# Grade 5 planting Tomato and Pepper Seedlings – Genetic Diversity

Date: mid to late May

Objectives: Students learn to transplant baby plants into the garden bed while considering the genetic variability (diversity) of traits in fruits and vegetables.

Background:

There are around 7,500 tomato varieties grown for various purposes and adapted to various environments. Although one tomato seed looks virtually the same as the seed from another plant, they will produce plants with very different fruits, depending on the genes contained in the seed.

Tomatoes have 25% more genes than we do and are highly adaptable! How could the main ingredient in ketchup be more genetically diverse than we are?

Genes determine not only color, but fruit size, firmness, and resistance to cracking and disease, blossom end rot susceptibility, and the shelf life, shape, sugar/acid levels and yield not to mention their resilience to adverse environmental conditions.

Traits or characteristics are affected by inheritance (genes) as well as the environment. Environmental conditions such as nutrients or water in the soil, presence of pests and air temperatures or high winds can also affect the traits of plants. A plant might have the genetic ability to be tall, but if high winds are common in the environment, it may sense that wind and develop to be a shorter plant.

So how can tomatoes have more genetic diversity than you and I? Think about how you deal with adversity? We deal with adversity by moving. For example: if you're hungry? walk to the store; cold? migrate to a warmer place; lonely? walk to a friend's.

A plant doesn't have these options and has to survive adversity without moving. Tomatoes can do this in part because they have more than one copy of a given gene – one copy for normal conditions and another for when it is under stress in adverse conditions.

It is surprising to learn that plants contain sophisticated sensory mechanisms not so different from our own. The most amazing aspect of a plant's life is that it takes in sensory information and will then signal which genes to turn on to help the plant adapt to its environment. Leaves, flowers, and roots exchange information regarding light, pests, weather and water, and together this leads to different genes being turned on and off. The information exchanged is in the form of chemical compounds.

One adaptation that can help plants survive a changing environment is often having more than one copy of a given gene. A plant can have one copy of a gene for a normal environment, and a second copy which comes into play when it's under environmental stress. This is how tomatoes have 25% more genes than humans!

Adaptations are similar to possessing super powers against adversity – consider the toxins that tomatoes produce once bitten by an insect. A tomato plant will sense when a neighboring tomato plant has been bitten by the chemical signals given off, and will increase its own toxins.

Preparation:

- prepare a garden bed (pull weeds, turn the soil with added compost),
- Gather tomato seeds from different varieties, pictures of diversity of tomato and pepper fruit.
- Gather seedlings from FFA or F2S, trowels, ruler, watering can, tomato cages

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Action:

1. Introduce yourself and briefly describe what you will be doing.
2. Ask students – "when you think of a tomato, what does it look like?" What are some of the ways in which tomatoes vary? What specifically is making a tomato plant produce different colored, shaped, flavored fruit?
3. Take a look at some tomato seeds from different tomato varieties. Can you tell what type of tomato these seeds will grow?
4. Now look at pictures in a seed catalog of different tomato fruit.
5. How can these tomatoes be so different? Have students think about this and share their idea with their neighbor about how there is such a variety in tomato fruits?
6. Show power point presentation
7. The difference in traits is determined by the genes contained in each seed. Cross pollination and mutation in the genes creates new characteristics or traits.
8. Should we plant all one type of tomato or a variety? What will be different? The fruit will look and taste different. And some plants may be better adapted to our climate, so may appear healthier.

9. Divide the students into two groups. One group will travel to the garden at a time and then switch. The group staying in the classroom will complete a tomato design activity

In the garden

10. Let students know they will be learning how to transplant baby plants into the garden. Ask about the sequence of planting 1)dig a hole, 2)remove the plant from the container and spread roots, 3)gently place it in the hole while holding the stem straight, 4) cover the roots with enough soil, 5) water. How much space do you think tomatoes need? -about 2 feet away from other plants. Use a ruler to see how many of your hands (or elbow to finger) it would take to be 2 feet and use this estimation to determine where to dig your hole.
11. Divide students into groups of three. Explain that one student will be strong and dig a hole, one student will be gentle when removing the plant from the pot, opening up the roots and placing into the hole and the 3rd student will be precise in carefully covering the plant roots and watering (or watering can be for a 4th students). Students decide among themselves who will do what job.
12. Don't hand out tools or plants until you are ready for them to plant. Demonstrate the process of transplanting one plant yourself, being careful to untangle the roots and to hold the stem straight while burying the roots. (Tomatoes can be planted deep. Just pinch off the lower leaves. The little hairs on the stem will turn into roots).
13. Hand the digging student the trowel and hand the gentle student the plant. Remind them about spacing between plants.
14. Repeat for peppers

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Black Krim

Cherokee Purple

Green Zebra

Pineapple

Sioux Red

Super San Marzan

Indigo Rose

Pink Berkeley