

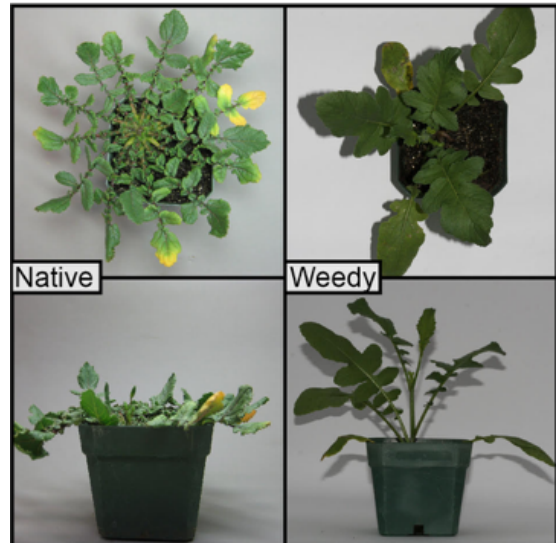
DATA *Nugget*

Fast weeds in farmer's fields

Featured scientists: Ashley Carroll from Gull Lake Middle School and Jeff Conner from the Kellogg Biological Station at Michigan State University

Research Background:

Weeds in agricultural fields cost farmers \$28 billion per year in just the United States alone. When fields are full of weeds the crops do not grow as well. Sometimes weeds even grow better than the crops in the same field. This may make you wonder, how do weeds grow so well compared to other types of plants? Scientists think that weeds may have evolved certain traits that allow them to do well in agricultural fields. These **adaptations** could allow them to grow better and pass on more of their genes to the next generation.



Native and weedy radish plants.

Weedy radish is considered one of the world's worst agricultural weeds. This plant has spread around the world and can now be found on every continent except Antarctica. Weedy radish commonly invades wheat and oat fields. It grows better than crops and lowers the amount of food produced in these fields. Weedy radish evolved from native radish only after humans started growing crops. Native radish only grows in natural habitats in the Mediterranean region.

Because weedy radish evolved from native radish recently, they are still very closely related. They are so closely related they are actually listed as the same species. However, some traits have evolved rapidly in weedy radish. For example, native radish grow much slower and take a few months to make flowers. However, weedy radish can make flowers only three weeks after sprouting! In a farmer's field, the crop might be harvested before a native radish would be able to make any seeds, while weedy radish had plenty of time to make seeds.

The differences between native versus weedy radish interested Ashley, a teacher in Michigan. To learn more she sought out a scientist studying this species. She found Jeff, a plant biologist at the Kellogg Biological Station and she joined his lab for a summer to work with him. That summer, Ashley ran an experiment where she tested



Ashley collecting data on the traits of weedy and native radish.

whether the rapid flowering and seed production of weedy radish was an adaptation to life in agricultural fields.

Ashley planted four populations of native radish and three populations of weedy radish into fields growing oat crops. Ashley made sure to plant multiple populations of radish to add replication to her experiment. Multiple populations allowed her to see if patterns were the same across populations or if each population grew differently. For each of these populations she measured **flowering frequency**. This trait is the total number of plants that produced flowers within the limited time between tilling and harvesting. Ashley also measured **fitness**, by counting the total number of seeds each plant produced over its lifetime. Whichever plant type produced a greater number of

seeds had higher fitness. Oats only grow for 12 weeks so if radish plants were going to flower and make seeds they would have to do it fast. Ashley predicted the weedy radish population would produce more flowers and seeds than native radish during the study. Ashley expected few native radish plants would flower before harvest.

Scientific Question: How does flower production differ between native and weedy radish? How does this affect fitness in an agricultural setting?

What is the hypothesis? Find the hypothesis in the Research Background and underline it. A hypothesis is a proposed explanation for an observation, which can then be tested with experimentation or other types of studies

Scientific Data:

Use the data below to answer the scientific question:

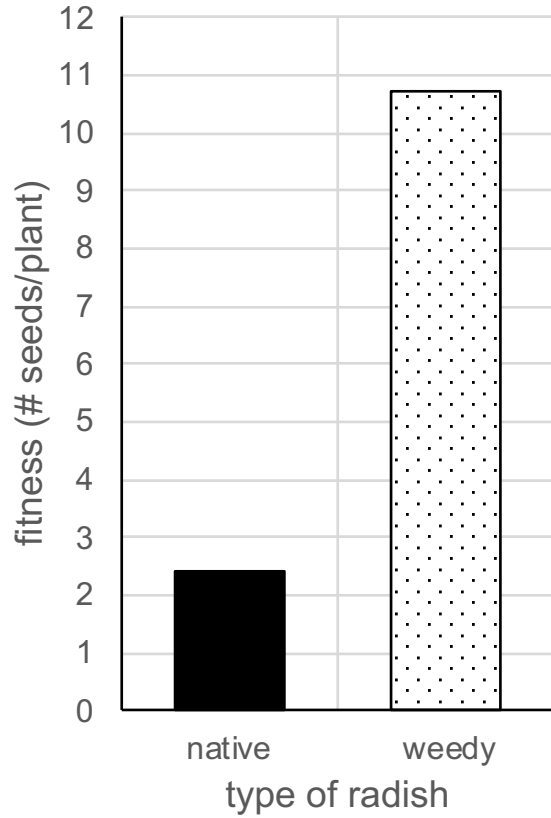
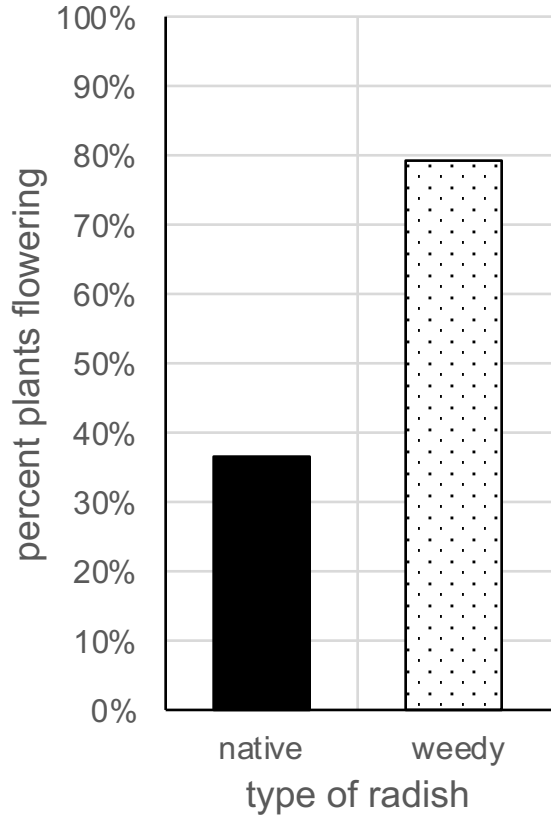
Type of Radish	Radish population	Number of plants	Percent (%) plants flowering	Fitness (number of seeds per plant)
Native	DAES	46	13%	0
	GHIL	33	64%	1
	MAES	44	9%	0
	ZYIL	45	60%	8.7
Average Native				
Weedy	AFFR	42	69%	17.4
	BINY	17	82%	10.5
	NAAU	30	87%	4.2
Average Weedy				

What data will you graph to answer the question?

Independent variable(s): _____

Dependent variable(s): _____

Below are graphs of the data: Identify any changes, trends, or differences you see in your graphs. Draw arrows pointing out what you see, and write one sentence describing what you see next to each arrow.



Interpret the data:

Make a claim that answers the scientific question.

Name _____

What evidence was used to write your claim? Reference specific parts of the table or graphs.

Explain your reasoning and why the evidence supports your claim. Connect the data back to what you learned about how weedy adaptations affect radish fitness in agricultural fields.

Did the data support Ashley's hypothesis? Use evidence to explain why or why not. If you feel the data were inconclusive, explain why.

Name _____

Your next steps as a scientist: Science is an ongoing process. What new question(s) should be investigated to build on Ashley's research? How do your questions build on the research that has already been done?