Analyzing Traits in Tomato Plants

In 2012, the tomato genome was fully sequenced. This knowledge allowed geneticists to study tomato traits and their genetic basis. For example, several genes affect the color of the fruit. Tomatoes can come in many colors. Interactions between the tomato's skin and the fleshy material result in the color we see. Tomato skin can either be yellow or clear.

Imagine you're a farmer and want to know the genotypes of your tomato plants regarding tomato skin color. You ran several testcrosses, shown in Figure 6, to determine the genotypes of your plants (the P generation).

1. DEFINE THE PROBLEM

With your team, write a statement outlining the problem you've been asked to solve. Record any questions you have about the problem and the information you need to solve it.

2. ANALYZE DATA

Make a plan for organizing the data and approaching the problem. How will you determine which allele is dominant and which allele is recessive? What assumptions can you make based on the data?

3. DEVELOP A MODEL

With your team, develop a system for modeling the yellow and clear alleles. When you have decided on a system, indicate the genotypes for each phenotype in the P-generation crosses. Then, use a Punnett square to calculate the probability of producing tomatoes with clear or yellow skin for each type of possible cross between heterozygous, homozygous-recessive, and homozygous-dominant plants. Determine the probability of producing each genotype and phenotype for each possible type of cross.

4. CONDUCT RESEARCH

Research ways that geneticists might alter or enhance this trait. Why might they want to do so?

5. COMMUNICATE

Write a report describing your findings and the process you used to determine how this trait is influenced by different alleles. In your report explain which allele is dominant and recessive, describe the model you used, and give the genotypes of the plants in the P generation.

FIGURE 5: Tomatoes can come in many colors including red, yellow, green, and even white.

FIGURE 6: Number of tomato plants resulting from crosses of parental plants with yellow or clear skin.

P generation phenotypes	F_1 generation phenotypes	
	number of yellow	number of clear
yellow × clear	16	17
yellow × yellow	25	8
yellow × yellow	32	0
yellow × clear	23	21
yellow × clear	26	0
clear × clear	0	29
yellow × yellow	33	11

CHECK YOUR WORK

A complete presentation should include the following information:

- an explanation based on evidence explaining how alleles are related to this trait in tomato plants
- a valid model for the alleles involved in this trait and correct Punnett squares showing the probability of each genotype and phenotype from different types of crosses
- a description of techniques geneticists use to genetically engineer plants and reasons for using technology in this way