PLSC 776
ADVANCED PLANT BREEDING
COURSE OUTLINE
INSTRUCTOR ELIAS M. ELIAS

2- Quantitative genetics in maize breeding. A.R. Hallauer and J.B. Miranda, FO.

Heritability
Definitions
Methods of estimation
Factors influencing heritability

Genotype X Environment Interaction
Models
Implications in testing program
Stability of genotype performance

Parent selection in a breeding program
Criteria for selecting parents
Type of crosses and strategies
Sources of parental germplasm

Breeding Methodology
Pedigree method
Bulk method
Single-seed descent method
Backcross method
Production of doubled haploids

Mixture, Blends, and Composites

Early Generation Testing

Selection Index - Multiple Trait Selection
Linkage and Plant Breeding

Introgression of Exotic Germplasm and Genetic Diversity
   - Wide crosses
   - Interspecific hybridization
   - Winter X Spring crosses

Recurrent Selection in Self Pollinated Crops

Preservation of Germplasm
   - Effective population size

Type of Gene Action:
   - Partitioning of the total genetic variance
   - Experimental designs used to estimate genetic variances

Intrapopulation Improvement
   - Selection theory
     - Hardy-Weinberg law
     - Normal distribution
     - Components of variation
     - Genetic advance
   - Mass selection
     - Genetic gain theory
     - Gardner’s Grid system
   - Half-sib family selection
     - Ear-to-row selection
   - Modified ear-to-row selection
     - Genetic gain theory
   - Half-sib recurrent selection (or test cross)
   - Testers
     - GCA vs SCA
   - S1 progeny recurrent selection
   - S2 family selection
   - Full-sib family recurrent selection
     - Genetic gain theory
Interpopulation Improvement
- Reciprocal recurrent selection
- Reciprocal recurrent selection based on test cross of half-sib families.
- Reciprocal recurrent selection based on half-sib progenies of prolific plants.
- Reciprocal full-sib recurrent selection

Hybrid Development
- Inbreeding
  - Methods of inbreeding
  - Inbreeding depression
- Types of hybrid
  - Factors in comparing hybrid types
  - Calculating number of possible hybrids
  - Prediction of double and 3-way hybrid yields from single cross data.
- Topcross testers for inbred line development
  - Type of testers
  - Stage of testing

Heterosis and Hybrid Breeding

Breeding for Disease Resistance

Molecular Genetics and Plant Breeding
- Utilization of genetic markers
PLANT SCIENCES 776 is a lecture that will cover techniques and methodology involved in breeding self and cross-pollinated crops. The proper application of basic genetic principals to crop improvement will be emphasized.

PRE-REQUISITES:

An introductory course in plant breeding, PLSC 718 and courses in statistics including experimental design PLSC 724 are required.

COURSE OBJECTIVES:

- To review several basic concepts that contribute to an understanding of the genetics and breeding of self and cross-pollinated crops.
- Discuss strategies and specific methods utilized in variety and population improvement and related research.
- To develop student interest and awareness of past and present activity reported in the literature on the genetic improvement of self and cross-pollinated crops.

REFERENCES:

- Textbooks on library reserves.
- Journal articles.
- Class handouts.

GRADING:

- Three one hour exams (20% each)
- Final exam (25%)
- Homework sets (15%)