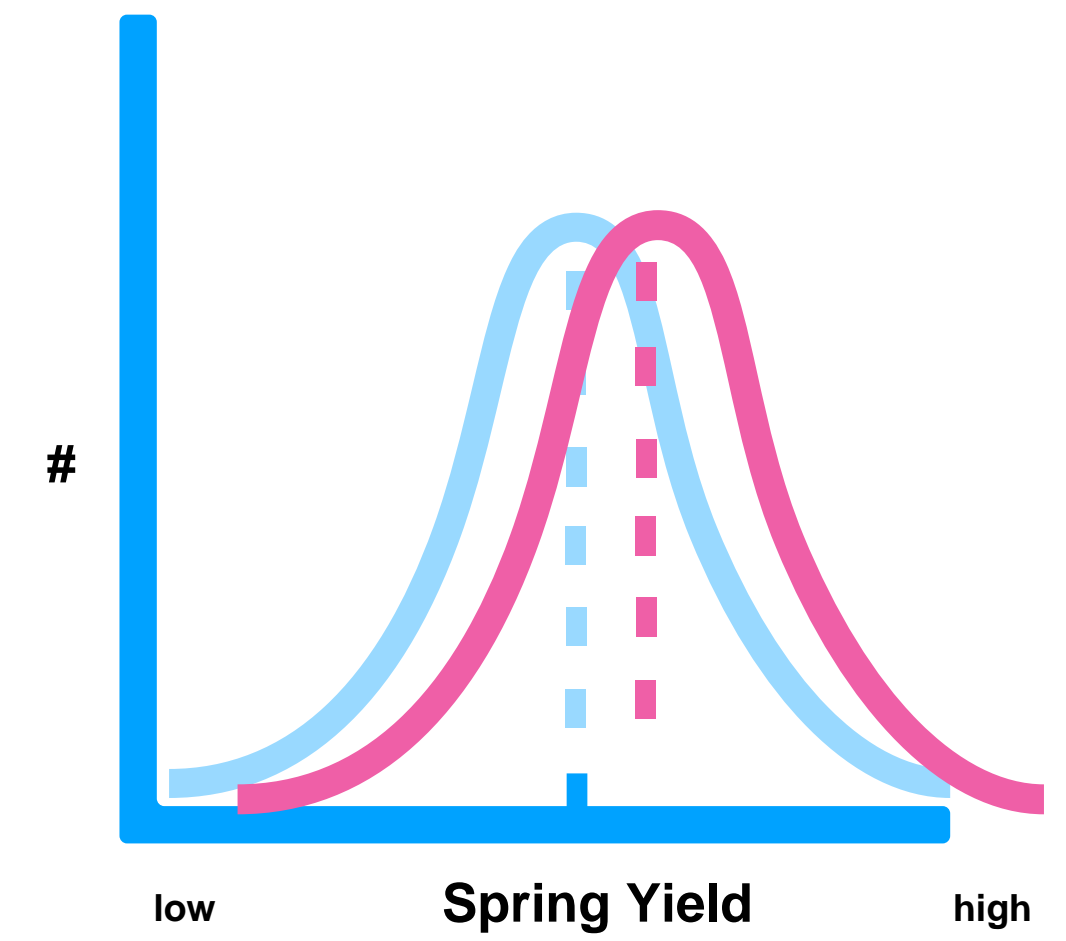
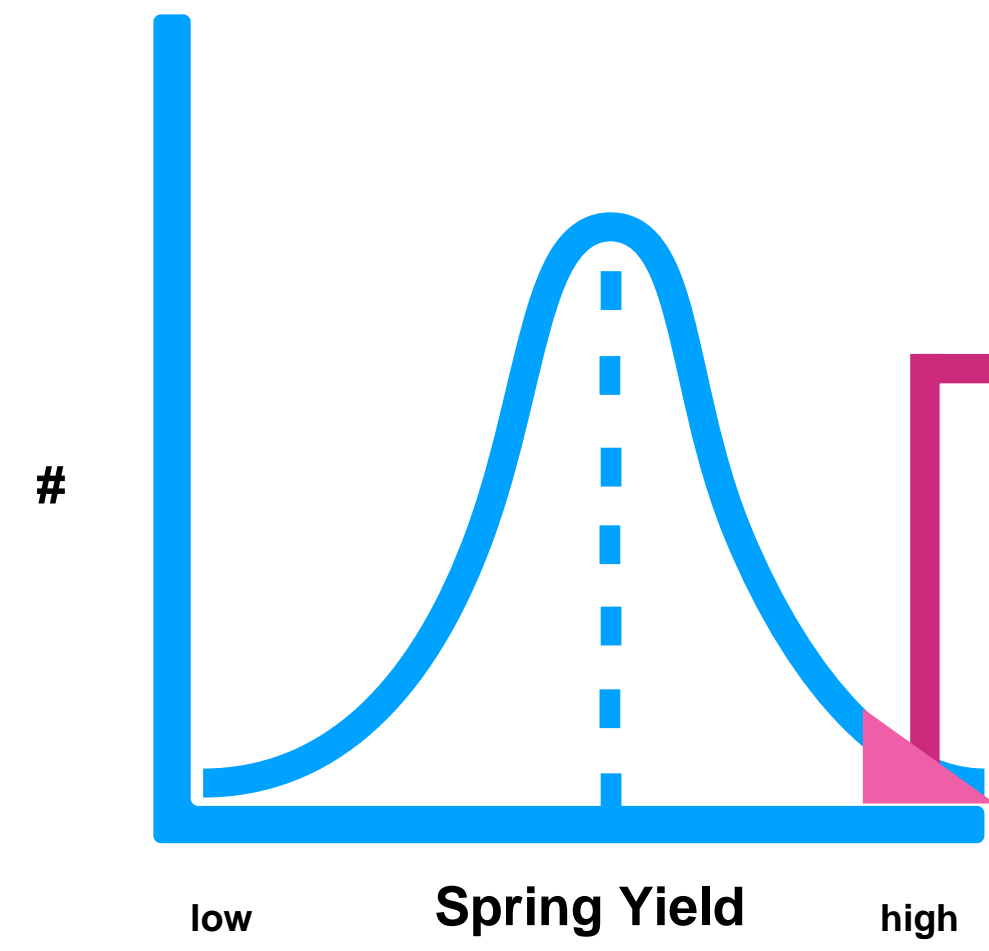
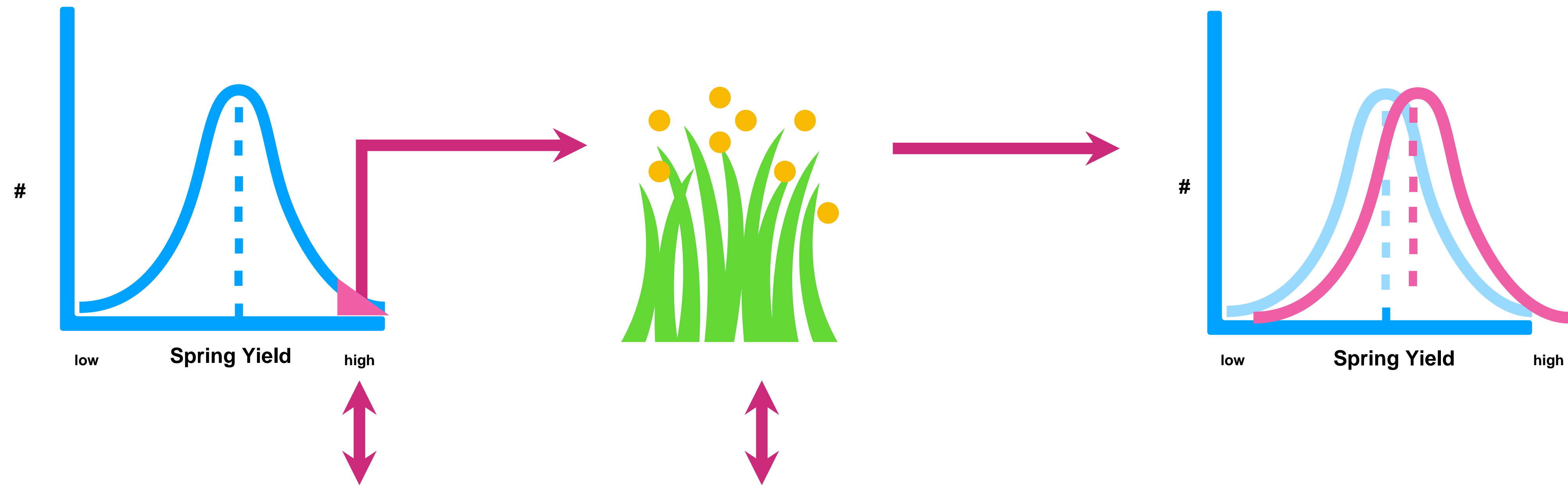


Application of genomic selection to grass breeding

Stephen Byrne
Teagasc, Crop Science Department

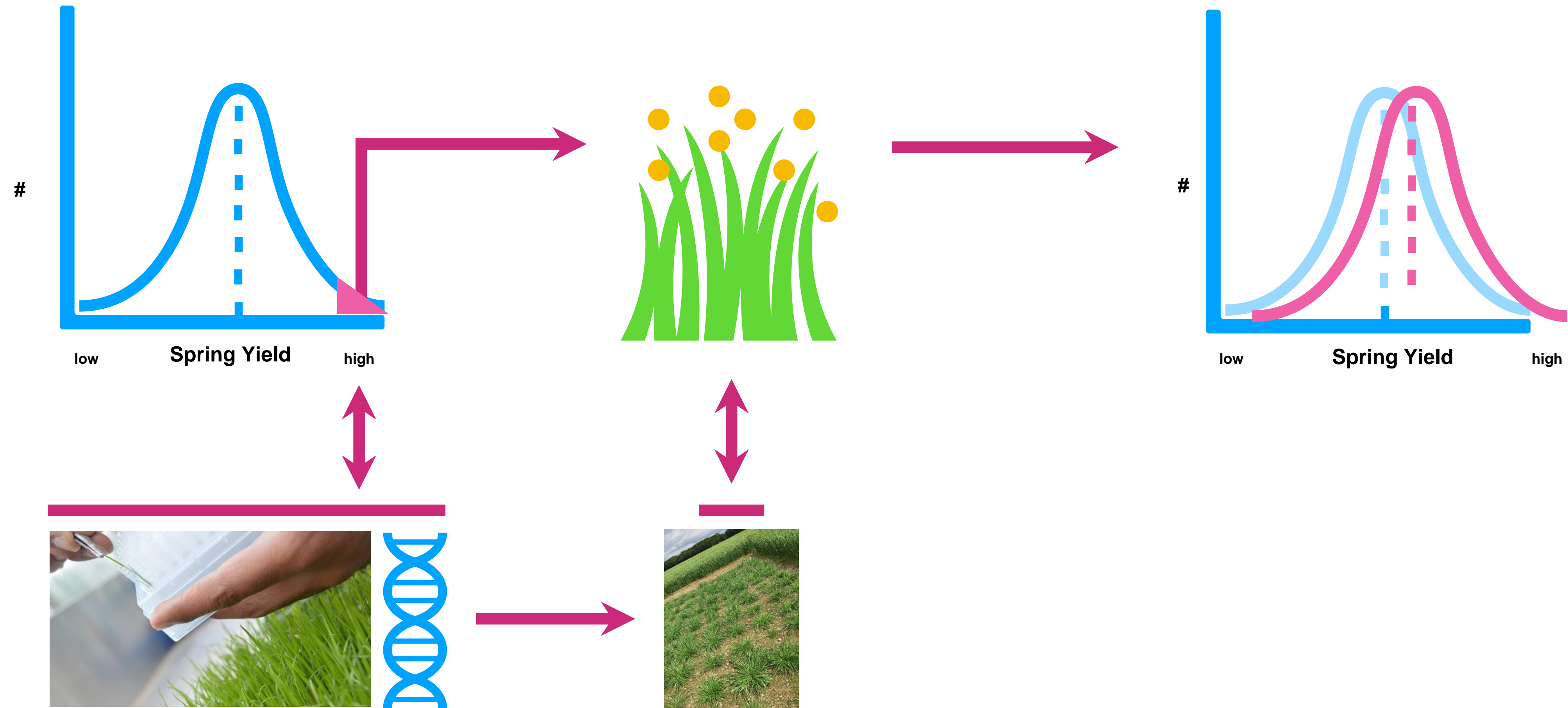
1. What is Genomic Selection?
2. How do we study the DNA of grasses and use this information in plant breeding?
3. What are the benefits of Genomic Selection?

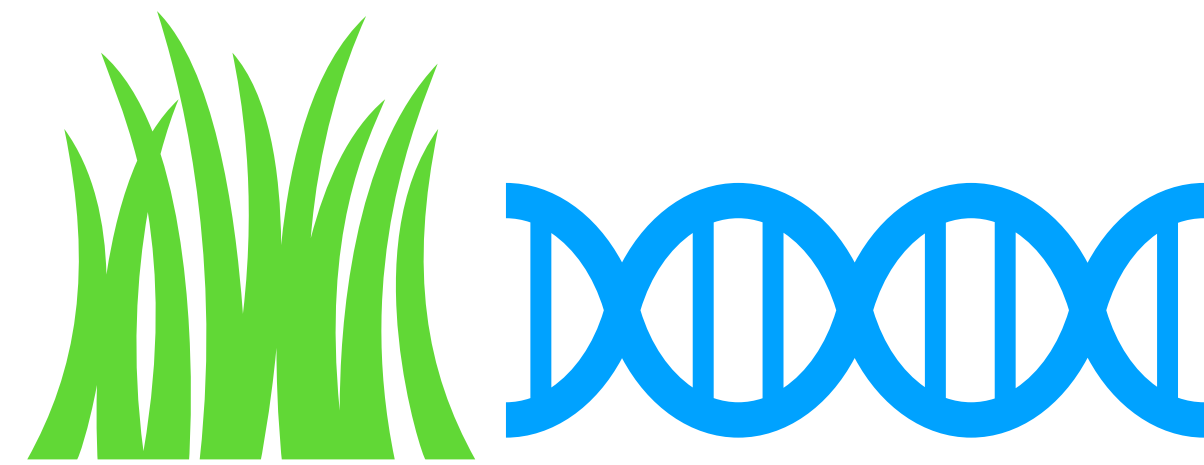




Genotypic Recurrent Selection (half-sib/full-sib)



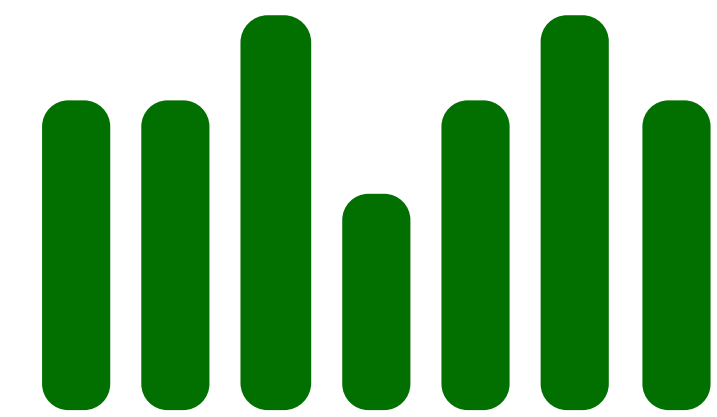




~2.5 billion

ATCGTGCGGCGGGTGTGCGCT

chromosomes



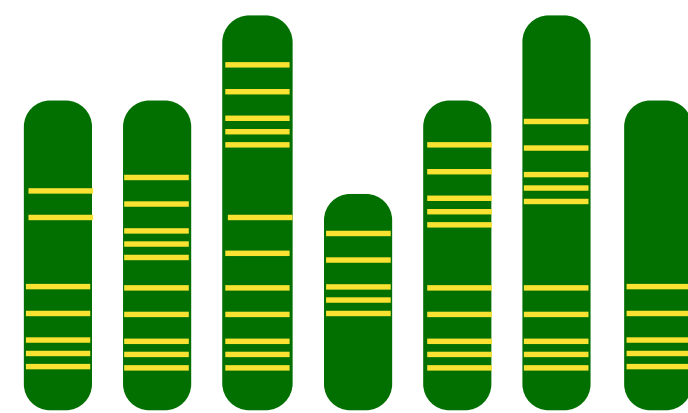
Single Nucleotide Polymorphisms (SNPs)





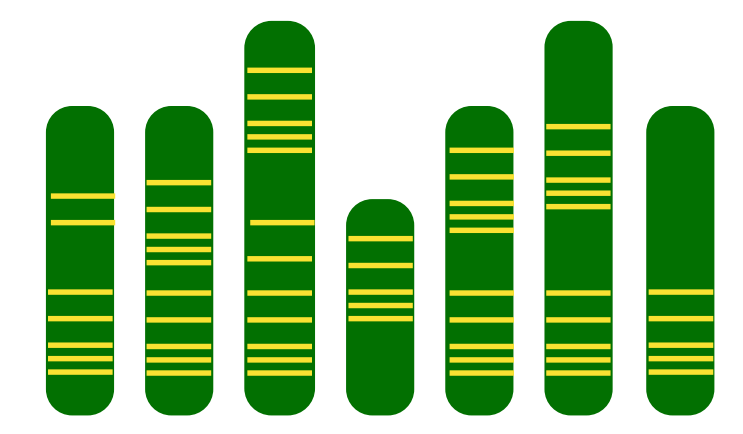
ATCGTCTGCA GCGGGTGTGCT

chromosomes

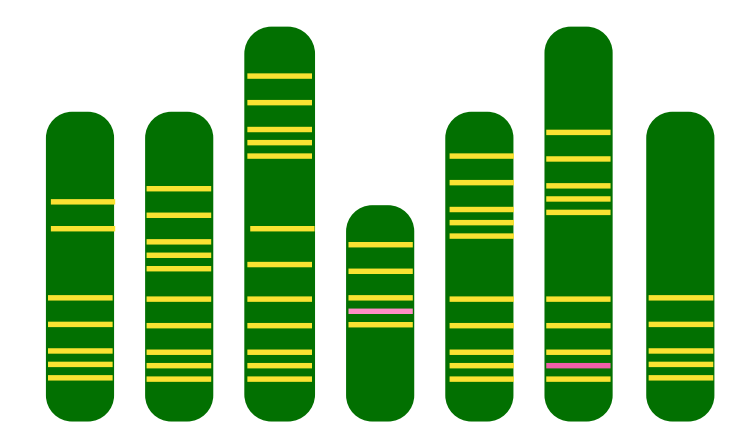


chromosomes

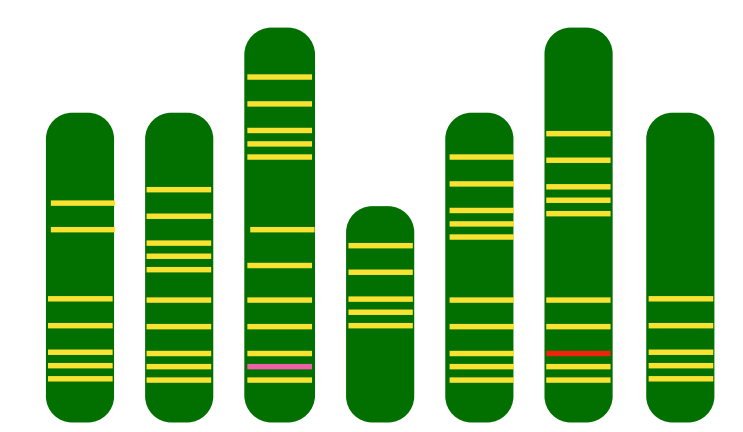
Plant 1



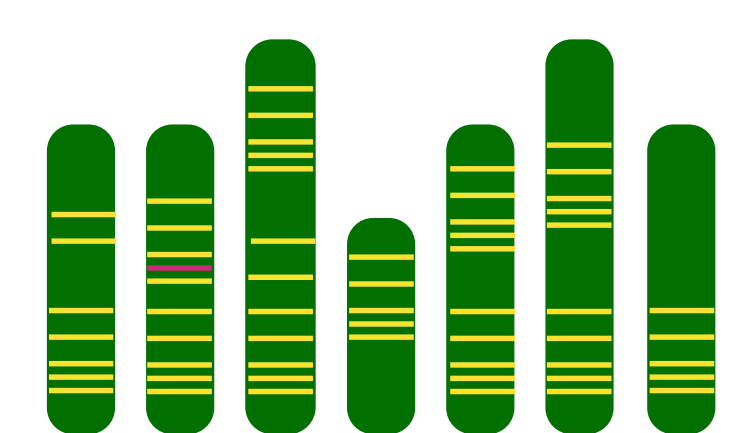
Plant 2



Plant 3



Plant *n*



Which plant has a 'good' DNA profile?

Spring Yield

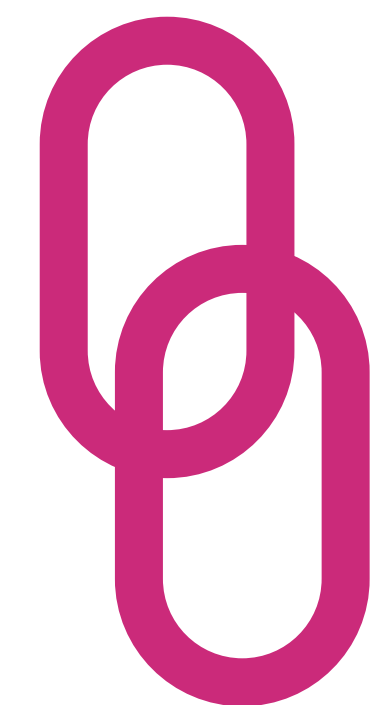


Plant 1

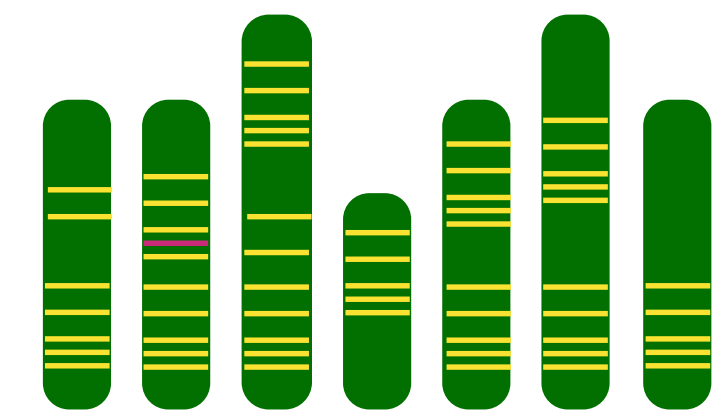
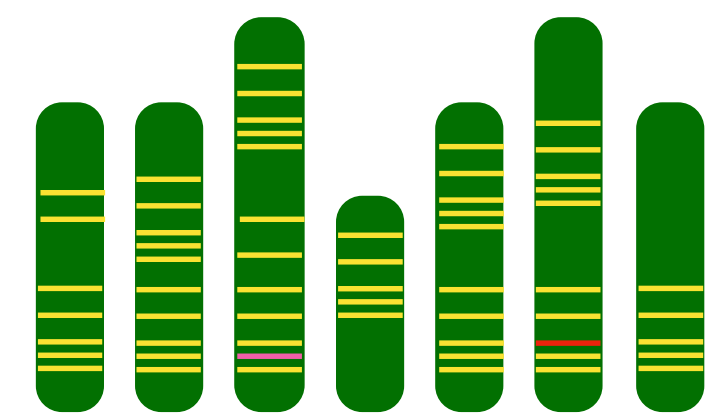
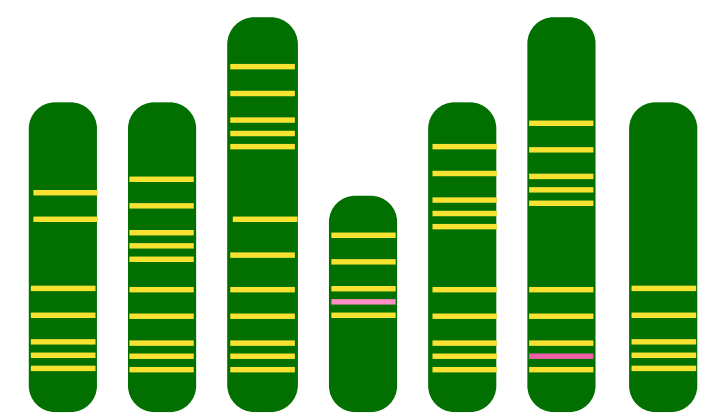
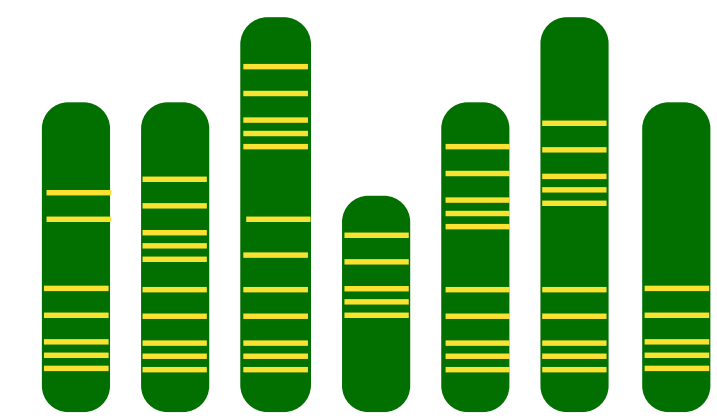
Plant 2

Plant 3

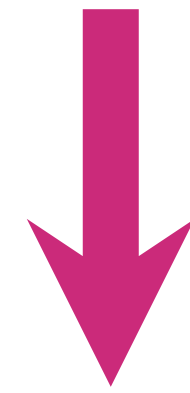
Plant *n*



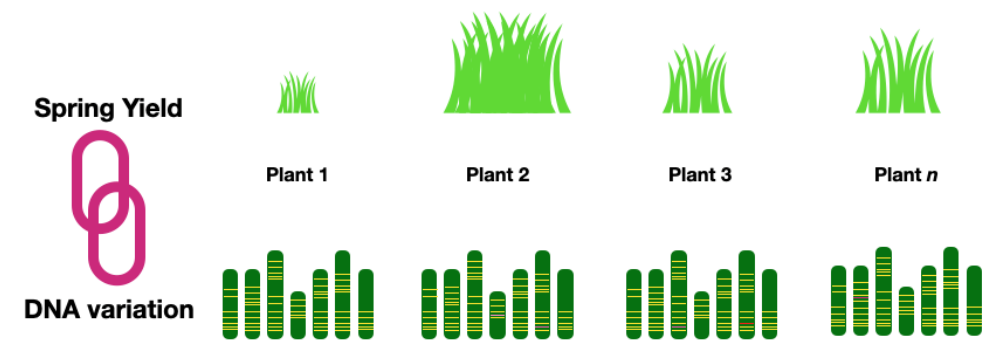
DNA variation



Spring Yield



DNA variation

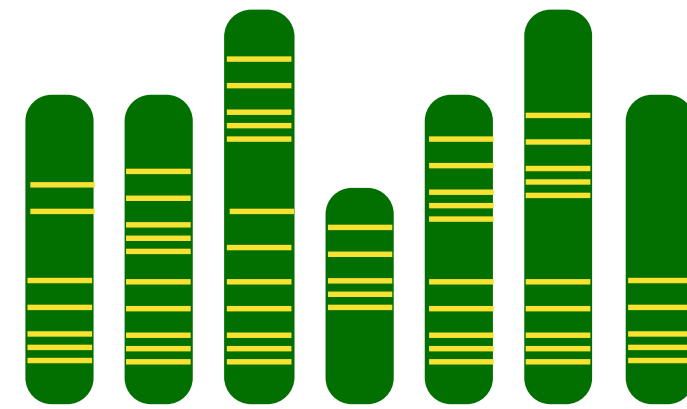


Predicted Spring Yield

Genomic Estimated Breeding Values

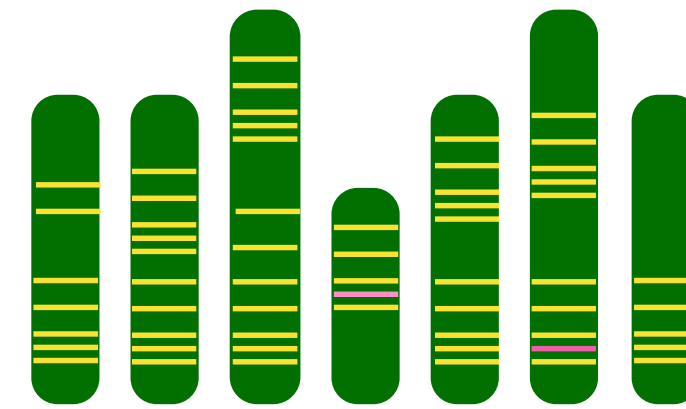
?

Plant 1



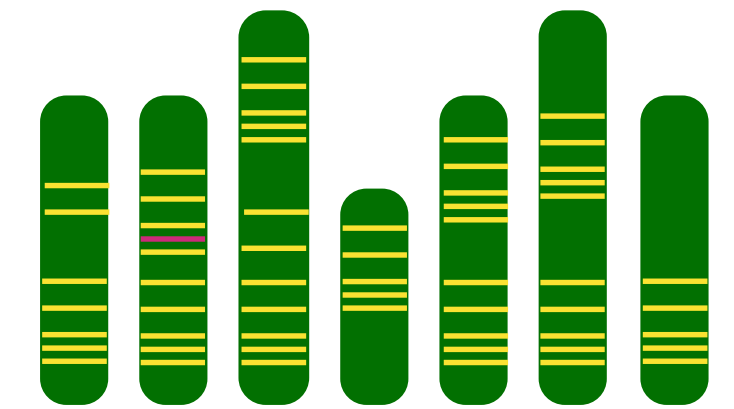
?

Plant 2



?

Plant *n*



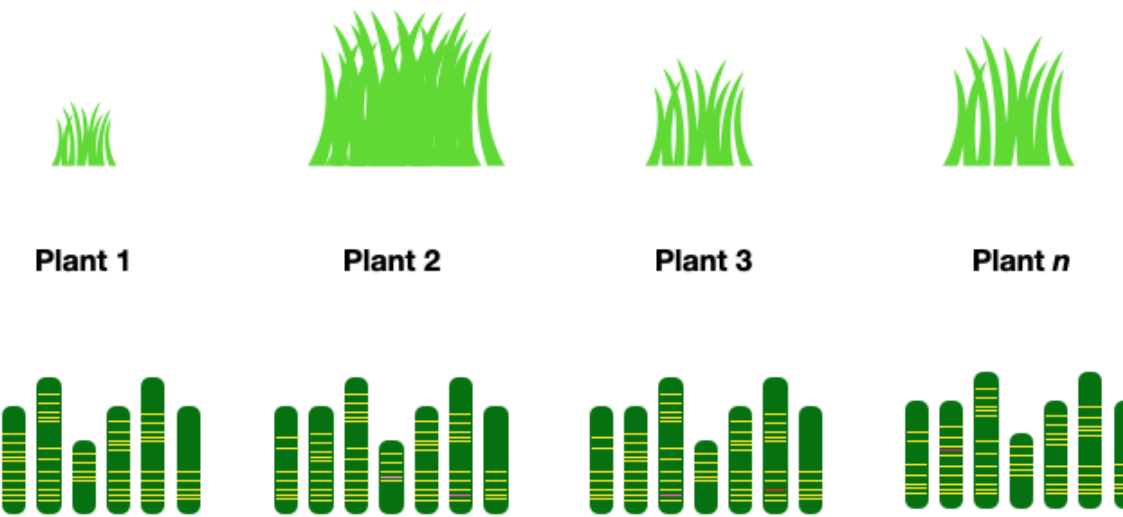
Single Nucleotide Polymorphisms (SNPs)



Spring Yield



DNA variation



Spring Yield

?

?

?



DNA variation



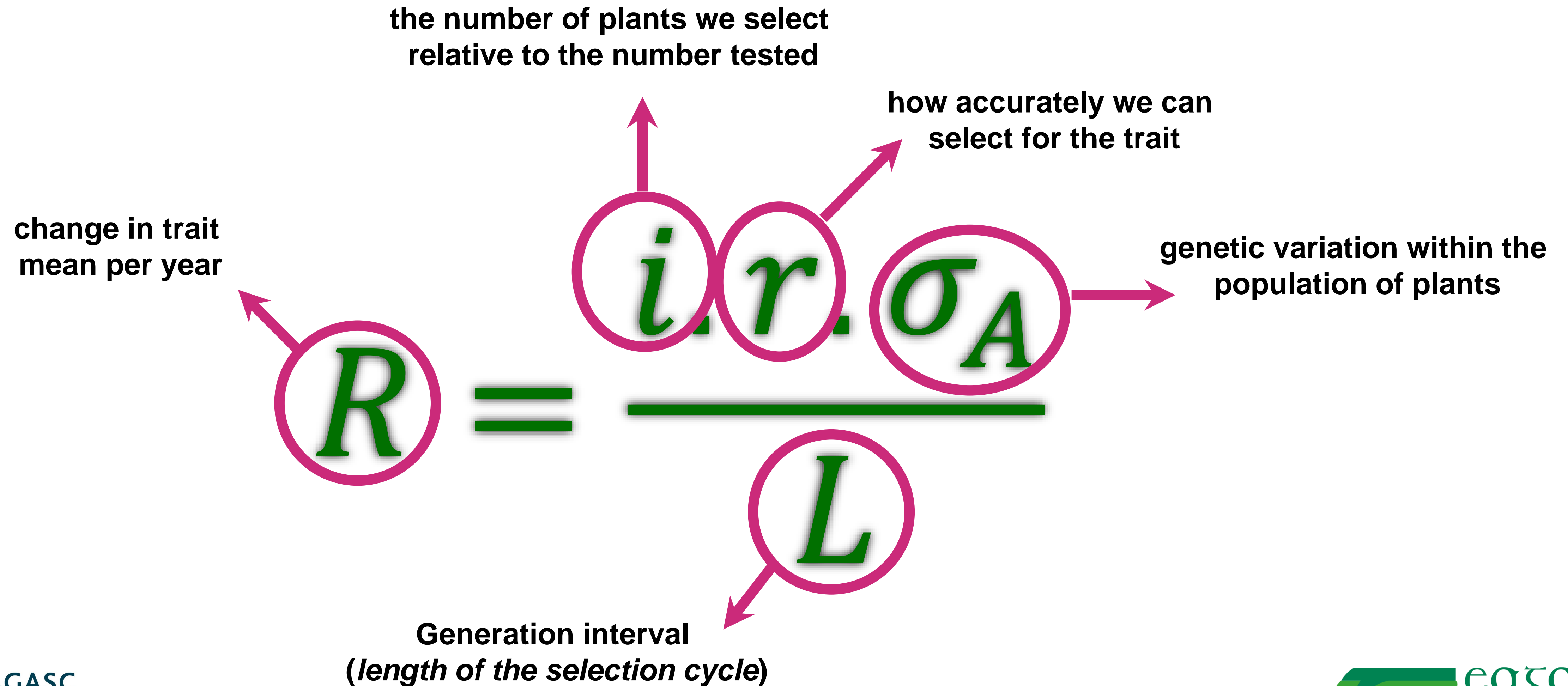
Predicted Spring Yield
Genomic Estimated Breeding Values



Advantages of Genomic Selection?

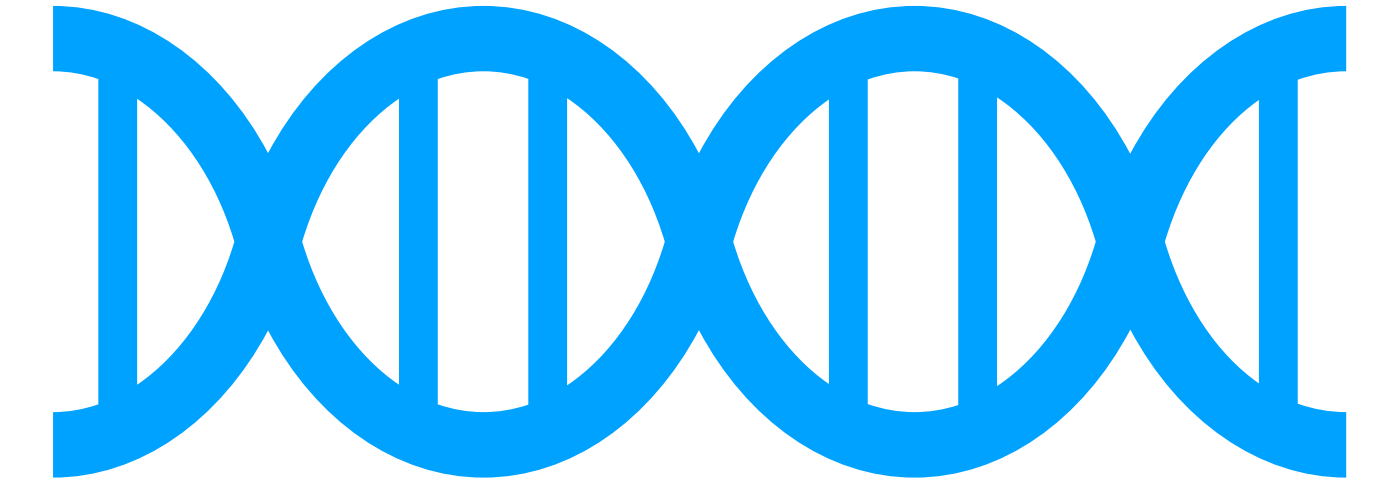
$$R = \frac{i \cdot r \cdot \sigma_A}{L}$$

Advantages of Genomic Selection?



Selection Intensity

$$R = \frac{i \cdot r \cdot \sigma_A}{L}$$

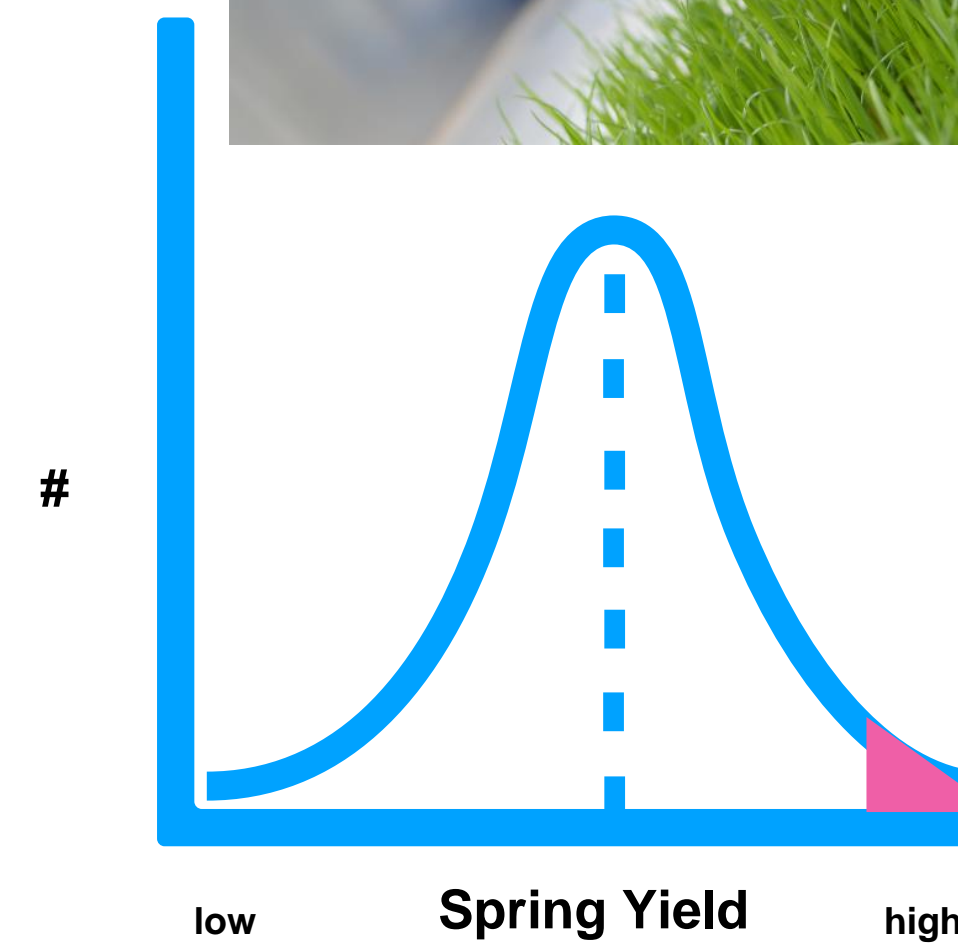


100s

1000s

Within Family Selection

$$R = \frac{i \cdot r \cdot \sigma_A}{L}$$



Shorten Selection Cycle

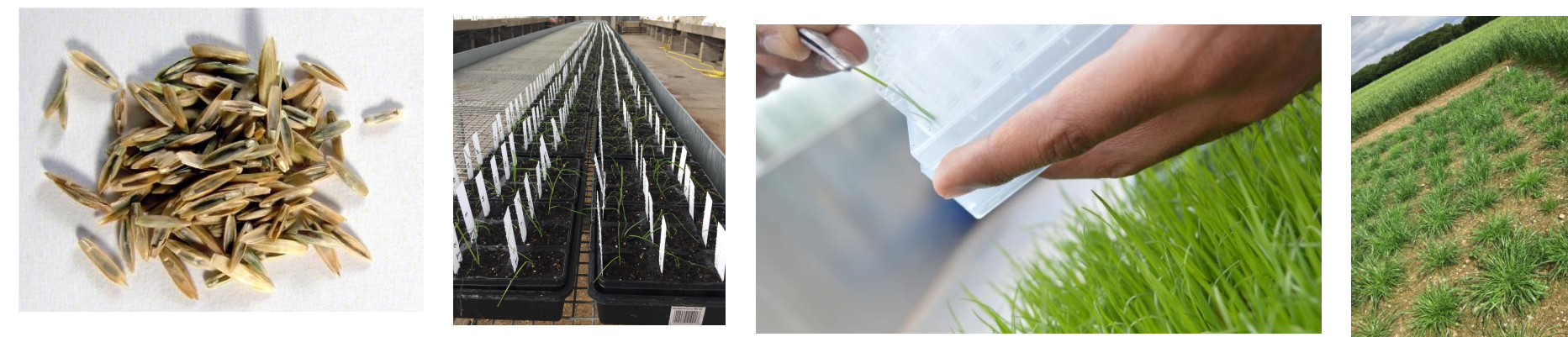
$$R = \frac{i \cdot r \cdot \sigma_A}{L}$$

Genotypic Recurrent Selection (half-sib/full-sib)



One cycle of selection (~7 years)

Genomic Selection



One cycle of selection (1 year)

Summary



- 1. Genomic Selection is simply a tool that can be used for indirect selection during plant breeding.**
- 2. We can use DNA sequencing to identify differences in the genetic code between plants and relate differences in DNA profiles to differences in field performance.**
- 3. Genomic selection can help forage breeding by increasing selection intensity, increasing selection accuracy, and reducing generation interval.**