GROW
NEXT GEN

Soybean Aphid Resistant Varieties

Background:

Soybean aphid continues to be an economically important pest in the United States. Soybean aphids pierce soybean tissues and feed on the sap, causing yield losses of up to 25 percent or more if left untreated. During outbreaks, if aphid populations are left untreated, their populations can easily exceed several thousand per plant. Once the economic threshold is achieved (250 aphids per plant), soybean producers rely on timely insecticide applications to prevent yield loss. However, a new tool called host plant resistance may reduce the number of insecticide applications needed to manage soybean aphids, increasing profits for producers. This process, **antibiosis**, works due to the suppression of aphid growth and reproduction on the plant. Other types of host plant resistance include **antixenosis**, the inability of an insect to find and/or feed on a plant and **tolerance**, the ability of a plant to produce yields despite insect feeding. A single plant can express one or more types of resistance.

Since the invasion of the soybean aphid in the 2000 growing season there has been intensive research and generous support for the development of soybean varieties that are resistant to the soybean aphid. Currently, five soybean genes have been found that provide some level of resistance to the soybean aphid. These soybean aphid resistant genes are known as Rag (Resistance to *Aphis glycines*) genes. Varieties with 2 genes (Rag1, Rag2) are commercially available either with 1 gene or a pyramid (stacked trait) that contains both. Research has shown that these varieties can keep soybean aphids under the economic threshold of 250 aphids per plant. New high yielding, resistant varieties under development would reduce or eliminate the need for soybean aphid insecticide application, which would help to control input costs, saving farmers time and money.

Targets:

1. Determine soybean aphid population density, variance, and dispersion using statistical analysis.
2. Analyze how different soybean Rag gene combinations impact soybean aphid populations.

Materials:

- Aphids (Contact OARDC for samples or collect them from a local soybean field)
- 6 inch pots
- Flexible Acrylic
- Packaging Tape
- Mesh screen
- Potting soil
- Seed Markers (popsicle sticks work well)
- 3 varieties of soybeans (Single trait, Stacked Traits, Control (no Rag genes); get these from your local seed salesman/agronomist)

GROW
NEXT GEN

- Aphid containment system (Cut flexible acrylic into __ x __ sheets (according to your container) and tape the ends together with packaging tape to form a cylinder to fit the soybean pot. Use the end of a cylinder to cut out a circular disk of mesh. Tape mesh to the top of the cylinder.

Procedure:

1. Plant 3 types of soybean seeds ½ inch deep into a 6 inch pot filled with potting mix equally spaced apart. Mark each seed placement with its gene type. Water until the soil is moist and place in a sunny spot to grow.
2. Maintain the plants for 2 weeks (do not let the soil dry out or get oversaturated) until they have begun to sprout nicely and show good photosynthetic activity.
3. Create a hypothesis about Rag gene resistance and aphid predation to be tested in your experiment.
4. Place an aphid containment system around the soybean pot to contain the introduced aphids.
5. Introduce an aphid colony on a leaf into the soybean pot.
6. Observe the movement of the aphids over several days.
7. Record the number of aphids on each variety of soybean each day in the chart below. It is best to continue this experiment through 4 continuous weeks in order to see aphid reproduction.
8. Graph the collected data below.

Data:

Aphid Population Density

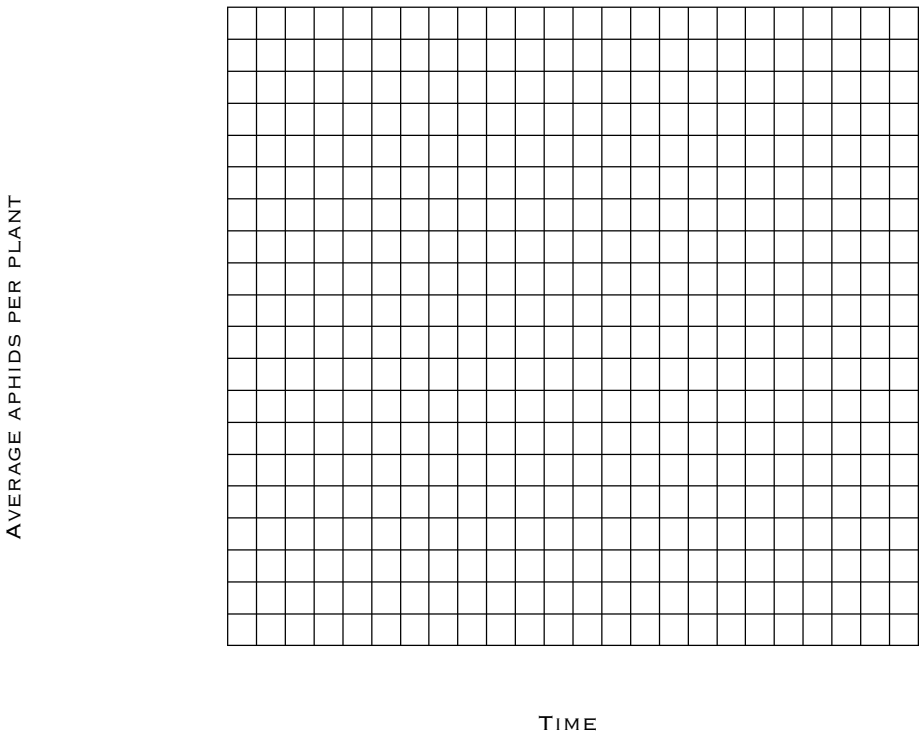
Day	Control	Single Trait (1)	Stacked Traits (2)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			

Aphid Population Density

Day	Control	Single Trait (1)	Stacked Traits (2)
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			

GROW
NEXT GEN

Aphid Population per Soybean Variety



Conclusion:
Consider the following prompts while creating your conclusion after careful analysis of your collected data for this experiment. Remember to refer to your results in your conclusion about Rag gene resistance.

1. Which variety exhibited the most aphid resistance? A variety with a Single Trait (Rag1, Rag2), stacked traits (Rag1 & Rag2 traits), or one without aphid resistance?

2. What physical aspects of the soybean varieties may have influenced the movement of the soybean aphids between the 3 varieties in the containment system?

3. What controls were created in your experiment to add validity to your data? What abiotic/biotic factors may have influenced the movement or reproduction of soybean aphids in your system?

4. Discuss further experimental design that will be necessary to improve the quality of your experiment.