

Agriculture in Print: Soy Ink

How can a soybean be used to make ink?

Why is soy ink good for the environment?

Skill Level

Intermediate

Age 11-13

Learner Outcomes

- Recognizes that properties of agricultural crops make them sustainable substitutes in industrial products
- Tests the properties of soy oil and soy lecithin in making ink

Science

- Build/construct
- Compare/contrast
- Observe
- Predict

Life

- Think creatively
- Reason
- Educational Standard
- Properties and changes of properties in matter
- Science and technology in society
- Science as a human endeavor

Success Indicator


- Uses materials creatively
- Prints with different kinds of inks
- Describes the outcome process
- plastic
- Describes the outcome process

Ink is basically pigment mixed in a liquid that will not blur when put on paper. Inks made with soybean oil are made from a renewable resource, are much more biodegradable, and print with brighter colors that don't rub off.

Do . . . the activities

What are the ingredients in ink? How do they work?
Create your own inks and test them.

Prepare two paints

1. **Gather these materials:** 2 Post-it™ notes, toothpicks, 2 small dishes, eyedropper, small bottle of oil-based model paint, small cup of liquid tempera paint, newspaper, water, and SoyClean™.
2. Pour water into the first container until half full.
3. Add 5 drops of liquid tempera paint. Stir.
4. Pour water into the second container until half full.
5. **Predict** what will happen if you add 5 drops of model paint. Then add 5 drops of model paint and stir.
6. Dip 1 Post-it™ note in container A, and 1 Post-it™ note in container B. Remove the Post-it™ notes and place on newspaper to dry.
7. Compare results.  **Record your observations.**



What's the science?

Soy oil and water do not mix. Sometimes that produces beautiful results.



Learn More extension

- Marbelized paper: its history and uses
- What is the difference between ink and paint?
- What is soy toner?

Virtual Fun extension

- Inside a printing facility
- Screen printing with soy ink
- Soy crayons

News & Careers extension

- Agrichemist
- Printer



..... Make soy ink

1. **Gather these materials:** plastic cup, small dish, paper towel, 1/8 teaspoon soybean (vegetable) oil, 1/8 teaspoon granular lecithin (found in health food stores); 1 teaspoon unsweetened powdered drink (like Kool-Aid), 1 teaspoon water, stir sticks, paper for printing, rubber stamp or paint brush.
2. Blend water and powdered drink in plastic cup using a stir stick.
3. Add soybean oil and stir well.
4. Add lecithin and stir until lumps are gone.



What's the science?

Soy oil and water do not mix well until you add soy lecithin (less-a-thin). Lecithin is a surfactant that causes the water molecules to separate and the oil to mix in.



..... Prepare for printing

5. Take a paper towel and fold it in half, then in half again.
6. Pour the contents of your soy ink into the center of the paper towel. The soy ink is quickly absorbed.
7. Use a rubber stamp to print images on paper or stationary. Let dry.
8. Try different colors. Adjust the recipe and check the results. What can you do to make the color brighter? The ink dry faster?

Note: Ink can stain fabrics!

E-Bite

Do you know how ink “dries”? Pigments are mixed into water-based and other organic solvents. When the liquid in the ink evaporates, only the pigments that were once dissolved in the liquid remain. Can you think of examples where slower drying times or faster drying times make a difference?



Records

Complete [Observation Log](#)

More Challenges

- Marbelized paper has been handmade by bookmakers for hundreds of years. Create book covers, wrapping paper, stationary, placemats with new types of ink.
- Interview a local printer or tour a newspaper to answer these questions: What problems were agriscientists and engineers trying to solve when they tested soy ink? Why do newspapers choose soy ink? Why do readers like newspapers printed with soy ink?
- Research and experiment with soy crayons. Compare the process of making soy crayons with soy ink. Test soy crayons and compare them to petroleum-based crayons. Design a survey with to see which crayons your friends prefer.

Glossary

ink—liquid that contains pigments or dyes used to color a surface to produce an image or text or design.

solvent— a liquid capable of dissolving substances.

toner — a powder used in laser printers and photocopiers for form the printed text and images on the paper.

Name _____

Date _____



Records—Intermediate Level
Agriculture in Print: Soy Ink

Share • • • *what you did*

What happened when you stirred each pigment into water?

What happened when you added oil to the liquid? How did lecithin change the mixture?

Compare your inks in terms of consistency and color and how it reacted on the paper.

Process • • • *the results*

What did you know about ink and printing before you made these inks? What did you learn?

How could you change the ink “recipes?” What differences would you expect in the printing?

Generalize • • • *about other things that you know*

What benefits can you list for a product like soy ink? Compare it with petroleum-based ink.

What other agricultural products could be used to substitute for petroleum? What kinds of scientists are working on these new products?

Apply • • • *in your daily life*

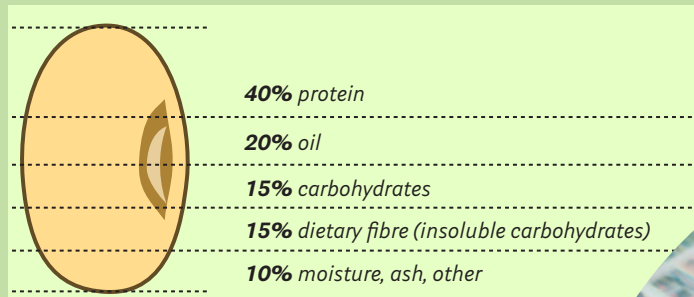
How can you use more renewable resources and agricultural products in your life?

How can you reduce your dependence on non-renewable resources and products?



Background Information

What is in a soybean?

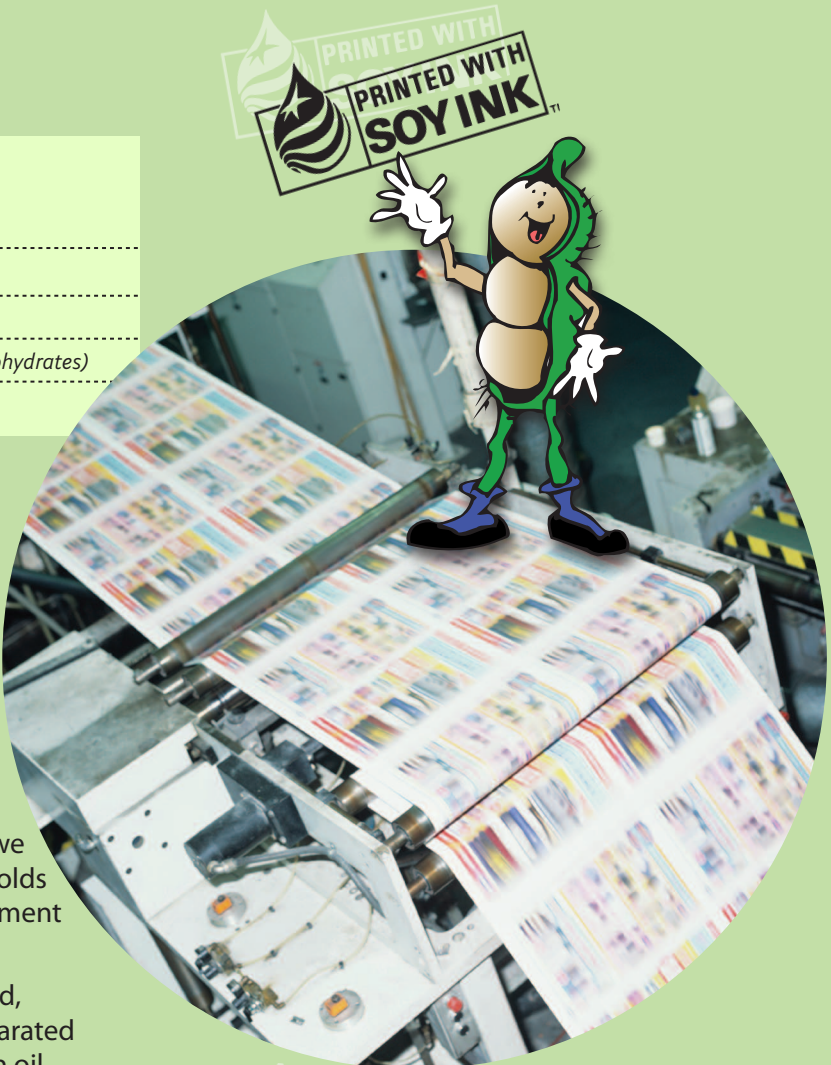


What part of the soybean is used to print 90% of the nation's daily newspapers?

When processed, soybeans produce about twenty percent oil and forty percent protein. One of the best protein sources, soybeans nourish the people and animals of the world. Biotechnology helps scientists apply what they know about crops to enhance the food we eat and the products we use to make households safer, communities healthier, and the environment more sustainable.

After soybeans are harvested, they are cleaned, cracked and de-hulled. The soybean oil is separated from the soy protein (soybean meal). Soybean oil is then refined for margarine, salad dressings, plus hundreds of consumer products. The newspaper that arrives at your door each morning is printed with soy ink. The foam insulation and carpet backing in your home could be made from soy plastic. The elevators taking visitors to the top of the Statue of Liberty rely on a soy hydraulic fluid. Whether it's candles, cleaners, crayons, cosmetics, concrete sealers, engine oil, fuel, industrial lubricants, paints, roof coatings or varnishes, soybeans create natural, renewable products.

To make soy ink, soybean oil is slightly refined and then blended with **pigment, resins** and **waxes**. Soybean oil is naturally clearer than petroleum oils, making it easier to obtain brightly colored ink. Since the oil is clearer, less pigment is necessary to produce the same effect. In addition to a brighter ink, printers report that they need less ink to print the same amount of paper when compared to petroleum inks.



Soy ink has been found to spread approximately 15% further, reducing ink use and printer cleanup costs.

While environmentally friendly soy ink has been used by newspapers for years, soy toner is now available for laser printers and fax machines. Soy toner is being used in many schools and offices today. The toner in most printer cartridges has been petroleum based. About two liters of petroleum oil yield one pound of toner powder, and volatile organic compounds (VOCs) are released in the process. What can you find out about VOCs and its effect on the environment?

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Name _____

Date _____



Records—Intermediate Level
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• • • • Prepare two paints

Test 1—Ink Formulas

Show the results of your ink formulas here.

What could you do to improve the recipes?

Test 2—Ink Formulas—New Recipe

Show the results of your new recipes here.

What else could you do to improve the recipes?

Test 3

Show the results of your test here:

What else could you do to improve the recipes?

