**Purpose:**

* Evaluate student’s ability to compare potential breeding methods based on the genetic gain equation.
* Extend student’s ability to simulate phenotypic data using models of quantitative genetics for multiple cycles of selection and recombination.

**Keywords**: Genetic Gain, heritability, additive genetic variance, Selection

**References:**

* CM Heritability and Selection
* Bernardo-Chapter 13, Section 11.9

ALA

Imagine that you are responsible for developing soybean varieties in maturity zone II. It has been suggested that early generation testing, i.e., testing F2 derived lines, will accelerate genetic gains relative to the standard testing of F5 derived lines. The two proposed breeding strategies are depicted in the following figure:

Determine whether the proposed EGT will result in greater genetic gain than the F5 GT:

Fall: *E x I*

Winter: *F1*

Summer: *F2*

Fall: *F2:3*

Winter: *F2:4*

Summer: *Eval F2:5*

Fall: *E x I*

Winter: *F1*

Summer: *F2*

Fall: *F3*

Winter:  *F4*

Summer: *F5*

Fall: *F5:6*

Winter: *F5:7*

Summer: *Eval F5:8*

**Early Generation Test**

**F5 Generation Test**

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where *i* is the selection intensity, *h2* is narrow sense heritability, **p, is the standard deviation of the phenotypes, *t* is time (years) and *c* is the cost ($). Assume that selection intensity is the same and that the number of field plots will be the same for the evaluation phase of both methods.

An alternative EGT procedure has been proposed. In this alternative project 2x the number of lines are evaluated as F2:3 in a single replicate during the first summer after the nursery (see figure 2). The idea is to eliminate ½ of the lines, followed by development of F5:8 for evaluation in the same number of environments as the traditional F5 GT.

Summer: *E x I*

Fall: *F1*

Winter: *F2*

Summer: *F2:3*

Fall:

Winter: *F4*

Summer: *F5*

Fall: *F5:6*

Winter: *F5:7*

Summer: *Eval F5:8*

Fall: *E x I*

Winter: *F1*

Summer: *F2*

Fall: *F3*

Winter:  *F4*

Summer: *F5*

Fall: *F5:6*

Winter: *F5:7*

Summer: *Eval F5:8*

**Alternative**

**Early Generation Test**

**F5 Generation Test**

Determine whether the proposed Alternative EGT will result in greater genetic gain than the F5 GT. Due to the complex nature of *h*2 with the proposed 2-stage evaluation and selection strategy, the analytical approach using the genetic gain equation cannot be used to approach the question. An alternative is to use simulation modeling to evaluate which of the strategies will be best.

In *DS8 RILs.xlsx* find tables in which both methods can be compared under the assumption of the same genetic architecture: equal additive effects at each of 10 functional marker loci. Two families of F2 and F5 derived lines have been simulated from crosses of 2 inbreds with a hub parent.

Conduct 3 cycles of evaluation and selection for each method and determine the realized gain from each. After each cycle of evaluation create two families with the best set of (3 or 4) lines. For the alternative EGT use one replicate of data for both families consisting of 100 F2:3 lines and 4 environments for the 50 F5:8 lines per family. For the traditional F5:8 evaluation use 4 environments, with 1 rep per environment for the 50 lines per family. Also, determine the relative costs for each method. Assume the cost of a field plot is $20 for the home site and $35 for an offsite environment.

Save your progeny genotypes and parents from each cycle of selection for use in a subsequent ALA.