

Purposes:

1. Apply the fundamental concepts of population genetics to address a complex social issue.

Keywords: Hardy Weinberg Equilibrium, drift, selection, transgene, migration

References:

Captivate: Population Genetics Foundations

ALA: Fate of a transgene.

A community of small farms exists in a valley located in the highlands of Central America. The farmers of this community produce grain on about 500 acres from an open pollinated variety that is adapted to their environmental conditions and cultural practices. They select seed from ears representing about 5% of their better performing plants to be used for seed each growing season (there are two growing seasons per year). One day a truck filled with seed of a transgenic hybrid overturns on the highway while passing through the valley. Most of the transgenic seed is recovered, but about 500 kernels remain in a farmer's 10 acre field. After five years this accident becomes widely known in Mexico City where grocers stop purchasing maize from the farmers of this valley. You have been retained by the law firm of Chase, Deep and Pockets to determine if it is likely that the transgene has spread throughout the valley and is now part of all grain being sold from the valley.

Determine the probability that the transgene can be found in samples of grain from this valley assuming that you obtain 500 ears of corn, one from each of the 500 acres in the valley. Assume each ear produces at least 250 kernels.

- a) there is no selective advantage conferred by the transgene and
 - a. Farmers plant about 5,000 kernels per acre.
 - b. Farmers plant ~ 1000 kernels per acre.
- b) There is selective advantage conferred by the transgene: The transgene, when present, protects plants from an insect. The insect kills the plants without the transgene before grain matures. The infestation rates are such that about 10% of a field will experience loss in most years.
 - a. Farmers plant about 5,000 kernels per acre.
 - b. Farmers plant ~ 1000 kernels per acre.