Purposes:

1. Establish the concepts of an ideal population and Hardy Weinberg Equilibrium.

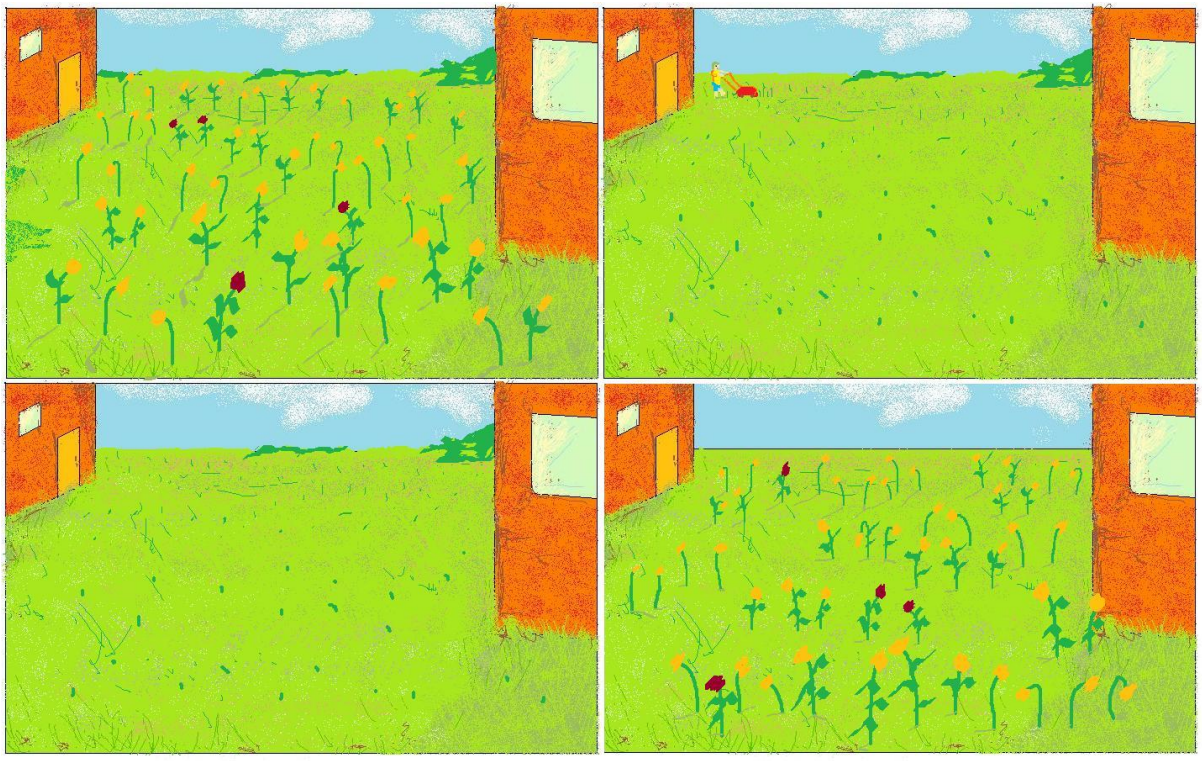
Keywords: Ideal population, Hardy Weinberg Equilibrium

References:

Captivate: Population Genetics - Foundations

ALA: The ideal population.

Imagine the ideal population without drift, selection, migration or mutation in a garden where 50 plants grow wild and happy in HWE (Hardy Weinberg Equilibrium). Every plant produces an average of one offspring per year depending on population density. Usually this species grows very old and survives winter, but here all plants are cut after seed production by an eager guy who likes the yard neat and clean in the fall. The yard has resources for 50 plants so that the population will stabilize at that number after many generations. In the picture see that the plants of this population segregate for flower color and for leafiness. These traits are visible when flowers are still buds. Interestingly, genetic variants for both traits are affected by allelic variants at the same genetic locus , i.e., it is a pleiotropic locus: the common allele is dominant for yellow flowers and recessive for barren stalk the other one is recessively coding for brown flower but dominant for generous leaf set. We can therefore find heterozygotes to be yellow with good leaf development. These plants are open pollinating and self-compatible.



Genotypes are denoted A and B for leaf phenotype and flower phenotype, respectively for convenience. Note that Ab and aB are the only two alleles because no recombination is possible within in pleiotropic genes. p = frequency of Ab, q = frequency of aB gamete. All others are counts for genotype, phenotype and gamete classes. Based on the two informative panels (upper left and lower right) fill out two tables such as the table at right:

50 plants	p =	q =	
genotypes	AbAb	AbaB	aBaB
count:			
Gametes	Ab	aB	
count:			
phenotypes	leafy brown	leafy yellow	barren yellow
count:			

Can this be considered an ideal population? Is this population in Hardy Weinberg Equilibrium? Provide evidence for your answer.

ideal population			
50 plants	p = 0.29	q = 0.71	
genotypes	AbAb	AbaB	aBaB
genotypes	4	21	25
Gametes	Ab	aB	
	29	71	
phenotypes	leafy brown	leafy yellow	barren yellow
phenotypes	4	21	25

after random mating			
50 plants	p = 0.29	q = 0.71	
genotypes	AbAb	AbaB	aBaB
genotypes	4	21	25
Gametes	Ab	aB	
	29	71	
phenotypes	leafy brown	leafy yellow	barren yellow
phenotypes	4	21	25

Table 1a and b) Genotypes are denoted A and B for leaf phenotype and flower phenotype, respectively for convenience. Note that Ab and aB are the only two alleles because no recombination is possible within in pleiotropic genes. p = frequency of Ab, q = frequency of aB gamete. All others are counts for genotype, phenotype and gamete classes.

Criteria for an Ideal Population:

1) The base population is infinite, or at least too large to count. **False**
2) There is no migration between sub-populations. **True**
3) There is no breeding between overlapping generations. **True**
4) The number of breeding individuals is the same in each sub-population. **True**
5) There is random mating within a sub-population. **True**
6) There is no Selection. **True**
7) There is no Mutation. **True**

Test for HWE at a single locus:

$$\widehat{D}_A = \widehat{P}_{AA} - p_A^2 = 0$$