**ALA 7.1 F2 enrichment**

**Prerequisite**

Understanding of:

1. Difference between marker-assisted backcrossing (MABC) and marker-assisted selection (MAS).
2. Awareness of the relative efficiency of MAS versus phenotypic selection.
3. Factors the influence the efficiency of MAS.
4. Alternative MAS strategies, such as F2 enrichment.

Read:

Bonnett, D.G., G.J. Rebetzke, and W. Spielmeyer. 2005. Strategies for efficient implementation of molecular markers in wheat breeding. Molecular Breeding. 15: 75–85. Available online at [http://link.springer.com/article/10.1007%2Fs11032-004-2734-5](http://link.springer.com/article/10.1007/s11032-004-2734-5).

**Purpose**

Exposure to F2 enrichment strategy for marker-assisted selection as described in detail by Bonnett et al. (2005).

**Background**

F2 enrichment is an appropriate method if the number of genes of interest exceeds the number of genes that can be reasonably handled by MABC (>5 genes), and is below about 10-20 genes. The basic strategy is to use markers in order to identify and discard (cull) genotypes that do not have at least one favorable allele at all of the loci of interest. This significantly increases the probability in the remaining genotypes (after culling) of identifying a genotype that has the favorable allele fixed at all loci of interest.

**Tasks**

Estimate population sizes required for enrichment vs. fixation of target loci (1-10) in F2 and doubled haploid (DH) populations. (you may refer to lessons 4 and 5 to obtain the probability function of the binomial distribution).

Derive a formula for the minimum population size for F2 enrichment, and calculate the minimum number of individuals required to find at least one genotype with all loci fixed, a) in F2 before enrichment, b) in F2 after enrichment, c) in DH before enrichment, and d) in DH after enrichment.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of loci | (a) in F2 before enrichment | (b) in F2 after enrichment | (c) in DH before enrichment | (d) in DH after enrichment |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |
| 6 |  |  |  |  |
| 7 |  |  |  |  |
| 8 |  |  |  |  |
| 9 |  |  |  |  |
| 10 |  |  |  |  |

**Tentative answers** (can differ, based on context / assumptions made)