Selection Heritability and Genetic Gain
Simulation Comparison

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Purpose:

- Compare potential breeding methods based on the genetic gain equation.
- Simulate phenotypic data using models of quantitative genetics for multiple cycles of selection and recombination.

Keywords:

Genetic Gain, heritability, additive genetic variance, Selection

References:

Chapter 9: Selection Response

Bernardo-Chapter 13, Section 11.9

ALA

An alternative EGT procedure has been proposed. In this alternative project 2x the number of lines are evaluated as $F_{2:3}$ 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 $F_{5:8}$ for evaluation in the same number of environments as the traditional F_5 GT.

Alternative Early Generation Test

Summer:	*E x I*
Fall:	F_1
Winter:	F_2
Summer:	$F_{2:3}$
Fall:	
Winter:	F_4
Summer:	F_5
Fall:	$F_{5:6}$
Winter:	$F_{5:7}$
Summer:	*Eval* $F_{5:8}$

F_5 Generation Test

Fall:	*E x I*
Winter:	F_1
Summer:	F_2
Fall:	F_3
Winter:	F_4
Summer:	F_5
Fall:	$F_{5:6}$
Winter:	$F_{5:7}$
Summer:	*Eval* $F_{5:8}$

Determine whether the proposed Alternative EGT will result in greater genetic gain than the F_5 GT: $\Delta G = ih^2\sigma_P / tc$, where i is the selection intensity, h^2 is narrow sense heritability, σ_p, is the standard deviation of the phenotypes, t is time (years) and c is the cost ($). 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 a file named "Selection Heritability and Genetic Gain ds8.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 F_2 and F_5 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 $F_{2:3}$ lines and 4 environments for the 50 $F_{5:8}$ lines per family. For the traditional $F_{5:8}$ 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.