpiled grazing in the upper Midwest. Crop Mgmt. doi:10.1094/CM-2003-0904-01-RS.

Tian, X., A.D. Knapp, L.R. Gibson, R. Struthers, K.J. Moore, **E.C. Brummer**, and T.B. Bailey. 2003. Response of Eastern gamagrass seed to gibberellic acid buffered below its pKa. Crop Sci. 43:927-933.

Brummer, E.C., K.J. Moore, and N.C. Bjork. 2002. Agronomic consequences of dormant-nondormant alfalfa mixtures. Agron. J. 94:782-785.

Casler, M.D., P.R. Peterson, L.D. Hoffman, N.J. Ehlke, **E.C. Brummer**, J.L. Hansen, M.J. Mlynarek, M.R. Sulc, J.C. Henning, D.J. Undersander, P.G. Pitts, P.C. Bilkey, and C.A. Rose-Fricker. 2002. Natural selection for survival improves freezing tolerance, forage yield, and persistence of festulolium. Crop. Sci. 42:1421-1426.

Cox, T.S., M. Bender, C. Picone, D.L. Van Tassel, J.B. Holland, **E.C. Brummer**, B.E. Zoeller, A.H. Paterson, and W. Jackson. 2002. Breeding perennial grain crops. Crit. Rev. Plant Sci. 21:59-91.

Gustine, D.L., P.W. Voigt, **E.C. Brummer**, and Y.A. Papadopoulos. 2002. Genetic variation of RAPD markers in North American white clover collections and cultivars. Crop Sci. 42:343-347.

Hoy, M.D., K.J. Moore, J.R. George, and **E.C. Brummer**. 2002. Alfalfa yield and quality as influenced by establishment method. Agron. J. 94:65-71.

Keller, D.K., and E.C. Brummer. 2002. Putting food production in context: Toward a postmechanistic agricultural ethic. BioScience 52:264-271.

Lemus, R., **E.C. Brummer**, K.J. Moore, N.E. Molstad, C.L. Burras, and M.F. Barker. 2002. Biomass yield and quality of 20 switchgrass populations in southern Iowa, USA. Biomass Bioenergy 23:433-442.

Riday, H., and **E.C. Brummer**. 2002. Forage yield heterosis in alfalfa. Crop Sci. 42:716-723.Riday, H., and **E.C. Brummer**. 2002. Heterosis of agronomic traits in alfalfa. Crop Sci. 42:1081-1087.

Riday, H., **E.C. Brummer**, and K.J. Moore. 2002. Heterosis of forage quality in alfalfa. Crop Sci. 42:1088-1093.

Tian, X., A.D. Knapp, K.J. Moore, **E.C. Brummer**, and T.B. Bailey. 002. Cupule removal and caryopsis scarification improves germination of Eastern Gamagrass seed. Crop Sci. 42:185-189.

Brummer, E.C. 2001. Response to Monsanto and Intellectual Property. Teaching Ethics 2:115-117.

Harmoney, K.R., K.J. Moore, **E.C. Brummer**, C.L. Burras, and J.R. George. 2001. Spatial legume composition and diversity across seeded landscapes. Agron. J. 93:992-1000.

Munkvold, G.P., W.M. Carlton, **E.C. Brummer**, and J.R. Meyer. 2001. Virulence of Iowa strains of Aphanomyces euteiches and benefits of resistance to Aphanomyces root rot in alfalfa cultivars. Plant Dis. 85:328-333.

Sleugh, B.B., K.J. Moore, **E.C. Brummer**, A.D. Knapp, J. Russell, L. Gibson. 2001. Forage

nutritive value of various amaranth species at different harvest dates. Crop Sci. 41:466-472.

4. **Professional activity;**
   American Association for the Advancement of Science (AAAS) American Society of Agronomy Crop Science Society of America Genetics Society of America Society for the Study of Evolution American Forage and Grasslands Council Iowa Forage and Grasslands Council Phi Kappa Phi Gamma Sigma Delta Alpha Zeta

5. **Expected responsibilities in this program;**
   I expect to continue teaching classes and serving on graduate committees.

1. Name: Peng W. Chee
Rank: Associate Professor
Academic discipline: Plant breeding and molecular genetics
Institutions attended, degrees earned:

Montana State University	B.S.	1992
Montana State University	M.S.	1994
North Dakota State University	Ph.D.	1998

2. Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;
I have 96% research and 4% teaching appointment in the Department of Crop and Soil Sciences. I direct a research program focusing on cotton molecular genetics and germplasm development; currently, the program consists of 2 postdoctoral associates, 2 research coordinators, one laboratory technician, 2 visiting research scientists, and 2 PhD students. In addition, I co-teach Agricultural Biotechnology, CRSS 4800/6800, a 3-hour course that is offered each Spring Semester. I anticipate my participation in the program would result in more involvement in the graduate student committee, which should not increase my workload significantly.

3. Scholarship and publication record for past five years;

Ulloa, M., C Brubaker, and **P. Chee**. 2006. Cotton. *In* C. Kole (ed) Genome Mapping & Molecular Breeding. Vol. 7: Technical Crops. Springer, Heidelberg, Berlin, New York, Tokyo.

Shen, X, G. Becelaere, K. Kumar, R.F. Davis, O.L. May, and **P.W**. **Chee**. 2006. QTL mapping for resistance to root-knot nematodes in the M-120 RNR Upland cotton line (*Gossypium hirsutum* L.) of the Auburn 623 RNR source. Theor. Appl. Genet. 113:1539-1549.

Gingle, A.R., H. Yang, **P. Chee**, O.L. May, J. Rong, D.T. Bowman, E.L. Lubbers, and A.H. Paterson. 2006. An Integrated Web Resource for Cotton. Crop Science 46:1998-2007

Kumar, P., A.H. Paterson, and **P.W. Chee**. 2006. Predicting introns sites by cotton ESTs to *Arabidopsis* genomic DNA alignment. J. Cotton Sci. 10:29-38.

Desai, A., **P. Chee**, J. Rong, L. May, and A. H. Paterson. 2006. Chromosome structural changes in diploid and tetraploid A genomes of *Gossypium*. Genome 49:336-345.

Rong, J., G.J. Pierce, V.N. Waghmare, C.J. Rogers, A. Desai, **P.W. Chee**, O.L. May, J.R. Gannaway, J.F. Wendel, T.A. Wilkins, and A.H. Paterson. 2005. Genetic mapping and comparative analysis of seven mutants related to seedborne fiber development in cotton. Theor. Appl. Genet. 111:1137-1146.

Chee, P., X. Draye, C-X. Jiang, L. Decanini, T.A. Delmonte, R. Bredhauer, C.W. Smith, and A.H. Paterson. 2005. Molecular dissection of phenotypic variation between *Gossypium hirsutum* and *G. barbadense* (cotton) by a backcross-self approach: I. Fiber Elongation. Theor. Appl. Genet. 111:757-763.

Chee, P., X. Draye, C-X. Jiang, L. Decanini, T.A. Delmonte, R. Bredhauer, C.W. Smith, and A.H. Paterson. 2005. Molecular dissection of phenotypic variation between *Gossypium hirsutum* and *G. barbadense* (cotton) by a backcross-self approach: III. Fiber Length. Theor. Appl. Genet. 111:772-781.

Draye, X., **P. Chee**, C-X. Jiang, L. Decanini, T.A. Delmonte, R. Bredhauer, C.W. Smith, and A.H. Paterson. 2005. Molecular dissection of phenotypic variation between *Gossypium hirsutum* and *G. barbadense* (cotton) by a backcross-self approach: II. Fiber Fineness. Theor. Appl. Genet. 111:764-771.

Van Becelaere, G., E.L. Lubbers, A.H. Paterson, and **P.W. Chee**. 2005. Pedigree vs. RFLP based genetic similarity estimates in cotton. Crop Sci. 45:2281-2287.

Sakhanokho, H.F., P. Ozias-Akins, O.L. May, and **P.W. Chee**. 2005. Putrescine enhances somatic embryogenesis and plant regeneration in upland cotton. Plant Cell, Tissue and Organ Culture 81:91-92.

Chee, P.W., J. Rong, D. Williams-Coplin, S.R. Schulze, and A.H. Paterson. 2004. EST derived PCR-based markers for functional gene homologues in cotton. Genome 47:449-462.

May, O.L., **P.W. Chee**, and H. Sakhanokho. 2004. Registration of GA98033 upland cotton germplasm line. Crop Sci. 44:2278-2279.

Paterson, A.H., R.K Boman, S.M. Brown, **P.W. Chee**, J.R. Gannaway, A.R. Gingle, O.L. May, and C.W. Smith. 2004. Reducing the genetic vulnerability of cotton. Crop Sci. 44:1900-1901.

Rong, J., C. Abbey, J.E. Bowers, C.L. Brubaker, C. Chang, **P.W. Chee**, T.A. Delmonte, X. Ding, J.J. Garza, B.S. Marler, C. Park, G.J. Pierce, K.M. Rainey, V.K. Rastogi, S.R. Schulze, N.L. Trolinder, J.F. Wendel, T.A. Wilkins, D. Williams-Coplin, R.A. Wing, R.J. Wright, X. Zhao, L. Zhu, and A.H. Paterson. 2004. A 3347-locus genetic recombination map of sequence-tagged sites reveals features of genome organization, transmission and evolution of cotton (*Gossypium*). Genetics 166:389-417.

Sakhanokho, H.F., P. Ozias-Akins, O.L. May, and **P.W. Chee**. 2004. Induction of somatic embryogenesis and plant regeneration in select Georgia and Pee Dee cotton (*Gossypium hirsutum* L.) lines. Crop Sci. 44:2199-2205.

Sakhanokho, H.F., A. Zipf, K. Rajasekaran, S. Saha, G.C. Sharma, and **P.W. Chee**. 2003. Somatic embryo initiation and germination in diploid cotton (*Gossypium arboreum* L.). In Vitro Cell. Dev. Biol.-Plant 40:177-181.

Sakhanokho, H. and **Chee P.W.** 2002. The current status of gene transformation in cotton. SAAS Bull. Biochem. Biotechn. 15:34-46.

Chee, P.W., E.M. Elias, J.A. Anderson, and S.F. Kianian. 2001. Evaluation of a high grain protein locus from *Triticum dicoccoides* in an adapted durum wheat background. Crop Sci. 41:295-301.

4. Professional activity;

2006-present	Treasurer/Secretary, International Cotton Genome Initiative
2005	Chair, writing committee for SDC-317 Multi-regional Research Project "Genetic improvement approaches to sustained, profitable cotton production in the U.S"
2004-2005	Vice-Chair, S-304 Multi-regional Research Project "Development of Genetic Resources for Cotton"

5. Expected responsibilities in this program;

I expect to participate in teaching courses related to crop improvement and in serving as

major advisor or a committee member for graduate students enrolled in the major.

1. Name: Patrick J. Conner
Rank: Associate Professor
Academic discipline: Plant breeding and genomics
Institutions attended and degrees:

Purdue University	B.S.	1991
Cornell University	Ph.D.	1996

2. Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;
100% research at Tifton. No courses taught. My main research emphasis is on producing superior pecan and muscadine cultivars adapted to the growing conditions of the southeastern United States. Current research projects involve: (1) Developing molecular marker linkage maps to increase our understanding of pecan genetics and as a tool for marker-assisted selection of valuable traits (2) Investigating the inheritance of key horticultural traits (3) Determining the inheritance of race-specific resistance to pecan scab (4) Evaluating existing pecan cultivars and germplasm for disease and insect resistance as well as nut quality and tree productivity. My workload would not be much affected except to serve on student committees or meetings involved.

3. Scholarship and publication record for the past five years;
Honors;
2005 Southeastern Pecan Growers Association Outstanding Presentation Award
2002 UGA Tifton Campus Award of Excellence for Junior Scientist

Publications;
Conner, P.J. 2005. Scion bud removal delays leaf development but decreases graft success in pecan four-flap graft. HortScience 40:2213-2214.
Beedanagari, S.R., S.K. Dove, B.W. Wood, and **P.J. Conner**. 2005. A first linkage map of pecan cultivars based on RAPD and AFLP markers. Theor. Appl. Genet. 110:1127-1137.
Wood, B.W., **P.J. Conner,** and R.E. Worley. 2004. Insights into alternate bearing of pecan. Acta Hort. 636:617-629.
Conner, P.J., and K.L. Stevenson. 2004. Pathogenic variation of *Cladosporium caryigenum* isolates and corresponding differential resistance in pecan. HortScience 39:553-557.
Conner, P.J., and T.E. Thompson. 2003. Evaluation of nine pecan cultivars and selections in southern Georgia. J. Amer. Pom. Soc. 57:115-120.
Wood, B.W., **P.J. Conner**, and R.E. Worley. 2003. Relationship of alternate bearing intensity in pecan fruit and canopy characteristics. HortScience 38:361-366.
Conner, P.J. 2002. A detached leaf technique for studying race-specific resistance to *Cladosporium caryigenum* in pecan. J. Amer. Soc. Hort. Sci. 127(5):781-785.
Conner, P.J. 2002. The effect of pollination bag type on fruit set and quality in pecan hybridization. J. Amer. Pom. Soc. 56(3):189-192.
Conner, P.J., and R.E. Worley. 2002. Performance of 15 pecan cultivars and selections through 20 years in southern Georgia. HortTechnology 12:274-281.
Conner, P.J., and B. W. Wood. 2001. Identification of pecan cultivars and their genetic

relatedness as determined by randomly amplified polymorphic DNA (RAPD) analysis. J. Amer. Soc. Hort. Sci. 126:474-480.

Dutcher, J.D., R.E. Worley, **P. Conner**, and S.E. Dove. 2001. Pecan variety differences in the incidence of hemipteran kernel damage. J. Entomol. Sci. 36:445-452.

4. Professional activity;

American Society for Horticultural Science
International Society for Horticultural Science
Southern Region, American Society for Horticultural Science
American Pomological Society
UGA Plant Center
Pecan Crop Germplasm Committee
Southeastern Pecan Growers Association
Georgia Pecan Growers Association
Northern Nut Growers Association

Professional service;

2006-2007	ASHS Fruit Breeding Working Group	Chair-Elect
2005-2006	ASHS Fruit Breeding Working Group	Secretary
2006-2007	ASHS Temperate Nut Working Group	Chair
2002-2004	ASHS Temperate Nut Working Group	Chair
2003	ASHS Fruit Publication Award Com.	Member

5. Expected responsibilities in this program;

Serve as major professor for graduate student or serve on student committees. Possibly serve on steering committee or as an officer.

1. Name: Katrien M. Devos
Rank: Associate Professor
Academic discipline: Cereal genetics and genomics
Institutions attended and degrees:

State University Ghent, Belgium	B.Sc.	1984
State University Ghent, Belgium	Lic.Sc.	1986
State University Ghent, Belgium	Ph.D.	1992

2. Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program; full time +Courses taught: Fall: PBIO/BIOL/CRSS 3020: 3 credit hoursSpring: PBIO 8820 (graduate seminar): 1 credit hourWorkload will not change.

3. Scholarship and publication record for past five years;

Dida, M.M., Ramakrishnan S. Srinivasachary, J.L. Bennetzen, and **K.M. Devos**. 2006. The genetic map of finger millet, *Eleusine coracana*. Theor. Appl. Genet. (in press).

Bennetzen, J.L., J. Ma, and **K.M. Devos**. 2005. Mechanisms of recent genome size variation in flowering plants. Ann. Bot. 95:127-132.

Beales, J, D. Laurie, and **K.M. Devos**. 2005. Allelic variation at the linked *AP1* and *PhyC* loci in hexaploid wheat is associated but not perfectly correlated with vernalization response. Theor. Appl. Genet. 110:1099-1107.

Appleford, N.E.J., D.J. Evans, J.R. Lenton, P. Gaskin, S.J. Croker, **K.M. Devos**, A.L. Phillips, and P. Hedden. 2005. Function and transcript analysis of gibberellin-biosynthetic enzymes in wheat. Planta 223:568-582.

Doust, A.N., **K.M. Devos**, M.D. Gadberry, M.D. Gale, and E.A. Kellogg. 2005. The genetic basis for inflorescence variation between foxtail and green millet *(Poaceae)*. Genetics 169:1659-1672.

Devos, K.M., J. Beales, Y. Ogihara, and A.N. Doust. 2005. Comparative sequence analysis of the *Phytochrome C* gene and its upstream region in allohexaploid wheat reveals new data on the evolution of its three constituent genomes. Plant Mol. Biol. 58:625-641.

Devos, K.M., J. Ma, A.C. Pontaroli, L.H. Pratt, and J.L. Bennetzen. 2005. Analysis and mapping of randomly chosen BAC clones from hexaploid bread wheat. Proc. Natl. Acad. Sci. 102:19243-19248.

Devos, K.M. 2005. Updating the crop circles. Curr. Opin. Plant Biol. 8:155-162.

McIntosh, R.A., **K.M. Devos**, J. Dubcovsky, W.J. Rogers, C.F. Morris, R. Appels, and O.A. Anderson. 2005. Catalogue of gene symbols for wheat: 2005 supplement. Annu. Wheat Newslet. 51:251-285.

Devos, K.M., W.W. Hanna, and P. Ozias-Akins. 2005. Pearl millet. *In* C. Kole (ed.) The genomes. Volume I: Cereals and millets (in press).

Dida, M.M., and **K.M. Devos**. 2005. Finger millet. *In* C. Kole (ed.) The genomes. Volume I: Cereals and millets (in press).

Yadav, R.S., C.T. Hash, F.R. Bidinger, **K.M. Devos**, C.J. Howarth, and K.P. Skot. 2004. Genomic regions associated with grain yield and aspects of post-flowering drought tolerance in pearl millet across stress environments and testers background. Euphytica 136:265-277.

Ma, J., **K.M. Devos**, J.L. Bennetzen. 2004. Analysis of LTR-retrotransposon structures reveal recent and rapid genomic DNA loss in rice. Genome Res. 14:860-869.

Doust, A.N., **K.M. Devos**, M.D. Gadberry, M.D. Gale, and E.A. Kellogg. 2004. Genetic control of branching in foxtail millet. Proc. Natl. Acad. Sci. 101:9045-9050.

McIntosh, R.A., **K.M. Devos**, J. Dubcovsky, and W.J. Rogers. 2004. Catalogue of gene symbols for wheat: 2004 supplement. Annu. Wheat Newslet. 50:286-313.

Qi, X., T.S. Pittaway, S. Lindup, H. Liu, E. Waterman, F.K. Padi, C.T. Hash, J. Zhu, M.D. Gale, and **K.M. Devos**. 2004. An integrated genetic map of pearl millet, *Pennisetum glaucum.* Theor. Appl. Genet. 109:1485-1493.

Wilson, J.P., and **K.M. Devos**. 2004. Linkage groups associated with partial rust resistance in pearl millet. ISMN 45:51-52.

Alm, V., C. Fang, C.S. Busso, **K.M. Devos**, K. Vollan, Z. Grieg, and O.A. Rognli. 2003. A linkage map of meadow fescue (*Festuca pratensis* Huds.) and comparative mapping with other *Poaceae* species. Theor. Appl. Genet. 108:25-40.

Devos, K.M., and J. Beales. 2003. Single nucleotide polymorphisms (SNPs) associated with the vernalisation response in wheat. p. 238-242. *In* N.E. Pogna, M. Romano, E.A. Pogna, and G. Galterio (ed.) Proc. 10th Int. Wheat Genet. Symp., S.I.M.I., Roma, Italy.

McIntosh, R.A., **K.M. Devos**, J. Dubcovsky, C.F. Morris, and W.J. Rogers. 2003. Catalogue of gene ymbols for wheat: 2003 supplement. Annu. Wheat Newslet. 49:246-282.

Poncet, V., E. Martel, S. Allouis, **K.M. Devos**, F. Lamy, A. Sarr, and T. Robert. 2002. Comparative analysis of QTLs affecting domestication traits between two domesticated x wild pearl millet (*Pennisetum glaucum* L., *Poaceae*) crosses. Theor. and Appl. Genet. 104:965-975.

Gale, M.D., J.E. Flintham, and **K.M. Devos**. 2002. Cereal comparative genetics and preharvest sprouting. Euphytica 126:21-25.

Devos, KM, J.K.M. Brown, and J.L. Bennetzen. 2002. Genome size reduction through illegitimate recombination counteracts genome expansion in *Arabidopsis*. Genome Res. 12:1075-1079.

Laurie, D.A., and **K.M. Devos**. 2002. Trends in comparative genetics and their potential impacts on wheat and barley research. Plant Mol. Biol. 48:729-740.

McIntosh, R.A., **K.M. Devos**, J. Dubcovsky, and W.J. Rogers. 2002. Catalogue of gene symbols for wheat: 2002 supplement. Annu. Wheat Newslet. 48:287-321.

Allouis, S., X. Qi, S. Lindup, M.D. Gale, and **K.M. Devos**. 2001. Construction of a BAC library of pearl millet, *Pennisetum glaucum*. Theor. Appl. Genet. 102:1200-1205.

Devos, K.M., and J.L. Bennetzen. 2001. Genome relationships: Maize and the Grass Model. p. 863-865. *In* S. Brenner, and J.H. Miller (ed.) Encyclopedia of Genetics. Academic Press, San Diego, CA.

Devos, K.M. 2001. Grass comparative genome analysis: from wheat to arabidopsis. p. 1-14. *In* Proceedings of The Second Hallim International Symposium on Recent Advances in Life Science and Biotechnology. KAST.

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McIntosh, R.A., **K.M. Devos**, J. Dubcovsky, and W.J. Rogers. 2001. Catalogue of gene symbols for wheat: 2001 supplement. Annu. Wheat Newslet. 47:333-354.

Qi, X., S. Lindup, T.S. Pittaway, S. Allouis, M.D. Gale, and **K.M. Devos**. 2001. Development of simple sequence repeat (SSR) markers from bacterial artificial chromosomes (BACs) without subcloning. BioTechniques 31:355-358.

Zhang, H., X. Liu, J.Z. Jia, M.D. Gale, and **K.M. Devos**. 2001. Construction of a comparative genetic map between the genomes of wheat and *Aegilops longissima*. Theor. Appl. Genet. 103:518-525.

Qi, X., S. Bakht, **K.M. Devos**, M.D. Gale, and A. Osbourn. 2001. L-RCA (ligation-rolling circle amplification): a general method for genotyping of single nucleotide polymorphisms (SNPs). NAR 29:e116

4. Professional activity;

Member of the Editorial Board of 'The Plant Genome'
Administrator for Rockefeller Travel Grants for developing country scientists to attend the yearly PAG meetings
Member of the Enabling Committee on Wheat Genomics
Co-curator of the Wheat Gene Catalog (since 1998)
NSF Plant Genome Research Panel (2002)
Plant Center Committee, UGA (2003 – 2006)
Administrator for Rockefeller Travel Grants for developing country scientists to attend the yearly PAG meetings (since 2004)
Member of the Editorial Board of 'The Plant Genome' (since 2005)
USDA-NRI Panel on Functional Genomics (2005)
Member of the Enabling Committee on Wheat Genomics (since 2006)

5. Expected responsibilities in this program;

Teaching of a graduate seminar courseTraining graduate students

1. Name: Wayne W. Hanna
Rank: Professor (part-time)
Academic discipline: Grass Breeding and Genetics
Institutions attended, degrees earned;

Texas A&M University	B.S.	1966
Texas A&M University	M.S.	1968
Texas A&M University	Ph.D.	1970

2. Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;
100% Research. Serve on graduate committees for 5 Ph.D. students--3 at UGA, one at the University of Florida and one at North Carolina State University. My input into the work of three of the graduate students is fairly high since they work in areas (and with germplasm) closed related to mine. I give about one lecture per semester at Athens to plant breeding or turf classes. Addition of the new program will not greatly impact my workload.

3. Scholarship and publication record for past five years;
Awards;
2002 Outstanding Technology Transfer Award. USDA-ARS
2003 C.Reed Funk Achievement Award. Turfgrass Breeders Association (national)
2003 Inventor of the Year. University of Georgia Research Foundation
2003 Distinguished Service Award from the Georgia Golf Course Superintendents Association
2005 Honorary Member Award from Turfgrass Producers International
2006 Agricultural Research Service Science Hall of Fame

Publications:
Branch, W.D. and **W.W. Hanna**. 2006. Natural occurrence of autopolyploidy within the allotetrploid-cultivated peanut. Plant Breed. 125:311-312.

Bethel C.M., E.B. Sciara, J.E. Bowers, **W. Hanna**, and A.H. Paterson. 2006. A framework linkage map of bermudagrass (*Cynodon dactylon* x *transvaalensis*) based on single-dose restriction fragments. Theor. Appl. Genet. 112:727-737.

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Shailendra, G., Z. Chen, Y. Akiyama, J.A. Conner, M. Basu, G. Gualtieri, **W.W. Hanna**, P. Ozias-Akins. 2006. Comparative physical mapping of the apospory-specific genomic region in two apomictic grasses: *Pennisetum squamulatum* and *Cenchrus ciliaris.* Genetics 173:389-400.

Culpepper, S.A., T.L. Grey, W.K. Vencill, J.M. Kichler, T.M. Webster, S.M. Brown, A.C. York, J.W. Davis, and **W.W. Hanna**. 2006. Glyphosate-resistant Palmer amaranth (*Amaranthus palmeri*) confirmed in Georgia. Weed Sci. 54:620-626.

Hanna, W. 2005. Controlling thatch in 'TifEagle' bermudagrass with the Graden verticutter. USGA Turfgrass and Environmental Research Online 4:1-6.

Braman, K., and **W. Hanna**. 2005. Development of pest-resistant turfgrasses. TPI Turf News. May/June. p. 46-47.

Braman, S.K., R. R. Duncan, **W.W. Hanna**, and M.C. Engelke. 2005. Dual defense: Pestresistant turf and natural enemy interactions. USGA Turfgrass and Environmental Research Online 4:1-7.

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Braman, K. R.R. Duncan, W.W. Hanna, and M.C. Engelke. 2004. Resistant turf: Front line defense for insect pests. USGA Turfgrass and Environmental Research Online 3:1-8.

Jauhar, P.P., K.N. Rai, P. Ozias-Akins, Z. Chen, and **W.W. Hanna**. 2005. Genetic improvement of pearl millet for grain and forage production: Cytogenetic manipulation and heterosis breeding. Volume 2, Chapter 10. pp. 281-307.

Yukio, A., **W.W. Hanna**, and P. Ozias-Akins. 2005. High-resolution physical mapping reveals that the Apospory-Specific Genomic Region (ASGR) in *C. ciliaris* is located on a heterochromatic and hemizygous region of a single chromosome. Theor. Appl. Genet. 111:1042-1051.

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Webster, T.M., **W.W. Hanna**, and B.G. Mullinix. 2004. Bermudagrass (*Cynodon* spp.) dose-response relationships with clethodim, glufosinate, and glyphosate. Pest Management Sci. 60:1237-1244.

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Hanna, W.W., D.D. Baltensperger, and A. Seetharam. 2004. Pearl millet and other millets. p. 537-560. *In* L. Moser, B. Burson, and L. Sollenberger (ed.) Warm-season (C_4) grasses. Number 45, ASA, CSSA, and SSSA. Madison, WI.

Hanna, W. W. 2004. Developing a new generation of bermudagrass turf cultivars. p. 23. Proc. 13th Ann. Rutgers Turfgrass Symposium. 15-16 Jan. 2004. New Brunswick, NJ.

Hanna, W. 2004. Manipulating bermudagrass germplasm to produce superior forage and turf hybrids. p. 35-37. Proc. 37th Grass Breeders Work Planning Conference, 14-17 May 2002. Moscow, Idaho/Pullman, Washington.

Hill, G.M., **W.W. Hanna**, B.C. Hand, A.E. Coy, and B.G. Mullinix, Jr. 2004. Digestibility and protein utilization in steers fed corn and pearl millet diets. Proc. Southern Assoc. Animal Scientists.

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Anderson W.F., G.W. Burton, **W.W. Hanna**, and M. Davis. 2004. Coastcross II Bermudagrass. Proc. Amer. Forage and Grassl. Counc. 12-16 June 2004. Vol. 13. Roanoke, VA.

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Braman, S.K., R.R. Duncan, **W.W. Hanna**, and M.C. Engelke. 2004. Integrated effects of host resistance and insecticide concentration on survival of, and turfgrass damage by the fall armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae). J. Entomol. Sci. 39:584-597.

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apomixes in *Pennisetum* and *Cenchrus*. p. 7. Workshop Abstracts of Plant & Animal Genome XI, 11-15 Jan. 2003, W12. San Diego, CA.

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Webster, T., C. Bednarz, and **W. Hanna**. 2003. Sensitivity of triploid hybrid bermudagrass cultivars and common bermudagrass to postemergence herbicides. Weed Tech. 17:509-515.

Shailendra, G., Z. Chen, J.A. Conner, Y. Akiyama, **W.W. Hanna**, and P. Ozias-Akins. 2003. Delineation by fluorescence in Situhybridization of a single himizygous chromosomal region associated with aposporous embryo sac formation in *Pennisetum squamulatum* and *Cenchrus ciliaris*. Genetics 163:1069-1082.

Wilson, J.P., R.N. Gates, and **W.W. Hanna**. 2003. Strip-till establishment of pearl millet. Int'l. Sorghum and Millets Newsletter 44:4-5.

Braman, S.K., R.R. Duncan, **W.W. Hanna**, and M.C. Engelke. 2003. Arthropod predator occurrence and performance of *Geocoris uliginosus* (Say) on pest-resistant and susceptible turfgrasses. Environ. Entomol. 32:907-914.

Ozias-Akins, P., Y. Akiyama, and **W. Hanna**. 2003. Molecular characterization of the genomic region linked with apomixis in *Pennisetum/Cenchrus*. Funct. Integr. Genomics 3:94-104.

Hanna, W.W., and J. Liu. 2003. Centipedegrass (*Eremochloa ophiuroides*). p. 287-293. *In* M. D. Casler and R.R. Duncan (ed.) Turfgrass biology, genetics and breeding. John Wiley and Sons, Inc., NJ.

Zarate, P., R.D. Garza, A.J. Saldivar, W.R. Ocumpaugh, and **W.W. Hanna**. 2003. Evaluation of eight bermudagrasses in central Tamaulipas. p. 318-322. *In* Proc. Amer. Forage and Grassl. Counc., Lafayette, LA. 26-30 Apr. 2003. AFGC, Georgetown, TX.

Dozier, W.A. III, W. Hanna, and K. Behneke. 2003. Grinding and pelleting responses of pearl millet-based diets. Proceeding of International Poultry Forum, January 2003, Atlanta, GA.

Goldman, J.J.(post-doc), W.W. Hanna, G. Fleming, and P. Ozias-Akins. 2003. An efficient system for biolistic transformation and plant regeneration of pearl millet using spikelets shaved from immature inflorescences. In Vitro 39:21A.

Shailendra, G., Y. Akiyama, J.A. Conner, Z. Chen, **W.W. Hanna**, and P. Ozias-Akins . 2004. Integrating genetic and physical maps: an approach to define the size of the Apospory Specific Genomic Region in *Pennisetum* and *Cenchrus*. Plant and Animal Genome XII. Available at http://www.intl-pag.org/12/abstracts/P5d_PAG12_504.html.

Ozias-Akins, P., Y. Akiyama, J. A. Conner, S. Goel, G. Gunawan, and W. W. Hanna. 2003. Molecular characterization of the genomic region associated with apomixis in *Pennisetum*. Proc. Intl. Colloquium on Plant Biotechnology. 20-21 Nov. Sakai, Osaka, Japan.

Hill, G.M., **W.W. Hanna**, A.C. Coy, B.C. Hand, W.B. Forlow, and B. G. Mullinix, Jr. 2003. Protein utilization of pearl millet grain supplements by growing steers. J. Anim. Sci. 81: 23.

Akiyama, Y., J.A. Conner, S. Goel, D. Morishige, J. Mullet, **W.W. Hanna**, and P. Ozias-Akins. 2003. High resolution physical mapping in *Pennisetum squamulatum* reveals extensive

chromosomal heteromorphism of the genomic region associated with apomixis. Plant Phys. 134: 1733-1741.

Roche, D., J.A. Conner, M.A. Budiman, D. Frisch, R. Wing, **W.W. Hanna**, and P. Ozias-Akins. 2002. Construction of BAC libraries from two apomictic grasses to study the microcolinearity of their apospory-specific genomic regions. Theor. Appl. Genet. 104:804-812.

Wilson, J.P., **W.W. Hanna**, D.M. Wilson, and A.E. Coy. 2002. Host- specific differences in preharvest grain infection by toxigenic fungi in dryland pearl millet and corn. Phytopathology 92:S87.

Gitaitis, R., J. Wilson, R. Walcott, H. Sanders, and **W. Hanna**. 2002. Occurrence of bacterial stripe of pearl millet in Georgia. Plant Disease 86:326.

Timper, P., J.P. Wilson, A.W. Johnson, and **W.W. Hanna**. 2002. Evaluation of pearl millet grain hybrids for resistance to *Meloidogyne* spp. and leaf blight caused by *Pyricularia grisea*. Plant Disease 86:909-914.

Hanna, W.W. 2002. Maintaining the ultradwarfs. Grounds Maintenance 37:G22-G24.

Shortman, S.L., S.K. Braman, R.R. Duncan, **W.W. Hanna**, and M.C. Engelke. 2002. Evaluation of turfgrass species and cultivars for potential resistance to two-lined spittlebug (Hemiptera: Cercopidae). J. Ent. 95:479-486.

Braman, S.K., R.R. Duncan, M.C. Engelke, **W.W. Hanna**, K. Hignight, and D. Bush. 2002. Grass species and endophyte effects on survival and development of fall armyworm (Lepidoptera: Noctuidae). J. Ent. 95:487-492.

Muuka, F.P., and **W.W. Hanna**. 2002. Pollen drying techniques in pearl millet [*Pennisetum glaucum* (L.) R. Br.]. International Sorghum and Millets Newsletter 43:88-90.

Hanna, W., I.Angarawai, A.Fofana, R. Gates, J.Gonda, S. Gupta, F.Muuka, B.Ouendeba, M.Sanogo, and J.Wilson. 2002. Peformance of various cycles of population hybrids between West African pearl millet landraces. Proc. of INTSORMIL PI Conference, 18-20 Nov. 2002. Addis Ababa, Ethiopia.

Hanna, W., A. Kumar, and K.N. Rai. 2002. Fertility restoration of diverse pearl millet cytoplasmic-nuclear male steriles by West African genotypes. Proc. of INTSORMIL PI Conference, 18- 20 Nov. 2002. Addis Ababa, Ethiopia.

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Wilson, J., **W.W. Hanna**, M. Sanogo, J. Gonda, I. Angarawai. 2002. Downy mildew incidence in pearl millet population hybrids in West Africa. Proc. of INTSORMIL PI Conference, 18-20 Nov. 2002. Addis Ababa, Ethiopia.

Hanna, W., I. Angrawai, J. Gonda, F. Muuka, B. Ouendeba, A. Fofana, M. Sanogo, and S. Gupta. 2002. Performance of pearl millet population hybrids in Africa and the USA. Amer. Soc. Agy. Abstracts, 10-14 Nov. 2002. Indianapolis, IN.

Goldman, J.J., **W.W. Hanna**, and P. Ozias-Akins. 2002. Tissue culture and transformation of TifSport and TifEagle bermudagrass. American Society of Agronomy Abstracts, 10-14 Nov. 2002. Indianapolis, IN.

Ozias-Akins, P., **W.W. Hanna**, Z.B. Chen, J. A. Conner, S. Goel and Y. Akiyama. 2002. Molecular cytogenetic characterization of apomictic introgression lines in millet. Amer. Soc. Agy. Abstracts, 10-14 Nov. 2002. Indianapolis, IN.

Seagle, E.D., M.J. Iverson, **W.W. Hanna**, K.J. Karnok, W.G. Hudson, and K. Jones. 2002. Characteristics of the turfgrass industry in 2020: a delphi study with implications for agricultural education programs. Amer. Soc. Agy. Abstracts, 10-14 Nov. 2002. Indianapolis, IN.

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Lee, R.D., and **W. Hanna**. 2002. Pearl millet in Georgia. Univ. of GA Coop. Ext. Ser. Bulletin 1216.

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Wilson, J.P., D.E. Hess, and W.W. Hanna. 2001. Evaluation of Striga resistance in the secondary and tertiary gene pools of pearl millet. Intl. Sorghum and Genetics Newsletter 42:87-89.

Sanogo, M.D., and **W.W. Hanna**. 2001. Effects of drying time and method on viability of stored pollen of pearl millet. Intl. Sorghum and Genetics Newsletter 42:63-64.

4. Professional activity;

Research: Breeding and genetics of warm-season grasses
Boards: Georgia Turfgrass Association Board, Georgia Agrirama Foundation Board

5. Expected responsibilities in this program;

Teach plant breeding and genetics classes as a guest.
Mentor students

1. Name: Jerry W. Johnson
Rank: Professor
Academic discipline: Plant breeding and genomics
Institutions attended and degrees:

Abraham Baldwin Agricultural College	A.S.	1968
University of Georgia	B.S.	1970
Purdue University	M.S.	1972
Purdue University	Ph.D.	1974

2. Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;
My position is 80% research, 20% administration. I average one graduate student every three years. No courses are taught, and my workload will not be impacted by this proposal.

3. Scholarship and publication record for the past five years;

Barnett, R.D., A.R. Blount, P.L. Pfahler, P.L. Bruckner, D.M. Wesenberg, and **J.W. Johnson**. 2006. Environmental stability and heritability estimates for grain yield and test weight in triticale. J. Applied Gen. 47:207-213.

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Johnson. J.W., R.D. Barnett, B.M. Cunfer, G.D. Buntin, and D.E. Bland. 2002. Registration of 'AGS 2000' wheat. Crop Sci 42:661-662.

Jang, C.S., D.S. Kim, S.Y. Bu, J.B. Kim, S.S. Lee, J.Y. Kim, **J.W. Johnson**, and Y.W. Seo. 2002. Isolation and characterization of lipid transfer protein genes from a wheat-rye translocation. J. of Plant Cell 20:961-966.

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Barnett, R.D., A.R. Blount, P.L. Pfahler, **J.W. Johnson**, B.M. Cunfer, and G.D. Buntin. 2002. Registration of 'Horizon 314' oat. Crop Sci. 42:1749-1750.

Barnett, R.D., A.R. Blount, P.L. Pfahler, **J.W. Johnson**, B.M. Cunfer, G.D. Buntin. 2002. Horizon 474: A new early maturing winter oat cultivar with excellent grain quality for the Southeast. University of Florida, IFAS, Fla. Agri. Exp Sta., NFREC-Quincy Research Report 2002-18. 18p.

C. Seong, and **J.W. Johnson**. 2001. Development of AFLP and STS markers for identifying wheat-rye translocation possessing 2RL. Euphytica 121:279-287.

Buntin, G.D., and **J.W. Johnson**. 2001. Evaluation of winter wheat for resistance to Hessian fly, 1999 & 2000. Arthropod Management Tests. 26: Report M12, 2p.

Blount, A.R., R.D. Barnett, **J.W. Johnson**, P.L. Pfahler, P.L. Bruckner, B.M. Cunfer, and G.D. Buntin. 2001. Registration of 'Chapman' oat. Crop Sci. 41:263.

Cunfer, B.M., **J.W. Johnson**, G.D. Buntin, R.D. Barnett, and J.J. Roberts. 2001. Registration of four soft red winter wheat germplasms resistant to *Stagonospora nodorum* and other foliar pathogens. Crop Sci. 41:933-934.

4. Professional activity;

American Society of Agronomy Crop Science Society of America Southern Association of Agricultural Scientists Southern Branch, American Society of Agronomy Georgia Agriculture Alumni

5. Expected responsibilities in this program;

I expect to provide graduate training for either M.S. or Ph.D. students.

1. Name: Steven J. Knapp
Rank: Professor and Georgia Research Alliance Eminent Scholar
Academic discipline: Plant Breeding, Genetics, and Genomics
Institutions attended, degrees eared:

University of Nevada-Reno	B.S.	1978
University of Nevada-Reno	M.S.	1980
University of Nebraska-Lincoln	Ph.D.	1983

2. Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;
No courses taught. The addition of the proposed program will not impact my workload.

3. Scholarship and publication record for past five years;

Church, S, K. Livingstone, Z. Lai, A. Kozik, **S.J. Knapp**, R.W. Michelmore, and L.H. Rieseberg. 2006 Using variable rate models to identify genes under selection in sequence pairs: their validity and limitations for EST sequences. J. Mol. Evol. (in press)

Filichkin, S, M.B. Slabaugh, and **S.J. Knapp**. 2006. Thioesterases isolated from *Cuphea calophylla*, a high laurate species, have broad substrate specificities and complement an Arabidopsis *fatb* mutant. Eur J Lipid Sci Tech (in press).

Bushman, B.S., A.A. Scholte, K. Cornish, D.J. Scott, J.L. Brichta, J.C. Vederas, O. Ochoa O, R.W. Michelmore, D.K. Shintani, and **S.J. Knapp**. 2006. Identification and comparison of natural rubber from two *Lactuca* species. Phytochemistry (in press).

Hass, C., S. Tang, S. Leonard, J.F. Miller, M. Traber, and **S.J. Knapp**. 2006. Three non-alllelic epistatically interacting methyltransferase mutations produce novel tocopherol (vitamin E) profiles in sunflower. Theor. Appl. Genet. 113:783-99.

Tang, S., C. Hass, and **S.J. Knapp**. 2006. *Ty3*/*gypsy*-like retrotransposon knockout of a 2-methyl-6-phytyl-1,4-benzoquinone methyltransferase is non-lethal, uncovers a cryptic paralogous mutation, and produces novel tocopherol (vitamin E) profiles in sunflower. Theor. Appl. Genet. 113:767-82.

Timms, L., R. Jimenez, M. Chase, L. McHale, D. Lavelle, A. Kosik, Z. Lai, R.W.. Michelmore, **S.J. Knapp**, A. Heesacker, L. Rieseberg, R. Kesseli. 2006. Analyses of synteny between *Arabidopsis thaliana* and species in the Asteraceae reveal a complex network of small syntenic segments and major chromosomal rearrangements. Genetics173:2227-2235.

Tang, S., A. Leon, and **S.J. Knapp**. 2006. Quantitative trait loci for genetically correlated seed traits are tightly linked to branching and pericarp pigment loci in sunflower. Crop Sci. 46:721-734.

Schuppert, G.F., S. Tang, M.B. Slabaugh, and **S.J. Knapp**. 2006. The sunflower high-oleic mutant *Ol* carries variable tandem repeats of *FAD2-1*, a seed-specific oleoyl-phosphatidyl choline desaturase. Mol. Breed. 17:241-256.

Lai, Z., K. Livingstone, Y. Zou, S.A. Church, **S.J. Knapp**, J. Andrews, and L.H. Rieseberg. 2005. Identification and mapping of SNPs from ESTs in sunflower. Theor. Appl. Genet. 111:1532-44.

Burke, J.H., **S.J. Knapp**, and L.H. Rieseberg. 2005. Genetic consequences of selection during the evolution of cultivated sunflower. Genetics 171:1933-1940.

Lai, Z., T. Nakazato, M. Salmaso, J.M. Burke, S. Tang, **S.J. Knapp**, and L.H. Rieseberg. 2005. Extensive chromosomal repatterning and the evolution of sterility barriers in hybrid sunflower species. Genetics 171:291-303.

Argyris, J., M.J. Truco, O. Ochoa, **S.J. Knapp**, D.W. Still, G. Lenssen, J. Schut, R.W. Michelmore, and K.J. Bradford. 2005. Quantitative trait loci associated with seed and seedling traits in *Lactuca*. Theor. Appl. Genet. 111:1365-1376.

Perez-Vich, B, S.T. Berry, L. Velasco, J.M. Fernandez-Martinez, S. Gandhi, C. Freeman, A. Heesacker, **S.J. Knapp**, and A.J. Leon. 2005. Genetic mapping of nuclear male-sterility genes in sunflower. Crop Sci. 45:1851-1857.

Knapp, S.J., R. Brunick, and J.M. Crane. 2005. Registration of Ross meadowfoam. Crop Sci. 45:407.

Bushman, B.S., B. Phillips, T. Isbell, B. Ou, J.M. Crane, and **S.J. Knapp**. 2004. Chemical composition of caneberry (*Rubus* spp.) seeds and oils and their antioxidant potential. J. Agric. Food Chem. 52:7982-7.

Gandhi S., A.F. Heesacker, C.A. Freeman, J. Argyris, K. Bradford, and **S.J. Knapp**. 2004. The self-incompatibility locus (*S*) and quantitative trait loci for self-pollination and seed dormancy in sunflower. Theor. Appl. Genet. 111:619-29.

Micic, Z., V. Hahn, E. Bauer, C.C. Schoen, **S.J. Knapp**, S. Tang, and A.E. Melchinger. 2005. Identification and validation of QTL for *Sclerotinia* midstalk rot resistance in sunflower by selective genotyping. Theor. Appl. Genet. 111:233-42.

Micic, Z., V. Hahn, E. Bauer, C.C. Schoen, **S.J. Knapp**, S. Tang, and A.E. Melchinger. 2004. QTL mapping of *Sclerotinia* midstalk rot resistance in sunflower. Theor. Appl. Genet. 109:1474-84.

Dussel, C.M., V. Hahn, **S.J. Knapp**, and E. Bauer. 2004. Pl_{Arg} from *Helianthus argophyllus* is unlinked to other known downy mildew resistance genes in sunflower. Theor. Appl. Genet. 109:1083-1086.

Perez-Vich B., **S.J. Knapp**, A.J. Leon, J.M. Fernandez-Martinez, and S.T. Berry. 2004. Mapping minor QTL for increased stearic acid content in sunflower seed oil. Mol. Breed. 13:313-322.

Kolkman, J.M., M.B. Slabaugh, J.M. Bruniard, S.T. Berry, S.B. Bushman, G. Abratti, A. Zambelli, J.F. Miller, A. Leon, and **S.J. Knapp**. 2004. Acetohydroxyacid synthase mutations conferring resistance to imidazolinone or sulfonylurea herbicides in wild sunflower biotypes. Theor. Appl. Genet. 109:1147-1159.

Burke, J.M., Z. Lai, M. Salmaso, T. Nakazato, S. Tang, A. Heesacker, **S.J. Knapp**, and L.H. Rieseberg. 2004. Comparative mapping and rapid karyotypic evolution in *Helianthus*. Genetics 167:449-457.

Kishore, V.K., P. Velasco, D.K. Shintani, J. Rowe, C. Rosato, N. Adair, M.B. Slabaugh, and **S.J. Knapp**. 2004. Conserved simple sequence repeats in the Limnanthaceae (Brassicales). Theor. Appl. Genet. 108: 450-457.

Pérez-Vich, B., B. Akhtouch, **S.J. Knapp**, A.J. Leon, L. Velasco, J.M. Fernández-Martínez, and S.T. Berry. 2004. Quantitative trait loci for broomrape (*Orobanche cumana* Wallr.) resistance in sunflower. Theor. Appl. Genet. 109:92-102.

Tang, S, V.K. Kishore, and **S.J. Knapp**. 2003. PCR-multiplexes for a genome-wide framework of simple sequence repeat marker loci in cultivated sunflower. Theor. Appl. Genet. 107: 6-

19.

Slabaugh, MG, J.K. Yu JK, S. Tang, A. Heesacker, X. Hu, G. Lu, F. Han, D. Bidney D, and **S.J. Knapp**. 2003. Haplotyping and mapping a large cluster of resistance gene candidates in sunflower using multilocus intron fragment length polymorphisms. Plant Biotech. J. 1: 167-185.

Tang, S, A. Heesacker, V.K. Kishore, A. Fernandez, E.S. Sadik ES, G. Cole, and **S.J. Knapp**. 2003. Genetic mapping of the Or_5 gene for resistance to *Orobanche* race E in sunflower. Crop Sci. 43:1021-1028.

Tang, S, and **S.J. Knapp**. 2003. Microsatellites uncover extraordinary molecular genetic diversity in Native American land races and wild populations of cultivated sunflower. Theor Appl Genet 106: 990-1003.

Kozik, A., R.W. Michelmore, **S.J. Knapp**, M.S. Matvienko, L. Rieseberg, H. Lin, M. van Damme, D. Lavelle, P. Chevalier, J. Ziegle, P. Ellison, J. Kolkman, M.S. Slaubaugh, K. Livingston, L. Z. Zhou, S. Church, S. Edberg, L. Jackson and K. Bradford. 2002. Lettuce and sunflower expressed sequences tags (ESTs). http://compgenomics.ucdavis.edu/.

Yu, JK, S. Tang, M.B. Slabaugh, A. Heesacker, G. Cole, M. Herring, J. Soper, F. Han, W.C. Chu, D.M. Webb, L. Thompson, K.J. Edwards, S. Berry, A. Leon, C. Olungu, N. Maes, and **S.J. Knapp**. 2002. Towards a saturated molecular genetic linkage map for cultivated sunflower. Crop Sci 43:367-387.

Burke, J.M., S. Tang, **S.J. Knapp**, and L.H. Rieseberg. 2002. Genetic analysis of sunflower domestication. Genetics 161:1257-1267.

Tang, S, J.K. Yu, M.B. Slabaugh, D.K. Shintani, and S.J. Knapp. 2002. Simple sequence repeat map of the sunflower genome. Theor. Appl. Genet. 105:1124-1136.

Pérez-Vich, B., J.M. Fernández-Martínez, M. Grondona, **S.J. Knapp**, and S.T. Berry. 2002. Stearoyl-ACP and oleoyl-PC desaturase genes cosegregate with quantitative trait loci underlying high stearic and high oleic acid mutant phenotypes in sunflower. Theor. Appl. Genet. 104:338-349.

Knapp, S.J., and J.M. Crane. 2002. Registration of Wheeler meadowfoam. Crop Sci. 42:2208-2209.

Burke, J.M., S. Tang, **S.J. Knapp**, and L.H. Rieseberg. 2002. Genetic analysis of sunflower domestication. Genetics 161:1257-1267.

Tang S, J.K. Yu, M.B. Slabaugh, D.K. Shintani, and **S.J. Knapp** SJ. 2002. Simple sequence repeat map of the sunflower genome. Theor. Appl. Genet. 105:1124-1136.

Pérez-Vich, B., J.M. Fernández-Martínez, M. Grondona, **S.J. Knapp**, and S.T. Berry. 2002. Stearoyl-ACP and oleoyl-PC desaturase genes cosegregate with quantitative trait loci underlying high stearic and high oleic acid mutant phenotypes in sunflower. Theor. Appl. Genet. 104:338-349.

Castro, A.J., X. Chen, P.M. Hayes, **S.J. Knapp**, R. Line, T. Toojinda, and H. Vivar. 2002. Coincident QTL which determine seedling and adult plant resistance to stripe rust in barley. Crop Sci. 42:1701-1708.

Yu, J.K., J. Mangor, L. Thompson, K.J. Edwards, M.B. Slabaugh, and **S.J. Knapp**. 2002. Allelic diversity of simple sequence repeat markers among elite inbred lines in cultivated sunflower. Genome 45:652-660.

Katengam, S., J.M. Crane, and **S.J. Knapp**. 2001. The development of a genetic map for meadowfoam comprised of amplified fragment length polymorphisms. Theor. Appl. Genet. 104:92-96.

Katengam, S., J.M. Crane, and **S.J. Knapp**. 2001. Genetic mapping of a macromutation and quantitative trait loci underlying fatty acid composition differences in meadowfoam oil. Crop Sci. 41:1927-1930.

Gedil, M.A., S.K. Berry, R. Jones, A. Leon, C. Wye, J. Peleman, and **S.J. Knapp**. 2001. An integrated RFLP-AFLP linkage map for cultivated sunflower. Genome 44:213-221.

Gedil, M.A., M.B. Slabaugh, S.K. Berry, R. Jones, R. Michelmore, J.F. Miller, T. Gulya, and **S.J. Knapp**. 2001. Candidate disease resistance genes in sunflower cloned using conserved nucleotide binding site motifs: genetic mapping and linkage to the downy mildew resistance gene *Pl1*. Genome 44:205-212.

Knapp, S.J., S. Berry, and L.H. Rieseberg. 2001. Genetic mapping in sunflowers. p. 379-403. *In* R.L. Phillips and I.K. Vasil (ed.) DNA markers in plants. Kluwer, Dordrecht, the Netherlands.

4. Professional activity;

2006-2007	Panel Manager, USDA National Research Initiative, Plant Genome Program
2006-Present	Associate Editor, Molecular Breeding
2004-Present	Associate Editor, Theoretical and Applied Genetics
1998-2003	Associate Editor, Crop Science
1994-2006	Associate Editor, Crop Science Germplasm Release Committee for Oilseeds, Crop Science Society of America, Madison, Wisconsin
1993-1998	Technical Editor, Euphytica (International Journal of Plant Breeding), Kluwer, Dordrecht, the Netherlands
1994-2000	Associate Editor, Industrial Crops and Products, Elsevier, Dordrecht, the Netherlands
1993-1994	Panel Manager, USDA National Research Initiative, Plant Genome Program
1992-1993	Visiting Scientist, Max Planck Institute, Cologne, Germany
2006	Panel Member, NSF, Eukaryotic Genetics and Genomics
2005	Panel Member, NSF, Eukaryotic Genetics and Genomics
2002	Panel Member, Deutsche Forschung Gemeinshaft, Plant Heterosis Program
2001	Panel Member, USDA IFAFS, Plant Genome Program
2000	Panel Member, USDA NRICGP, Plant Genome Program
1994	Panel Member, NIH, Plant Biology Special Study Section
1993	Panel Member, USDA NRICGP, Plant Genome Program
1991	Panel Member, USDA NRICGP, Plant Genetic Mechanisms Program
2005-2006	Consultant, Law Firm of Brown, Winick, and Graves on Behalf of Crookham Seeds
2004-2005	Consultant, Law Firm of McKee, Voorhees, and Sease, PLC on Behalf of Prodigene
2004	Consultant, Law Firm of McKee, Voorhees, and Sease, PLC on Behalf of Pioneer Hi-Bred International

2004	Consultant, Law Firm of Bartlit, Beck, Herman, Palenchar, and Scott LLP on Behalf of Pioneer Hi-Bred International
2002-2003	Consultant, Law Firm of Hall, Farley, Oberrecht, and Blanton on Behalf of Seminis Seeds
2001-2002	Consultant, Law Firm of Howrey, Simon, Arnold, and White on Behalf of DeKalb and Monsanto
2001-2002	Consultant, Law Firm of Howrey, Simon, Arnold, and White on Behalf of Asgrow and Monsanto
1999-2001	Consultant, Oilseed Breeding Program, Seaphire International, Phoenix, Arizona

5. Expected responsibilities in this program;

I expect to mentor graduate students, serve on committees, participate in programs for recruiting, evaluating, and selecting graduate students, and participate in outreach activities to promote graduate training opportunities in the program.

1. Name: David A. Knauft
Rank: Michael A. Dirr Professor of Horticulture
Academic discipline: Plant breeding
Institutions attended, degrees earned:

University of Wisconsin	B.S.	1973
Cornell University	Ph.D.	1977

2. Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;
My position is 50% teaching/50% research. Three courses are taught in the fall; one course in spring. There is no anticipated workload impact.

3. Scholarship and publication record for past five years;
Grants over $2.3 million as PI, an additional $400,000 as co PI

Fischer, J.R., and **D. A. Knauft**. 2001. The professional portfolio: Beyond the curriculum vitae. Council for Agricultural Science and Technology Issue Paper No. 18. Ames, Iowa. 8 pp.

Rojas, J.I., **D.A. Knauft**, J.M. Broder, and B. Campbell-Burden. 2002. Academic counseling for students within a college of agricultural and environmental sciences. NACTA J. 46:16-20.

Scott, A.K., J.S. Oliver, and **D.A. Knauft**. 2005. Service learning and science: A successful model. Academic Exchange Quarterly 9:222-228.

Knauft, D.A. 2005. Developing and offering a course on the history of a college of agriculture. NACTA J. 50:2-5.

4. Professional activity;
American Association for the Advancement of Science
American Society of Agronomy
American Society of Horticultural Science
Crop Science Society of America
Gamma Sigma Delta
Council for Agricultural Science and Technology
International Plant Propagators Society
National Association of Colleges and Teachers of Agriculture
Georgia Science Teachers Association
Georgia Green Industry Association

5. Expected responsibilities in this program;
Teach introductory plant breeding course CRSS/HORT 4140/6140
Participate in graduate seminars
Participate in graduate student training

6. If it will be necessary to add faculty in order to begin the program, give the desired qualifications of the persons to be added, with a timetable for adding new faculty and plan for funding new positions.
Not needed for this program, assuming all current positions open in horticulture will be funded at some point in the near future.

1. Name: Peggy Ozias-Akins
Rank: Professor
Academic Discipline: Molecular breeding and genetics
Institutions Attended and Degrees:

Florida State University	B.S.	1975
University of Florida	Ph.D.	1981

2. Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program:
92% research appointment; 8% teaching appointment, Sp 2006 14 students in HORT 4800, Agricultural Biotechnology, 14 advisees - AES major (F 2006 as well). In 2002 developed new course for UGA AES maor offered in Tifton - HORT(CRSS) 4800/6800 Agricultural Biotechnology - Responsibility - 60%; Taught every Spring ('04, '05, '06, '07). I serve as advisor to undergraduate students, hosted an NSF summer apprenticeship student from Fort Valley State Universisty in 2002 and hosted NSF-funded Research Experience for Teachers in 2003-2005. I have served as major professor for three Ph.D. students and served as committee member for five students. My program has hosted 10 postdocs and five visiting scientists. Workload should remain approximately the same with addition of the proposed program.

3. Scholarship and publication record for past five years:

Ramos, M.L., G. Fleming, Y. Chu, Y. Akiyama, M.Gallo, **P. Ozias-Akins**. 2006. Genomic and evolutionary context for conglutin genes in *Arachis*. Mol. Gen. Gen. 275:578-592.

Goel, S., Z. Chen, Y. Akiyama, J.A. Conner, M. Basu, G. Gualtieri, W.W. Hanna, **P. Ozias-Akins**. 2006. Comparative physical mapping of the apospory-specific genomic region in two apomictic grasses, *Pennisetum squamulatum* and *Cenchrus ciliaris.* Genetics 173:389-400.

Gualtieri, G., J.A. Conner, D.T. Morishige, J.E. Mullet, and **P. Ozias-Akins**. 2006. A segment of the apospory-specific genomic region is highly microsyntenic not only between the apomicts *Pennisetum squamulatum* and buffelgrass, but also with a rice chromosome 11 centromeric-proximal genomic region. Plant Physiol. 140:963-971.

Akiyama, Y, S. Goel, Z. Chen, W.W. Hanna, and **P. Ozias-Akins**. 2006. *Pennisetum squamulatum*: Is the predominant cytotype hexaploid or octaploid? J. Hered. 97:521.

Ozias-Akins, P. 2006. Apomixis: Developmental characteristics and genetics. Crit. Rev. Plant Sci. 25:199-214.

Chu, Y, C. Holbrook, P. Timper, and **P. Ozias-Akins**. 2006. Development of a PCR-based molecular marker to select for nematode resistance in peanut. Crop Sci. (in press).

Sakhanokho, H.F., **P. Ozias-Akins**, O.L. May, and P.W. Chee. 2005. Putrescine enhances somatic embryogenesis and plant regeneration in elite upland cotton (*Gossypium hirsutum* L.) genotypes. Plant Cell Tiss. Organ Cult. 81:91-95.

Joshi, M., C. Niu, G. Fleming, S. Hazra, Y. Chu, C. J. Nairn, H. Yang, **P. Ozias-Akins**. 2005. Use of green fluorescent protein as a non-destructive marker for peanut genetic transformation . In Vitro Plant 41:437-445.

Akiyama, Y., W.W. Hanna, and **P. Ozias-Akins**. 2005. High-resolution mapping reveals that the apospory-specific genomic region (ASGR) in *C. ciliaris* is located on a heterochromatic and hemizygous region of a single chromosome. Theor. Appl. Genet. 111:1042-1051.

Sorghum Genomics Planning Workshop Participants. 2005. Toward sequencing the sorghum genome. A U.S. National Science Foundation-Sponsored Workshop Report. Plant Physiol. 138:1898-1902.

Yang, H.Y., **P. Ozias-Akins**, A.K. Culbreath, D.W. Gorbet, J.R. Weeks, B. Mandal, and H.R. Pappu. 2004. Field evaluation of *Tomato spotted wilt virus* resistance in transgenic peanut (*Arachis hypogaea*). Plant Dis. 88:259-264.

Akiyama, Y., J.A. Conner, S. Goel, D.T. Morishige, J.E. Mullet, W.W. Hanna, and **P. Ozias-Akins**. 2004. High-resolution physical mapping in *Pennisetum squamulatum* reveals extensive chromosomal heteromorphism of the genomic region associated with apomixis. Plant Physiol. 134:1733-1741.

Sakhanokho, H.F., **P. Ozias-Akins**, O.L. May, and P.W. Chee. 2004. Induction of somatic embryogenesis and plant regeneration in select Georgia and Pee Dee cotton (*Gossypium hirsutum* L.) lines. Crop Sci. 44:2199-2205.

Goldman, J. W.W. Hanna, and **P. Ozias-Akins**. 2004. Tissue culture, plant regeneration and an analysis of somaclonal variation from TifEagle and TifSport bermudagrass cultivars. HortScience 39:1381-1384.

Goel, S., Z. Chen, J.A. Conner, Y. Akiyama, W.W. Hanna, and **P. Ozias-Akins**. 2003. Physical evidence that a single hemizygous chromosomal region is sufficient to confer aposporous embryo sac formation in *Pennisetum squamulatum* and *Cenchrus ciliaris*. Genetics 163:1069-1082.

Yang, H.Y., J. Nairn, and **P. Ozias-Akins**. 2003. Transformation of peanut using a modified bacterial mercuric ion reductase gene driven by an actin promoter from *Arabidopsis thaliana*. J. Plant Physiol. 160:945-952.

Goldman, J. J., W. W. Hanna, G. F. Fleming, and **P. Ozias-Akins**. 2003. Fertile transgenic pearl millet [*Pennisetum glaucum* (L.) R. Br.] plants recovered through microprojectile bombardment and phosphinothricin selection of apical meristem-, inflorescence-, and immature embryo- derived embryogenic tissues. Plant Cell Rep. 21:999-1009.

Ozias-Akins, P., Y. Akiyama, and W.W. Hanna. 2003. Molecular characterization of the genomic region linked with apomixis in *Pennisetum/Cenchrus*. Funct. Integr. Genomics 3:94-104.

Goldman, J.J., W.W. Hanna, G.H. Fleming, and **P. Ozias-Akins**. 2003. Ploidy variation among herbicide-resistant bermudagrass plants of cv TifEagle transformed with the bar gene. Plant Cell Rep. 22:553-560.

Ozias-Akins, P., H. Yang, R. Gill, H. Fan, R.E. Lynch. 2002. Reduction of aflatoxin contamination in peanut: A genetic engineering approach. ACS Symposium Series 829:151-160.

Roche, D.R., J.A. Conner, M.A. Budiman, D. Frisch, R. Wing, W.W. Hanna, and **P. Ozias-Akins**. 2002. Construction of BAC libraries from two apomictic grasses to study the microcolinearity of their apospory-specific genomic regions. Theor. Appl. Genet. 104:804-812.

Roche, D.R., Z. Chen, W.W. Hanna, and **P. Ozias-Akins**. 2001. Non-Mendelian transmission of an apospory-specific genomic region in a reciprocal cross between sexual pearl millet (*Pennisetum glaucum*) and an apomictic F1 (*P. glaucum* X *P. squamulatum*). Sex. Plant Reprod. 13:217-223.

Roche, D., W.W. Hanna, and **P. Ozias-Akins**. 2001. Gametophytic apomixis, polyploidy, and supernumerary chromatin. Sex. Plant Reprod. 13:343-349.

Ozias-Akins, P., and R. Gill. 2001. Progress in the development of tissue culture and transformation methods applicable to the production of transgenic peanut. Peanut Sci. 28:123-131.

4. Professional activity;

American Association for the Advancement of Science
American Society of Plant Biology
Society for In Vitro Biology
International Society for Plant Molecular Biology
American Society for Horticultural Science
Phi Beta Kappa
Alexander von Humboldt Society
Genetics Society

Professional and professional society activities

2005 **Invited workshop presentation**, "Physical and functional characteristics of the genomic region associated with apomixis in *Pennisetum*", Apomixis Workshop at the Plant and Animal Genome XIII, Jan 15-19, 2005, San Diego, CA

2005 **Panel member and discussant**, research plots at the Fifty-ninth Annual Southeastern Turfgrass Conference, May 2-3, 2005, Tifton, GA

2005 **Presented paper** entitled, "Marker-assisted selection for nematode resistance" at the annual meeting of the American Peanut Research and Education Society, 11-15 Jul, Portsmouth, VA. Paper has been nominated for the Bailey Award

2005 **Invited presentation**, "Genes Linked with Apomixis: Identification and Characterization, International Botanical Congress, 17-23 July, Vienna, Austria

2004 **Oral presentation**, "TILLING for a reduced allergen peanut", Georgia Agricultural Commodity Commission Reports, 11 Feb

2004 **Poster presentation**, "Initial Genotyping of Bermudagrass Plant Accessions Using Genetic and Chemical Approaches", Anderson, W.F., M.E. Shook, P. Ozias-Akins, Keystone Symposium on Comparative Genomics of Plants, Taos, New Mexico, 4-9 March

2004 **Oral presentation** to Georgia Science Supervisor's Association, Tifton, GA, 18 Mar

2004 **Oral presentation**, "Genetic engineering of peanut for reduction of aflatoxin contamination", Peanut Foundation Reports, Atlanta, GA, 24 Mar

2004 **Oral presentation**, "TILLING for a reduced allergen peanut", Peanut Foundation Reports, Atlanta, GA, 24 Mar

2004 **Attended**, along with two postdocs, the Annual Meeting of the Society for In Vitro Biology, San Francisco, CA, 22-26 May

2004 **Oral presentation**, "Genetic engineering of peanut for disease resistance", American Peanut Research and Education Society, San Antonio, TX, 13-16 July

2004 **Poster presentation**, "Aligning physical and functional maps of a genomic region spanning the apomixis locus by exploiting model cereal genomics", 7th Annual NSF Plant Genome Awardees Meeting, Arlington, VA, 23-24 September

2004 **Oral presentation**, "Introduction of antifungal genes into peanut", 17th Annual Multi-Crop Aflatoxin Elimination Workshop, Sacramento, CA, 25-28 Oct

2004 **Attended** NCFAP-sponsored workshop, "Public Research and Regulatory Review of Small-Market Biotechnology-Derived Crops", Riverdale, MD, 8 Nov

2004 **Participated** in NSF-sponsored workshop, "Sorghum Genomics", St. Louis, MO, 9 Nov

2004 **Attended** (a postdoc presented our work) "Southeastern Tospovirus Conference", Tifton, GA, 2 Dec

2003 **Invited workshop presentation**, "Characterization of the genomic region associated with the transmission of apomixis in P*ennisetum* and C*enchrus*". Apomixis Workshop at the Plant and Animal Genome XI, Jan 11-15, 2003, San Diego, CA

2003 **Oral presentation** "Genetic Engineering of Peanut for Reduction of Aflatoxin Contamination", Peanut Foundation Reports, Mar. 18, 2003, Atlanta, GA

2003 **Poster presentation**, "Aligning Physical and Functional Maps of a Genomic Region Spanning the Apomixis Locus by Exploiting Model Cereal Genomics", National Science Foundation Plant Genome Research Program Investigators' Meeting, Sept. 18-20, 2003, Arlington, VA

2003 **Oral presentation "**Genetic Engineering Of Peanut For Reduction Of Aflatoxin Contamination", Aflatoxin Elimination Workshop, Oct. 13-15, 2003, Savannah, GA

2003 **Invited colloquium presentation**, "Molecular characterization of the genomic region associated with apomixis in *Pennisetum*", Nov. 20-21, 2003, Sakai, Osaka, Japan

2003 **Attended** Annual meeting of the Society for In Vitro Biology, 01-04 Jun., 2003

2003 **Attended** Annual Meeting of the American Peanut Research and Education Society, 08-10 Jul., 2003

2002 **Invited workshop presentation**, "Architecture of the Apomixis Locus in *Pennisetum/Cenchrus*". Apomixis Workshop at the Plant and Animal Genome X, Jan 12-16, 2002, San Diego, CA

2002 **Invited workshop presentation**, "Quest for Apomixis Genes in Grasses". Forage and Turfgrass Workshop at the Plant and Animal Genome X, Jan 12-16, 2002, San Diego, CA

2002 "Production and Analysis of Transgenic Peanut Plants with Pathogen-derived Resistance to Tomato Spotted Wilt Virus", Georgia Agricultural Commodity Commission Reports, Feb. 13, 2002, Tifton, GA

2002 **Invited seminar**, "Apomixis: Eternal Celibacy?", Horticulture Seminar Series, Feb. 27, 2002, Athens GA

2002 "Genetic Engineering of Peanut for Reduction of Aflatoxin Contamination", Peanut Foundation Reports, Apr. 9, 2002, Albany, GA

2002 **Invited seminar**, "Genome Oddities In a Selfish Angiosperm", Molecular and Environmental Plant Science Interdisciplinary Seminar Series, Texas A&M University, Apr. 25, 2002, College Station, TX

2002 **Invited symposium presentation**, "Peanut Better and Jelly Sandwiches (Peanut Improvement Through Biotechnology)", Plant Center Retreat, May 13-14, 2002, Amicalola Falls, GA

2002 **Invited symposium presentation**, "Genomic Structure Of The Apomixis Locus In *Pennisetum*", International Association of Plant Tissue Culture and Biotechnology, Jun. 24-28, 2002, Orlando, FL

2002 "Field Resistance to Tomato Spotted Wilt Virus in a Transgenic Peanut (*Arachis hypogaea* L.)", American Peanut Research and Education Society, Jul 16-19, 2002, Research Triangle Park, NC

2002 Poster presentation, "Aligning Physical and Functional Maps of a Genomic Region Spanning the Apomixis Locus by Exploiting Model Cereal Genomics", National Science Foundation Plant Genome Research Program Investigators' Meeting, Sept. 26-27, 2002, Arlington, VA

2002 "Genetic Engineering Of Peanut For Reduction Of Aflatoxin Contamination", Aflatoxin Elimination Workshop, Oct. 21-25, 2002, San Antonio, TX

2002 **Invited symposium presentation**, "Molecular Cytogenetic Characterization of Apomictic Introgression Lines of Millet", ASA-CSSA-SSSA Annual Meeting, Nov. 10-14, 2002, Indianapolis, IN

2001 **Invited presentation**, “Apomixis in *Pennisetum*”. Plant and Animal Genome IX, Jan 13-18, 2001, San Diego, CA

2001 **Invited speaker**, 2nd International Apomixis Symposium, 24-28 April, Italy

2001 **Invited lecture** in AGG2362 “Seeds of Change” on Peanut Engineered with the Bt Gene, February, University of Florida, Gainesville.

2001 Production and Analysis of Transgenic Peanut Plants Containing a Truncated Tomato Spotted Wilt Virus N-protein Gene That Could Confer Resistance to Tomato Spotted Wilt Virus, Georgia Agricultural Commodity Commission Annual Reports, 7 Feb., Tifton, GA

2001 Genetic Engineering of Peanut for Reduction of Aflatoxin Contamination, Peanut Foundation Reports, 27 Mar., Albany, GA

2001 **Invited presentation** on Genetically engineered crops, Georgia Farm Bureau Annual Meeting, Aug., Macon, GA

2001 **Invited presentation** on “Peanut Allergen Gene Characterization and Tool Development for Gene Silencing”, Fairfax, VA

2001 **Invited presentation**, “Potential for genetic engineering in turf”, 55th Annual Southeastern Turfgrass Conf., Tifton, GA

2001 Transgenic peanut for preharvest aflatoxin reduction, USDA Aflatoxin Elimination Workshop, 24-26 Oct., Phoenix, AZ

National and/or regional offices held and committee assignments, including special

assignments

2001-02	Co-organizer of Apomixis Workshop, Intl. Plant and Animal Genome Meeting
2001-02	APRES - Dow AgroSciences Awards Committee
2002	Co-organizer of Plant Symposium entitled “Gene Silencing: Use for High Throughput Gene Validation and/or Functional Genomics” for annual meeting of the Society for In Vitro Biology, 01-04 Jun. 2003, Portland, OR
2003	Moderated Plant Symposium entitled “Gene Silencing: Use for High Throughput Gene Validation and/or Functional Genomics” for annual meeting of the Society for In Vitro Biology, 01-04 Jun. 2003, Portland, OR
2003	Society for In Vitro Biology Plant Program Co-Co-Chair
2004	Society for In Vitro Biology Plant Program Co-Chair
2004-05	Co-organizer of Fluorescent Marker Workshop, 2005 Annual Meeting, Society for In Vitro Biology
2004-05	Member, Peanut Genomics Steering Committee
2005	Society for In Vitro Biology Plant Program Chair

5. Expected responsibilities in this program;

My primary responsibility will be graduate student training. The Agricultural Biotechnology course I co-teach at the Tifton campus is cross-listed as a graduate course and could substitute for Gene Technology under certain circumstances.

1. Name: Wayne A. Parrott
Rank: Professor
Academic discipline: Plant breeding and genomics
Institutions attended, degrees earned;

University of Kentucky	B.S.	1981
University of Wisconsin-Madison	M.S.	1983
University of Wisconsin-Madison	Ph.D.	1985

2. Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;
Research currently under way in my laboratory centers on the development of tissue culture and gene transfer systems, primarily for leguminous species, emphasizing soybean, alfalfa, and peanut, and the use of gene transfer systems to introduce value-added traits into these crops. Research is also geared towards developing methodology for multiple gene transformation, alternative selection systems, early analysis of transgenes, and dissection of centromere function in maize. I have served as both chair and member of numerous graduate committees, have served as advisor for postdoctoral scientists and have hosted visiting scientists.
Courses taught:

- Tropical Agroecology - lecture course taught every spring
- Tropical Agroecology - Study Abroad course in Costa Rica taught every summer
- Issues on Genetic Engineering of Crop Plants - Honors seminar course taught one semester a year
- Behavior and Evolution of the Plant Genome - Graduate-level course taught every other fall
- Advanced Agronomy Seminar Technique - A course taught every spring on communication technique

3. Scholarship and publication record for past five years;

Phan, B., W. Jin, C. Topp, C. Zhong, J. Jiang, R. Dawe, and **W. Parrott**. 2006. Transformation of rice with long DNA-segments consisting of random genomic DNA or centromere-specific DNA. Trans. Res. On-line first.

Zhu, S., D.R. Walker, H.R. Boerma, J.N. All, and **W.A. Parrott**. 2006. Fine mapping of a major insect resistance QTL in soybean and its interaction with minor resistance QTLs. Crop Sci. 46:1094–1099.

LaFayette, P.R., P.M. Kane, B.H. Phan, and **W.A. Parrott**. 2005. Arabitol dehydrogenase as a selectable marker for rice. Plant Cell Rep. 24:596-602.

Schmidt, M.A., D.M. Tucker, E.B. Cahoon, and **W.A. Parrott**. 2005. Towards normalization of soybean somatic embryo maturation. Plant Cell Rep. 24:383-391.

Bradford, K.J., A. Van Deynze, N. Gutterson, **W. Parrott**, and S.H. Strauss. 2005. Regulating transgenic crops sensibly: Lessons from plant breeding, biotechnology and genomics. Nature Biotech. 23:439-444.

Bradford, K.J., N. Gutterson, **W. Parrott**, A. Van Deynze, and S.H. Strauss. 2005. Strauss and colleagues respond. Nature Biotech. 23:787-789.

Walker, D.R., J. M. Narvel, H. R. Boerma, J. N. All, and **W. A. Parrott**. 2004. A QTL that enhances and broadens Bt insect resistance in soybean. Theor. Appl. Genet. 109:1051-1057.

Stacey, G., L. Vodkin, **W.A. Parrott**, and R.C. Shoemaker. 2004. National Science Foundation-sponsored workshop report. Draft plan for soybean genomics. Plant Physiol. 135:59-70.

Schmidt, M.A., G.S. Martin, B.A. Artelt, and **W.A. Parrott**. 2004. Increased transgene expression level by breeding and selection in white clover. Crop Sci. 44:963-967.

Rosellini, D., P. LaFayette, P. Barone, F. Veronesi, and **W.A. Parrott**. 2004. A point mutation in the alfalfa chloroplast DNA conditions for kanamycin resistance. Plant Cell Rep. 22:774-779.

Jiang, J., J.A. Birchler, **W.A. Parrott**, and R.K. Dawe. 2003. A molecular view of plant centromeres. Trends Plant Sci. 8:570-575.

Thomson, J.M., P.R. LaFayette, M.A. Schmidt, and **W.A. Parrott**. 2002. Artificial gene-clusters engineered into plants using a vector system based on intron- and intein-encoded endonucleases. In Vitro-Plant 38:537-542.

Sledge, M.K., J.H. Bouton, M. Dall'Agnoll, **W.A. Parrott** and G. Kochert. 2002. Identification and confirmation of aluminum tolerance QTL in diploid *Medicago sativa coerulea*. Crop Sci. 42:1121-1128.

Walker, D.R., H.R. Boerma, J.N. All and **W.A. Parrott**. 2002. Combining *cry1Ac* with QTL alleles from PI 229358 to improve soybean resistance to lepidopteran pests. Mol. Breed. 9:43-51.

Dinkins, R., M.S.S. Reddy, C.A. Meurer, B. Yan, J. Finer, F. Thibaud-Nissen, **W. Parrott**, and G.B. Collins. 2001. Increased sulfur amino acids in soybean plants expressing the maize 15 kDa zein protein. In Vitro Plant.37:742-747.

Narvel, J.M., D.R. Walker, B.G. Rector, J.N. All, **W.A. Parrott**, and H.R. Boerma. 2001. A retrospective DNA marker assessment of the development of insect resistant soybean. Crop Sci. 41: 1931-1939.

Schmidt, M.A., and **W.A. Parrott**. 2001. Quantitative detection of transgenes in soybean (*Glycine max* (L.) Merrill) and peanut (*Arachis hypogaea* L.) by real-time PCR. Plant Cell Rep. 20:422-428.

Walker, D.R., and **W.A. Parrott**. 2001. Effect of polyethylene glycol and sugar alcohols on soybean somatic embryo germination and conversion. Plant Cell Tiss Organ Cult. 64:55-62.

LaFayette, P.R., and W.A. Parrott. 2001. A non antibiotic marker for amplification of plant transformation vectors in *E. coli*. Plant Cell Rep. 20:338-342.

Meurer, C.A., R.D. Dinkins, C.T. Redmond, K.P. McAllister, D.T. Tucker, D.R. Walker, **W.A. Parrott**, H.N. Trick, J.S. Essig, H.M. Franz, J.J Finer, and G.B. Collins. 2001. Embryogenic response of multiple soybean [*Glycine max* (L.) Merrill] cultivars across three locations. In Vitro Plant. 37:62-67.

1. **Name:** Paul L. Raymer
Rank: Professor
Academic discipline: Plant breeding and genetics
Institutions attended, degrees earned:

University of Arkansas	B.S.	1975
Texas Tech University	M.S.	1977
University of Illinois	Ph.D.	1984

2. **Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;**
My appointment is 50% research, 50% extension. I direct the turfgrass breeding and genetics research program at the Griffin Campus. Research areas include breeding methodology, genetics of salt tolerance and disease resistance traits, and development of molecular markers for important traits such as salt tolerance. This program has state and federal support and is also funded by external grants from the USGA, EPA, Cultivar Development Grants, and industry grants. This is an interdisciplinary program that works closely with scientists from a range of disciplines including stress physiology, weed science, plant pathology, entomology and molecular genetics. To date, this program has released two tall fescue cultivars and three seashore paspalum cultivars, 2 canola cultivars, and 1 canola germplasm. In Fall 2006, I taught AESC 4960, Undergraduate Research Methods, with an enrollment of 10; Fall 2005 AESC 4950 - Special Problems with one student. I have served as program chair for one M.S. student, advisory committee member for one M.S. student, and served on six Ph.D. advisory committees, two of which were through Alabama A&M University. Addition of the proposed program will not impact my workload.

3. **Scholarship and publication record for past five years;**
No. of book chapters - 3
No. of refereed papers/by journal (18)

Crop Science - 2	Agronomy Journal - 2
Weed Technology - 4	Pesticide Science - 1
Env. Biosaftey Res. - 2	Mol. Ecology - 1
J. Econ. Ent. - 2	Hort. Sci. - 1
Intl. Turf Soc. Res. J. - 1	GCIRC Intl.Res.Bul. - 1
Genetic Resources & Crop Evol. - 1	

Contributions to Extension:
Ag Exp. Station Reports - 6
Extension Crop Production Guides - 3
Extension Crop Newsletters - 8
Development of Georgia Soybean Extension Web Page

Publications:

Grey, T.L., **P.L. Raymer,** and D.C. Bridges. 2006. Herbicide-resistant canola (*Brassica napus)* response and weed control with postemergence herbicides. Weed Tech. 20:551-557.

Braman, S.K., and **P. L. Raymer**. 2006. Impact of Japanese beetle (*Coleoptera: Scarabaeidae*) feeding on seashore paspalum. J. Econ. Entomol. 99:1699-1704.

Shin, J.S., **P. Raymer**, and W. Kim. 2006. Environmental factors influencing germination of seeded seashore paspalum. Hort. Sci. 41:1330-1331.

Grey, T. L., **P. L. Raymer**, and G. D. Buntin. 2005. Tolerance of traditional and imidazolinone resistant canola to soil applied residual herbicides in the southeastern United States. GCIRC Bulletin 22.

Raymer, P.L., R.N. Carrow, and D.A. Wyatt. 2005. Screening for salt tolerance in seashore paspalum. p. 129-133. Proc. Inter. Salinity Forum. 25-27 April, 2005. Riverside, CA.

Chen, Z., M. Newman, K. Wook, M. Wang, and **Paul Raymer**. 2005. Molecular characterization of genetic diversity in the USDA Seashore Paspalum germplasm collection. ITS Res. J. 10: 543-549.

Halfhill, M.D., T.W. Rufty, A.K. Weissinger, C.N. Stewart Jr., **P.L. Raymer**, H.S. Moon, J.P. Sutherland, and S. I. Warwick. 2005. Growth, productivity, and competitiveness of introgressed weedy *Brassica rapa* hybrids selected for the presence of Bt cry1Ac and gfp transgenes. Mol. Ecol. 14:3177-3189.

Wang, M.L., Z.B. Chen, N.A. Barkley, M.L. Newman, W. M.L. Wang, Z.B. Chen, N.A. Barkley, M.L. Newman, W. Kim, **P. Raymer**, and G.A. Pederson. 2004. Characterization of seashore paspalum (*Paspalum vaginatum* Swartz) germplasm by transferred SSRs from wheat, maize, and sorghum. Gen. Resources and Crop Evol. 00:1-13.

Grey, T.L., **Paul Raymer,** and G. David Buntin. 2004. Tolerance of ALS-resistant canola to soil applied residual herbicides used in row crop production in the Southeastern United States. GCIRC Bull. 21:26-32.

Prostko, E.P., J.K. Norsworthy, and **P.L. Raymer**. 2003. Soybean response to glyphosate, diflubenzuron, and boron tank-mixtures. Weed Tech. 17:186-189.

Raymer, P. L., and T. L. Grey. 2003. Challenges in comparing transgenic and non-transgenic soybean cultivars. Crop Sci. 43:1584-1589.

Buntin, G.D., **P.L. Raymer**, C.W. Bednarz, D.V. Phillips, and R.E. Baird. 2002. Winter crop, tillage, and planting date effects on double-crop cotton. Agy. J. 93: 273-280.

Grey, T.L., and **P. Raymer**. 2002. Sicklepod (Senna obtusifolia) and red morningglory (Impomoea coccinea) control in glyphosate-resistant soybean with narrow rows and

postemergence herbicide mixtures. Weed Tech. 16:669-674.

Halfhill, M.D., R.J. Millwood, **P. L. Raymer**, and C.N. Stewart, Jr. 2002. Bt-transgenic oilseed rape hybridization with its weed relative, *Brassica rapa*. Env. Biosafety Res. 1:19-28.

Raymer, P.L., D.V. Phillips, D.A. Wyatt, and A.E. Coy. 2001. Registration of 'Flint' canola-quality rapeseed. Crop Sci. 41:593.

4. Professional activity;

International

International Crucifer Genetics Workgroup
U.S. Delegate to Du Groupe Consultatif International De Recherche Sur Le Colza (Canola)

National

Chairman of SERA-IEG 11 (Canola) 2002
Organizing Committee for 2003 U.S. Canola Research Conference
ASA Canola Monograph Committee
Crop Science Soc. C852 Crop Registration Sub-com. for Minor Oilseeds
USDA-PGR Advisory Committee for Oilseed Brassicas
USDA-PGR Advisory Committee for Forage and Turf Grasses
USDA-S009 Germplasm Unit Advisory Board

State

Georgia State Seed Arbitration Board – Ag. Experiment Station Representative

College

Cultivar and Germplasm Release Committee
UGARF Cultivar Development Grant Review Committee
Strategic Planning – Image Subcommittee
Georgia Oilseed Task Force
Organizing Committee for Agroforestry and Wildlife Field Day

Departmental

Graduate Committee
Chairman, Soybean Variety Recommendations Subcommittee
Chairman, Griffin CSS Space Utilization Committee
Chairman, Griffin Faculty Campus Planning Committee
Search Committees for various faculty and staff positions
Liaison for Griffin Research Services
Young Scholars Mentor

Sources of Grants/amounts:

CSRS/NCRP	$ 124,000
USDA/BRA RPG	$ 101,000
EPA	$ 30,000
Various Industry	$ 27,000
UGARF-Plant Breeding Fund	$ 252,000
State Agencies	$ 20,000

Total	$614,000

5. Expected responsibilities in this program;

I expect to continue serving as major advisor or committee member for graduate students and teaching classes as assigned.

1. Name: Carol Robacker
Rank: Associate Professor
Academic discipline: Plant Breeding
Institutions attended, degrees earned;

Pennsylvania State University	B.S.	1975
University of Minnesota	M.S.	1977
University of Minnesota	Ph.D.	1981

2. Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;
My appointment is 95% research, 5% teaching. I currently chair the PhD committee for two student's, and serve on another student's PhD committee. I teach a one-hour course in ornamental plant breeding every other year (HORT 8102). The remainder of my time is spent on plant breeding. I have served as chair of four graduate committees and as a committee member for three students. The addition of this proposed program will not increase my workload.

3. Scholarship and publication record for past five years:

Scheiber, S.M., **C.D. Robacker**, and O.M. Lindstrom. 2002. Stem and leaf hardiness of twelve *Abelia* taxa. J. Environ. Hort. 20:195-200.

Scheiber, S.M., and **C.D. Robacker**. 2003. Effect of pericarp removal, gibberellic acid treatment, and stratification on seed germination of *Abelia ×grandiflora*. J. Environ. Hort. 21:34-37.

Scheiber, S.M., and **C.D. Robacker**. 2003. Interspecific hybridization between *Abelia* × *grandiflora* 'Francis Mason' and *A. schumannii* via ovule culture. Euphytica 132:1-6.

Clark, M.B., H.A. Mills, **C.D. Robacker**, and J.G. Latimer. 2003. Influence of nitrate: ammonium ratios on growth and elemental concentration in two azalea cultivars. J. Plant Nutrition 26:2503-2520.

Scheiber, S.M., and **C.D. Robacker**. 2004. Interspecific hybridization in *Abelia*. Acta Hort 630: 71-76.

Chappell, M., and **C. Robacker**. 2006. Leaf wax extracts of four deciduous azalea genotypes affect azalea lace bug (*Stephanitis pyrioides* Scott) survival rates and behavior. J. Amer. Soc. Hort. Sci. 131:225-230.

Chappell, M., **C. Robacker**, and O. Lindstrom. 2006. Pruning leads to increased incidence of freezing damage in abelia hybrids. J. Environ. Hort. 24:197-200.

4. Professional activity;
American Society for Horticultural Science
American Society for Horticultural Science - Southern Region
Azalea Society of America
Landscape Plant Development Center

Professional Society meetings attended
Southern Nurseryman's Association Annual Mtg, 2002, Atlanta, GA
American Society for Horticultural Science Annual Conf., 2003, Providence, RI

Southern Nurseryman's Association Annual Mtg, 2003, Atlanta, GA
Southern Nurseryman's Association Annual Mtg, 2004, Atlanta, GA
American Society for Horticultural Science Annual Conf, 2005, Las Vegas, NV
Southern Nurseryman's Association Annual Mtg, 2005, Atlanta, GA
American Society for Horticultural Science Annual Conf, 2006, New Orleans, LA
Southern Nurseryman's Association Annual Mtg, 2006, Atlanta, GA

National, regional, and local offices, committee membership, and other special assignments in professional societies

2001-2004 Secretary, Landscape Plant Development Center Board of Directors
2004-2006 Member, Landscape Plant Development Center, Research Committee

Other professional society activities such as external reviewer for grants, manuscripts, panels, and programs

ActaHort; Horticulture Reviews; HortScience; HortTechnology; Journal of the American Society for Horticultural Science; Journal of Environmental Horticulture; Plant Breeding Reviews; Plant Cell Reports; Plant Cell, Tissue, and Organ Culture; Tropical and Subtropical Agriculture, USDA-CREES, Special Research Grants

5. Expected responsibilities in this program:

I expect to continue teaching Hort 8102, Ornamental Plant Breeding, and to train M.S. and Ph.D. students, and serve on graduate committees.

1. Name: John M. Ruter
Rank: Professor, Nursery Crops Research and Extension
Academic Discipline: Plant breeding
Institutions attended, degrees earned:

Calif. Polytechnic State Univ., San Luis Obispo	B.S.	1984
Univ. Tennessee, Knoxville	M.S.	1986
University of Florida, Gainesville	Ph.D.	1989

2. Current workload for typical semester, including specific courses usually taught; explain how workload will be impacted with the addition of proposed program;
My position is 80% Research/20% Extension, and my workload will not be impacted by this proposal.

3. Scholarship and publication record for past five years;

Awards;

2000 D.W. Brooks Faculty Award for Excellence in Research, University of Georgia
2002 William F. Kosar Award, Holly Society of America
2002 Distinguished Achievement Award for Nursery Crops, American Society for Horticultural Science

Publications;

Hanna, W.W., and **J.M. Ruter**. 2005. 'Prince' and 'Princess' napiergrass. HortScience 40:494-495.

Ruter, J.M. 2005. Effect of nickel applications for the control of mouse ear disorder on river birch. J. Environ. Hort. 23:17-20.

Ruter, J.M. 2004. Resistance of Rhaphiolepis selections to Entomosporium leaf spot. Acta Hort. (ISHS) 630:43-45. http://www.actahort.org/books/630/630_3.htm.

Blythe, E.K., J.L. Sibley, K.M. Tilt, and **J.M. Ruter**. 2004. Auxin application to stem cuttings of selected woody landscape plants by incorporation into a stabilized organic rooting substrate. J. Environ. Hort. 22(2):63-70.

Beeson, R.C. Jr., M.A. Arnold, T.E. Bilderback, B. Bolusky, S. Chandler, H.M. Grambling, J.D. Lea-Cox, J.R. Harris, P.J. Klinger, H.M. Mathers, **J.M. Ruter**, and T.H. Yeager. 2004. Strategic vision of container nursery irrigation in the next ten years. J. Environ. Hort. 22:113-115.

Blythe, E.K., J.L. Sibley, K.M. Tilt, and **J.M. Ruter**. 2004. Rooting of rose cuttings in response to foliar applications of auxin and surfactant. HortTechnology 14:479-483.

Blythe, E.K., J.L. Sibley, **J.M. Ruter**, and K.M. Tilt. 2004. Cutting propagation of foliage crops using a foliar application of auxin. Scientia Hort. 103:31-37.

Blythe, E.K., J.L. Sibley, K.M. Tilt, and **J.M. Ruter**. 2003. Foliar application of auxin for rooting stem cuttings of selected ornamental crops. J. of Environ. Hort. 21:131-136.

Olsen, R.T., **J.M. Ruter**, and M.W. Rieger. 2002. Photosynthetic responses of container-grown *Illicium* L. taxa to sun and shade. J. Amer. Soc. Hort. Sci. 127:919-924.

Garber, M.P., **J.M. Ruter**, J.T. Midcap and K. Bondari. 2002. Survey of container nursery irrigation practices in Georgia. HortTechnology 12:727-731.

Hodges, G., **J.M. Ruter**, and S.K. Braman. 2001. Susceptibility of *Ilex* species, hybrids, and

cultivars to Florida wax scale (*Ceroplastes floridensis* Comstock). J. Environ. Hort 19:32-36.

Olsen, R.T. and **J.M. Ruter**. 2001. Preliminary study shows that cold, moist stratification increases germination of 2 native *Illicium* species. Native Plants J. 2:79-83.

Dunwell, W.C., D. Fare, M. Arnold, K. Tilt, G. Knox, W. Witte, P. Knight, M. Pooler, W. Klingeman, A. Niemiera, **J. Ruter**, T. Yeager, T. Ranney, R. Beeson, J. Lindstrom, E. Bush, A. Owings, and M. Schnelle. 2001. Plant evaluation program for nursery crops and landscape systems by the Southern Extension and Research Activities/Information Exchange Group-27. HortTechnology 11:373-375.

4. Professional activity;

American Public Gardens Association American Society for Horticultural Science American Society for Horticultural Science, Southern Region American Camellia Society American Conifer Society Florida Native Plant Society Georgia Green Industry Association Holly Society of America International Society for Horticultural Science International Plant Propagators Society

Summary Productivity (Past Five Years):

13 Referred Journal Articles
45 Non-refereed Conference Proceedings Publications
61 Extension and Trade Publications
40 Other Articles, Reports and Notes
13 Invited Presentations (Regional, National and International Meetings)
36 Additional Contributed Presentations (Regional, National and International Meetings)
60 Industry Presentations and Workshops (State, Regional and National Meetings)
15 Grants and Contracts
15 Individual Gifts/Financial Contributions to Research
30 Manuscripts and 2 Books reviewed for several publishers

5. Expected Responsibilities in this program:

I expect to have graduate students in the program or serve on graduate committees.