

Planting & Harvesting

Introduction

Engineering is a form of problem solving used by scientists and mathematicians. One area where there are problems to solve is in planting and harvesting. Planting and harvesting seed by hand is hard work! Fortunately, we can build machines to plant and harvest seed.

Machines must be built with care, though. The machines must be able to sort seeds without losing them! The machines must handle seeds even when they are different shapes and sizes.



How would you engineer a system for harvesting seed?

Explore

Which comes first – planting or harvesting? Do you have to plant seed to harvest it? Or do you have to harvest seed to plant it? It's safe to say this is an age-old question like “which comes first – the chicken or the egg?”

During much of human history, humans gathered food from wild plants. Around 12,000 years ago, humans turned to agriculture. Instead of searching for fruit and nuts to harvest, humans collected seed, spread that seed, and cared for the plants as they grew. As time and technology progressed, humans built machines to spread and harvest those seeds.

Let's first see how harvesters work.

1. Thoroughly mix the rice, beans, and oregano listed in the materials list. Rice represents our desired seed and beans represent seed from a different plant. Oregano represents the leaf litter which is sometimes mixed in with seed.

Explore Materials List

- Dry Rice (30 ml or 2 Tbsp)
- Dry Beans (15 ml or 1 Tbsp)
- Oregano, Parsley Flakes, or a similarly-sized plant fragment (5 ml or 1 tsp)
- Spoon
- Fork
- Other Tools for Separation (e.g., paper cup, sieve, fan)

2. Use your spoon to separate the desired seed (rice) from the other materials. Try to separate about half of it. How long do you think it would take for you to separate all the rice from the other materials? (If you've separated half of it, multiply the time it took by two.)

You can record your results in the data table on the next page.

Thanks for participating in Engineering Week!

This activity is one of many which teach 4-H youth ages 10+ about cover crops. If you'd like to learn more, you can contact us through the form at <https://go.illinois.edu/CoverCropInterest>

Explore (Continued)

3. When you've made an estimate, mix everything back together. Now try using your fork. How long do you think it would take to separate all of the rice from the other materials?

4. When you've made an estimate, mix everything again. What is another tool you could use to separate rice? Try it – how long do you think it would take?

Tool	Predicted Time	How You Made Your Prediction
Spoon		
Fork		

Try a few more ideas. Can you find or make a reliable sieve? (A sieve is an object with holes to help separate materials based on size.)

As you try each idea, make note of each tool's benefits and shortcomings in the table below. Don't forget that time could be an important benefit or shortcoming!

Are there other methods or tools you could use to improve your process?

Tool or Method	Benefits	Shortcomings	Other Notes

Explain

Which of the tools you tried worked best? What evidence do you have to support that claim?

Which of the tools you tried worked second-best? What evidence do you have to support that claim?

How might you combine two methods to do the work better or faster than either method alone?

Extend

Modern combine harvesters use a series of tools to harvest only seed. Leaves, stems, cobs, and any other materials are left on the field. These materials provide nutrients to future crops and can help prevent soil erosion.

Watch the video at <https://vimeo.com/350413370>.

The video shows the series of tools used in harvesting most crops:

1. The header gathers and cuts the plants.
2. A conveyor belt under the cab carries the plant materials into the combine.
3. A variety of rotors and shaking screens break and separate the materials.
4. The heavier seed falls into a collection pan.
5. Fans blow the other materials behind the machine.

You just saw how a mechanical harvester works. Which of these processes do you think are used in mechanical planters?

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Reflect

Think back to the tool systems used in harvesters. Focus on the corn kernel, and draw or describe the steps you think the kernel (and only the kernel) goes through. What is the corn kernel attached to? How does it get separated? What happens to the kernel when it is no longer a part of the cob?

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Look back at the previous question. Which of the steps you’ve described could you adapt for planting corn in the spring?

What kind of jobs do you think are related to building, maintaining, and using planters or harvesters?

Why do you think there are a lot of different jobs related to the same tools?



Career Connection: Agricultural Engineer

Engineers solve problems related to structures, machines, and the environment. An agricultural engineer can solve these problems and more! In agriculture, there will always be a need for a greater yield, improved crop quality, and more environmental safety.

Ag. engineers must complete a four-year bachelor’s degree. Usually this is in agricultural engineering or biological engineering. Some ag. engineers get a master’s degree to gain more specific knowledge.

