

PLANT BREEDING Science Page

DID YOU KNOW?

Seed banks around the world save millions of varieties of crop seeds. These seeds contain genes that plant breeders use to develop new crops.



PLANT BREEDING BY SELECTING SEEDS

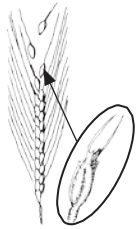
As ancient farmers grew their crops, they noticed which ones had desirable traits — like bigger fruits. They knew that planting the seeds from crops they liked produced crops with similar traits.

Over thousands of years of selecting seeds, the quality of the crops improved.



Wild grain seeds break off the plant and scatter widely. Because farmers cannot easily collect scattered seeds, they selected for plants that held on to their seeds until harvest.

ear of wild wheat ripe ear of domesticated wheat



The seeds break off easily from the stem and scatter.



Seeds do not break off easily from the stem. The stem must be threshed, or beaten, to separate the grain.

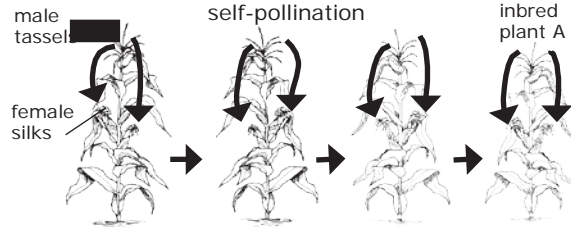
Selecting seeds from corn with bigger ears led to larger ears over the centuries.



PLANT BREEDING BY CROSSING DIFFERENT VARIETIES

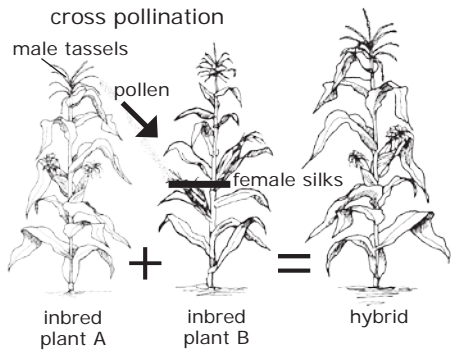
In the early 1900s, scientists began working with farmers to develop better crops. Here is how plant breeders cross two varieties to produce a “hybrid” variety.

A plant with a desirable trait, such as high yield, is mated with itself. Pollen from the male parts of the plant is used to fertilize the female parts of the same plant. After several generations of self-pollination, the offspring are very similar and have the desirable trait.

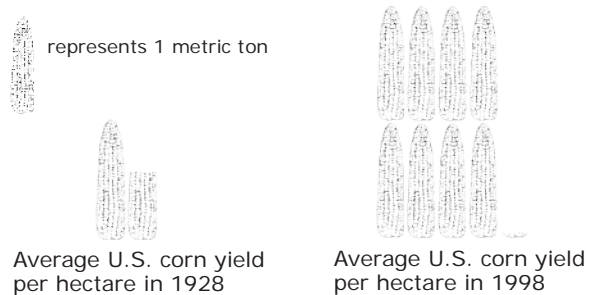


Another plant with another desirable trait, such as disease resistance, is mated with itself over several generations.

The two varieties are mated with each other. The offspring, called a hybrid, carries the desirable traits of both varieties. Hybrid plants grow vigorously, but plants grown from hybrid seeds do not yield as much. So farmers do not save seeds of hybrid plants.

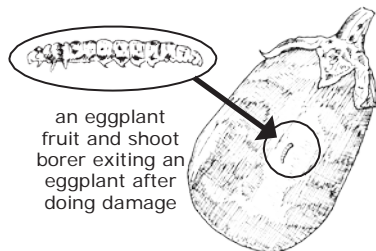


Plant breeders have developed an amazing diversity of new crops — varieties with more nutrients, and the ability to resist diseases, grow in poor soils, and produce higher yields.



PLANT BREEDING BY GENETIC ENGINEERING

Recently, scientists have discovered ways to move a gene from one species to another. Genetic engineering is faster and more precise than traditional plant breeding.



an eggplant fruit and shoot borer exiting an eggplant after doing damage

A gene from a bacterium called Bt produces a chemical that is toxic to the fruit and shoot borer, an insect pest of eggplant. When scientists take the Bt gene and add it to the eggplant, the genetically modified plant resists the insect pest. If farmers use this GM seed, they can reduce the amount of insecticides they have to spray on eggplants.



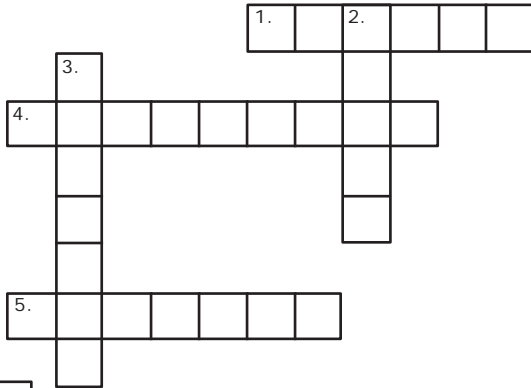
PUZZLE

Across

- Plant breeders cross two varieties to create a _____.
- Ancient farmers bred crops by _____ seeds.
- Seeds from crops with desirable traits produce crops with _____ traits.

Down

- Genes are stored in seed _____.
- A single gene can be moved from one species to another using _____ engineering.



TRY THIS

Vegetable Variety Hunt

How many different vegetable varieties do gardeners grow in your area? What are the special traits of each variety? Go on a vegetable variety hunt to find out!

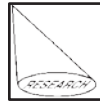
What you need

- * 3" by 5" cards
- * pencil
- * seed catalogues and a list of recommended crop varieties from a local extension office

What to do

- Go to community or backyard gardens in your area. Ask permission from the gardeners before entering their gardens, and be careful not to damage any crops.
- Look for different crop varieties. Compare the traits of different varieties of the same crop. Talk to the gardeners about what crop varieties they are growing, and why.
- Make a card for each crop variety. Take notes on, and draw pictures of the special traits of each variety.
- If possible, find out the name of each variety and add it to the card. Ask gardeners, or you may be able to identify varieties using seed catalogues or recommended variety lists.
- Visit <vegvarieties.cce.cornell.edu> to report your findings or search for varieties that have been rated by gardeners in your area.

- In a community garden or other public place, make a display of different vegetable varieties in your area.



SPOTLIGHT ON RESEARCH

Breeding Better Cowpeas

Cowpeas are an important multi-purpose crop for poor farmers in the tropics. They are very high in protein, and they can grow in very dry, poor soils. The young leaves and pods are used as vegetables, and the grain is used for snacks and main meals. The stalks are fed to cattle in the dry season, when grass is not available. Cowpeas are a legume, so they add nitrogen to the soil. Because they can tolerate shade, they can be planted between other crops, like corn, millet, and cassava.

Cowpea yields of 2,500 kilograms per hectare (kg/ha) are possible, but farmers' yields are usually only between 350 and 700 kg/ha. Yields are low mostly because of insect pests like aphids, pod borers, and pod suckers.

Since 1970, the International Institute of Tropical Agriculture (IITA) in Nigeria has worked on developing new insect-resistant cowpea varieties to distribute to farmers in over 60 countries. IITA has a collection of about 15,000 different varieties of cowpeas and 1,500 wild cowpea relatives in their seed bank. Plant breeders screened 8,000 different cowpea varieties, but they could not find any resistant to the worst cowpea insect pests. However, they did find excellent insect resistance in some of the wild cowpea relatives. They tried crossing the wild species with cowpeas, but the resulting fertilized egg cells died within 4 or 5 days. This problem was solved using a new method called embryo rescue. They put the fertilized egg cells in a special nutrient medium, where they are able to survive and grow. Using embryo rescue, plant breeders successfully transferred genes for insect resistance from wild species into cowpeas. The new insect-resistant cowpea varieties could benefit farmers all around the world.

Source: B.B. Singh, D.R. Mohan Raj, K.E. Dashiell, and L.E.N. Jackai. (1997) "Advances in Cowpea Research." IITA and JIRCAS. Ogbuinya, P.O. (1997), "Advances in Cowpea Research." Biotechnology and Development Monitor, No. 33, p. 10-12.



RIDDLE

What do you get when you cross a rose with a collie?

Answer: A cauliflower!

Answers to crossword puzzle
Across: 1. hybrid; 4. selecting; 5. similar.
Down: 2. banks; 3. genetic.