Soybean science challenge™

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2022 SOYBEAN SCHOLARS

DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

ARKANSAS SOYBEAN PROMOTION BOARD

Meet Your 2022 Soy Scholars

The Soybean Science Challenge is a farmer-funded, statewide, junior and senior high school education program that seeks to increase student knowledge about the value of Arkansas soybeans to the Arkansas economy, to the labor force, and ultimately to feed and fuel the world.

The Challenge is co-sponsored by the Arkansas Soybean Promotion Board and the University of Arkansas System, Division of Agriculture, Cooperative Extension Service.

The Challenge has reached thousands of students and teachers through real-time and on-line education, in-service training, Virtual Field Trips, virtual mini-lessons, classroom lab instruction, Arkansas-based educational publications, mentoring, and awards for independent student research.

Abby Berger

Southwestern Energy Arkansas State Science and Engineering Fair First Place Winner, UCA-Conway, AR, and West Central Arkansas-ASMSA Regional Science Fair Winner, Hot Springs, AR

Teacher-Mentor: Dr. Brian Monson
Category: Plant Sciences
School: Arkansas School for Mathematics, Sciences, and the Arts, Hot Springs, AR

Project Title: The Potential of Forage Soybeans as a Grazing Source for Cattle

Abstract:
Farmers across the nation feed their cattle some form of fibrous plant material such as wheat or alfalfa. Soybean prices are decreasing, so forage soybeans are being considered as an alternative grazing option for cattle if they can withstand grazing damage and regrow a decent crop. Soybeans' large leaf area and protein content maximizes the activity of ruminal microorganisms in a cow's digestive tract. Five varieties from Eagle Seed and one from a competitor were planted an inch deep in rows in a three-acre field and clipped throughout the growing season to see how the plants would hold up to simulated grazing damage. It was hypothesized that the varieties of soybeans would be similar in their regrowth after they were snipped above the V1 stage except for the MultiMaxZ soybean which would grow forage faster because MultiMaxZ grows three times the amount of leaves a normal forage soybean does. Four clippings were taken throughout the season: V1, V3, V5, and R1 growth stages. The treatments were carried out on consecutive sets of six feet of plants in their respective rows. MultiMaxZ led significantly in dry weight and fresh weight, but Big Fellow® led in leaf area although the error bars overlap. By the R1 stage, MultiMaxZ had a fresh weight of 1656 tons per acre whereas Big Fellow® had 1390 tons per acre. The results indicate that forage soybeans could be used as a nutritional grazing alternative for cattle although nutritional and cattle testing should be conducted in the future.

"The Soybean Science Challenge is an excellent motivator for students interested in agricultural science."
– Dr. Brian Monson

Sydney Wolf

Southwestern Energy Arkansas State Science and Engineering Fair Second Place Winner-UCA, Conway, and Northeast Arkansas Regional Science Fair Winner, ASU-Jonesboro, AR

Teacher-Mentor: Ms. Allyson Goodin
Category: Plant Sciences
School: The Academies at Jonesboro High School, Jonesboro, AR

Project Title: Does overcrowding affect the growth of soybeans?

Abstract:

To investigate this idea, the student planted one to eight seeds of 2 different varieties of soybeans in 5 containers each. The seeds were spaced the same distance from each other depending on the number of seeds in the container. She tracked the growth over the span of two weeks. Every other day, the soybeans were watered with 3 tablespoons of regular water. Then the next day, the soybeans were watered with a spray bottle. The plants were set on a windowsill to ensure sunlight. Each was planted in the Aquarium Grave on the bottom for drainage then Expert Gardener potting mix, in the cutout bottom of a milk jug. The first variety is Roundup soybeans, and the second variety is Tofu soybeans. The independent variable was the number of soybeans in each container. The dependent variable was the growth of the soybean plants. The controlled variables were the amount and type of water given, the amount of sunlight, the type of plants, and the type of soil.

After analyzing the data, it was found that soybeans could grow more when close together, than when alone. On the sixth day, some of the seeds in both varieties sprouted. The growth of every container of soybeans continued to progress daily. However, contradicting the hypothesis, the containers with higher amounts of seeds grow more exponentially compared to the container with a single seed. On day 10, the average growth of the eight seeds container to the one seed container for variety one is 7.06 to 3.50, which gives us evidence that the null hypothesis is true. The null hypothesis is also true when looking at the variety twos average growth of the two containers which is 3.19 to 2.8. This style of growth was continued throughout the entire experiment. All of the containers had at least the majority of the soybeans sprout.

"Since my student's participation in the Soybean Science Challenge, I have gained new knowledge for myself and gained another great tool to get my students engaged in their learning. This challenge enables me to work with students one on one and really help develop those important critical thinking and communication skills. My students and I also learned that it is okay to fail. Sometimes the experiment, presentation or display does not turn out how you thought it would. But you learn, grow and always try to do better the next time."
– Allyson Goodin

Cameryn Berryhill

Southwestern Energy Arkansas Science and Engineering Fair Honorable Mention Winner, UCA-Conway, AR

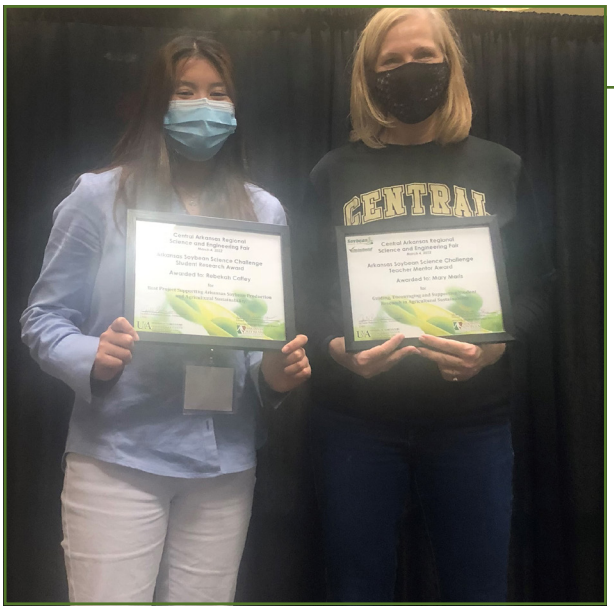
FFA Advisor: Dr. Lindsey Waddell
Category: Plant Sciences
School: Arkansas School for Mathematics, Sciences, and the Arts, Hot Springs, AR

Project Title: Using stream bacteria to promote soybean growth

Abstract:

As the world's population steadily grows, agricultural innovations are becoming more necessary to meet food demand. Unlike increasing the use of pesticides that are hazardous to human health and synthetic fertilizers that produce harmful nutrient runoff, developments in the field of biotechnology have the potential to increase yields without damaging the environment. One form of biotechnology that has recently gained popularity is the use of plant growth promoting (PGP) bacteria. These bacteria are in abundance in both soil and water, and have many different mechanisms through which they benefit plants, such as through the production of the plant growth hormone indoleacetic acid (IAA). This project aimed to determine if aquatic bacteria found in Hot Springs, Arkansas, could promote the growth of soybeans, an extremely important agricultural product in the state. Through the use of Salkowski's reagent, microorganisms sampled from three streams were qualitatively tested for production of IAA. Soybean seeds and soil were then primed with no bacteria or bacteria that produced high, low, or no IAA. Soybeans that were primed with non-IAA producing bacteria showed significantly longer roots than the control, as well as significantly greater shoot height and growth rate than the other experimental groups. The results did not support the hypothesis that IAA producing bacteria would significantly promote growth, but show the importance of further experimentation to determine the mechanisms through which growth was promoted. Identification of the bacteria could also have commercial uses, as there are a limited number of PGP microorganisms on the market today.

"As an environmental science instructor, I would say soybean research is very relevant. Soy factors into a lot of discussions including food supply, sustainable agriculture, soil fertility, and other areas. They are also so easy and fast to grow compared to many other plants, which makes them perfect for use in student experiments."
– Dr. Lindsey Waddell



Rebekah Caffey

Central Arkansas Regional Science and Engineering Senior Level Fair Winner, UA–Little Rock, AR

Teacher-Mentor: Ms. Mary Maris
Category: Earth & Environmental Science
School: Little Rock Central High School, Little Rock, AR

Project Title: The Effects of Defoliation and Fungicide Treatment

Abstract:
When legumes are planted, pesticides used for the disinfection of the seeds can be harmful to the rhizobium sp., decreasing the number in the rhizosphere so, it may be detrimental to the amounts of atmospheric nitrogen fixed. In this experiment, the fungus Rhizoctonia solani would have been used to treat two separate soybean crops and then the use of two different fungicides would be used to treat the fungus. Unfortunately, the Rhizoctonia solani was not grown in time of this science fair date. However, local store-bought fungicides were treated on soybeans to compare and conclude which local fungicide would be best. Both Captain Jack's Neem oil and Arbor bio protectant were treated on soybeans. The two fungicide treatments were sprayed on soybeans as needed for four weeks. Of the soybean treatments, none showed a significant increase in germination when treated. The measurements taken weekly were too close to not be significant. However, it was difficult to conclude due to extenuating circumstances such as temperature, environment and at home growing of soybeans. Therefore, the null hypothesis was accepted, and the hypothesis was rejected. The P value was 0.37506 and the F statistic value was 0.9177 concluding that there was no statistical difference.

"I've had students enter the Soybean Science Challenge in the past, and I think it is a great way for them to learn about the many uses for this crop which is so important to our state." – Mary Maris

Aakash Bhattacharyya

Central Arkansas Regional Science and Engineering Fair Junior Level Winner, UA–Little Rock, AR

Teacher-Mentor: Ms. Erin Votaw
Category: Energy and Transportation
School: Lisa Academy West Middle School, Little Rock, AR

Project Title: Electronic Soil Moisture Sensor: Save Water, Save the Future

Abstract:
Access to good quality water is a growing concern. According to the U.S. Geological Survey, in 2010, approximately 29% of surface water and 65% of fresh groundwater are used for agricultural needs. 2/3 of fresh water is used in irrigation, and half of that is wasted because of irrigation inefficiency and water wastage (i.e. 108 billion gallons of water wasted per day in USA alone). Therefore, improving irrigation water usage efficiency is significant. Improving the efficiency of irrigation involves putting accurate amounts of water. In my project, I made a new and improved Soil Moisture Sensor to reduce unnecessary water consumption. I used a NAND 4011 circuit to make a soil moisture sensor. In this project, I am using a durable capacitance-based Arduino circuit board with an LCD display to make quantitative and accurate readings. To make it work, I wrote customized Adriano code to load my Arduino Circuit. It was tested with relevant soils, especially Arkansas Stuttgart soil variations. Silty Loam and Silty Clay, Loam, and Loamy soil, with different amounts of water. I observed how my circuit performed and displayed the exact moisture percentage. My control variables were soil amount, soil height, and the circuit. I tested two times for each soil type and water amount combination. After conducting the experiment and looking at my circuit, I have concluded that my circuit is indeed sensitive and accurate, fully functional and able to reduce unnecessary water consumption. My hypothesis was proven correct because my soil moisture sensor worked.

"The Soybean Science Challenge is a great way for my students to explore a new topic outside of what we are studying in class. I am passionate about sustainability, and I believe it is so important for young minds to get involved in making our state, and planet, a better place for their future." – Erin Votaw

Emily Hudnall

Ouachita Mountains Regional Science and Engineering Fair Winner, Hot Springs, AR

Teacher-Mentor: Bobby Young
Category: Plant Sciences
School: Mountain Pine High School, Mountain Pine, AR

Project Title: Can Plants Stop Soil Erosion?

Abstract:
The purpose of this experiment is to determine whether the roots of plants reduce soil erosion and if plants are a viable option to help reduce soil erosion globally. The issue of soil erosion goes further than just infertile land and flooding. Studies have shown that this can lead to rising pollution and sedimentation in streams and rivers. So, the question is does the presence of roots have an effect on slowing or stopping the process of soil erosion? Synthetic roots were placed in soil and water was added to the system after which the amount of erosion was determined per system. The results of this experiment were recorded in a lab journal to chart the amount of soil eroded. My data supports my hypothesis that soil containers with synthetic roots all reduced soil erosion in the three trials that were done. Therefore, the presence of roots does influence reducing the amount of soil erosion.

"A few years ago, I attended my first regional science fair in Arkansas and learned about the Soybean Science Challenge. I thought it was an interesting initiative so when I started my local science fair, I encouraged students to participate in it." – Bobby Young

McKenzie Butler

Northwest Arkansas Regional Science and Engineering Fair Senior Level Winner, UA–Fayetteville, AR

Teacher-Mentor: Tiffany Schrivner
Category: Plant Sciences
School: Alma High School, Alma, AR

Project Title: Drought Resistant

Abstract:

The purpose of this experiment is to figure out to what extent does sodium polyacrylate in soil affect the drought resistance and growth in soybeans. This was done by mixing various amounts of sodium polyacrylate into planters with soybean seeds in them and watering them every few days until they become large enough and sturdy enough to be left alone. After they reach this point, stop watering them slowly and record how long it takes the plants to die. This took around 108 days for the control plants to be killed off and it took around 112 days for the 5 mg plants to die. At this point the 10 mg plants were still alive and well and showed very little signs of dying. This is when the experiment was ended due to the fact that the plants showed no interest in dying. Ultimately the hypothesis was somewhat rejected because the 5 mg plants ended up growing better than all of the other ones but the 20 mg plants ended up living the longest.

"The soybean challenge gives students the opportunity to do work that can directly impact local problems that farmers may face. It is a real-world connection to their education." – Tiffany Schrivner

Alex Pagliani

Northwest Arkansas Regional Science and Engineering Fair Junior Level Winner, UA–Fayetteville, AR

Teacher-Mentor: Pat Briney
Category: Plant Sciences
School: Fayetteville Christian School, Fayetteville, AR

Project Title: Soybean Pollen Viability under Low Temperature Stress

Abstract:
Low temperature stress can reduce or increase pollen viability in different varieties of soybeans. Twenty-four soybean plants for two varieties (MG4 and MG5) were grown in controlled growth chambers at 26°/18° C and 18°/12° C. MG5 soybean plants flowered less and produced fewer pods under stress of being grown at lower temperatures. In contrast, MG4 plants flowered more and produced more pods at lower temperatures.

"I introduced my students to the Soybean Science Challenge to learn about science with a major producer of soybeans (the farmers of Arkansas) and to work with a scientist at the University of Arkansas in Fayetteville. The Challenge is real asset to my classroom." – Pat Briney

Jailyn Strong

Northeast Arkansas Regional Science Fair Junior Level Winner, ASU–Jonesboro, AR

Teacher-Mentor: Ms. Amanda Smith
Category: Plant Sciences
School: Salem High School, Salem, AR

Project Title: Save the Soybeans

Abstract:
Research Question: Do essential oils work as a natural bug repellent?

Purpose: I did this project to see if there is a natural bug repellent. I want the soybean plants protected from the bugs so people can eat them, and farmers sell them. Soybean plants without bugs eating them allow for more money for farmers, better crops for stores, and better food for people. Soybean plants are important because they are a good food source and a job for farmers.

Procedure: I planted 9 soybeans in little cups. Then I watered them and let them grow into adults. Once the plants were of age, I took 20 ladybugs from outside and put them into a container so I would have them to put on the soybean plants. I put the ladybugs on 8 of the soybean plants, peppermint oil on 4 of the plants. I checked to see if the essential oil protected the soybean plants from the ladybugs.

Results: The peppermint oil kept the bugs from eating the soybeans and drove them away. The ladybugs did not like the scent, so they left the area. Plants 2-5 did not have any bugs on them.

"I decided to have my students participate in the Soybean Science Challenge JR level so they could learn more about agriculture in Arkansas. It is important for my students to know where their food comes from and the major role that soybeans have in Arkansas agriculture. I also wanted them to learn about the STEM jobs available in Arkansas."
– Amanda Smith

Ayla Buford

Southwest Arkansas Regional Science Fair Senior Level Winner, Southern Arkansas University, Magnolia, AR

Teacher-Mentor: Ms. Christy Hoyle
Category: AG/Earth/Environmental
School: Taylor High School, Taylor, AR

Project Title: How drinks affect plant growth

Abstract:
The science fair project I chose to do this year was about hydrogen's peroxides effect on soybean plant growth. I chose to do this project because hydrogen peroxide is often used in pesticides on crops. I wanted to know if the plants were being positively or negatively affected by the substance. I had five different solution types that were to be given to fifteen plants each. The experiment was done in twenty-one days. I hypothesized that the 50% hydrogen peroxide and 50% water solution would cause the plants to grow faster than the other plants given different solutions. My hypothesis was proven incorrect. The results showed that the 75% hydrogen peroxide and 25% water solution grew the plants faster than the plants given the other solution types.

"Through the Soybean Science Challenge, my students gain increased knowledge and greater opportunity to research in the areas of plant, soil and agricultural sciences." – Christy Hoyle

Noah Beard

Southwest Arkansas Regional Science Fair Junior Level Winner, Southern Arkansas University, Magnolia, AR

Teacher-Mentor: Jackie Raney
Category: Plant Sciences
School: Bearden High School, Bearden, AR

Project Title: Poop for Plants

Abstract:
The purpose of this experiment is to figure out which of my animal's manure I can do my farming with.

My hypothesis is that that chicken manure would help grow faster because it is the most used by famers.

I collected an equal amount of chicken, rabbit and goat manure and mixed it with potting soil in the same size pots. I let it grow for 5 weeks and measured it at the end of every week.

Data: Every plant grew some, and some even shrunk, but the chicken manure grew the most in width and height.

Conclusion: The chicken manure grew the plant most in width and height, so my hypothesis was correct!

"Through the Soybean Science Challenge Online Course, I learned that farmers are using cutting edge technology to grow soybean crops. – Noah Beard

Hannah and Hadleigh Baker

FFA Arkansas State Agriscience Fair Soybean Science Challenge Senior Level Winners

Teacher-Mentor: Josh Baker and Carson White
Category: Plant Systems
School: Mountain Home Junior High School, Mountain Home, AR

Project Title: Measuring early soybean growth response to commercial fertilizer and turkey litter

Abstract:
Fertilizer applications to fields cropped with legumes is sensible because soybeans biologically fixate nitrogen gas from the atmosphere. By allowing fertilizers to be applied to fields, we as agriculturists can restore potassium and phosphate levels into the soil to maximize yield potentials in our legumes and soil. The question is; what type of fertilizer would meet the requirement soybeans need to reach maximum soil potential? Our experiment compares the difference in early soybean growth and germination rate with no fertilizer or nutrient altercations (control) to common industrial fertilizer and turkey litter. The purpose of this experiment is to provide soybean farmers with an accurate recommendation of what type of fertilizer will effectively produce the maximum yield potential of soybeans that is also most cost effective. Our hypothesis is the poultry litter application will be the most beneficial.

We found that poultry litter had the best germination rate and growth over a 19-day period, so our hypothesis was correct.

"Any chance we can give our students the ability to diversify and learn new aspects about agriculture is a plus, and the Soybean Science Challenge does just that."
– Josh Baker

Jenny Garcia-Torres

FFA State Agriscience Fair Junior Level Winner, Hot Springs, AR

Teacher-Mentor: Jonathan Roberts
Category: Plant Sciences
School: Southwest Junior High School, Springdale, AR

Project Title: Does temperature matter for soybean germination

Abstract:
Soybeans are important because they provide a lot of protein. Every cell in the human body contains protein. You need protein in your diet to repair cells and make new ones. The purpose of this project is to determine the best temperature to grow soybeans. There is contradicting information on whether soybeans germinate better at 12.8C or 29.4C. 10 plants were planted at 12.8C, 10 plants were planted at 29.4C and ten plants were planted at room temperature. They were given the same amount of light, water and soil. After 14 days, 10 of the plants at 27C germinated, six of the plants germinated at 29.4C and zero plants germinated at 12.8C. In conclusion, the warm climate is more favorable for soybeans because more plants germinated at warmer temperatures.

"I have used the Soybean Challenge in my high school Plant Science class for a few years to introduce content about row crop farming as well as research methods. It was great to introduce these concepts to my junior high students this year through the program." – Jonathan Roberts

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www.uaex.uada.edu/soywhatsup

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Free Educational Resources and Materials Available from the Soybean Science Challenge at www.uaex.uada.edu/soywhatsup

The Arkansas Soybean Science Challenge is a science enrichment program open to students in grades 6-12.

The Arkansas Soybean Science Challenge research program includes:

- $300 cash awards for high school student science projects impacting sustainability at Arkansas regional science fairs and Arkansas FFA Agriscience Fair; $1000 first place, $500 second place and $250 Honorable Mention at the Arkansas state science fair.
- $200 cash awards for junior high (6-8th grade) student science projects impacting sustainability at Arkansas regional science fairs and Arkansas FFA Agriscience Fair.
- $200 cash awards to teachers whose students win the Soybean Science Challenge at regional. Teacher awards at state are $300 for first place, $200 for second place and $100 for Honorable Mention. $100 for junior level Soybean Science Challenge teacher awardees at regional.

STUDENT ONLINE COURSE – 6 MODULES

- The Science of Soybean Production
- The Miracle Bean: Food
- The Miracle Bean: Fuel
- The Miracle Bean: Feed
- The Faces & Challenges of Farming: Emerging Issues
- Ready…Set…Research!

6-12th grade students who successfully complete the Soybean Science Challenge online course and enter a soybean related project in one of the Arkansas regional and state science fairs, and FFA Agriscience Fair are eligible to have their projects judged for cash awards.

For more information about the Soybean Science Challenge Program, contact:
Dr. Julie Robinson (jrobinson@uada.edu)
Diedre Young (dyoung@uada.edu)
Phone 501-671-2086

FREE CLASSROOM RESOURCES

Teacher In-Service Online Course
7 Hours ADE Approved – 6 Modules
1 Hour ADE Approved: Science Fair 101

Teacher Resources Course for Classroom Use
6 Modules, Tests, Answer Keys and over 50 other soybean-related articles and resources

Teacher Classroom Lessons in 7E & GRC-3D (NGSS Aligned) Format covering multiple subjects.

5-10-minute NGSS aligned agriculturally based mini-lesson videos for the virtual and face to face classroom. Video lessons cover a multitude of subjects with accessible Power Points.

High School Science Curriculum Resource Guide

Arkansas High-School Science Project Development Guide

Soybean Science Challenge Brochure

Free Soybean Science Challenge Seed Store for Student Research Projects

Several Virtual Field Trip videos that include Teacher Guides

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Harvesting the potential of Arkansas' young scientists!

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

Learn more at: www.uaex.uada.edu/soywhatsup

Funding provided by:

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Cultivating Arkansas' student scientists to change the world