Arkansas High School

Science Project Development Guide

Real problems • Real questions • Real discovery

Real science that can make a difference
for Arkansans and the world

Soybean science challenge™

Our Soy Checkoff™
Progress Powered by U.S. Farmers

U of A DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

ARKANSAS SOYBEAN PROMOTION BOARD

The GOAL of the Arkansas Soybean Science Challenge is to engage high school science students in "real world" education to support soybean production, agricultural sustainability and to reward scientific inquiry and discovery that supports the Arkansas soybean industry.

Funding for the Arkansas High School Science Project Development Guide and the Soybean Science Challenge is provided through a partnership with the Arkansas Soybean Promotion Board and the University of Arkansas Division of Agriculture-Cooperative Extension Service in support of student scientific scholarship and research.

Getting Started

8 Steps to a successful science project

"A journey of a thousand miles begins with a single step."

– Lao Tzu

In other words . . . the key to success with your science project is to begin. START your research journey by taking these steps:

1. **Choose a project idea.**
2. **Conduct background research about your topic.**
3. **Create your hypothesis.**
4. **Design your experiment.**
5. **Get project approval.**
6. **Do your experiment, collect and record your data.**
7. **Analyze your data & answer your questions.**
8. **Communicate your results.**

Travel Tip:
Create a project that you care about & follow the signs.

What are YOU interested in?

Decide which trail you want to follow

Lots of options to study for your project . . .

Biotechnology

Do you like to dive into controversial issues? You could do a project with genetically modified organisms (GMOs). What is the role of GMOs in food, fuel and feed production for America and the world? What does the scientific research say about them? What do consumers think about them? Why do farmers use them?

Engineering

There are lots of questions around this topic to explore. What is the viability of soy biodiesel? What varieties are the most promising?

Arkansas is among the top 10 producers of soybeans in the United States. Soybeans are not native to Arkansas or to the Midwest. A brief history of soybeans in Asia and the United States will be explored. You will learn how soybeans are grown and produced, including their many uses in the food, fuel and feed industries. Soybean production and use play an important and beneficial role in the Arkansas agricultural industry and economy.

Soy biodiesel is an alternative fuel playing an increasingly significant role in agriculture, manufacturing and other fields. Soy biodiesel is a high performing diesel fuel made from soybeans. It contains no petroleum, but can be blended at any level to create a soy biodiesel blend. Soy diesel is clean, non-toxic and 100% bio-degradable, renewable and made in the United States. Soy biodiesel can help America reduce its dependence on foreign oil and create more jobs.

Do you have an interest in Animal Nutrition?

Poultry and livestock and other animals consume about 98% of U.S. soybean meal. The United States also exports soybean meal to other countries. The animal agricultural industry is the number one customer for soybean producers in Arkansas. Because of soybean's high protein content (38% or more), it is accepted worldwide as the most important supplemental protein in livestock feed. Arkansas soybean producers have a mutually profitable relationship with the livestock producers.

What about Environmental Science & Soil Science?

Do you like to play in the dirt? Do you like water and plants?

Arkansas is heavily invested in soybean production. Good roads and the Arkansas and Mississippi Rivers make the state an ideal and efficient delivery system for soybeans, which are grown and transported with relative ease throughout the state, the nation and universally. The weather, invasive insects, the growth of technology in farming and "family farm" issues continue to impact the Arkansas soybean and agricultural industry as a whole. Arkansas soybean producers are well-equipped to face the emerging challenges of farming.

Scientific research plays a vital role in the successful growth and production of Arkansas soybeans. The Arkansas Soybean Promotion Board invests the majority of its funding in research projects such as studying the effects of certain types of insects on the plants, identifying the best water and soil conditions for effective growth, and pest management. Identifying the best combination of soymeal for feeding purposes and developing new products from soy, including the expansion of soy biodiesel, is also a research focus. During this module students will explore how research contributes to more effective and efficient production of soybeans. Scientific careers in agriculture that support agricultural sustainability will also be reviewed.

Interested in Human Nutrition and/or the Creation of New Food Products?

Like to experiment in the kitchen? Soy products are nutritional powerhouses. Use your imagination and create new products using soy ingredients (soy milk, tofu, edamame, etc.).

Soybeans are a very important crop to the Arkansas economy. Soybeans are a food source for humans and also help to preserve the soil. Humans consume soybean products such as soy milk, edamame, salad dressings, miso, soy bars, soy nuts, soy sauce and tofu. Soy is also used in mayonnaise, high fiber breads such as pizza crust, and in many other recipes. Soybeans are an excellent source of protein and have been grown and consumed by other cultures for thousands of years. Soybeans are also 18-20% oil, so the oil can be extracted and used in salad or cooking oil and other edible products.

Include taste tests and consumer acceptance and you have a project ready to develop!

To conduct your background research, link to **www.uaex.uada.edu/soywhatsup** for more information.

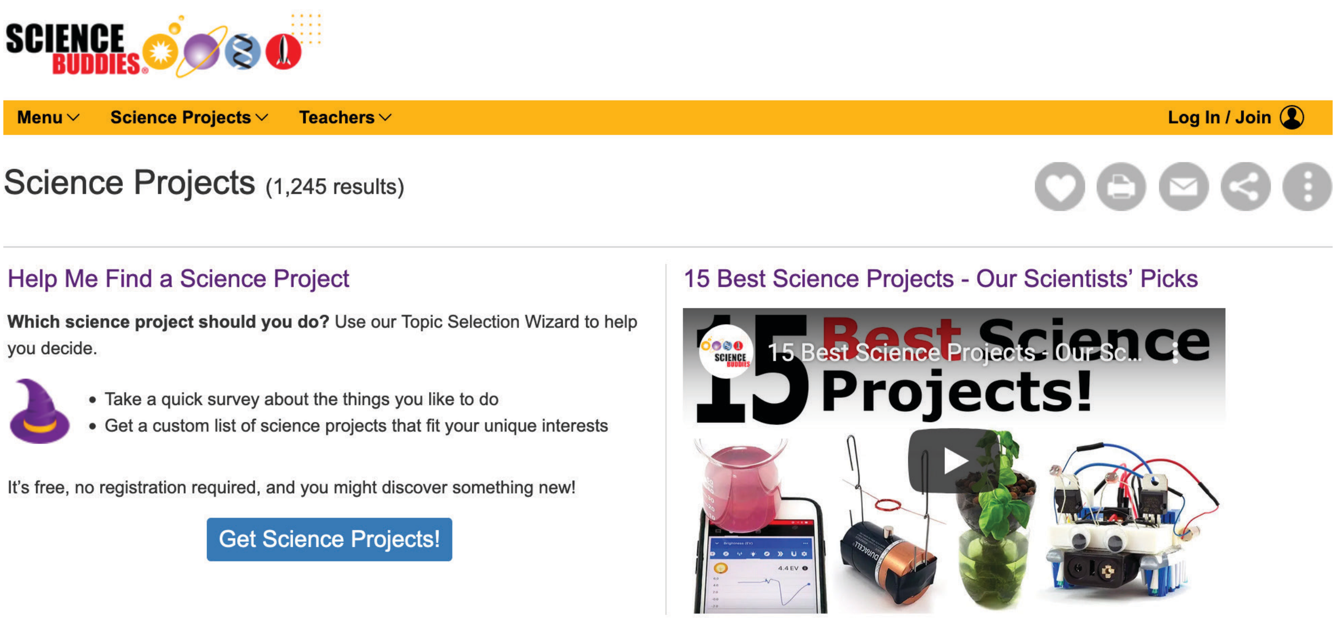
Enroll in: Soybean Science Challenge (SSC) online course to guide the development of your research and qualify you for competition.

Order free soybean seeds from the Online Seed Store to conduct your research.

Need more help to identify a project?

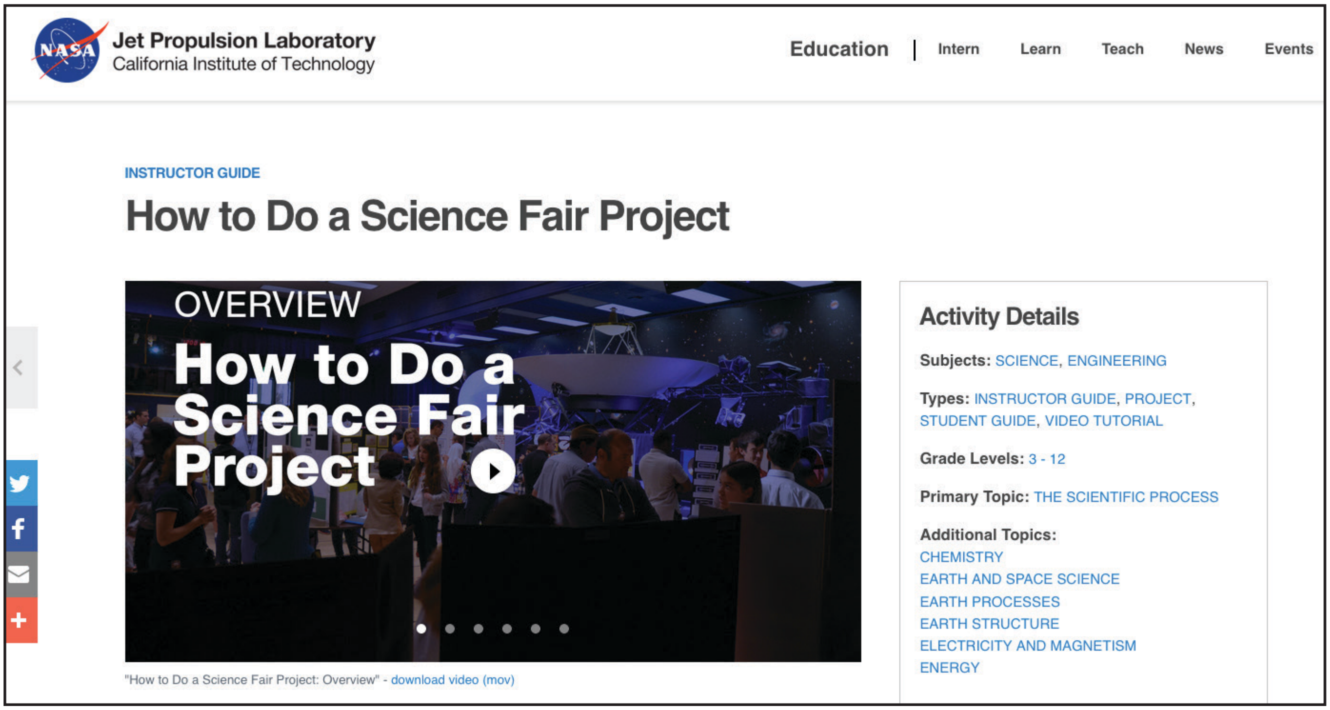
Check out these additional resource sites:

https://www.sciencebuddies.org/science-fair-projects/science-projects



- Answer a short questionnaire about your interests & hobbies.
- It uses your responses to recommend ideas you will enjoy.

http://www.jpl.nasa.gov/edu/teach/activity/how-to-do-a-science-fair-project/



YOU have arrived at your first destination. . .

Make a list of the topics you are interested in:

Next destination...

Background Research

Choose a topic from your list to learn more about

After you've chosen a topic from your list, ask yourself:

What do I know about this topic?

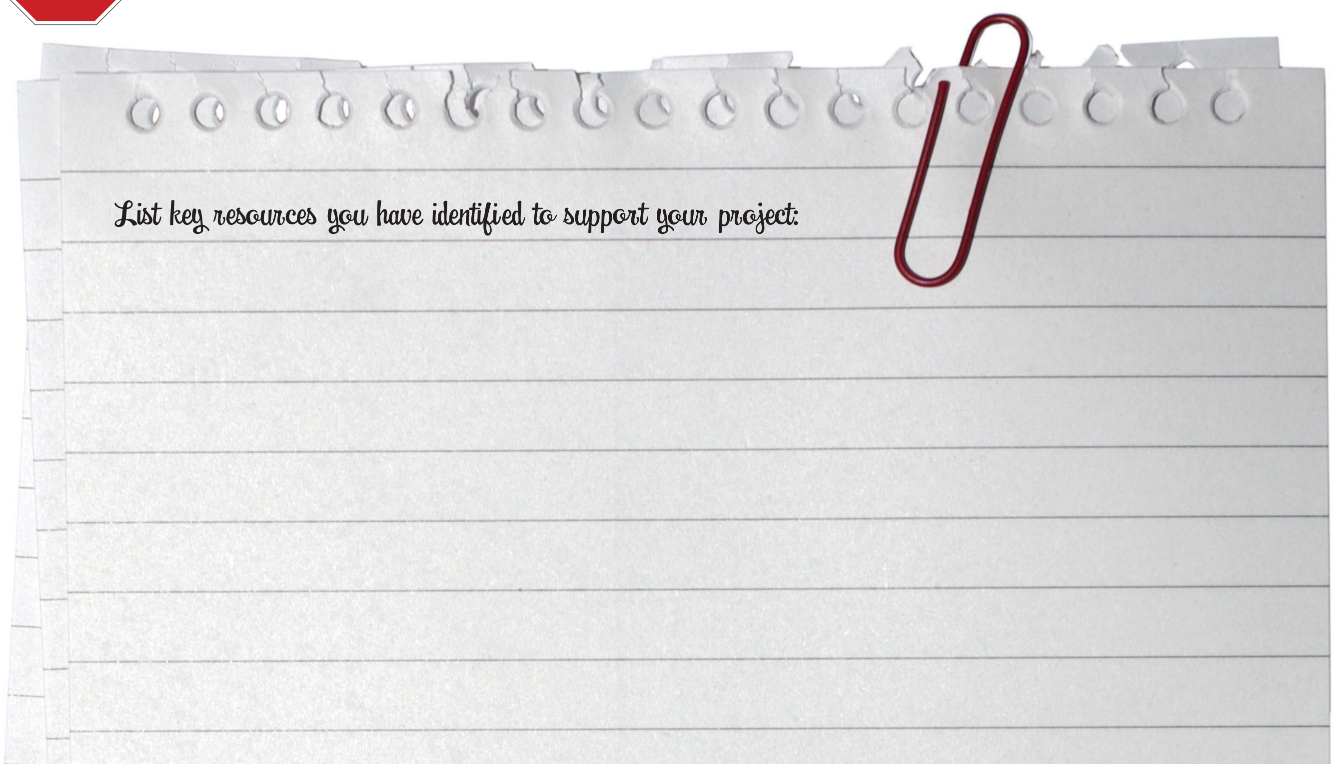
What additional information do I need?

Completion of the Soybean Science Challenge online course provides lots of information that will get you on your way. You can register for the course by going to www.uaex.uada.edu/soywhatsup

Travel Tip:

The University of Arkansas Division of Agriculture, Cooperative Extension Service has agents/educators in every county and faculty members across the state that can answer your questions to support your research. For more information contact your local county extension office or call (501) 671-2082 or e-mail jrobinson@uada.edu for assistance.

STOP **Complete the next leg of your journey**



Create your hypothesis

Your questions will take you where you need to go

After you have identified something you are interested in:

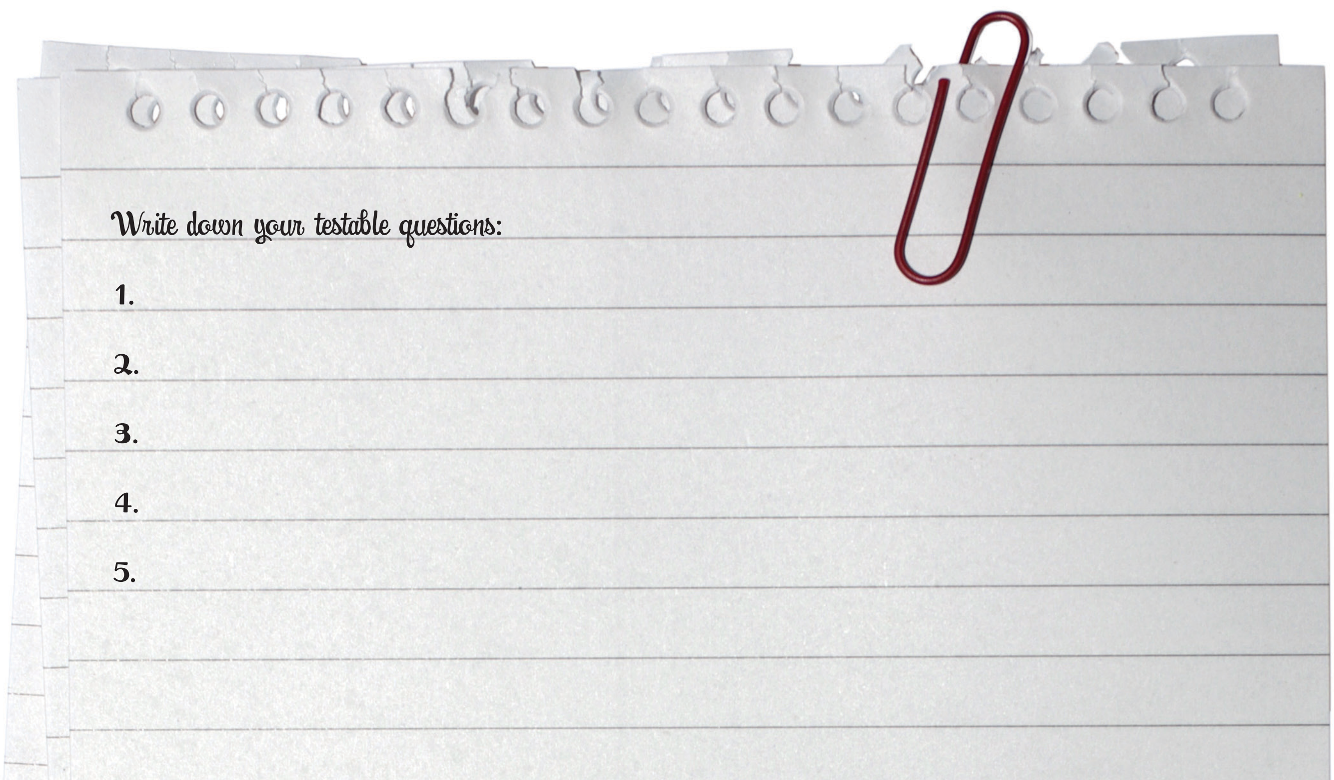
Based on your research . . .

- **What is a problem that needs to be solved?**
- **How can this problem be fixed?**

WHY is a great place to start . . .

Which of your questions are "testable" questions? How does "this" affect "this"? Can you measure changes like count, percentage, height, weight, width, length, time, composition, cost, etc.?

Source: http://school.discoveryeducation.com/sciencefaircentral/Science-Fair-Projects/Investigation-Compose-Hypothesis.html



var•i•a•ble

/verēəb(ə)l/

noun

Identify WHAT variables you want to test

Three categories of variables should be identified and included in your science project: dependent, independent, and controlled variables.

The Dependent Variable is what will be measured; it's what you will be examining/testing during the experiment (to determine if the independent variable influences it).

For example, you may want to study soybean growth. Possible dependent variables include: number of beans, weight of the plant, leaf surface area, time to maturation, height of stem, etc.

The Independent Variable is what is varied during the experiment; it's what you are seeking to determine if it has an effect on the dependent variable.

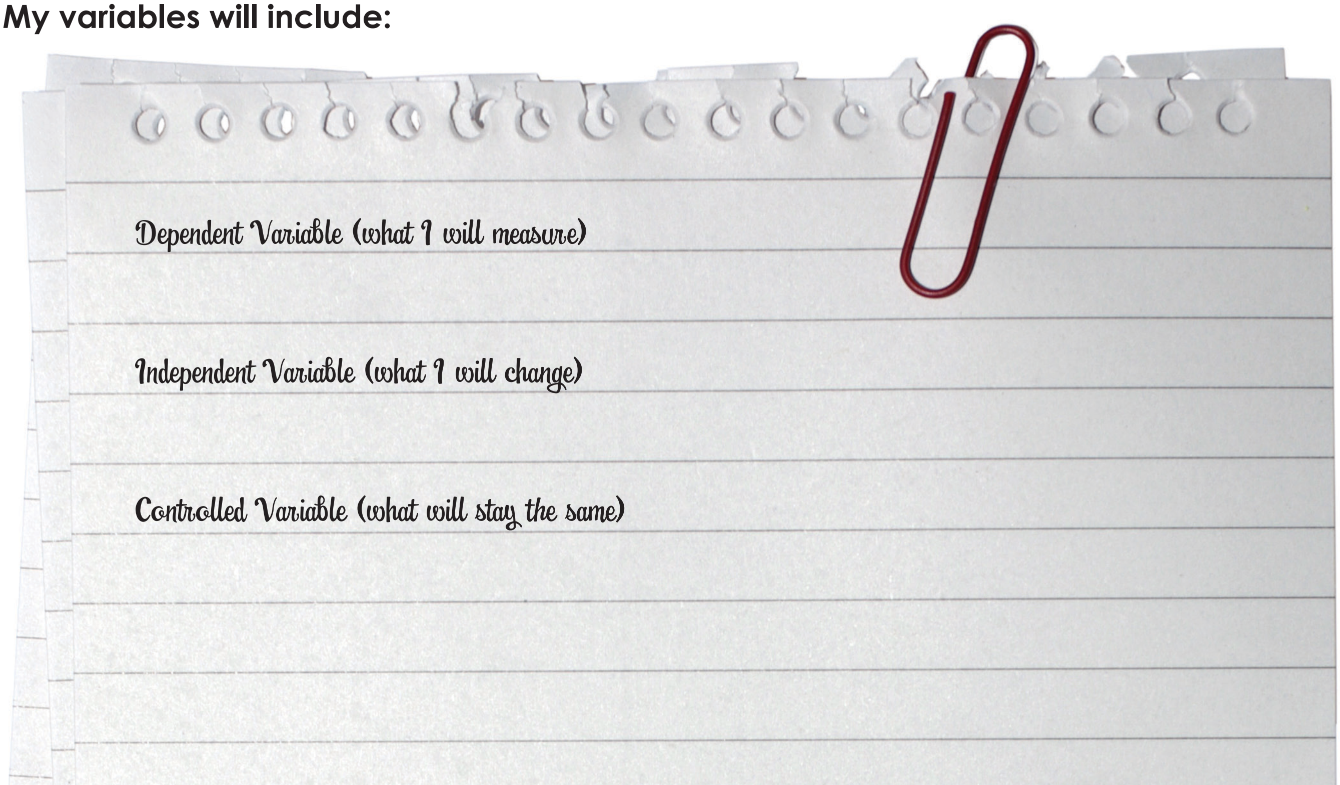
Possible independent variables could include: amount of fertilizer, type of fertilizer, temperature, amount of $H2O$, day length, all of these may affect the number of beans, weight of the plant, leaf area, etc.

NOTE: Since you need to know which factor is affecting the dependent variable(s), there may be only one independent variable measured at a time. The investigator must choose the one that he/she thinks is most important. You can measure as many dependent variables as you think are important indicators of soybean growth.

The Controlled Variables are the conditions that remain constant. Since you want to study the effect of one particular independent variable, the possibility that other factors are affecting the outcome must be eliminated.

Source: http://www2.lv.psu.edu/jxm57/irp/var.htm

My variables will include:



hy·poth·e·sis

/hī päTHəsəs/
noun

A statement about cause and effect that is directional and can be tested. An educated guess.

Source: http://www.merriam-webster.com/dictionary/hypothesis

Examples of scientific hypothesis

Examples of the Null Hypothesis

- Soil type is unrelated to plant growth.
- Plant density is unrelated to yield.
- A person's preference for soy foods is unrelated to its color.
- Soy feed for animal production is equal in nutritional value to corn-based animal feed.

Examples of a Positive Hypothesis

- The use of GMOs reduces required pesticide applications for pest management.
- High oleic soybeans are a viable biofuel crop.
- Isoflavones (soybean components) have multiple potential health benefits.
- Drones are an effective tool for crop monitoring.
- 25 grams/day of soy protein as part of a daily diet low in saturated fat reduces the risk of coronary heart disease.

Examples of a Negative Hypothesis

- Insect pressure does not influence yield.
- Nematodes do not influence plant growth.
- Double-cropping does not impact soil fertility.
- Grain storage is not influenced by environmental factors.
- There are no differences in yield between soybean varieties.

My hypotheses are . . . (one or more)

1.

2.

3.

4.

Create your roadmap

Design your experiment

Be clear about what you are testing.

Identify Your **Variables**

- Controlled: MUST remain the same for each subject
  Examples: type of plant, temperature where plants are kept, amount of liquid given to each plant

- Independent (Manipulated): MUST be different for each trial
  Example: type of liquid given to each plant

- Dependent (Responding): How test subjects respond to the independent variables
  Example: How much each plant grows

Travel Tip:

A Project Protocol Worksheet is provided in this workbook for your use.

Plan your procedures

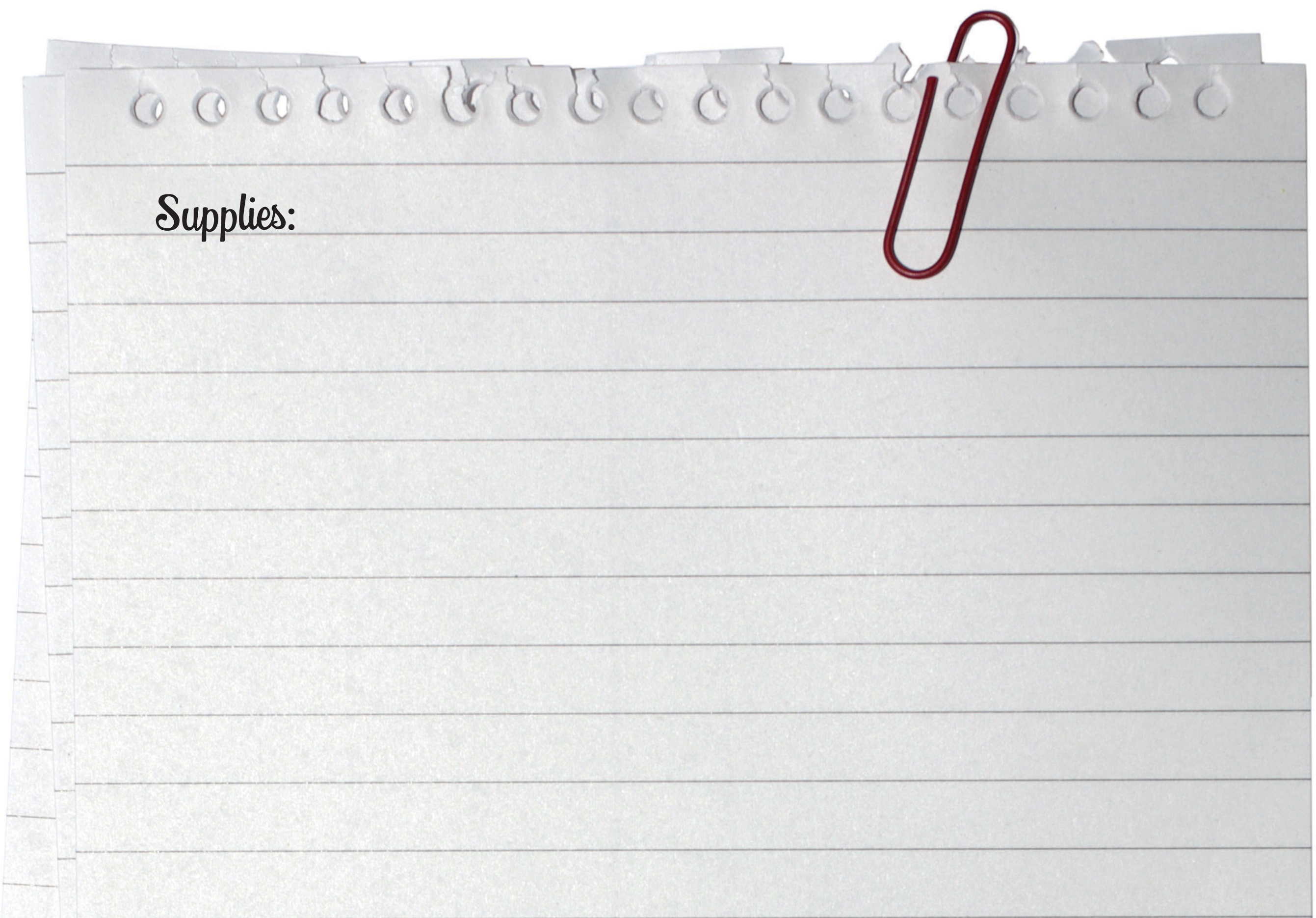
- List all of your steps.
- Design your project to test your questions (need at least three replications/trials for each independent variable).
- Each trial needs to be conducted in exactly the same way to produce data that can be compared.
- Plan how, when and where you will collect and record your data.
- Remember to keep it simple so anyone could repeat the process.
- Conduct your experiment & record your results.

Make a schedule

- What are you going to do?
- When are you going to do it?
- Where will your experiment be conducted?

Prepare your shopping list

- What supplies do you need?
- How much do you need?
- When do you need them?
- How much will they cost?



Get approval from your teacher **BEFORE** you begin

Is your experiment safe to perform?

Most science fairs follow safety rules established by the Intel International Science and Engineering Fair (ISEF). If your proposed project includes work in any of the following categories, you will need to work with your teacher to complete a research proposal to a Scientific Review Committee (SRC):

Travel Tip:

You can use forms your teacher provides or the Project Protocol Worksheet included in this workbook for documentation of your proposed project design and protocols.

1) human subjects,
2) hazardous substances or devices,
3) nonhuman vertebrate animals and/or
4) potentially hazardous biological agents (including blood or body fluids, animal/human tissue DNA or microorganisms).

Some fairs have an Institutional Review Board (IRB) that reviews your proposal. The purpose of the IRB review is to ensure that no undue risks are experienced by the research subjects and/or student researcher.

Resource: https://student.societyforscience.org/international-rules-pre-college-science-research

Do Your Experiment

- **Follow the steps you listed for your procedure.**

- **Record ALL Observations:** Collect your data as you go.

- **Consider all forms of data you can collect** while conducting your experiment including qualitative and quantitative data, secondary data (data some other group is collecting), and photographs to assist with communicating conditions, procedures and results. Permission should be obtained for photos of human research subjects.

There are two basic approaches to research, which can be used alone or combined.

Qualitative research gathers information that is not in numerical form. It is primarily exploratory and seeks to gain an understanding of opinions, motivations and reasons for choices or behaviors. Structured or semi-structured interviews, focus groups, and observations are methods used in qualitative research.

Quantitative research generates numerical data or information that can be converted into numerical data. This data is used to formulate facts and uncover patterns in research. Quantitative data can include measurement of acres, soil composition, plant size, yield, input costs, and other variables.

Some examples of the differences between qualitative and quantitative data are provided on the next page.

Qualitative Data

Overview:

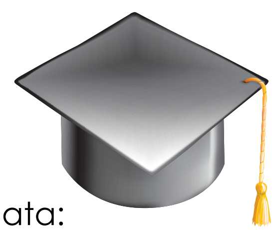
- Deals with descriptions.
- Data can be observed but not measured.
- Colors, textures, smells, tastes, appearance, beauty, etc.
- **Qualit**ative – **Qualit**y

Example 1:
Oil Painting

Qualitative data:
- blue/green color, gold fume
- smells old and musty
- texture shows brush strokes of oil paint

Example 2:
Latte

Qualitative data:
- robust aroma
- frothy appearance
- strong taste
- blue cup



Example 3:
Senior Class

Qualitative data:
- friendly demeanors
- civic minded
- environmentalists
- positive school spirit

Quantitative Data

Overview:

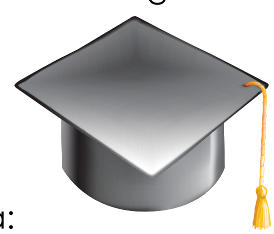
- Deals with numbers.
- Data which can be measured.
- Length, height, area, volume, weight, speed, time, temperature, humidity, sound levels, cost, members, ages, etc.
- **Quantit**ative – **Quantit**y

Example 1:
Oil Painting

Quantitative data:
- picture is 10" x 14"
- with frame 14" x 18"
- weighs 8.5 pounds

Example 2:
Latte

Quantitative data:
- 12 ounces of latte
- serving temperative 150° F
- serving cup 7 inches in height
- cost $4.95



Example 3:
Senior Class

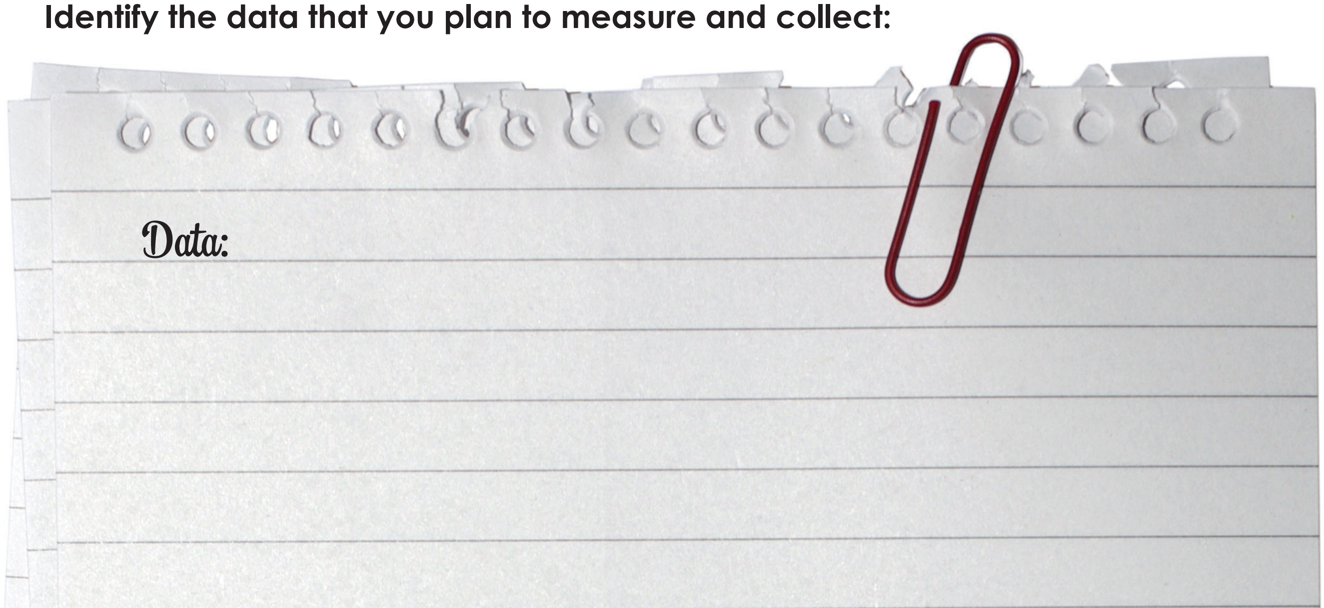
Quantitative data:
- 672 students
- 394 girls, 278 boys
- 68% on honor roll
- 150 students accelerated in mathematics

QUALITATIVE VERSES QUANTITATIVE RESEARCH

Criteria	Qualitative Research	Quantitative Research
Purpose	To understand & interpret social interactions.	To test hypotheses, look at cause & effect, & make predictions.
Group Studied	Smaller & not randomly selected.	Larger & randomly selected.
Variables	Study of the whole, not variables.	Specific variables studied.
Type of Data Collected	Words, images, or objects.	Numbers and statistics.
Form of Data Collected	Qualitative data such as open-ended responses, interviews, participant observations, field notes, & reflections.	Quantitative data based on precise measurements using structured & validated data-collection instruments.
Type of Data Analysis	Identify patterns, features, themes.	Identify statistical relationships.
Objectivity & Subjectivity	Subjectivity is expected.	Objectivity is critical.
Results	Particular or specialized findings that are less generalizable.	Generalizable findings that can be applied to other populations.
Scientific Method	Exploratory or bottom-up: the researcher generates a new hypothesis and theory from the data collected.	Confirmatory or top-down: the researcher tests the hypothesis and theory with the data.
Most Common Research Objectives	Explore, discover, & construct.	Describe, explain, & predict.
Focus	Wide-angle lens: examines the breadth & depth of phenomena.	Narrow-angle lens: tests a specific hypothesis.
Nature of Observation	Study behavior in a natural environment.	Study behavior under controlled conditions; isolate causal efforts.
Final Report	Narrative report with contextual description & direct quotations from research participants.	Statistical report with correlations, comparisons of means, & statistical significance of findings.

Reference – Adapted from: Xavier University Library. (October 2012). Qualitative versus qualitative research. Source: http://www.xavier.edu/library/students/documents/qualitative_quantitative.pdf

Identify the data that you plan to measure and collect:



Analyze your data

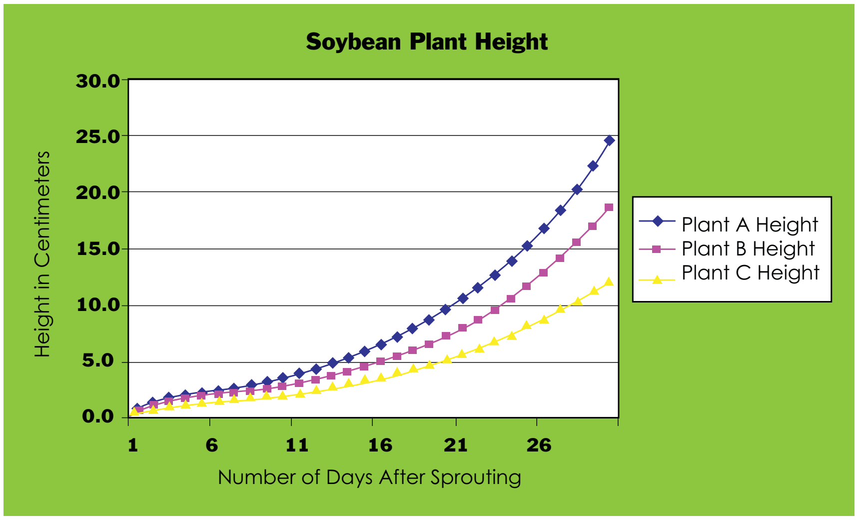
Step back and ask yourself...what did I learn?

It doesn't matter if you prove or disprove your hypothesis. Your data is your research story.

- Organize your data in charts and graphs to help interpret your data.
- Compare your research questions to your data.
- What does the data tell you?
- Can you explain your data?
- Did you run into problems with your procedures?

Soybean Plant Response to Light

Time	A Plants (12 hours light)		B Plants (8 hours light)		C Plants (4 hours light)	
Day	Height (cm)	Leaves	Height (cm)	Leaves	Height (cm)	Leaves
11	1.0	1	1.0	1	1.0	1
12	1.5	2	1.3	1	1.1	1
13	1.9	2	1.4	1	1.2	2
14	2.1	2	1.6	2	1.3	2
15	2.3	2	1.7	2	1.4	2
16	2.5	3	1.9	2	1.6	2
17	2.7	3	2.1	2	1.7	3
18	3.0	3	2.3	2	1.8	3
19	3.3	4	2.5	2	2.0	3
20	3.7	4	2.8	3	2.2	3
21	4.0	4	3.1	3	2.4	3
22	4.4	5	3.4	3	2.6	3
23	4.9	5	3.7	3	2.8	4
24	5.3	6	4.1	4	3.1	4



The most important things are to:

- Have good records of your data
- Be able to interpret and understand what you discovered
- Be able to explain your project and what you learned

Source: http://school.discoveryeducation.com/sciencefaircentral/Science-Fair-Projects/Investigation-Analyze-Data-and-Draw-Conclusions.html

Communicate your results

What is your story?

The organization and presentation of your data is critical to the success of your project.

- Remember a picture is worth a thousand words.
- Use tables, graphs & photos to tell your story.
- Explain the BIG PICTURE (why people should care).
- Explain how your research findings could be used to address a real world problem.
- Identify what additional questions you have and how your study could be continued.
- Your board should be professional and organized to tell your story.

Get Rewarded by winning the
Soybean Science Challenge

Resources

GO

University of Arkansas Division of Agriculture: http://www.uaex.uada.edu

Student's Packet for the Science Fair Project: http://phsd144.net/cms/lib3/IL01001725/Centricity/Domain/572/Science FairPacket.pdf

Science Buddies –
http://www.sciencebuddies.org/science-fair-projects/project_guide_index.shtml

Teach Hub: http://www.teachhub.com/science-fair-video-student-guide

Video Series: How to do a Science Fair Project - http://www.jpl.nasa.gov/edu/teach/activity/how-to-do-a-science-fair-project/

file:///C:/Users/Karen/Desktop/2016%20SSC%20Science%20Rules%20Project%20Notebook/ScienceFairPacket.pdf

http://school.discoveryeducation.com/sciencefaircentral/Science-Fair-Projects/10%20Steps%20to%20an%20Investigation%20Project.pdf

http://school.discoveryeducation.com/sciencefaircentral/Science-Fair-Projects/Science%20Fair%20Central%20Experimental%20Investigation%20Planning%20and%20Approval%20Sheet.pdf

http://school.discoveryeducation.com/sciencefaircentral/Science-Fair-Projects/Science_Fair_Project_Steps.pdf

http://school.discoveryeducation.com/sciencefaircentral/Getting-Started/Investigation.html

http://www.themiraclebean.com/

www.arkansassoybean.com/

www.uaex.uada.edu/soywhatsup

My Project Protocol Worksheet

NAME: ______________________________ **Date of Science Fair:** ______________________________

1. Project Title: ______________________________

2. The PURPOSE of my project: A statement of what question(s) you are trying to answer.

3. What hypothesis you wish to test?

4. Methods for conducting my project:
How will you set up and conduct your experiment? ______________________________

How many experimental groups/trials will you have? ______________________________

How will you measure the effect you wish to study? ______________________________

How long will the experiment last? ______________________________

5. Project Controls:
Think about the variable(s) you are manipulating. Your control group needs to be held under conditions not affected by the tested variable. Identify the conditions for your control group:

6. Project Materials:

7. Journal/Data Collection:

What data will you collect?

Collection Dates

8. Data Analysis:
Data must be organized and summarized so that you can determine if the hypothesis has been supported or negated.

Results are usually shown in tables and graphs (figures).
Statistical analyses are often made to compare experimented and controlled populations.

I plan to conduct my analysis by: ____
____
____
____
____
____

9. References: ____
____
____
____
____
____
____

Project Approved: ____

Date: ____

Approver Notes: ____

____

Source: Adapted from - http://www2.lv.psu.edu/jxm57/irp/prot.htm

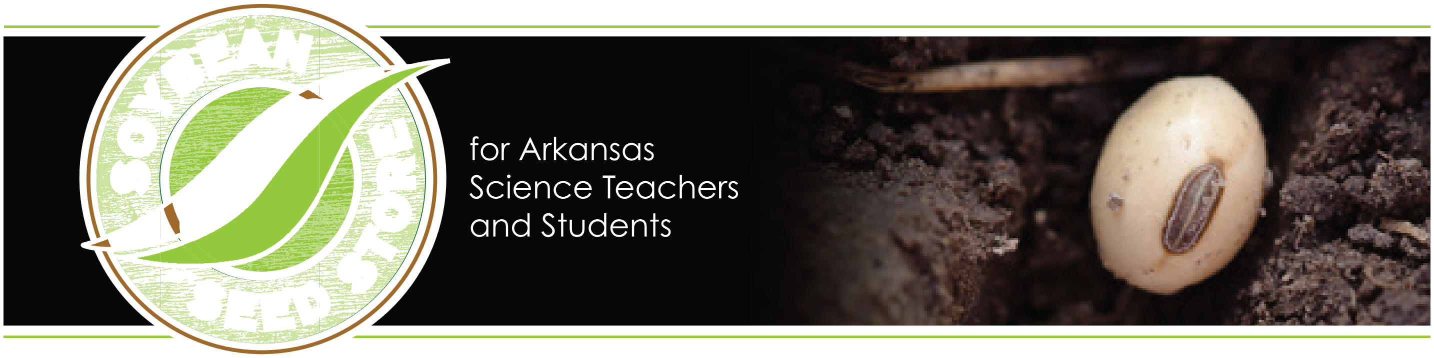
USE Your RESOURCES

Go to www.uaex.uada.edu/soywhatsup for the following resources:

Soybean Science Challenge – 6th-12th Grade Student Online Course

Students in grades 6-12 who successfully complete the Soybean Science Challenge online course and enter a project in an Arkansas regional or the state science fair are eligible for consideration for cash awards.

Soybean Science Challenge – Online Seed Store



Obtain soybean seeds for student research from the University of Arkansas Division of Agriculture. Soybean seeds are being provided to support student projects through the Soybean Science Challenge.

Three different types of seed are available:

Seed Varieties	Seed Quantities
Conventional Soybeans	☐100 ☐200 ☐300 ☐400 ☐500
Roundup Ready Soybeans	☐100 ☐200 ☐300 ☐400 ☐500
Tofu (food grade) Soybeans	☐100 ☐200 ☐300 ☐400 ☐500

These seed are all Arkansas varieties supplied by the Crop, Soil, and Environmental Sciences department seed breeders at the University of Arkansas - Fayetteville. To submit a request go to **www.uaex.uada.edu/soywhatsup.**

Soybean science challenge™

Our Soy Checkoff™ Progress Powered by U.S. Farmers

UofA Division of Agriculture Research & Extension University of Arkansas System

Arkansas Soybean Promotion Board

Arkansas Soybean Science Challenge Student Research Award

Qualifications for the award: This award will be presented to an outstanding individual or team project that utilizes the practical application of scientific principles and advanced technology to support the sustainability of soybean production for Arkansas farmers. Projects can address problems as diverse as world hunger, environmental sustainability, renewable energy and improved human health as well as plant production and processing efficiency and safety. Projects on sustainability and conservation, in any category, that relate to soybean production, agriculture, crop sciences, or other UADA/ASPB field of interest are eligible for this award. Engineering projects on innovation of technology related to agriculture, natural resources, and sustainability/conservation will also be considered. Students must have completed the online Soybean Science Challenge course to be eligible for judging.

Specific judging criteria includes:

Social and/or Commercial Value to the Soybean Industry: Has the student or team made a viable correlation between their research and a key issue related to the production, marketing, consumption, or sustainability of soybean production? Is there a clear strategy related to the practical application of their research to the soybean industry? What is the potential for the application of this research?

Marketability and Sustainability of Product, Process, and/or Strategy for the Soybean Industry: Is the target market clearly identified? Has the student/team considered how this concept/application could be utilized on a large commercial scale? Will the product/process/strategy have a long-term impact on production, the environment and/or consumers? How easily could this product/process/strategy be introduced to the marketplace?

Journal Notes

Journal Notes

Arkansas Extension Office List

ARKANSAS* (870) 659-2058 (DeWitt)
ARKANSAS* (870) 673-2661 (Stuttgart)
ASHLEY* (870) 853-2080 (Hamburg)
BAXTER* (870) 425-2335 (Mountain Home)
BENTON* (479) 271-1060 (Bentonville)
BOONE* (870) 741-6168 (Harrison)
BRADLEY* (870) 226-8410 (Warren)
CALHOUN* (870) 798-2231 (Hampton)
CARROLL* (870) 423-2958 (Berryville)
CHICOT* (870) 265-8055 (Lake Village)
CLARK* (870) 246-2281 (Arkadelphia)
CLAY (870) 857-6875 (Corning)
CLAY (870) 598-2246 (Piggott)
CLEBURNE* (501) 362-2524 (Heber Springs)
CLEVELAND* (870) 325-6321 (Rison)
COLUMBIA* (870) 235-3720 (Magnolia)
CONWAY (501) 354-9618 (Morrilton)
CRAIGHEAD* (870) 933-4565 (Jonesboro)
CRAWFORD* (479) 474-5286 (Van Buren)
CRITTENDEN *(870) 739-3239 (Marion)
CROSS* (870) 238-5745 (Wynne)
DALLAS* (870) 352-3505 (Fordyce)
DESHA* (870) 222-3972 (McGehee)
DREW* (870) 460-6270 (Monticello)
FAULKNER* (501) 329-8344 (Conway)
FRANKLIN* (479) 667-3720 (Ozark)
FULTON* (870) 895-3301 (Salem)
GARLAND* (501) 623-6841 (Hot Springs)
GRANT* (870) 942-2231 (Sheridan)
GREENE* (870) 236-6921 (Paragould)
HEMPSTEAD* (870) 777-5771 (Hope)
HOT SPRING* (501) 332-5267 (Malvern)
HOWARD* (870) 845-7517 (Nashville)
INDEPENDENCE* (870) 793-8840 (Batesville)
IZARD* (870) 368-4323 (Melbourne)
JACKSON* (870) 523-7450 (Newport)
JEFFERSON* (870) 534-1033 (Pine Bluff)
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Cooperative Extension History

All universities engage in research and teaching, but the nation's more than 100 land-grant colleges and universities, have a third critical mission—extension. "Extension" means "reaching out," and—along with teaching and research—land-grant institutions "extend" their resources, solving public needs with college or university resources through non-formal, non-credit programs.

Congress created the extension system nearly a century ago to address exclusively rural, agricultural issues. At that time, more than 50 percent of the U.S. population lived in rural areas, and 30 percent of the workforce was engaged in farming. Extension's engagement with rural America helped make possible the American agricultural revolution, which dramatically increased farm productivity:

In 1945, it took up to 14 labor-hours to produce 100 bushels of corn on 2 acres of land.

By 1987, it took just under 3 labor-hours to produce that same 100 bushels of corn on just over 1 acre.

In 2002, that same 100 bushels of corn were produced on less than 1 acre.

That increase in productivity has allowed fewer farmers to produce more food.

Fewer than 2 percent of Americans farm for a living today, and only 17 percent of Americans now live in rural areas. Yet, the extension service still plays an important role in American life—rural, urban, and suburban. With its unprecedented reach—with an office in or near most of the nation's approximately 3,000 counties—extension agents help farmers grow crops, homeowners plan and maintain their homes, and children learn skills to become tomorrow's leaders.

Despite the decline in the population and economic importance of rural America, the national Cooperative Extension System remains an important player in American life. It increasingly addresses urban, suburban, in addition to rural issues, and it has responded to information technology changes in America. Extension expertise meets public needs at the local level with approximately 2,900 extension offices nationwide.

Beginning of Extension in the United States

The roots of U.S. agricultural extension go back to the early years of our country. There were agricultural societies and clubs after the American Revolution, and in 1810 came the first Farm Journal. It survived for only 2 years, but in 1819 John Stuart Skinner of Baltimore began publishing the American Farmer. Farmers were encouraged to report on their achievements and their methods of solving problems. Some worthwhile ideas, along with some utterly useless ones, appeared on the pages of the publication.

The Morrill Act of 1862 established land-grant universities to educate citizens in agriculture, home economics, mechanical arts, and other practical professions. Extension was formalized in 1914, with the Smith-Lever Act. It established the partnership between the agricultural colleges and the U.S. Department of Agriculture to provide for cooperative agricultural extension work. At the heart of agricultural

extension work, according to the Act, was:

- Developing practical applications of research knowledge.
- Giving instruction and practical demonstrations of existing or improved practices or technologies in agriculture.

Smith-Lever mandated that the federal government (through USDA) provide each state with funds based on a population-related formula. Today, the National Institute of Food and Agriculture (NIFA) distributes these so-called formula grants annually.

President Woodrow Wilson called the Smith-Lever Act "one of the most significant and far-reaching measures for the education of adults ever adopted by the government."

The extension service's first big test came during World War I, when it helped the nation meet its wartime needs by:

- Increasing wheat acreage significantly, from an average of 47 million acres annually in 1913 to 74 million in 1919.

- Helping the USDA implement its new authority to encourage farm production, marketing, and conserving of perishable products by canning, drying, and preserving.

- Helping to address war-related farm labor shortages at harvest time by organizing the Women's Land Army and the Boys' Working Reserve.

- More generally, extension's role in WWI helped it expand its reputation as an educational entity to one that also emphasized service for individuals, organizations, and the federal government.

During the Great Depression, state colleges and the USDA emphasized farm management for individual farmers. Extension agents taught farmers about marketing and helped farm groups organize both buying and selling cooperatives. At the same time, extension home economists taught farm women—who traditionally maintained the household—good nutrition, canning surplus foods, house gardening, home poultry production, home nursing, furniture refinishing, and sewing—skills that helped many farm families survive the years of economic depression and drought.

During World War II, the extension service again worked with farmers and their families, along with 4-H club members, to secure the production increases essential to the war effort. Each year for 5 years, total food production increased. In 1944, food production was 38 percent above the 1935-1939 average.

The Victory Garden Program was one of the most popular programs in the war period, and extension agents developed programs to provide seed, fertilizer, and simple gardening tools for victory gardeners. An estimated 15 million families planted victory gardens in 1942, and in 1943 some 20 million victory

gardens produced more than 40 percent of the vegetables grown for that year's fresh consumption. Between 1950 and 2007, the number of farms in the U.S. declined dramatically—from 5.4 million to 2.2 million. Because the amount of farmland did not decrease as much as the number of farms, many of the remaining farms have a much larger average. However, the number of small farms has also increased during the past ten years. During the same period, farm production increased from one farmer supporting the food needs of 15.5 persons in 1950 to one farmer supporting 100 persons in 1990. By 2007, one farmer supported the food needs of almost 155 people. That increased productivity, despite the decline in farm numbers, resulted from increased mechanization, commercial fertilizers, new hybrid seeds, and other technologies. Extension played an important role in extending these new technologies to U.S. farmers and ranchers.

Beginning of Extension in Arkansas

About the earliest recorded historical fact pertaining to Extension work in Arkansas is the establishment of the Arkansas Industrial University (the land- grant college) in 1872, founded in accordance with the Morrill (federal) Act of 1862. In 1875, the Arkansas General Assembly authorized the holding of agricultural and mechanical fairs. The Arkansas Agricultural Experiment Station under the Hatch (federal) Act became active in 1888. A year later, the General Assembly created the Bureau of Mines, Manufacture, and Agriculture, with a commissioner in charge whose duties were primarily regulatory. However, he was expected to encourage and promote interest in other agricultural work and, especially, to keep an exhibit at his office in the state capitol building.

The first Cooperative Extension work conducted by the University of Arkansas was in 1905 when several Farmers' Institutes were held, but this work was limited because of a small state appropriation. Later the number of institutes held was increased as larger appropriations were made. These were discontinued after the Smith-Lever Act went into effect in 1914.

The Farmers' Cooperative Demonstrative Work of the United States Department of Agriculture under Dr. Seaman Knapp's direction was begun in Arkansas in 1905 with the appointment of J. A. Evans as state agent and A. V. Swatty as district agent. By 1907, four district agents and seven county agents had been appointed.

4-H club work was started in 1908 and home demonstration (canning clubs) work was begun in 1911. The first African-American county agent was appointed in 1914.

When the Smith-Lever Act went into effect, the personnel of the state organization (Farmers' Cooperative Demonstration Work) consisted of a state agent in charge, a state home demonstration agent, a state 4-H club agent, three district men agents, several specialists, fifty-two county agents, fifteen home demonstration agents, and the necessary clerical force.

Information courtesy of:

USDA-National Institute of Food and Agriculture; and J. A. Evans, Recollections of Extension History, Extension Circular No. 224 (Raleigh, N.C.: North Carolina Agricultural Extension Service, 1938). pp. 1-51.


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