Positions for the Plant Breeding, Genetics, and Genomics Program

Background: Plant breeders have traditionally been educated in land grant universities, however, over the past few decades, as new technologies have evolved and funding for field-based plant breeding programs has been lost, many institutions have turned their focus to basic research, plant biology, molecular biology/genetics, and biotechnology, and away from plant breeding programs. Consequently, we have lost an entire generation of plant breeders with the concomitant result that we now are unable to meet the demand for plant breeders globally. Although much of the work of plant breeding, particularly for the major agricultural commodities, has shifted to the private sector and to international agricultural research institutions, it remains the responsibility of land grant institutions to both train plant breeders and to develop the breeding methodologies necessary to meet current and future demands for plant breeders.

Modern plant breeding programs and by extension the training of the modern plant breeder require an optimal balance between molecular genetic studies and the necessary experience gained from working in an active, field-based plant breeding program. At Missouri, we have competitive field-based breeding programs in wheat and soybean along with germplasm enhancement efforts in maize. We also have teaching efforts at the graduate and undergraduate levels in plant breeding theory. Training students for modern plant breeding positions requires additional training in both molecular breeding and in population and quantitative statistical applied plant genomics. We currently have gaps in curriculum and collaborative research opportunities in both of these critical areas and as such, are currently unable to adequately train plant breeding graduate students who will be competitive in the marketplace. Two positions would begin to rebuild the plant breeding and genetics tradition for which MU has long been recognized.

Position #1 – Cereal Genomics and Breeding

Justification: The plant breeder of the 21st century needs both traditional and new technological skills. At MU, we have competitive field-based plant breeding programs and teaching efforts in plant breeding theory. We also have a critical mass of faculty working in the areas of biotic and abiotic stress biology and a widely-acclaimed interdisciplinary plant group that through courses and collaborative research provide students with invaluable opportunities to hone their research skills. However, we currently have limited capacity in the area of molecular breeding to adequately train graduate plant breeding students in the translation of that research to the field and ultimately to our stakeholders. A faculty member in a cereal genomics and breeding position could provide course work in the areas of advanced plant breeding or genomics-assisted breeding. The successful candidate could also provide a molecular genetics laboratory setting that would complement our existing strong, field-based breeding research where both graduate students and undergraduate student interns could gain the essential practical, hands on, experience necessary to be competitive in the marketplace. Without this position, our ability to adequately train graduate students in plant breeding is severely compromised. Despite a growing interest in the field by our undergraduates we are currently unable to effectively provide them with the breath of exposure to the field they require.

Position: - Cereal Genomics and Breeding:

A tenure track position at the Assistant/Associate Level; 80% research 20% teaching.

Responsibilities:
Teach a course each semester in plant breeding, genomics, molecular breeding, bioinformatics, or related area.
Conduct molecular genetics / genomic research that complements current cereal genetics/breeding programs (specifically maize and wheat) in the Division of Plant Sciences. Potential areas of research include the development of markers for marker-assisted-selection for biotic and abiotic stresses, whole genome selection techniques for quantitative traits, candidate gene analysis, association mapping of quantitative traits, etc.

Potential Linkages: Plant Stress Biology Group; IPG; USDA-ARS Plant Genetics Group; Bioinformatics Institute; Mizzou Advantage (Food for the Future and bioenergy areas); Danforth Plant Science Center; Missouri Plant Science Center; Industry including but not limited to Monsanto, Limagrain, Pioneer, and Syngenta; commodity organizations (Missouri Corn Merchandising Council, National Corn Growers Association, and Missouri Rice Merchandising Council).

Position # 2 – Quantitative Statistical Genetics/Genomics

Justification: Much of the work of plant breeding is in the improvement of quantitative traits such as yield, stress resistance (both biotic and abiotic), and quality or fitness for purpose. Improvement in these traits has long been hindered by the complexity of the genetic systems conditioning them. Conventional approaches directed at understanding the genetics of these traits to better exploit them in breeding programs have been successful and plant breeders must be trained in the statistical analysis of data generated from these approaches. Additionally, a focus of modern molecular plant breeding is on developing more effective approaches for improving quantitative traits that include but are not limited to quantitative trait analysis, association mapping, and genome-wide selection. These approaches require the analysis of specific populations and generate large volumes of data that must be analyzed using unique approaches. At MU, we have competitive field-based plant breeding programs working predominantly with quantitative traits. We also have a critical mass of faculty working in the areas of biotic and abiotic stress biology, the results of which must be translated to the field. The Division of Plant Sciences lacks faculty expertise in the area of quantitative statistical genetics and applied plant genomics to collaborate in the analysis of the data generated through both conventional and molecular approaches. A faculty member focused on population and statistical genetics and genome data analyses would fill this research gap and assist in the critical need to train plant breeding graduate students in this area. The successful candidate would also be expected to fill the gap in our plant breeding curriculum in theoretical and applied population and quantitative statistical genetics, and could establish a new training potential for genome data analysis. Recruitment of new faculty with expertise in these areas is an opportunity to rebuild a plant breeding research and training program that can put

the Division of Plant Sciences as the premium destination for professional development and collaboration in the critical field of Plant Breeding, Genetics, and Genomics.

Position: Quantitative Statistical Genetics/Genomics

A tenure track position at the Assistant/Associate Level; 80% research 20% teaching

Responsibilities: The successful candidate would develop an innovative, research program in population and quantitative genetics/applied plant genomics that would develop knowledge and tools to complement and strengthen existing field-based plant breeding programs in the Division of Plant Sciences and/or basic research in the Plant Stress Biology research area. In addition, the candidate would be expected to fill gaps in the graduate plant breeding curriculum including but not limited to a graduate level course in population and quantitative statistical genetics and genomics.

Potential Linkages: Plant Stress Group; IPG; Computer Sciences; Bioinformatics Institute; USDA-ARS Plant Genetics Group; Mizzou Advantage (Food for the Furure and Bioenergy areas); Danforth Plant Science Center; Missouri Plant Science Center; Industry including but not limited to Monsanto, Limagrain, Pioneer, and Syngenta; commodity organizations (Missouri Corn Merchandising Council, National Corn Growers Association, Missouri Rice Merchandising Council, Missouri Soybean Merchandising Council, and United Soybean Board).