

# Plant Breeding and Genetics Program at Michigan State University



**Background :**

- Created in 1981 by the College of Agriculture and Natural Resources at Michigan State University (MSU)
- An inter-disciplinary program with 23 faculty members from Crop and Soil Sciences, Entomology, Forestry, Horticulture, Plant Biology and Plant Pathology.
- More than 70 M.S. and Ph.D. degrees have been awarded since its inception.
- Currently are about 20 graduate students in the program.
- Support comes from MI-AES, The College of Agriculture and Natural Resources, Project GREENE, Commodity Grants, USDA-National Needs Fellowship Program, USDA-NRI and USDA-CSREES (among others)

**Faculty:**

- Allison, Richard - Molecular biology of plant viruses; virus host specificity; RNA recombination.
- Bughrara, Suleiman - Turfgrass breeding and genetics, marker assisted selection to improve disease resistances.
- Douches, Dave - Potato breeding and genetics, insect and disease resistance, integration of genetic engineering, use of wild species.
- Epperson, Bryan - Theoretical population genetics, studies of structure and function of genomic diversity, spatial statistics and coalescence theory.
- Grumet, Rebecca - Plant-virus interactions, sex expression in cucurbits, cucurbit transformation.
- Hammerschmidt, Ray - Physiology and biochemistry of resistance and disease; induced resistance.
- Han, Kyug-Hwan - Metabolic engineering of plant species. Incorporation of molecular biology techniques into tree improvement programs.
- Hancock, Jim - Blueberry and strawberry breeding, polyploid evolution and QTL analysis of day-neutrality in strawberry.
- Iezzoni, Amy - Cherry breeding and genetics: disease resistance, comparative mapping and polyploid evolution.
- Jiang, Ning - Function of transposable elements (TEs) in eukaryotic genome diversification.
- Kelly, Jim - Dry bean breeding and genetics, marker assisted selection for disease resistance and stress tolerance.
- Loescher, Wayne - Physiology, biochemistry, and molecular biology of carbohydrate partitioning and transport, cell wall metabolism, and abiotic stress tolerance mechanisms.
- McGrath, Mitch - Sugar beet breeding and genetics including use of wild species; application of molecular markers to dissect the beet genome and the genetics of agronomic traits.
- Maredia, Karim M. – Environmental and food biosafety in developing countries; intellectual property issues.
- Sears, Barbara - Chloroplasts and mitochondria of plants: genetic controls of their replication, recombination, and repair.
- Sink, Ken - Regeneration, vector construction, and transformation strategies for celery, blueberry, and tart cherry.
- Sticklen, Mariam - Genetic engineering for production of alternative energy biofuels and bio-based industrial material. Also, genetic engineering of cereals and turfgrasses for resistance to biotic and abiotic stresses.
- Sunden, George - Plant Pathology, phyto bacteriology, bacterial diseases, tree fruit.
- Thomashow, Mike - Molecular genetic basis of plant freezing tolerance; low temperature gene regulation and signal transduction.
- VanNocker, Steven - Molecular biology and genetics of phase change and flowering.
- Wang, Dechun - Soybean breeding and genetics, disease and insect resistance, QTL mapping, soybean genomics.
- Warner, Ryan - Environmental stress tolerance, increasing efficiency of greenhouse crop production.

**Breeding efforts by activity:**

	PYs	%
a) Plant Breeding Research	2.56	17
b) Germplasm Enhancement	2.45	16
c) Cultivar Development	3.40	23
d) Biotechnology Research and Development	5.00	34
e) Plant Breeding Education	1.55	10
<b>Total</b>	<b>14.90</b>	<b>100%</b>

**Students Trained:**

**Graduated last 5 years (34):**

PhD	Domestic	12
	International	9
MS	Domestic	7
	International	6

**Current Students (25):**

PhD	Domestic	10
	International	8
MS	Domestic	4
	International	3

**Job placement of recent graduates:**

Position	Percent
Private Industry	11
National Research Programs	26
International Research Programs	7
University Faculty	26
Postdoctoral	22
PhD students	8
<b>Total</b>	<b>100%</b>

The number of jobs has remained the same over the last five years, although post-docs are more prevalent.

The number of applied and basic jobs has also been stable for our graduates.

**Graduate courses:**

The graduate program fully integrates emerging plant biotechnologies with traditional breeding for crop improvement. The principal feature of the PBG Program is a set of core courses integrated with a flexible graduate curriculum. A key component of the PBG program is a student run seminar series and a symposium that is open to the campus wide community.

- Required Courses**
- CSS/HRT 451 Biotechnology Applications for Plant Breeding and Genetics. 3 credits.
- HRT/CSS 819 Advanced Plant Breeding. 3 credits
- HRT 820 Plant Reproductive Biology and Polyploidy. 1 credit.
- STT 464 Statistics for Biologists. 3 credits
- STT 814 Advanced Statistics for Biologists. 4 credits.
- PLB/BMB/CSS 856 Plant Molecular Biology. 3 credits.
- HRT 892 Plant Breeding and Genetics Seminar. 1 credit. (3 credits required). Experience in review, organization, oral presentation, and analysis of research.
- Additional courses clustered by topic area**
- Plant Breeding and Quantitative Genetics**
- ANS 870 Techniques for Analyzing Unbalance Research Data. 4 credits.
- CSS/HRT 441 Plant Breeding and Biotechnology. 4 credits.
- CSS 941 Quantitative Genetics in Plant Breeding. 3 credits.
- HRT/PHL 486 Biotechnology in Agriculture: Applications and Ethical Issues. 3 credits.
- HRT 891B Selected Topics in Plant Breeding and Genetics. 1 to 2 credits.
- FOR 842 Population Genetics, Genealogy and Genomics. 3 credits.
- Evolution**
- HRT/CSS/FOR 821 Crop Evolution. 1 credit.
- HRT/CSS/FOR 822 Historical Geography of Crop Plants. 1 credit.
- ZOL 445 Evolution. 3 credits.
- ZOL 849 Evolutionary Biology. 3 credits.
- ZOL 855 Molecular Evolution: Principles and Techniques. 3 credits.
- Molecular Biology**
- BMB 801 Molecular Biology. 3 credits.
- BMB 802 Metabolic Regulation & Signal Transduction. 3 credits.
- BMB 803 Protein Structure and Function. 2 credits.
- BMB 960 Selected Topics in Biochemistry I. 1 to 2 credits.
- MMG 833 Microbial Genetics. 3 credits.
- MMG/GEN 835 Eucaryotic Molecular Genetics. 3 credits.

**Breeding efforts by crop:**

Crop Group	PYs	Releases in the past 5 years	
		Germplasm	Cultivars
Blueberry	1.10	0	3
Celery	0.75	1	0
Cowpeas	0.20	0	0
Dry bean	1.75	0	6
Melon	0.60	0	0
Oats	0.45	0	0
Potato	1.00	0	5
Rice	0.48	0	0
Soybean	1.05	1	1
Sour cherry	1.60	0	1
Strawberry	0.40	7	0
Sugar beets	1.10	0	5
Turfgrass	1.15	34	0
Wheat	1.00	0	5
Forest trees (8)	2.00	0	0
Other (3)	0.27	0	0
<b>Total</b>	<b>14.90</b>	<b>43</b>	<b>26</b>