# **Mendelian Genetics**

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## Purpose:

* To reinforce understanding of gene action and differences that can exist between populations from crosses.
* To reinforce understanding of segregation patterns following self-fertilization from F1 generation to F2 generation.

Keywords: Genes, alleles, crosses, complete dominance, recessive

References: [*Genetics, Agriculture, and Biotechnology*](https://iastate.pressbooks.pub/genagbiotech/) Chapter 13

## Scenario

A large international seed company has hired you to work with plant breeders to develop corn hybrids for central Iowa. Based on the maps below **(Figure 1 and Figure 2)**, your team has predicted that drought and elevated temperature will be a prevalent problem in the future.



Figure The impact of drought in Iowa (2020)



Figure June temperatures in Iowa (2020)

Because of the drought concern, your team has decided to place an emphasis on developing maize hybrids with higher drought tolerance. Use your knowledge from the Lecture on Mendelian Genetics to select from the table below **two trait alternatives per each trait** to incorporate into the new improved drought tolerant maize.

Table 1. Genes and traits they control. The traits assort independently.

|  |  |  |  |
| --- | --- | --- | --- |
| **Gene locus**  | **Trait controlled by the gene** | **Alternative dominant trait**  | **Alternative recessive trait** |
| R | Root depth  | Long  | Shallow and widespread |
| H | Plant height  | Tall  | Short |
| C | Leaf cuticle  | Thick  | Narrow |
| P | Heat shock proteins | Present  | Absent |
| S | Leaf stomatal density | Low  | High |
| R | Photosynthesis rate  | Heat sensitive  | Heat insensitive |
| A | Antioxidants | High | Low |
| D | Drought stress hormone | Hormone sensitive  | Hormone insensitive |

1. List the two alternative traits (dominant or recessive) you have selected and justify your choice. The justification should also be in your own words and be between 100 and 120 words.
2. Perform a cross between true-breeding parents containing the traits you have selected. Capital letters indicate complete dominance.
3. Indicate the genotype and phenotype of F1 progeny from the cross in B.
4. You perform a cross between two F1 plants and obtain 1000 F2 progeny. How many F2 plants will contain all dominant alleles for the two traits you have selected? What will be their phenotype?
5. What is the expected phenotypic ratio in the F2 generation?