SBAR

SUSTAINABLE BIOECONOMY FOR ARID REGIONS

Extension & Outreach Newsletter

January 2021; Volume 2, Issue 1

HIGHLIGHTS

NOTEWORTHY & NEWSY

Dr. Frannie Miller
New Mexico State University Assistant Professor in the Department of Agricultural Economics and Agricultural Business.

Frannie joined the SBAR Youth Outreach Team and will develop activities to engage 4-H participants.

Mr. Alan Daugherty
Science teacher at Melrose Jr. High and High School in Melrose, NM., and a 2019 Excellence in STEM Award recipient.

Alan joined the Education Team and will bring SBAR themed lessons into his middle school science classroom.

Accomplishments

Education Fellow Arisbeth Ibarra Nieblas won 2nd place at the 2020 American Institute of Chemical Engineers K-12 STEM Outreach Competition for her lesson "Exploring Bioproducts: Glue for Piñatas" - read more HERE

Extension Team Lead Blase Evancho hosted the Guayule Field Day in October 2020 with Bridgestone Americas and the UArizona Extension Office. Learn about guayule research and production and watch the Field Day presentations HERE

SBAR goes virtual in 2020! Read about our progress, learn about our next steps, and watch the Annual Retreat student research presentations HERE

SBAR StoryMap: A Guayule and Guar Story

As the SBAR Center of Excellence embarks on the 4th year of research, development, deployment, and community engagement, the team's accomplishments are highlighted in a new SBAR Accomplishments ArcGIS StoryMap available to the public. Some questions remain (and some new ones have been uncovered), but we are making progress toward achieving the mission to build a sustainable bioeconomy in arid regions of the Southwest! Explore the progress we've made and share the link with your colleagues! Check out our story HERE

Guar in New Mexico

FIELD DAYS

Due to COVID-19 restrictions, many Field Day events were postponed. However, Dr. John Idowu, NMSU Extension Lead, presented at the 2020 Virtual Field Day hosted at the Rex E. Kirksey Agricultural Science Center at Tucumcari, NM. SBAR research was presented in his talk: The Potential of Guar for Eastern New Mexico. Watch John's talk HERE

DEMONSTRATION TRIALS

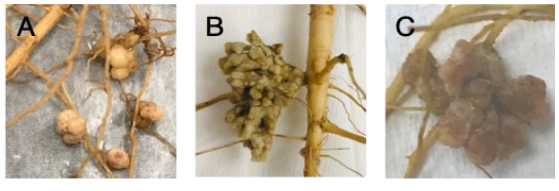
Demonstration trials were conducted on guar's response to limited irrigation in Las Cruces, NM, and Artesia, NM. Field trials evaluated plant characteristics that determine seed yield, agronomic and physiological response of guar genotypes under five drip-irrigated water regimes, and plant response with and without biogenic silica application. Biogenic silica is a naturally deposited material that can be mined and applied to the soil. It is a powdery material that has been shown to increase the soil water holding capacity, thus helping crops to be more drought resistant. In general, the I1 regime (irrigation through the entire season) produced the highest guar seed yield followed by I5 regime (terminate irrigation at flowering + biogenic silica) in Las Cruces (2016-2018) and in Artesia (2018). As compared to the I1 regime (normal irrigation), the I2 regime (no irrigation at 75% pod formation) and I3 regime (no irrigation at 50% and 75% pod formation) resulted in 20.8 % and 23.4% decline in guar seed yield, respectively. The lowest seed yield was obtained under I4 regime (terminate irrigation at flowering) which resulted in 26.4% decline in seed yield as compared to the I1 regime (irrigation through entire season). The I5 regime (terminate irrigation at flowering + biogenic silica) resulted in 17.3% higher seed yield as compared to the I4 regime (terminate irrigation at flowering) at Las Cruces. Results indicated a positive impact of biogenic silica on guar growth and seed yield under limited irrigation conditions. Dr. Kulbhushan Grover reported results.

Denotes NMSU Science Center with guar

Dr. Grover harvesting guar with students (Tucumcari, NM. Dec, 2019)

IDENTIFICATION OF *RHIZOBIUM* AND OTHER SYMBIOTIC BACTERIA IN NODULES OF GUAR IN NEW MEXICO

Guar (*Cyamopsis tetragoloba L.)* is a drought-tolerant legume that produces seeds rich in galactomannan or guar gum, a polysaccharide used as a lubricant, binder, food thickener, or hardener. Like other legumes, guar associates with symbiotic nitrogen-fixing rhizobia bacteria and form root nodules. The symbiotic nodules are specialized root organs that house rhizobia capable of using nitrogen gas (N_2) diffused into the soil from the air to produce organic nitrogen that the plant can use to grow. The rhizobia in the root nodules convert N_2 in the soil to ammonia, which is then taken up by plants to synthesize amino acids and other nitrogen compounds.



Nodules from guar plants grown at the Leyendecker, Fabian Garcia, and Los Lunas (A, B, C) Agricultural Science Centers in NM. Two types of guar nodules were identified: Determinate and indeterminate.

Guar plants with roots experiencing nodulation have been identified in the last two growing seasons (2019 and 2020) in NM at three different planting sites. In the 2019 growth season, Dr. Idowu's group identified nodule containing guar plants at the Leyendecker Plant Science Center in Las Cruces. Later, Dr. Grover's group identified 11 guar varieties showing nodulation at the NMSU Fabian Garcia Plant Science Center Las Cruces. In 2020 guar nodulating plants were found at the Los Lunas NMSU Agricultural Science Center.

Two types of guar nodules were identified: Determinate and indeterminate. Nodules from each guar plant were provided to Dr. Laura Rodriguez-Uribe of the SBAR Characterizations and Co-Products team, who isolated the symbiotic bacteria from the guar nodules.

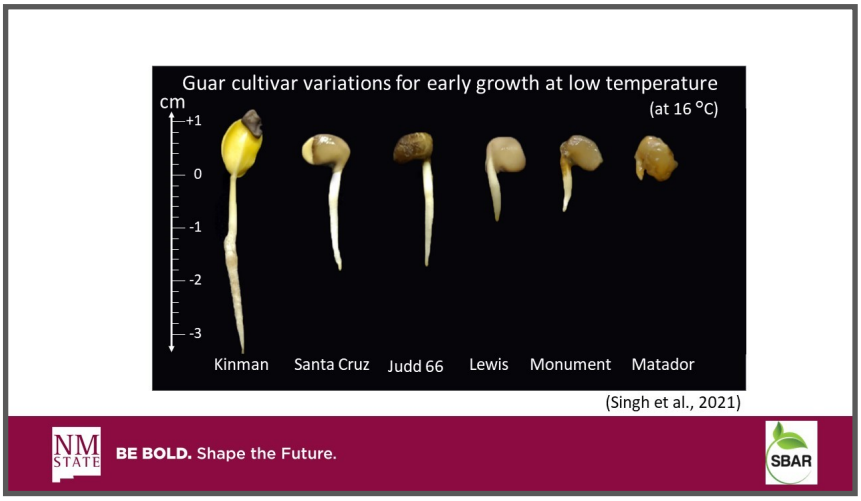
Three species of bacteria other than rhizobia were also identified: *Pseudomonas*, *Bordetella*, and *Agrobacterium*. Identifying the *Rhizobia* species associated with guar nodulation in NM will assist in optimizing the production of guar in the Southwest. The bacteria in nodules of different guar varieties shows that a diverse population of bacteria reside within the guar nodules. These bacteria may not be capable of fixing nitrogen but can potentially enhance legume survival, especially under environmental stress conditions.

The identified nodule associated bacteria could be used as bio-inoculants combined with *Rhizobia* to study their ability to enhance nodulation, rhizobial performance or persistence, and reduce chemical use fertilizers and pesticides for guar. Dr. Laura Rodriguez -Uribe reported results.

Guar in New Mexico

PROPER CULTIVAR SELECTION HELPS IN PLANTING GUAR IN COOLER REGIONS

Domestic supply of guar is becoming more important in the US to meet growing demand by diverse industries and to buffer supply uncertainty. Guar is a desert adapted crop and is well suited for New Mexico and Arizona. However, guar is grown in warmer regions of the world. Therefore, we studied germination and early growth of currently available guar cultivars under a range of temperatures to identify suitable cultivars for lower temperatures to potentially expand guar production to cooler regions. Lowering the temperature from 28 to 13°C decreased the overall final seed germination percentage, seed vigor index, primary root length, and speed of germination index in most of the cultivars. However, Kinman cultivar maintained a longer root and recorded higher values for most of the vigor indices at cooler temperatures. Matador cultivar had the lowest values for most of the vigor indices throughout the experiment. Results indicate with proper cultivar selection, guar area can be extended to colder regions. Kinman cultivar can be used in the cooler regions of the Southern High Plains of USA. Jagdeep Singh and Dr. Sangu Angadi reported results.



Guayule in New Mexico

COLD-ACCLIMATION AND FREEZING IN GUAYULE

A recently completed study analyzed the metabolome of leaves of the guayule germplasms AZ-2 and W6-429 exposed to cold-acclimation and freezing temperatures. Dr. Rodriguez-Uribe, a molecular biologist and research Assistant Professor in the Department of Plant and Environmental Sciences and a member of the SBAR Characterization and Co-Products research team, used the guayule metabolomes to identify metabolic biomarkers for cold-acclimation and freezing. Dr. Rodriguez-Uribe produced the manuscript "Untargeted metabolome profiling of guayule (*Parthenium argentatum* A. Gray) to identify metabolic biomarkers for cold-acclimation and freezing temperature tolerance" that includes the guayule metabolomes and metabolic biomarkers. This manuscript is the first report of metabolome profiles from leaves of the USDA guayule germplasms, polyploid AZ-2, and diploid W6-429 in cold-acclimation and freezing. It is also the first report on the identification of metabolic biomarkers associated with these environments.
The manuscript is expected to be published in the Industrial Crops and Products peer-reviewed journal soon.

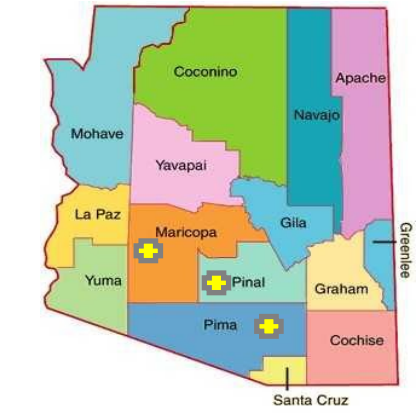
A six months old guayule W6-429 seedling gown in greenhouse at 38/23°C day/night.

Three guayule germplasms with mature plants in the field identified to have a low cold injury in Las Cruces.

A follow-up study on the guayule temperature response in leaf and bark tissues is underway to gather information on the possible sequence of events leading to rubber biosynthesis and accumulation. Three germplasm groups with mature plants in the field that Bridgestone identified to have a low cold injury in Las Cruces are being studied for their metabolic and transcriptomic response to decreasing clinal temperature. The initial samples were collected by the graduate student Ujala Sehar in September. Subsequent monthly sample collection will be carried out up to March 2021. Dr. Laura Rodriguez-Uribe reported results.

Grower Updates: Guayule Research & Activities

Guayule in Arizona



Denotes SBAR or Bridgestone plot with guayule trials

FIELD DAYS

The 2020 Virtual Guayule Field Day brought together people from all over the world to learn about guayule! The field day, originally scheduled for early summer was postponed by COVID-19. The UArizona SBAR Extension Team transitioned the event to a virtual platform and hosted over 100 people from 5 states and 2 countries and featuring several presentations discussing guayule production. We were fortunate to have presentations from University of Arizona Extension Specialists, Bridgestone researchers and SBAR researchers discussing insect pests, agronomic production, weed control and economic outlook for guayule. View presentations by Dr. Bill McCloskey on weed control, Trent Teegerstrom on guayule crop budgets, and others HERE

We thank everyone for attending and look forward to an in person field day next year.

Get Involved: Youth Outreach

INTERN WITH SBAR IN SUMMER 2021

OPEN TO HIGH SCHOOL STUDENTS IN ARIZONA

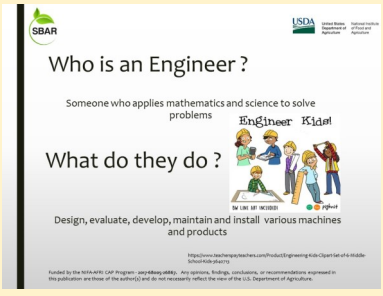
Interns gain valuable field skills while spending time with industry chemists, geneticists, engineers, or other research scientists at the University of Arizona. Interns are required to make a scientific poster about the research that they conduct during their internship, which will be presented at the 2021 SBAR Retreat in Tucson, AZ.

Learn more HERE

SBAR interns at Agriculture Field Day Event

SBAR Content with 4-H

University of Arizona 4-H Youth Development Resources



Check out SBAR 4-H virtual programming, camps and curriculum, and get involved **HERE**

4-H Ambassador Program

SBAR partners with 4-H Ambassadors, a leadership experience for 4-H teens.
Get involved **HERE**

Guardians of the Biosphere After School Clubs

Coming soon! Create a "GOB" club at your school with content by SBAR 4-H .
Initiated by New Mexico science educators Cathy Bradley and Tracie Mikesell.
Watch a GOB blurb **HERE**

SBAR Content with FFA

Future Farmers of America

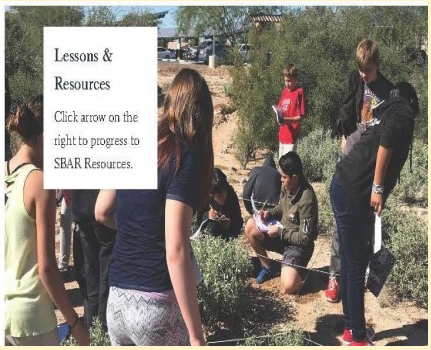
New Mexico State University researchers and educators have created SBAR lessons and activities for FFA.
Check out content and get involved **HERE**

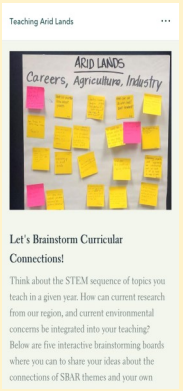
Educator Resources

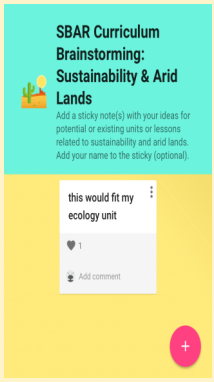
EDUCATION DIGITAL CORNER

The SBAR Education Partnership offers a digital treasure trove of lessons, activities, videos and graduate students to support educators in creating and teaching arid regions themed lessons. Learn more from the interactive Story Map.

SBAR Story Map Orientation— created by Education Researcher Corey Knox, PhD







Images from SBAR Story Map

SBAR Education Partnership

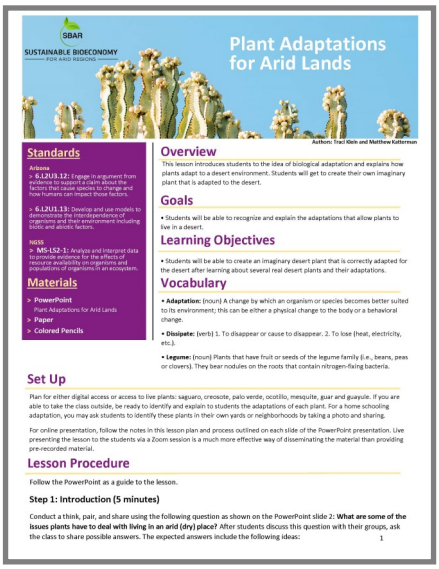
We are expanding our Education reach by going statewide and virtual. SBAR curricula align with NGSS and focus on FIVE main areas that connect to SBAR Research:

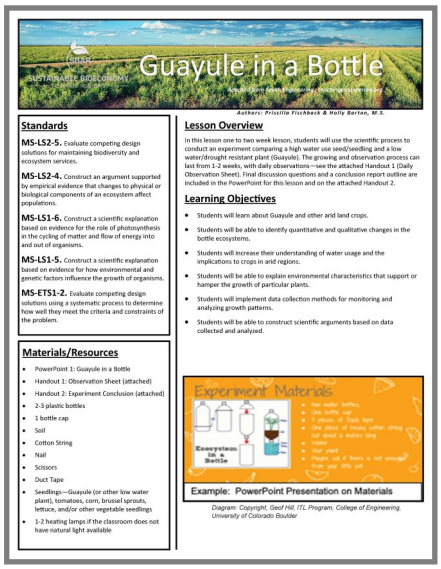
> Arid Lands, Agriculture & Sustainability
> Land Use, Farming & Culture in Arid Regions
> Building Bioeconomy in Arid Regions
> Sustainable Crops: Guar & Guayule
> Chemistry & Engineering

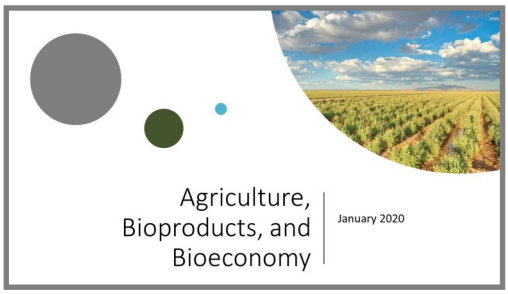
Hear what teachers say about SBAR HERE

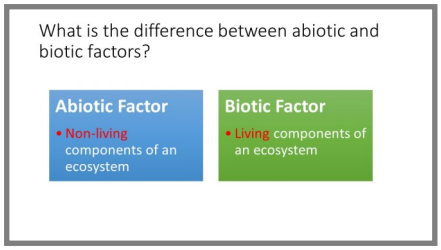
Virtual SBAR Education Content

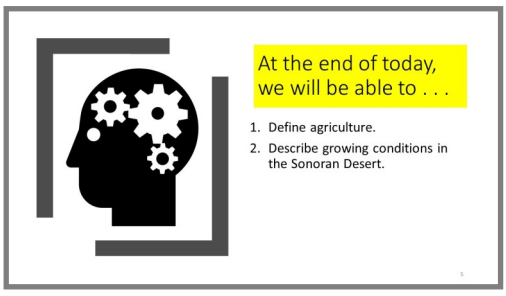
DOWNLOAD AND USE SBAR THEMED LESSONS, VIDEOS AND ACTIVITIES HERE











These images are a few examples of the lesson plans, power point presentations and videos available for free download.

Educators Join SBAR today! Fill out an Interest Form HERE

COMING SOON!

Recruiting: Growers

SBAR is seeking growers for trial plots of guar (NM) or guayule (AZ)

Available Spring 2021

Contact: John Idowu (Guar, NM)

Contact: Blase Evancho (Guayule, AZ)

Recruiting: Educators

SBAR is seeking educators for virtual partnership

Available Fall 2021

Contact: Catie Brewer (NM)

Contact: Corey Knox (AZ)

Recruiting: 4-H Volunteers

SBAR is seeking community members as 4-H volunteers

Available Fall 2021

Contact: Laura Rodriguez-Uribe (NM)

Contact: Nick Morris (AZ)

USDA Plant Guide on Guayule

Available Spring 2021

Contact: Blase Evancho

SBAR Plant Guide on Guar

Available Spring 2021

Contact: John Idowu

SBAR Whole Farm Analysis Tool

for Evaluating the Adoption of Guayule and Guar into Your Current Operation

Available Spring 2021

Contact: Trent Teegerstrom

Contact Our Team

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Frannie Miller - New Mexico
4-H Contact
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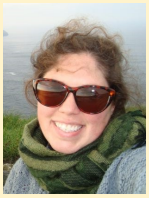

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We would love to hear from you!

Sign up for the SBAR List to receive our Newsletter and email updates. Email sbar-outreach@list.arizona.edu with SUBSCRIBE on the subject line.

Check out the SBAR website for more information, videos, publications and resources: https://sbar.arizona.edu

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