

ARKANSAS AGRICULTURE DEPARTMENT

Specialty Crop Block Grant Program

Award Number 15SCBGPAR0052

Final Report

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Project 1: Providing Technical Assistance to Increase the Use of Farm to School Practices

ACTIVITIES PERFORMED

Reporting Period: 9/30/15 – 11/1/18

Project Summary:

- Provide a background for the initial purpose of the project, which includes the specific issue, problem, or need that was addressed by this problem.
 - This project was written with the purpose of increasing Arkansas specialty crop sales to Arkansas public schools. Arkansas schools have food costs of over 100 million dollars per year, and a majority of this spending currently goes to markets outside of Arkansas (1). While specialty crop farmers in Arkansas are seeking expanded markets, there is a large demand for local food in schools that is going unfulfilled (2). Furthermore, in 2011, 9% of high school students in Arkansas reported that they did not consume fruit or 100% fruit juice during the 7 days before a survey. And 10.3% reported not consuming vegetables during the 7 days before a survey. The 2017 data show a worsening of consumption patterns with 12.9% reporting no fruit or 100% fruit juice within 7 days before the survey 14.6% reporting no vegetables within 7 days before the survey (3). This is a contributing factor in the current obesity epidemic and leads to morbidity and mortality for students later in life (4). Farm to school practices can help alleviate all of these problems by providing markets for specialty crop farmers, providing child nutrition programs with fresh quality produce and local agricultural connections, and increasing fruit and vegetable intake among students (5). This project sought to increase the use of farm to school practices in Arkansas by providing training and technical support to farmers and schools.
- Establish the motivation for this project by presenting the importance and timeliness of the project.
 - This project was timely because farmers were preparing to adapt to the new requirements of the Food Safety Modernization Act rules and regulations (6). Farms that receive USDA GAP training and certification will be more prepared when new FSMA requirements come into effect, and will increase the likelihood of selling their products to schools in the future, as more schools require food safety knowledge and certification from farmers.
- If the project built on a previously funded project with the SCBGP or SCBGP-FB describe how this project complimented and enhanced previously completed work.
 - This project was not built on a previously funded project.

Project Approach:

- Briefly summarize activities performed and tasks performed during the grant period. Whenever possible, describe the work accomplished in both quantitative and qualitative terms. Include the significant results, accomplishments, conclusions and recommendations. Include favorable or unusual developments.
 - The major activities and tasks performed during the grant period are as follows:
 - Four Level 1 Food Safety Trainings held
 - Level 1 trainings were held in four cities using a regional approach.
 - Agenda included local procurement, Food Safety Modernization Act, food liability, marketing and economics, Good Agricultural Practices, and food safety plans.
 - Classroom format was used.
 - Attendees included farmers/producers, Cooperative Extension professionals, food service professionals, teachers, state/agency representatives, nonprofit representatives, technical service providers, dietitians, farmers market managers, legislator liaisons, garden educators and nurses.
 - Dates, locations, and attendance:
 - November 4, 2016 – Benton County Extension Office, Bentonville, AR – 17 registered, 15 attended
 - November 7, 2016 – Arkansas State University, Reng Student Union, Jonesboro, AR – 29 registered, 25 attended
 - November 8, 2016 – Innovation Hub, North Little Rock, AR – 34 registered, 33 attended
 - November 9 – Southwest Research and Extension Center, Hope, AR – 15 registered, 13 attended
 - Results and accomplishments:
 - 83.9% (n=47) of responding attendees said that they gained new knowledge about purchasing local foods for school meal programs as a result of this training.
 - “Yes more ways to incorporate local into our bids and how to make our requests more user friendly for farmers too”
 - “What programs that are available for local farms and how to approach becoming a vendor”
 - 93.1% (n=54) of responding attendees said that as a result of the training they gained new knowledge about farm food safety.
 - “Learned more about GAP certs and what all it takes for school districts to purchase local foods-tricks and tools they can use to buy local”
 - “We currently practice food safety, but this class showed me a deeper insight into moving honing my safety program”

- 96.5% (n=55) of responding attendees said that they would recommend the training to a colleague.
- The following topics were cited by responding attendees as ones they would like additional training on:
 - 43.4% (n=23) Finding local producers / farmers
 - 41.5% (n=22) Local procurement rules / regulations
 - 41.5% (n=22) Food safety regulations
 - 28.3% (n=15) Menu planning using local foods
 - 45.3% (n=24) Promotions and outreach of farm to school programs
 - 41.5% (n=22) Developing school gardens
- Conclusions and recommendations:
 - The Level 1 Trainings were attended by farmers and school nutrition staff and it was difficult to adapt the content of the presentations in a way that did not focus on one group or the other. In the future breakout sessions for different stakeholder groups could be useful if the groups were brought back together to share what they had learned and ask questions of one another to facilitate relationship building and understanding.
 - Consistently throughout all Levels and types of trainings offered, attendees requested assistance with finding local producers/farmers, local procurement rules/regulations, food safety regulations, school gardens, and promoting farm to school. It is suggested that these topics and relevant information be shared with many different agencies and organizations working with farmers and learning institutions so that the information is available in a variety of formats from a variety of sources.
 - Offering trainings at various locations across the state seemed to be very helpful to attendees, especially those working in a school environment.
- Two Level 2 Food Safety Trainings held
 - Level 2 trainings were held in two cities serving the northern and southern parts of the state.
 - Agenda included developing an on-farm food safety plan, getting ready for a GAP audit, and farm to school market opportunities.
 - Classroom format was used with application-based activities to practice concepts discussed.
 - Speakers included the Arkansas Farm to School Core Partner and Cooperative Extension Agent with the Small Farms Program. The state USDA auditor was also in attendance and answered questions throughout the day.

- Attendees included farmers/producers, Cooperative Extension professionals, food service professionals, state/agency representatives, nonprofit representatives, and parents.
- Dates, locations, and attendance:
 - July 17, 2017 – University of Arkansas Extension Office, Little Rock, AR – 19 registered, 17 attended
 - July 24, 2017 – Baxter County Farm Bureau Office, Mountain Home, AR – 9 registered, 9 attended
- Results and accomplishments:
 - 81.8% (n=18) of responding attendees said that they gained new knowledge about purchasing local foods for school meal programs as a result of this training.
 - “I learned that there are many avenues we can go through and the kind of budget/price range schools can work with”
 - “I learned how to get into the business of selling to schools and also the standards that should be followed to do so”
 - 81.8% (n=18) of responding attendees said that as a result of the training they gained new knowledge about farm food safety.
 - “Audit process, GAP checklist, more details about Food Safety Plan”
 - “Comparison of food safety plans at farm and school kitchen allows for great confidence when encouraging F2S with CND’s”
 - 100.0% (n=23) of responding attendees said that they would recommend the training to a colleague.
 - The following topics were cited by responding attendees as ones they would like additional training on:
 - 11.8% (n=2) Finding local producers / farmers
 - 41.2% (n=7) Local procurement rules / regulations
 - 52.9% (n=9) Food safety regulations
 - 11.8% (n=2) Menu planning using local foods
 - 47.1% (n=8) Promotions and outreach of farm to school programs
 - 23.5% (n=4) Developing school gardens
- Conclusions and recommendations:
 - It was extremely difficult to find content experts in the state who could assist in the facilitation of this training for farmers. Project staff mostly had to teach themselves by using online resources and conversations with various Extension Agents and other industry experts. This is a knowledge gap within the state of Arkansas and many farmers will need assistance with completing their food safety plans and will struggle to find help.

An unlikely partnership occurred late in the grant period with Communities Unlimited in Memphis. They are value chain coordinators and had a grant funded position to assist farmers in getting GAP certified. This individual offered additional technical assistance to several farmers who attended the Food Safety Trainings through this grant.

- Several farmers thanked project staff for putting together an extensive binder of resources and materials for creating a food safety plan. This binder was created based on an existing binder from the Small Farms program at the University of Arkansas at Pine Bluff.
- Two USDA GAP auditors were present at both Level 2 trainings and were very helpful in answering questions related to the process and scoring of audits. It is recommended that they be invited to any trainings related to GAP certification.
- There is still so much uncertainty about rules and eligibility for GAP. There were farmers in attendance at the Level 2 workshop who ultimately weren't eligible to receive certification based on what they grew, so it is recommended that information regarding GAP and which products are covered be shared with various agencies and organizations that support farmers so that this information is available. The ineligible farmers mentioned that they still learned valuable information, but perhaps they would not have attended a full day training if they had known that they were ineligible. This also speaks to the lack of content experts in Arkansas regarding GAP.
- Two Level 3 Food Safety Trainings held
 - Level 3 trainings were held in two cities serving the northern and southern parts of the state.
 - Agenda included a farm and packinghouse tour, mock audits of both the farm and packinghouse, and food safety plan binder review and audit.
 - Trainings were held at farms with packinghouse operations and tours were given by the owner/operators. These tours were followed by mock audits of the farm and the packinghouse.
 - Speakers included the Arkansas Farm to School Core Partner and Cooperative Extension Agent with the Small Farms Program. The state USDA auditor was also in attendance and answered questions throughout the day.
 - Attendees included farmers/producers, food service professionals, state/agency representatives, nonprofit representatives and a horticulture consultant.
 - Dates, locations, and attendance:
 - August 14, 2017 – Caston Fruit, Onia, AR – 15 registered, 15 attended

- August 21, 2017 – D & S Produce, Pine Bluff, AR – 9 registered, 9 attended
- Results and accomplishments:
 - 64.7% (n=11) of responding attendees said that they gained new knowledge about purchasing local foods for school meal programs as a result of this training.
 - “DOD procurement process”
 - “I learned about the benefits and challenges of Global GAP”
 - 82.4% (n=14) of responding attendees said that as a result of the training they gained new knowledge about farm food safety.
 - “Paperwork, paperwork, paperwork, etc.”
 - “I did not realize how much fruit that is processed and not washed. I also learned that the drip irrigation under the dirt instead of above is better for safety”
 - 100.0% (n=18) of responding attendees said that they would recommend the training to a colleague.
 - The following topics were cited by responding attendees as ones they would like additional training on:
 - 47.1% (n=8) Finding local producers / farmers
 - 70.6% (n=12) Local procurement rules / regulations
 - 64.7% (n=11) Food safety regulations
 - 41.2% (n=7) Menu planning using local foods
 - 41.2% (n=7) Promotions and outreach of farm to school programs
 - 17.6% (n=3) Developing school gardens
- Conclusions and recommendations:
 - Meeting on the farm of two GAP certified farmers was especially helpful to attendees who were able to see a mock audit performed on an in-field harvest, as well as a packinghouse facility. Most of the Level 3 training was informal and occurred through conversation and question and answer. The experienced GAP farmers shared invaluable information with attendees regarding their experiences and tips and tricks for the process. It is recommended that GAP trainings include an on-farm component if at all possible.
 - Two USDA GAP auditors were present at both Level 3 trainings and were very helpful in answering questions related to the process and scoring of audits. It is recommended that they be invited to any trainings related to GAP certification.
- One 5-hour Local Procurement Training held
 - In order to reach a larger number of Child Nutrition Directors (CNDs) and nutrition staff members, a five-hour local procurement training was developed to be offered in conjunction with the timing of the annual

statewide summer training for CNDs offered by the Department of Education Child Nutrition Unit (ADE CNU). The ADE CNU promoted the local procurement training in their promotional materials and event registration was embedded within the summer training registration materials.

- Dates, locations, and attendance:
 - July 26, 2016 – Holiday Inn, Little Rock, AR – 70 registered, 62 attended
- Results and accomplishments:
 - Event evaluation:
 - 57 event evaluations were collected
 - 98.3% (n=56) of responding attendees either agreed or strongly agreed that the training was helpful
 - 80.7% (n=46) of responding attendees either agreed or strongly agreed that after attending the training they had a general understanding of farm to school.
 - 82.5% (n=47) of responding attendees either agreed or strongly agreed that they understood the benefits of farm to school.
 - 59.7% (n=34) of responding attendees either agreed or strongly agreed that after attending the training they understood the different types of procurement and how to use them to advance farm to school in their school or district.
 - 59.7% (n=34) of responding attendees either agreed or strongly agreed that they are aware of where to find local products.
 - 100.0% (n=57) of responding attendees reported that the training had increased their likelihood of using farm to school practices.
 - When asked “Which aspects of today’s training did you most like?”, respondents replied:
 - “The casual setting to ask questions and get info.”
 - “Talking with other CNDs to see what they are doing.”
 - “Farm to School 101 – How to set up bids, marketing and resources.”
 - “Group discussions.”
 - “There was a lot of information. This is the first time I’ve gotten information that explains it to where I can understand.”
 - “Better understanding of procurement methods for F2S. Better understanding of how to start.”

- “How to get more support from parents, teachers, and administration.”
- “I enjoyed the overall training. I learned a lot of good information. On how the program works.”
- “Learn how to get farmers, community and schools working together to better our children nutrition.”
- When asked “What aspects of today’s training did you find confusing or unclear?”, respondents replied:
 - “The slides were hard to read. Print was too small.”
 - “It was too much and not enough time.”
 - “Some of the procurement (a lot of info). Room was a little uncomfortable (seating crowded, boxed in).”
 - “The standards for farmers.”
 - “Procurement.”
 - “Writing bid spec seems complicated to me.”
 - “We are managed by a food management company, how do you get their procurement to match what you want to do.”
 - “Too much info to cover.”
 - “The pricing for the farmers.”
 - “The budgeting part.”
 - “I am with a management company so we have additional hoop to jump through, which will require additional help to get to the point of being able to actually call ourselves farm to school program.”
- Self-assessment data:
 - 49 self-assessment surveys were collected
 - 57.2% (n=28) of respondents answered “yes” or “yes, but need improvement or support” when asked if they are currently buying any products grown or produced in Arkansas.
 - 93.9% (n=46) of respondents answered “yes” or “yes, but need improvement or support” when asked if there are products that they currently use that could be replaced with an Arkansas product.

- 34.7% (n=17) of respondents answered “yes” or “yes, but need improvement or support” when asked if their distributor offers Arkansas products.
- 69.4% (n=34) of respondents said that they had not yet asked their prime vendor or produce distributor to inform them when Arkansas products are available.
- 81.6% (n=40) of respondents said they do not specify Arkansas products as part of their bidding process.
- 67.3% (n=37) of respondents said they do not currently purchase Arkansas products from a local farmer or producer.
- 75.5% (n=37) of respondents said they do not currently purchase Arkansas products from a local farmers market or food co-op.
- 89.8% (n=44) of respondents said they do not have a growing plan and contract with a farmer or orchard to produce specific items for their school meal program.
- When asked which of the following pieces of kitchen equipment they currently have, the following number responded “no” or “yes, but need more”:
 - 53% (n=26) Food Processor or Robot Coupe
 - 34.7% (n=17) Steamers or combination oven
 - 89.8% (n=44) Immersion food blender
 - 85.7% (n=42) Panini or clamshell grill
 - 16.3% (n=8) Knives and cutting boards
 - 6.1% (n=3) Mixers
- When asked which of the following would be the two most helpful pieces of equipment for processing fresh produce, respondents answered:
 - 65.3% (n=32) Food Processor or Robot Coupe
 - 38.8% (n=19) Steamers or combination oven
 - 20.4% (n=10) Immersion food blender
 - 8.2% (n=4) Panini or clamshell grill
 - 26.5% (n=13) Knives and cutting boards
 - 4.1% (n=2) Mixers
- When asked which of the following storage facilities they have, the following respondents answered “no” or “yes, but need more”:
 - 32.7% (n=16) Refrigerator/Cold storage
 - 24.5% (n=12) Freezer space
 - 18.4% (n=9) Dry storage
- When asked if they have the storage capacity to purchase more fresh products, 79.5% (n=39) of

- respondents answered “yes” or “yes, but need improvement or support”
 - When asked if they have the staff capacity to increase fresh produce processing, 59.2% (n=29) answered “yes” or “yes, but need improvement or support”
 - When asked if kitchen staff have enough time to cook meals from scratch, 93.8% (n=46) of respondents answered “yes” or “yes, but need more”
 - When asked if they know what products are available locally and when they are in season, 18.4% (n=9) of respondents answered “yes”, 44.9% (n=22) of respondents answered “no”, and 34.7% (n=17) of respondents answered “yes, but need more information”
 - When asked if they can adopt seasonal menus, 91.8% (n=45) of respondents answered “yes” or “yes, but need more information”
 - When asked if they can cycle menus for when local options are not available, 89.3% (n=44) of respondents answered “yes” or “yes, but need more information”
 - When asked if they have existing farm to school programs, 22.4% (n=11) of respondents answered “yes” or “yes, but need improvement or support”
- Pre and post self-efficacy data:
 - A total of 55 matched pre-post self-efficacy surveys were collected
 - 45 respondents had an overall higher self-efficacy score after attending the training, although 3 of those 45 left one to five questions unanswered in both the pre and post tests
 - 10 respondents had an overall lower self-efficacy score after attending the training, although 4 of the 10 left seven questions unanswered all in the post test
- Follow up self-efficacy data:
 - A link to a follow up self-efficacy survey instrument was sent via email to the attendees more than a year after the initial training.
 - 18 surveys were returned
 - When asked how confident they felt to buy any locally grown or locally produced food products (from Arkansas),
 - 11.1% (n=2) were not confident
 - 5.6% (n=1) were not very confident
 - 22.2% (n=4) were somewhat confident

- 44.4% (n=8) were confident
- 16.7% (n=3) were very confident
- When asked how confident they felt to replace current products with any Arkansas product,
 - 5.9% (n=1) were not confident
 - 23.5% (n=4) were not very confident
 - 29.4% (n=5) were somewhat confident
 - 35.3% (n=6) were confident
 - 5.9% (n=1) were very confident
- When asked how confident they felt to ask their prime vendor or produce distributor to inform them when Arkansas products are available,
 - 0.0% (n=0) were not confident
 - 0.0% (n=0) were not very confident
 - 38.9% (n=7) were somewhat confident
 - 27.8% (n=5) were confident
 - 33.3% (n=6) were very confident
- When asked how confident they felt to specify Arkansas products in their bidding process,
 - 0.0% (n=0) were not confident
 - 22.2% (n=4) were not very confident
 - 27.8% (n=5) were somewhat confident
 - 33.3% (n=6) were confident
 - 16.7% (n=3) were very confident
- When asked how confident they felt to increase storage capacity for local produce if needed,
 - 5.6% (n=1) were not confident
 - 27.8% (n=5) were not very confident
 - 27.8% (n=5) were somewhat confident
 - 27.8% (n=5) were confident
 - 11.1% (n=2) were very confident
- When asked how confident they felt to have trained staff available to process more fresh products,
 - 0.0% (n=0) were not confident
 - 0.0% (n=0) were not very confident
 - 50.0% (n=9) were somewhat confident
 - 27.8% (n=5) were confident
 - 22.2% (n=4) were very confident
- When asked how confident they felt to know what products are available locally and when they are in season,
 - 5.6% (n=1) were not confident
 - 11.1% (n=2) were not very confident

- 33.3% (n=6) were somewhat confident
- 44.4% (n=8) were confident
- 5.6% (n=1) were very confident
- When asked how confident they felt to adopt seasonal menus,
 - 0.0% (n=0) were not confident
 - 16.7% (n=3) were not very confident
 - 33.3% (n=6) were somewhat confident
 - 33.3% (n=6) were confident
 - 16.7% (n=3) were very confident
- When asked how confident they felt to educate administrators about why they should support farm to school programs,
 - 5.6% (n=1) were not confident
 - 11.1% (n=2) were not very confident
 - 33.3% (n=6) were somewhat confident
 - 27.8% (n=5) were confident
 - 22.2% (n=4) were very confident
- 50.0% (n=6) of respondents stated that they purchased locally grown or locally produced food products (from Arkansas) during the 2015-2016 school year.
 - When asked how much they spent on locally grown or locally produced food products (from Arkansas) during the 2015-2016 school year,
 - 13 did not respond, 2 were unsure, and remainder of responses were: \$5,000 est., \$5500, and \$8000.
 - When asked how many pounds of locally grown or locally produced food products (from Arkansas) were purchased during the 2015-2016 school year,
 - 14 did not respond, 3 were unsure, and 1 responded 7500 pounds.
- 66.7% (n=8) of respondents stated that they purchased locally grown or locally produced food products (from Arkansas) during the 2016-2017 school year.
 - When asked how much they spent on locally grown or locally produced food products (from Arkansas) during the 2016-2017 school year,
 - 10 did not respond, 1 was unsure, and the remainder of responses were: \$200, <\$250, \$1000, \$2500, \$6500, \$7000 est., and \$25000.

- expansion of farm to school activities in individual schools and entire districts.
 - In the future it is advisable to send the follow-up survey email sooner rather than later to attendees. Also, periodic contact with attendees over the following year reminding them that there will be a follow up survey might have improved the response rate.
- One 1-hour Local Procurement Training held
 - A condensed 1-hour version of the full local procurement training was offered at the De Queen / Mena Educational Co-op to a group of Food Service Professionals from three districts.
 - 29 individuals were in attendance at this event
 - No evaluation data was collected from this group of attendees
 - Self-assessment data:
 - 18 self-assessment surveys were collected
 - 22.3% (n=4) of respondents answered “yes” or “yes, but need improvement or support” when asked if they are currently buying any products grown or produced in Arkansas.
 - 72.3% (n=13) of respondents answered “yes” or “yes, but need improvement or support” when asked if there are products that they currently use that could be replaced with an Arkansas product.
 - 27.8% (n=5) of respondents answered “yes” or “yes, but need improvement or support” when asked if their distributor offers Arkansas products.
 - 22.2% (n=4) of respondents said that they had not yet asked their prime vendor or produce distributor to inform them when Arkansas products are available.
 - 72.2% (n=13) of respondents said they do not specify Arkansas products as part of their bidding process.
 - 83.3% (n=15) of respondents said they do not currently purchase Arkansas products from a local farmer or producer.
 - 83.3% (n=15) of respondents said they do not currently purchase Arkansas products from a local farmers market or food co-op.
 - 88.9% (n=16) of respondents said they do not have a growing plan and contract with a farmer or orchard to produce specific items for their school meal program.
 - When asked which of the following pieces of kitchen equipment they currently have, the following number responded “no” or “yes, but need more”:
 - 88.9% (n=16) Food Processor or Robot Coupe

- 55.6% (n=10) Steamers or combination oven
 - 100.0% (n=18) Immersion food blender
 - 100.0% (n=18) Panini or clamshell grill
 - 5.6% (n=1) Knives and cutting boards
 - 5.6% (n=1) Mixers
- When asked which of the following would be the two most helpful pieces of equipment for processing fresh produce, respondents answered:
 - 22.2% (n=4) Food Processor or Robot Coupe
 - 61.1% (n=11) Steamers or combination oven
 - 5.6% (n=1) Immersion food blender
 - 0.0% (n=0) Panini or clamshell grill
 - 33.3% (n=6) Knives and cutting boards
 - 22.2% (n=4) Mixers
 - When asked which of the following storage facilities they have, the following respondents answered “no” or “yes, but need more”:
 - 11.2% (n=2) Refrigerator/Cold storage
 - 16.7% (n=3) Freezer space
 - 11.2% (n=2) Dry storage
 - When asked if they have the storage capacity to purchase more fresh products, 38.9% (n=7) of respondents answered “yes” or “yes, but need improvement or support”.
 - When asked if they have the staff capacity to increase fresh produce processing, 11.1% (n=2) answered “yes” or “yes, but need improvement or support”.
 - When asked if kitchen staff have enough time to cook meals from scratch, 22.3% (n=4) of respondents answered “yes” or “yes, but need more”.
 - When asked if they know what products are available locally and when they are in season, 5.6% (n=1) of respondents answered “yes”, 88.9% (n=16) of respondents answered “no”, and 0.0% (n=0) of respondents answered “yes, but need more information”.
 - When asked if they can adopt seasonal menus, 44.5% (n=8) of respondents answered “yes” or “yes, but need more information”.
 - When asked if they can cycle menus for when local options are not available, 50.0% (n=9) of respondents answered “yes” or “yes, but need more information”.

- When asked if they have existing farm to school programs, 5.6% (n=1) of respondents answered “yes” or “yes, but need improvement or support”.
 - Pre and post self-efficacy data:
 - A total of 28 matched pre-post self-efficacy surveys were collected
 - 14 respondents had an overall higher self-efficacy score after attending the training, although 4 of the 14 left one or two questions unanswered mostly in the pre-test
 - 4 respondents had no change in their self-efficacy score after attending the training
 - 10 respondents had an overall lower self-efficacy score after attending the training, although 4 of the 10 left one to seven questions unanswered mostly in the post test
 - No follow-up self-efficacy data was collected from this group of attendees
 - Conclusions and recommendations:
 - It appears that this particular group of attendees are staff in districts with a much different overall capacity for farm to school activities than that of the statewide training attendees. It is recommended that the self-assessment tool be used in an ongoing manner to continually assist schools with developing farm to school plans for their districts that reflect the realities that exist in their particular situations.
 - The creation of an educational resource for schools and districts that are under-resourced could be helpful to those schools who have a diminished capacity to participate in farm to school for a variety of factors, such as old or non-existent kitchen equipment, poor staff training, low staff interest, low levels of farm to school knowledge, or undeveloped relationships with teachers, administration or community.
 - Nine Arkansas Grown memberships purchased for Arkansas farmers
 - In an effort to assist Arkansas growers with promotion and marketing of their businesses, one-year Silver-level Arkansas Grown memberships were purchased for interested, eligible farmers.
 - Three USDA GAP audits reimbursed for Arkansas farmers
 - After attending one or more of the food safety trainings provided through this grant mechanism, farmers were able to be reimbursed if they received a USDA GAP audit for one or more crops.
 - Additionally, project staff will continue to work with the three newly certified farms to connect them with institutional buyers (via website, social media, email blasts, and possibly farm tours) to ensure that their

products are being purchased and served in school meal programs across the state of Arkansas.

- Conclusions and recommendations:
 - It was surprising to project staff that in the end, only three farmers were able to receive GAP certification. There appear to be numerous barriers for farmers for attaining the certification. These barriers include a lack of capacity to take on the paperwork load, lack of helpful one-on-one technical assistance for writing a food safety plan, burdensome financial investment for a not-guaranteed increase in sales, among others. It is recommended that the barriers to certification be studied thoroughly and then solutions be developed for each to increase the likelihood that farmers can receive this certification and be connected to the existing value chain through distributors, processors and manufacturers.
 - Farmers who were audited were very thankful for the financial support to get through the process for their first year. It is recommended that a grant program be developed for farmers to receive reimbursement for their first GAP audit. This would reduce one of the barriers for farmers receiving their certification.
 - There is a very real need to offer more one-on-one technical assistance to farmers in writing their food safety plans, in addition to providing training, resources and templates. This would address one of the barriers for farmers receiving their certification.
- Present the significant contributions and role of project partners in the project.
 - The ADE CNU was a huge partner in the CND procurement training. They promoted the procurement training to all CNDs in the state of Arkansas, as well as allowed our registration to be handled through the Visitor and Conventions Bureau alongside their registration process.
 - The Wallace Center at Winrock was a Level 1 Food Safety Training partner through event planning, paying for event space, as well as the speaker fees for our consultant. They also handled color printing of training materials and were involved in facilitating the Level 1 trainings.
 - The University of Arkansas – Division of Agriculture Cooperative Extension Service was another Level 1 Food Safety Training partner through identification of agents to act as topic experts and speakers at events, assisting with event space, providing resources and information, and donating equipment and materials for the events. Additionally, Extension was involved during Level Two and Three through acting as topic experts and speakers at events, identifying farmers who have successfully navigated the audit process to speak to attendees, and identifying farms willing to host attendees for on-farm mock audits.

- Stephan Walker of the University of Arkansas at Pine Bluff Small Farms Program was another great partner on this project. Stephan served as an advisor to and facilitator at all of the Level 2 and 3 trainings.
- John Lansdale and Tammy Winsor of the Arkansas State Plant Board were also critical in providing information regarding the audit process at all of the Level 2 and 3 trainings and were always available to answer questions from project staff.
- Farmers Robert Caston of Caston Fruits in Onia, AR and Ester Doolittle of D & S Produce in Pine Bluff, AR played a critical role in allowing the Level 3 trainings to be held at their farms and packinghouses. The ability of farmers to meet at working farms and packinghouses, while discussing and learning about the audit process was crucial. Real world examples brought the concepts to life and both Robert and Ester were available for the entire day to answer questions about their experiences with the audit process.
- The Arkansas Agriculture Department was a continuous partner throughout the project and were always available to answer questions and provide guidance to project staff.
- Explain how project insured that only specialty crops benefited if overall scope of project benefited commodities.
 - Although any farmer was invited to attend any of the Food Safety trainings, due to the specific nature of GAP covering mostly fruits and vegetables through the certification process, the audit reimbursements and Arkansas Grown memberships were made available to farmers growing specialty crops that can be offered to learning institutions offering federally reimbursable school meals.

Goals and Outcomes Achieved

- Include the activities that were completed in order to achieve the performance goals and measurable outcomes for the project.
 - Goal 1: Provide up to a total of 8 USDA GAP trainings for Arkansas specialty crop farmers.
 - Four Level 1 trainings, two Level 2 trainings, and 2 Level 3 trainings were held.
 - Goal 1 Performance Measures:
 - Number of Arkansas farms completing GAP certification
 - 3 farms completed and passed the GAP certification process.
 - Number of GAP certified farms supplying Arkansas schools with product
 - The list of USDA GAP certified farms is constantly changing. Three of the farms that were on the list when project staff called and spoke to everyone on the list are now off of the list, and there are now four new farms on the list. Based on what project staff knows at time of report submission is as follows: There are 13 farms currently on the list and one more farm certified through this grant mechanism has been informed they have passed, but they are not yet on the list on the USDA website. If we count that farm there are 14 farms, 3 of which were certified through this grant mechanism. Of those 14 farms: 7 have not sold to schools but are interested in doing so, 1 has not sold to schools and is not interested in doing so, 2 have sold to schools, and 4 are unable to be determined at this time.

- 11 did not respond, 3 were unsure, and the remainder of responses were: <100 lbs., 100, 1600, and 7800.
- Goal 2: Provide up to a total of 8 USDA GAP trainings for Arkansas specialty crop farmers.
 - 1 5-hour Local Procurement training and 1 1-hour Local Procurement training were held.
- Goal 2 Performance Measures:
 - Improvement in child nutrition director confidence in their ability to purchase Arkansas grown produce for their school meals program
 - Pre and post self-efficacy data:
 - A total of 55 matched pre-post self-efficacy surveys were collected from attendees of the 5-hour Local Procurement training
 - 23 of 55 respondents had a higher self-efficacy score related to buying locally grown or locally produced products from Arkansas after attending the training
 - 27 of 55 respondents had no change in their self-efficacy score related to buying locally grown or locally produced products from Arkansas after attending the training
 - 5 of 55 respondents had a lower self-efficacy score related to buying locally grown or locally produced products from Arkansas after attending the training
 - A total of 28 matched pre-post self-efficacy surveys were collected from attendees of the 1-hour Local Procurement training
 - 7 of 28 respondents had a higher self-efficacy score related to buying locally grown or locally produced products from Arkansas after attending the training
 - 16 of 28 respondents had no change in their self-efficacy score related to buying locally grown or locally produced products from Arkansas after attending the training
 - 5 of 28 respondents had a lower self-efficacy score related to buying locally grown or locally produced products from Arkansas after attending the training

- Follow up self-efficacy data:
 - A link to a follow up self-efficacy survey instrument was sent via email to the attendees more than a year after the initial 5-hour Local Procurement training.
 - 18 surveys were returned
 - When asked how confident they felt to buy any locally grown or locally produced food products (from Arkansas),
 - 11.1% (n=2) were not confident
 - 5.6% (n=1) were not very confident
 - 22.2% (n=4) were somewhat confident
 - 44.4% (n=8) were confident
 - 16.7% (n=3) were very confident
- Number of schools purchasing Arkansas grown produce
 - This metric continues to be difficult to capture.
 - 57.2% (n=28) of respondents who attended the 5-hour Local Procurement training answered “yes” or “yes, but need improvement or support” when asked if they are currently buying any products grown or produced in Arkansas.
 - 22.3% (n=4) of respondents who attended the 1-hour Local Procurement training answered “yes” or “yes, but need improvement or support” when asked if they are currently buying any products grown or produced in Arkansas.
 - The following data comes from a follow up self-efficacy survey completed by a small number of attendees from the 5-hour Local Procurement training. However, there is a small increase between the number that purchased locally in 2015-2016 and those that did so in 2016-2017. This is another reminder about the lack of an accurate and thorough reporting system by which this information can be collected and reported.
 - 50.0% (n=6) of respondents stated that they purchased locally grown or locally produced food products (from Arkansas) during the 2015-2016 school year.
 - 66.7% (n=8) of respondents stated that they purchased locally grown or locally produced food products (from Arkansas) during the 2016-2017 school year.
- Amount of Arkansas grown produce (dollars and lbs.) purchased by schools
 - This metric continues to be difficult to capture. The only data we have comes from a follow up self-efficacy survey completed by a small number of attendees from the 5-hour Local Procurement training. However, there is a small increase between the amount that was purchased locally in 2015-2016 and amount purchased in 2016-2017. This is another reminder about the lack of an accurate and thorough

reporting system by which this information can be collected and reported.

- 50.0% (n=6) of respondents stated that they purchased locally grown or locally produced food products (from Arkansas) during the 2015-2016 school year.
 - When asked how much they spent on locally grown or locally produced food products (from Arkansas) during the 2015-2016 school year,
 - 13 did not respond, 2 were unsure, and remainder of responses were: \$5,000 est., \$5500, and \$8000.
 - When asked how many pounds of locally grown or locally produced food products (from Arkansas) were purchased during the 2015-2016 school year,
 - 14 did not respond, 3 were unsure, and 1 responded 7500 pounds.
- 66.7% (n=8) of respondents stated that they purchased locally grown or locally produced food products (from Arkansas) during the 2016-2017 school year.
 - When asked how much they spent on locally grown or locally produced food products (from Arkansas) during the 2016-2017 school year,
 - 10 did not respond, 1 was unsure, and the remainder of responses were: \$200, <\$250, \$1000, \$2500, \$6500, \$7000 est., and \$25000.
 - When asked how many pounds of locally grown or locally produced food products (from Arkansas) were purchased during the 2016-2017 school year,
 - 11 did not respond, 3 were unsure, and the remainder of responses were: <100 lbs., 100, 1600, and 7800.
- If outcome measures were long term, summarize the progress that has been made towards achievement.
 - While the goals and performance measures for this project were mostly time bound to the several years of the grant period, a good foundation was laid and progress made toward educating farmers and nutrition professionals about how to increase the use of locally produced products in school meals. Additionally, through the information collected from various instruments and conversations with participants, a clearer picture of the existing barriers has formed, which will assist in crafting solutions.
- Provide a comparison of actual accomplishments with the goals established for the reporting period.
 - The goal was to train 40 farmers through the trainings and a total of 42 attended and were trained at the Level 1, Level 2 and Level 3 trainings.

- It was posited that there would be a net increase of \$120,000 in sales over two years spread among the 40 farmers trained. This information was not collected in any way, so it is unable to be determined.
- The goal was to train 45 child nutrition staff through trainings and 91 attended and were trained at two different events.
- It was posited that there would be a net increase of \$180,000 in sales over two years spread among the 45 schools represented at trainings. The information collected regarding this particular metric was incomplete and therefore cannot be determined.
- Clearly convey completion of achieving outcomes by illustrating baseline data that has been gathered to date.
 - Each of the outcomes has been achieved at time of reporting and data regarding the current realities of farmers and child nutrition staff collected and reported. Data has been collected related to the:
 - number of GAP certified farms in Arkansas
 - number of GAP certified farms selling to schools
 - change in knowledge of food safety based on training attendance
 - limited info on the amount of Arkansas grown produce purchased by schools
 - change in confidence of child nutrition directors in their ability to purchase Arkansas grown produce for their school meal programs
 - limited info on the number of schools purchasing Arkansas grown produce
- Highlight successful outcomes of the project in quantifiable terms.
 - Three farmers are now GAP certified that were not prior to this project.
 - Nine Arkansas farms are now utilizing the Arkansas Grown membership that were not prior to this project.
 - 86 individuals were trained at the Level 1 Food Safety training events.
 - 26 individuals were trained at the Level 2 Food Safety training events
 - 24 individuals were trained at the Level 3 Food Safety training events
 - 91 individuals were trained on Local Procurement between two events

Beneficiaries

- Provide a description of the groups and other operations that benefited from the completion of this project's accomplishments.
 - Arkansas farmers benefited from this project through the receipt of food safety and local procurement information and resources, as well as through the likelihood of an increase in sales to child learning facilities.
 - Arkansas nutrition professionals benefited from this project through the receipt of food safety and local procurement information and resources, as well as through the likelihood of an increase in sales from Arkansas farmers.
 - Arkansas children benefited from this project through the buyer/seller relationships developed at the trainings, as well as an increased likelihood that local, seasonal products will be purchased and served through school meal programs.
- Clearly state the quantitative data that concerns the beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project.

- The goal was to train 40 farmers through the trainings and a total of 42 attended Level 1, Level 2 and Level 3 trainings.
- It was posited that there would be a net increase of \$120,000 in sales over two years spread among the 40 farmers trained. This information was not collected in any way, so it is unable to be determined.
- Three farmers are now GAP certified that were not prior to this project. This certification gives them access to the portion of the value chain that requires it in order to purchase from them.
- Nine Arkansas farms are now utilizing the Arkansas Grown membership that were not prior to this project. This membership increases the visibility of these farms and should help customers identify their products as being Arkansas Grown.
- The goal was to train 45 child nutrition staff through trainings and 91 attended two different events.
- It was posited that there would be a net increase of \$180,000 in sales over two years spread among the 45 schools represented at trainings. The information collected regarding this particular metric was incomplete and therefore cannot be determined.
- Please give number of beneficiaries affected by project's accomplishments.
 - Approximately 200 individuals were trained through this project and tens of thousands of school children are served by the nutrition professionals and farmers who attended the trainings.

Lessons Learned

- Offer insights into the lessons learned by the project staff as a result of completing this project. This section is meant to illustrate the positive and negative results and conclusions for the project.
 - Conclusions and recommendations are embedded within the Project Approach section of each major deliverable. The following lessons learned are distilled from those already mentioned.
 - Content expertise related to third party audits is scarce in the state and should be strengthened.
 - Additional technical assistance and resources are needed to help farmers and customers find one another. This consistently ranks high on the needs list whenever attendees are asked.
 - Additional technical assistance and resources are needed to help farmers and nutrition professionals understand procurement rules and regulations.
 - Whenever possible hold multiple trainings at multiple locations across the state and take the planting, harvesting and school calendars into consideration.
 - Hosting on-farm mock audits at certified farms was helpful to farmers interested in pursuing the certification and is suggested for future trainings.
 - Involving GAP auditors in the trainings was especially helpful to farmers and project staff.
 - Utilizing existing practitioners to share their successes and lessons learned with peers is a highly effective teaching method. This should be included in trainings whenever possible.

- The information presented in the trainings was valuable and helpful to attendees. This highlights the need for continued training and sharing of similar information, which will help keep confidence levels high among practitioners over time.
 - There is no current system in place for reporting the sale or purchase of local foods by schools and other child learning facilities. Determining a consistent and credible way for districts to track and report their local purchases monthly or annually would be a huge asset to capturing the economic impact of farm to school procurement in Arkansas.
 - It was surprising to project staff that in the end, only three farmers were able to receive GAP certification. There appear to be numerous barriers for farmers for attaining the certification. These barriers include a lack of capacity to take on the paperwork load, lack of helpful one-on-one technical assistance for writing a food safety plan, burdensome financial investment for a not-guaranteed increase in sales, among others. It is recommended that the barriers to certification be studied thoroughly and then solutions be developed for each to increase the likelihood that farmers can receive this certification and be connected to the existing value chain through distributors, processors and manufacturers.
- Provide unexpected outcomes or results that were an effect of implementing this project.
 - The most unexpected outcome of this project was the limited number of farmers who ultimately received GAP certification. Project staff anticipated that a much higher number of farmers would receive this certification. This highlights the extensive barriers that exist in this process and the wide range of capacities of individual farms.
- If goals or outcome measures were not achieved, identify and share the lessons learned to help others expedite problem-solving.
 - While all outcome measures were achieved, there were some that were more difficult to track.
 - There continues to be a lack of data on the amount of Arkansas produce purchased (dollars and pounds) by schools. It is highly recommended that a tracking system be developed and managed by an agency or organization that could collect and report this information in a meaningful way, in order to more fully tell the story of the economic impact of farm to school on the overall economy of Arkansas.

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Additional Information

- Provide additional information available (i.e. publications, websites, photographs) that is not applicable to any of the prior sections.
 - None at this time.

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Project 2: Identifying Attributes of Arkansas Fresh-Market Blackberries that Impact Marketability

Final Report

Blackberry plants (*Rubus subgenus Rubus*) produce nutraceutical-rich, fresh-market fruit with potential for an increased role in commercial markets due to consumers' increasing demand for locally grown, healthy foods. The introduction of new blackberry genotypes (cultivars and advanced non-released selections) with shipping-quality fruit can expand the role of blackberries in fresh-market fruit production in the United States. The University of Arkansas System Division of Agriculture fruit breeding program is one of the main public breeding programs in the United States and has released many blackberry cultivars, including fresh-market cultivars that can expand seasonal availability. The University of Arkansas has patents on many cultivars of blackberries, but released the first primocane-fruited blackberry cultivar in 2004. Blackberries typically produce fruit on the second-year canes (floricanes), requiring canes to be overwintered to produce a crop. However, primocane fruited blackberry plants can bear fruit on current-season canes (primocanes). Thus, primocane-fruited blackberry cultivars can produce two cropping seasons, one during the summer on floricanes and the other during midsummer to fall on primocanes. Primocane fruiting has contributed to the expansion of blackberry production and can improve the availability of fresh-market blackberries worldwide. The marketing potential and consumer preferences of new genotypes needs to be defined so that growers in Arkansas and other regions can compete in U.S. fresh-market blackberry production. This project from the University of Arkansas was a collaborative approach to address challenges that face the blackberry industry

ACTIVITIES PERFORMED

1. Evaluate physiochemical attributes of fresh-market blackberries

Measure physical attributes, composition attributes, and nutraceutical attributes of fresh-market blackberries

2. Identify consumer-driven sensory attributes of fresh-market blackberries

Conduct descriptive sensory analysis and perform online consumer surveys to determine key sensory characteristics of consumers of fresh-market blackberries

3. Disseminate information to fresh-market blackberry industries

Provide the blackberry industry with information on attributes that drive marketability for fresh-market blackberries and host a workshop entitled "Blackberries: Farm to Table"

Data generated from the proposed work will establish potential uses of fresh-market blackberry genotypes by identifying attributes that impact marketability. This project was built on data from two previous Specialty Crop Block Grant Proposals (2013 and 2014) on fresh-market blackberries.

Fresh-market blackberries were harvested for this project from the University of Arkansas Fruit Research Station (FRS), Clarksville in June 2016 and FRS and a commercial grower in June 2017. After harvest, the fruit was taken to the Department of Food Science, University of Arkansas, Fayetteville for evaluation of physiochemical and sensory attributes. The work on the project was done by Dr. Segantini (January 2016 to August 2016), Mayla Rocha (May to July 2016), Molly Felts (January 2017 to September 2018), and Aubrey Dunteman (August 2016 to September 2018).

The project timeline for the evaluation of fresh-market blackberries was January 2016-September 2018. The timeline for the project is listed below with the steps for each objective of the project. The project was supervised by the Project Director, Dr. Renee Threlfall, Principal Investigators, Dr. John Clark and Dr. Luke Howard from the University of Arkansas. In addition, the work for the project was done by post-doctoral personnel, Dr. Daniela Segantini (Departamento de Horticultura, Produção Vegetal, Universidade Estadual Paulista/UNESP, Botucatu, SP, Brasil), Molly Felts, (University of Arkansas Food Science Department Masters Graduate Student), Mayla Rocha (Undergraduate Exchange Student Brazilian Scientific Mobility Program), and Aubrey Dunteman (University of Arkansas Food Science Department Undergraduate Honors student).

This project resulted in the first publication showing a comparison of fresh-market blackberries harvested from floricanes and primocanes from a primocane-fruiting plant and expanded knowledge for this new type of blackberry. **This is important because the University of Arkansas was the first to release the primocane-fruiting cultivars.** This project had the only consumer online surveys that just focused on consumer perceptions of fresh-market blackberries, with 879 consumers participating in the survey. **This is important because the consumer's perceptions will ultimately drive the breeding efforts for commercial fresh-market blackberries.** The data generated from this Specialty Crop Block Grant project (2015) and previous projects (2013 and 2014) on Arkansas-grown, fresh-market blackberries, provided data that will create more output during the next few years. **There will be a publication using three years of descriptive sensory and physiochemical data and another publication for the online consumer survey that will both be the first of that kind in print.** This research was important, but year-to-year differences can impact variables in this type of research, indicating that environmental effects can be substantial and growers should be aware of this influence. Evaluation of quality fresh-market blackberry properties should continue in Arkansas and other locations would be valuable, particularly from areas where commercial blackberry production is established.

There were significant contributions between our project partners. This project was done as a collaborative effort between the Institute of Food Science and Engineering, Food Science Department and Horticulture Department at the University of Arkansas Systems Division of Agriculture. Dr. Renee Threlfall, PI for the project, designed and implemented this study working with Dr. John Clark and Dr. Luke Howard. Drs. Clark and Threlfall supervised the Horticulture Department post doctoral associate, Dr. Daniela Segantini. Dr. Segantini's work was sponsored by Departamento de Horticultura, Produção Vegetal, Universidade Estadual Paulista/UNESP,

Botucatu, SP, Brasil (Note: Dr. Segantini was financially sponsored by the CAPES Foundation, Brazil to work on this project for 1 year, Feb 15, 2015 to Feb. 14, 2016 and then sponsored by the University of Arkansas from Feb. 15, 2016 to Aug. 15, 2018). Dr. Threlfall worked with Dr. Segantini on the data analysis for presentations, posters and publications of the 2013, 2014 and 2015 Arkansas Agriculture Department Specialty Crop Block Grants funded for fresh-market blackberries. The role of the project partners was as follows:

Dr. Renee Threlfall served as the Principal Investigator for the research, managed the funds, created the project design, coauthored the publication, presented invited talks, posters and presentations from data from this project, and supervised the post-doctoral and other students working on the project.

Dr. John R. Clark contributed to the project by selecting the cultivars and advanced selections, providing input on the harvest dates, and coauthoring the publication, presentations and posters.

Dr. Luke Howard contributed to the project assisting with methods for phytochemical analysis, interpreting data and coauthoring the publication, presentations and posters from this project.

Dr. Daniela Segantini managed the research for part of this project in 2016 and 2017, was the lead author of the publications, and presented posters and presentations from data from this project.

Cindi Brownmiller, Dr. Howard's research technician, worked with the post doc and other students to complete the nutraceutical analysis.

Molly Felts, a M.S candidate in the Department of Food Science, worked on this project as part of her thesis titled "*Postharvest Physiochemical Analysis and Nutraceutical Evaluation of Arkansas Grown Blackberries, Peaches, Table Grapes, and Muscadine Grapes*" in 2017 and 2018.

Aubrey Dunteman, an Undergraduate Honors Student in the Department of Food Science, worked on this project as part of her honor thesis titled *Identifying Consumer Perceptions of Fresh-Market Blackberries* in 2016-2017.

Mayla De Almeida Rocha, from the Brazilian Scientific Mobility Program (BSMP) Student Research Internship, worked on this project for her research on *Determining How Sweetness and Sourness Impact Sensory of Fresh-Market Blackberries* in 2016.

This project only focused on fresh-market blackberries as a specialty crop, with emphasis on Arkansas-grown blackberries, and provided three years of data on physiochemical and sensory for future presentations and publications.

PERFORMANCE GOALS AND OUTCOMES ACHIEVED

Overview of Activities:

Blackberry plants (*Rubus subgenus Rubus*) produce nutraceutical-rich, fresh-market fruit with potential for an increased role in commercial markets due to consumers' increasing demand for locally grown, healthy foods. The introduction of new blackberry genotypes (cultivars and advanced non-released selections) with shipping-quality fruit and primocane-fruiting capability

can expand the role of blackberries in fresh-market fruit production in the United States. The University of Arkansas fruit breeding program is one of the main public breeding programs in the United States and has released many blackberry cultivars, including fresh-market cultivars that can expand seasonal availability. The marketing potential and consumer preferences of new genotypes needs to be defined so that growers in Arkansas and other regions can compete in U.S. fresh-market blackberry production. This proposal from the University of Arkansas offered a collaborative approach to address challenges that face the blackberry industry, by identifying postharvest through the following objectives:

1. Evaluate physiochemical attributes of fresh-market blackberries

Measure physical attributes, composition attributes, and nutraceutical attributes of fresh-market blackberries

2. Identify consumer-driven sensory attributes of fresh-market blackberries

Conduct descriptive sensory analysis and perform online consumer surveys to determine key sensory characteristics of consumers of fresh-market blackberries

3. Disseminate information to fresh-market blackberry industries

Provide the blackberry industry with information on attributes that drive marketability for fresh-market blackberries and host a workshop entitled “Blackberries: Farm to Table”

Data generated from the proposed work established potential uses of fresh-market blackberry genotypes by identifying attributes that impact marketability.

WORK ACCOMPLISHED

The data was collected for the Arkansas-grown blackberry genotypes for physiochemical and sensory attributes.

Objective 1. Evaluate physiochemical attributes of fresh-market blackberries

Measure berry attributes, pyrene attributes, composition, and nutraceutical attributes of fresh-market blackberry genotypes in 2016 and 2017. Evaluations for physiochemical attributes of the blackberries were done at the Department of Food Science, University of Arkansas, Fayetteville. Attributes varied by year, but some genotypes had consistent marketable attributes.

Berry and Pyrene Analysis: The berry and pyrene attributes (berry weight, berry length, berry width, drupelets/berry, pyrene weight/berry, and pyrenes/berry) of fresh-market blackberry genotypes were measured. The berry and pyrene attributes of the blackberries varied significantly by genotype, particularly size attributes.

Composition Analysis: The composition attributes (soluble solids, pH, titratable acidity, soluble solids/titratable acidity ratio, acids, and sugars) of fresh-market blackberry genotypes were measured. Composition values at harvest were within a commercially acceptable range for fresh blackberries.

Nutraceutical Analysis: The nutraceutical attributes (total ellagitannins, total phenolics, total flavonols, and total anthocyanins) of fresh-market blackberry genotypes were measured.

Objective 2. Identify consumer-driven sensory attributes of fresh-market blackberries

Conduct descriptive analysis to determine key sensory characteristics of fresh-market blackberry genotypes

Descriptive Sensory Analysis: Descriptive sensory analysis of the 11 fresh-market blackberry genotypes was conducted at the Sensory Research and Consumer Center in the Food Science Department at the University of Arkansas in 2016. Five cultivars (Natchez, Osage, Ouachita, Prime Ark® 45, and Prime Ark® Traveler) and 6 advanced selections evaluated. The descriptive panelists (n=9) used the fresh-market blackberry lexicon (sensory terms for blackberries) developed in 2014 to scale the attributes for the samples. The panelists were trained to use to a modified Sensory Spectrum® method, an objective method for describing the intensity of attributes in products using references for the attributes. The descriptive panel identified fresh blackberry attributes for appearance (n=8), basic tastes (n=3), feeling factors (n=2), aromatics (n=8), texture (n=7) and uniformity of sample (n=2) and evaluated those attributes using a 15-point scale.

- **Appearance attributes.** The appearance attributes of the blackberries evaluated included color, uniformity of color, size of berry, size of drupelets, uniformity of drupelets, amount of styles, amount of blemishes and glossiness. The color of the blackberries was scored in the black range. ‘Natchez’ was the largest berry and A-2453 the smallest. The descriptive panel identified A-2453 as the glossiest berry.
- **Basic tastes.** The panelists evaluated the basic tastes (sweet, sour and bitter) of the blackberries. A-2491 was rated as the most sweet and ‘Osage’ as the most sour.
- **Feeling factors.** The panelists evaluated the feeling factors (astringent and metallic) of the blackberries and found no differences among the genotypes for the metallic feeling factor, but A-2491 was the least astringent and A-2450 the most.
- **Aromatic attributes.** The aromatic attributes (volatiles perceived by the olfactory system while chewing a sample in the mouth) of the blackberries included overall aromatic impact, blackberry, earthy/dirty, green/unripe, overripe/fermented, chemical, mold/mildew and metallic. A-2434 had the highest overall aromatic intensity, and ‘Ouachita’ had the highest blackberry aromatic. The earthy/dirty, green/unripe, overripe/fermented, chemical, mold/mildew and metallic aromatic intensities were very low. The overall and blackberry aromatics were the highest scored intensities.
- **Texture attributes.** The texture attributes included firmness, moisture release, popping/bursting, size of seeds, amount of seeds, toothpack and loose particles. A-2453 was the most firm, and ‘Osage’ was the least firm. The panelists could not identify differences in the size of the pyrenes, the amount of pyrenes, toothpack, or loose particles of the blackberry genotypes evaluated.

Consumer Sensory. Consumers (n=84) evaluated three genotypes of blackberries and three sugar/acid solutions in 2016 to determine the influence of different ratios between soluble solids and titratable acidity on the overall impression/liking.

- Consumer panelists liked the blackberries with mid and high ratio of soluble solids and acidity.
- There was no significant difference in the preference of the three blackberry genotypes.

- Consumers preferred the solution with the highest ratio compared to the solutions with mid and low ratio.

Consumer Sensory. Consumers (n=80) evaluated three genotypes of blackberries and four sugar/acid solutions in 2017 to determine the influence of different ratios between soluble solids and titratable acidity on the overall impression/liking.

- Significant sensory differences were found between genotypes and soluble solids/titratable acidity ratio solutions.
- Consumers like Natchez with a SS/TA ratio of 8.93 the most.
- Consumers liked the high ratio solution (16) the most, followed by the mid-high solution (11).

Online Consumer Survey: An online survey was developed to gather information on consumer perceptions and purchase intent of blackberries. This survey was active from February to May 2017. The survey had 1,179 consumers respond with 879 consumers of blackberries that completed the survey. Data from the survey will be used for future presentations and publications. The online survey provided unique data to characterize consumer perception and purchasing of fresh-market blackberries.

- 41.6 % responded that they consume fresh blackberries once per month, followed by 29.1% once per year, and 12.2% once per week
- Consumers that purchased blackberries once per month purchased mostly at grocery stores (33.6%), and once per year 30% purchased at either grocery stores, farmer stores, or roadside stands.
- 90% agreed with the statements “Blackberry consumption is beneficial for my health” and “I love the flavor of blackberries”.
- The freshness of the berries (98.1%) and the price (87.8%) were rated highest as reasons to buy fresh blackberries.
- When shown several individual berries for shape and size, the consumers ranked large, oblong berries higher.
- When shown two clamshell containers of blackberries, one filled with large berries and one with small berries, 68.6% of the consumers preferred the clamshell with the larger berries.
- When shown three clamshell containers of blackberries with increasing levels of red drupelets (black drupelets appear red), 72.9% of the consumers preferred blackberries with the least red drupelets as compared to 20.1% that preferred the mid-level, and 7.0% that preferred the most.
- The survey showed that participants consume blackberries once per month, like large, oblong blackberries, prefer blackberries with less red drupelets, purchase blackberries based on freshness and price, purchase blackberries at grocery stores, and think blackberries are healthy and have a well-liked flavor.

Objective 3. Disseminate information to fresh-market blackberry industries

Provide the blackberry industry with information on the composition and sensory attributes that drive marketability for fresh-market blackberry genotypes.

Host Blackberry Workshop: Researchers hosted a workshop entitled Blackberry Workshop and Field Day at the University of Arkansas Fruit Research Station, Clarksville, AR on June 9, 2016. **There were 97 attendees for the workshop and 60 attendees completed the workshop evaluation.** The 60 (36 male and 24 female) attendees that completed the evaluation were ages 21 to over 65 with the majority from Arkansas and Oklahoma. The complete survey results are attached, but a summary is listed below:

- 46% indicated they were growers and the remaining were extension employees, educators, researchers, homemakers, students, private blackberry breeders and consultants
- 98% thought the workshop material was what they were expecting to learn
- 44% (as expected) and 55% (better than expected) thought the workshop meet the objectives for attending
- 100% thought the workshop content was understandable and organized and they had a better understanding of the production of blackberries
- 18% found the workshop useful, 44% very useful and 38% extremely useful
- 93% thought the speakers were the best part about the workshop, followed by the field tour and the fruit display
- 88% thought the information presented helped if they were considering becoming a blackberry grower
- 97% would you like to attend more workshops on blackberries
- Additional comments on ways to improve this workshop were as follows:
 - Put the speaker with the basic information first
 - Grower discussion panel
 - More detailed information on disease and pest identification and management
 - Great first pass-inclusive, wide coverage- would like deeper on more limited topics
 - Great, thank you!
 - Great job!
 - This was so very well done. Great speakers. Every topic was essential to all in the room.
 - Very good
 - Very well done
 - Workshop was excellent

Disseminating Outreach Plan: Researchers have presented findings on blackberries at conferences and published in scientific journals. See Additional Information section for a list of outreach materials. There were many significant results and accomplishment resulting from this project. The following outputs were generated as a result of this project:

- Students Working on Project: 1 post-doctoral, 2 graduate students and 2 undergraduate student

- Publications: 1 referred manuscripts, 1 non-referred manuscript, 1 honor thesis, 5 abstracts
- Presentations: 3 oral and 4 poster
- Workshop: 97 attendees

Project Activity	Who did the work?	When was activity accomplished?
Start of Project		January 2016
Evaluate physiochemical attributes of fresh-market blackberries		June 2016- March 2018
Berry and Pyrene Analysis (Researchers measured berry size, berry weight, pyrenes/berry, firmness, red drupe, etc.)	Threlfall, Post-doctoral Personnel, Masters graduate student, undergraduate exchange student, Honors undergraduate student	June 2016 June 2017
Composition Analysis (Researchers measured blackberry pH, soluble solids, titratable acidity, sugar and acid content, etc. of blackberries.)	Threlfall, Post-doctoral Personnel, Masters graduate student, undergraduate exchange student, Honors undergraduate student	June-December 2016 June-December 2017
Nutraceutical Composition Analysis (Researchers measured the anthocyanins, phenolics, ellagitannins, flavanols, of blackberries.)	Threlfall, Howard, Post-doctoral Personnel, Masters graduate student, undergraduate exchange student, Honors undergraduate student	July-December 2016 January-March 2018
Identify consumer-driven sensory attributes of fresh-market blackberries		June 2016-June 2017
Descriptive Sensory Analysis (Panelists (n=12) evaluated 12 genotypes of blackberries in duplicate on two harvest dates (6 genotypes/harvest).)	Threlfall, Clark and Post-doctoral Personnel	June 2016
Consumer Sensory Analysis (Consumers (n=84) evaluated three genotypes of blackberries and three sugar/acid solutions to determine the influence of different ratios between soluble solids and titratable acidity on the overall impression/liking.)	Threlfall, Clark, Post-doctoral Personnel, and undergraduate exchange student	June 2016
Consumer Sensory Analysis (Consumers (n=80) evaluated three genotypes of blackberries and four sugar/acid solutions to determine the influence of different ratios between soluble solids and titratable acidity on the overall impression/liking.)	Threlfall, Clark, and Honors undergraduate student	June 2017
Online Consumer Survey (Participants (n=879) completed on online survey to gather information on consumer perceptions and purchase intent of blackberries.)	Threlfall, Clark, and Honors undergraduate student	June 2016-June 2017
Disseminate information to fresh-market blackberry industries		June 2016-September 2018
Host Blackberry Workshop (Researchers hosted a workshop entitled "Blackberries: Farm to Table" at the University of Arkansas Fruit Research Station, Clarksville, AR.)	Threlfall, Clark, and Howard	June 2016
Disseminate Outreach Plan (Researchers presented findings on blackberries at conferences and publish in scientific journals.)	Threlfall, Post-doctoral Personnel, Masters graduate student, undergraduate exchange student, Honors undergraduate student	January 2017 - September 2018 but more publications and presentations planned
End of Project		September 2018

BENEFICIARIES

Over 1,000 consumers of fresh-market blackberries have a more increased awareness of blackberries through taking the surveys or tasting the fruit in the consumer and descriptive sensory analysis. Over 90 people attended the blackberry workshop in Arkansas with over half

of the attendees indicating they were growers and the remaining were extension employees, educators, researchers, homemakers, students, private blackberry breeders and consultants. Over 200 researchers and growers attended presentations about this research.

LESSONS LEARNED

This project included three years (2016-2018) of data generated for fresh-market blackberries. We were able to leverage these funds with other smaller grants and awards to extend our data collection and have additional participants work on the projects. The project positively demonstrated that Arkansas is one of the foremost leaders in fresh-market blackberry breeding, research and dissemination. Our biggest concern with this project each year was the unpredictability of working with fresh fruit, fruit availability, and inclement weather. There were no other problems or delays with the project. The goals of this project were achieved.

CONTACT PERSON

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rthrelf@uark.edu

ADDITIONAL INFORMATION

Students Advised or Committees working on blackberries

M.S candidate, Molly Felts, Department of Food Science. Dr. Renee Threlfall, Thesis Title: *Postharvest Physiochemical Analysis and Nutraceutical Evaluation of Arkansas Grown Peaches, Table Grapes, and Muscadine Grapes 2016-present*

M.S. candidate, Melinda Yin, Department of Horticulture. Dr. John Clark, Thesis Title: *Standardized Phenotyping for the Purpose of Identifying Horticulturally Important Molecular Markers in the Arkansas Breeding Program, 2015-2017*

Undergraduate Honors Project, Aubrey Dunteman, Department of Food Science. Advisor, Dr. Renee Threlfall, Project Title: *Identifying Consumer Perceptions of Fresh-Market Blackberries 2016-Present*

Visiting Scientist Post-Doctoral, CAPES Program, Brazil, Dr. Daniela Segantini, Advisor Dr. John R. Clark and Dr. Renee Threlfall. Project: "Identifying Attributes of Arkansas Fresh-Market Blackberries that Impact Marketability" 2015-2016

Brazilian Scientific Mobility Program (BSMP) Student Research Internship, Mayla De Almeida Rocha (May 29-August 5, 2017). 2016

Publications

Segantini, D.M., R.T. Threlfall, J.R. Clark, L.R. Howard, and C.R. Brownmiller. 2018. Physiochemical changes in florican and primocane blackberries harvested from primocane genotypes. *HortScience* 53(1):9-15.

Undergraduate Honors Thesis

Dunteman, A.N. 2018. Identifying Consumer Perceptions of Fresh-market Blackberries. Honors Thesis. University of Arkansas Dale Bumpers College of Agricultural, Food and Life Sciences.

Publications (non referred)

Dunteman, A.N., R.T. Threlfall, J.R. Clark, and M. Worthington. 2018. Evaluating consumer sensory and compositional attributes of Arkansas-grown fresh-market blackberries. *Discovery, The Student Journal of Dale Bumpers College of Agricultural, Food and Life Sciences* 19:16-23.

Published Abstracts (*Denotes Speaker)

Segantini, D.M., R.T. Threlfall*, J.R. Clark. 2017. Physicochemical attributes impacted by postharvest storage and harvest season of primocane blackberry genotypes. *HortScience* 52(9) (Supplement) – 2017 SR-ASHS Annual Meeting. P. S58.

Threlfall, R.T., D.M. Segantini*, J.R. Clark. 2017. Descriptive sensory attributes of Arkansas fresh-market blackberry cultivars harvested in multiple years. *HortScience* 52(9) (Supplement) – 2017 SR-ASHS Annual Meeting. P. S44.

Threlfall*, R.T., D.M. Segantini, J.R. Clark, C.R. Brownmiller, L.R. Howard. 2017. Phytochemical contents impacted by postharvest storage and harvest season of primocane blackberry genotypes. *HortScience* 52(9) (Supplement) – 2017 SR-ASHS Annual Meeting. P. S47.

Threlfall*, R.T., M. Rocha, D.M. Segantini, J.R. Clark. 2017. Determining how sweetness and sourness perception impacts consumer sensory of fresh-market blackberries. *HortScience* 52(9) (Supplement) – 2017 SR-ASHS Annual Meeting. P. S29.

Yin*, M.H., M.L. Worthington, B.M. Sebesta, R.T. Threlfall, J.R. Clark. 2017. Blackberry red drupelet incidence after cold storage and associated fruit quality implications. *HortScience* 52(9) (Supplement) – 2017 SR-ASHS Annual Meeting. P.S44.

Oral Presentations Presented at Meetings (*Denotes Speaker)

Threlfall*, R.T., D.M. Segantini, and J.R. Clark. 2017. Determining How Sweetness and Sourness Perception Impacts Consumer Sensory of Fresh-market Blackberries. Southern Region-American Society for Horticulture Science Annual Meeting. February 3-7, Mobile, AL.

Segantini, D.M., R.T. Threlfall*, and J.R. Clark. 2017. Physicochemical Attributes Impacted by Post-harvest Storage and Harvest Season of Primocane Blackberry Genotypes. Southern Region-American Society for Horticulture Science Annual Meeting. February 3-7, Mobile, AL.

Threlfall*, R.T., D.M. Segantini, and J.R. Clark. 2016. Sensory and Composition Attributes of Arkansas Blackberry Cultivars. American Society for Horticultural Science Annual Conference, August 8-11, 2016, Atlanta, GA.

Posters Presented at Meetings (*Denotes Speaker)

Threlfall*, R.T., D.M. Segantini, and J.R. Clark. 2017. Descriptive Sensory Attributes of Arkansas Fresh-market Blackberry Cultivars Harvested Multiple Years. Southern Region-American Society for Horticulture Science Annual Meeting. February 3-7, Mobile, AL. Poster #4

Segantini, D.M., R.T. Threlfall*, J.R. Clark, L.R. Howard, and C.R. Brownmiller. 2017. Physiochemical Contents Impacted by Post-harvest Storage and Harvest Season of Primocane Blackberry Genotypes. Southern Region-American Society for Horticulture Science Annual Meeting. February 3-7, Mobile, AL. Poster #12

Yin*, M.H., B.M. Sebesta, R.T. Threlfall, and J.R. Clark. 2017. Blackberry Red Drupelet Incidence After Cold Storage and Associated Fruit Quality Implications. Physiochemical Contents Impacted by Post-harvest Storage and Harvest Season of Primocane Blackberry Genotypes. Southern Region-American Society for Horticulture Science Annual Meeting. February 3-7, Mobile, AL. Poster #2G

Threlfall*, R.T., D.M. Segantini, and J.R. Clark. 2016. Descriptive Sensory Attributes of Arkansas Blackberries Harvested Multiple Years. American Society for Horticultural Science Annual Conference, August 8-11, 2016, Atlanta, GA. Poster #264



Evaluating consumer sensory and compositional attributes of Arkansas-grown fresh-market blackberries

Meet the Student-Author

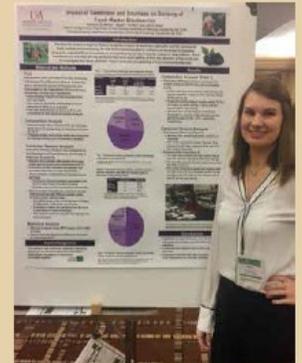


Aubrey Dunteman

My interest in food began at a young age, and I pursued it by taking all the cooking and nutrition courses offered in high school. I knew I wanted to study one of the sciences, though I was conflicted about which one. It wasn't until I began looking at colleges that I became aware of the Food Science track; once I looked into it, I immediately knew it was what I wanted to study. I chose to attend the University of Arkansas because the Food Science Department made what I considered to be a giant university feel more personal. The opportunity to do research allowed me to gain invaluable experience in the field of Food Science, collaborate with the Horticulture department, and compete in the Southern Region American Society for Horticultural Sciences (ASHS) poster and oral competitions. My goals after graduating in 2019 are to pursue a master's degree in Food Science and then a career in Food Science focusing on either fruit or sensory science. Thank you to Dr. Renee Threlfall for mentoring me throughout this research experience, to Dr. John Clark for allowing me to conduct research on his blackberry genotypes, and to Dr. Luke Howard and Dr. Margaret Worthington for being part of my Honors committee and giving feedback on my work. Finally, thank you to Molly Felts for teaching me numerous analytical techniques essential for my research.

Research at a Glance

- Consumers appear to prefer fresh-market blackberries with a medium-level balance of sweetness to sourness.
- Consumers are not strictly sweet-lovers or sour-lovers when it comes to fresh-market blackberries.
- The fresh-market blackberry, "Natchez", was the most liked of the three blackberries tested and it had a medium level of perceived sweetness.



Aubrey presenting her poster at the Southern Region ASHS annual conference. She won second place in the undergraduate student oral presentation competition.

Blackberry Workshop & Field Day Evaluation Results

University of Arkansas, Fruit Research Station, Clarksville, AR

Thursday, June 9, 2016 2:30-7:30 pm

There were 97 attendees for the workshop and 60 attendees completed the evaluation.

What is your gender? Male: 36 Female: 24

What is your age range? 21 or under: 5 22-34: 7 35-44: 3 45-54: 7 55-64: 18 65 or older: 20

Please list your county and state: Attendees mostly from Arkansas and Oklahoma but also Indiana, Texas and West Virginia

Were you interested in this workshop as: Entrepreneur: 0 Grower: 28 Extension Employee: 3 Educator: 2 Researcher: 2 Homemaker: 7 Student: 7 Other: 12

Explain if you checked other. General knowledge; Consultant; Employees; State/Government Employee; Private Breeder; Curious; Wanted more information on blackberries

Was the workshop material what you were expecting to learn about? Yes: 59
No: 1

If yes, then how well did this workshop meet your objectives for attending?

Not as well as expected: 0 As expected: 26 Better than expected: 33

Was the workshop content understandable and organized? Yes: 59
No: 0

Do you have a better understanding of the production of blackberries? Yes: 60 No: 0

How would you rate this workshop in terms usefulness?
Not useful at all: 0 Not very useful: 0 Useful: 11 Very useful: 26
Extremely useful: 23

What was your favorite part of the workshop?
Fruit display: 8 Speakers: 56 Field tour: 10 Other: 1
Explain if you checked other: the farmer—Bill Jacobs

If you are considering becoming a blackberry grower, will the information presented help?
Yes: 53 No: 7

Explain if no, then what additional information do you need? Already a grower

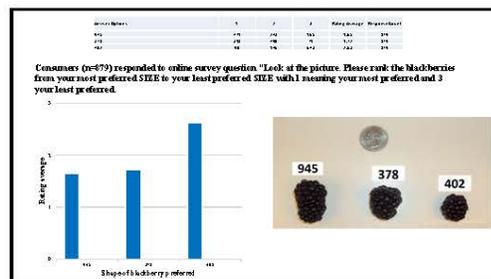
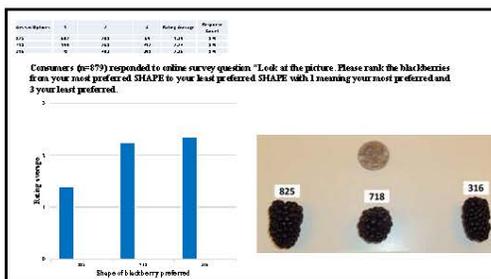
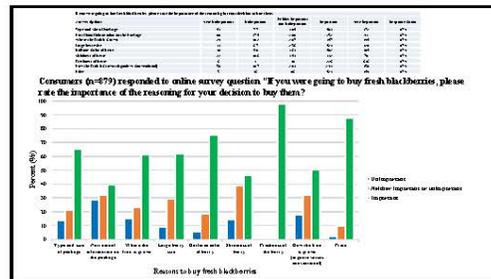
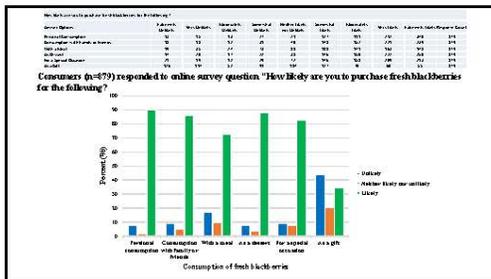
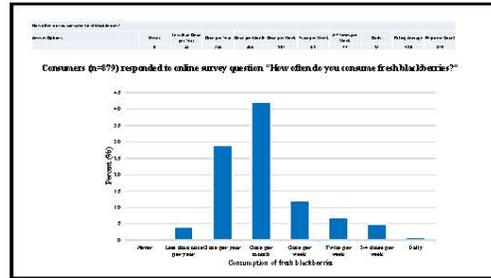
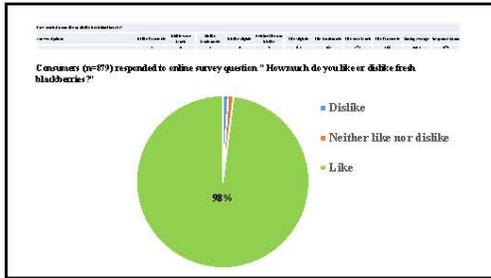
Would you like to attend more workshops on blackberries? Yes: 58 No: 2

Please share any additional comments on ways to improve this workshop:

- Put the speaker with the basic information first.
- Grower discussion panel.
- More detailed information on disease and pest identification and management.
- Great first pass-inclusive, wide coverage- would like deeper on more limited topics.
- Great, thank you!
- Need a workshop on growing strawberries.
- Would like to see seminars on high tunnels.
- Great job!
- Blueberry workshop would be helpful.
- This was so very well done. Great speakers. Every topic was essential to all in the room.
- For my needs Amanda's talk could have provided excellent information
- Very good.
- Good job.
- Very well done.
- Workshop was excellent

Initial Online Survey Results

10/31/2017



Project 3: Development of Innovative and Value-Added Edamame-based Food Systems for Consumer Wellness, and for Potential Local and Regional Markets in Arkansas

FINAL REPORT

Project Summary

Arkansas State is considered a pioneer in edamame production in the country. Its production has been expanding in recent years due to the development of various varieties and potential for higher acreage allotment by the growers due to the profitability. Currently, there has been a strong thrust to grow and expand edamame products to meet the consumer demand while catering to the nutritional requirements. To meet this demand, the current project aimed at developing novel, value-added and wellness-promoting products, including pizza crust and cookies, with an integrated food system approach for the local and regional markets. The process and formulation were optimized for superior quality of the end products. The physical and texture properties as well as consumer sensory appeal and acceptance of the prepared products were tested. This is the first time that cookies and pizza crust rich in protein were made from edamame as the main ingredient. The consumer sensory acceptances of the introductory cookies and pizza crust prepared based on the optimum formula show a promising consumer acceptability with a score of 5.8 and 6.8 out of 9-scale respectively. These edamame products with high protein, low calories, vegan, gluten-free, and tasty can serve as an alternate source of enjoyable snack (with a craving to consuming more) that can substitute high-calorie dense food products. It is expected that the promising and novel developed edamame products can be promoted locally including farmers' markets, and local and regional food and health food stores. However, for further commercialization consumer marketing study needs to be completed to evaluate their visibility from marketing point of view.

The primary goal of this project is to develop optimized safe, nutritious food products from locally grown edamame with other compatible alternate crops to enhance quality in food systems. These products are timely and in demand by the consumer and can help the economy by providing healthy alternative food and snacks. Increased edamame consumption via these potential novel products will have a positive impact on the Arkansas Specialty Crop industry. The approach used to develop alternative edamame products has the potential to expand integrating food systems for a wider value-added application and brand building. This project can lead to the development of innovative concepts for creating broad food systems targeted towards local and regional agri-based food markets. As part of greater prospective for production and consumption of edamame, development of unique and innovative commercial food products is warranted for enhancing value-addition to this remarkable vegetable.

- If the project built on a previously funded project with the SCBGP or SCBGP-FB describe how this project complimented and enhanced previously completed work.

Not applicable - This is the first funded project with SCBGP

Project Approach

Two products were developed from dry edamame seeds, namely edamame cookies and pizza crust. Nutritious cookies and pizza crust that are inexpensive packaged food products from locally grown edamame with other compatible alternate crops to enhance quality in food systems were developed. The products were optimized to provide quality including nutrient content, shelf-life, color, flavor, texture and overall acceptability by the consumer.

Product 1: Edamame cookies

Ground dried edamame soybean seed flour was used to prepare edamame cookies containing chia seed paste, buckwheat flour, low calorie dairy-free butter, salt and baking powder. For formula optimization, a full factorial design was conducted using 3 levels of chia seed paste, butter and baking powder. Cookies were baked at 350°F for 20 min. Color $L^*a^*b^*$ index, water activity (A_w) and texture properties (hardness and fracturability/crispiness) were conducted to evaluate the physical-chemical properties, while a 9-point hedonic scale was used to evaluate the sensory attributes (appearance, hardness flavor, texture, mouth-feel, after taste, and overall acceptance).

The A_w of the cookies ranged from 0.257-0.673. Chia seed (P-value<0.0001) and butter (P-value=0.0246) significantly affected the A_w ; cookies with higher chia seed and butter levels had higher A_w values. However, baking powder levels did not affect the A_w values of cookies. L values ranged from 55.9-70.8 and was significantly affected by butter level (P-value<0.0001). Baking powder levels had a significant effect on the hardness (P=0.0309), higher levels had lower the hardness, while other ingredients (chia seed paste and butter) did not significantly affect the hardness. Fracturability values ranged from 1,255-59,040 N. Butter and baking powder levels (P values are 0.0893 and 0.0604, respectively) slightly affected the fracturability of the cookies, while chia paste did not have significant effect on the fracturability (P-value=0.7232). The average sensory attribute value was 5.6. From the same study the overall consumer acceptance value was 5.8. These cookies made from edamame as the major ingredient (54 % of total formulation containing 5% buckwheat flour and chia seed paste and 16% butter substitute) can serve as a source of protein-dense, and low calorie snack

Product 2: Edamame pizza crust.

A preliminary trial was conducted to optimize the edamame pizza crust preparation from dry edamame flour. In addition to edamame flour, brown rice flour, buckwheat flour and oat flour in various combinations and amounts were included to improve the flavor and texture properties of pizza dough and the baked pizza crust. Xanthan gum (natural hydrocolloid) and baking powder were added to improve the dough expansion during fermentation due to the activation of yeast used. A factorial experimental design using three different levels of edamame flour, cereal flours (buckwheat, brown rice and oat flour with the

same amount for each cereal), xanthan gum and baking powder were used to optimized the process. The dry ingredients containing edamame, oat, brown rice and buckwheat flour in their respective amounts (10 g of edamame with either 0 g, 1 g or 2 g of each cereal flours), salt and baking powder, xanthan gum were mixed and kneaded followed by the addition of activated yeast to make the doughs in a covered bowl. After expansion by fermentation, the doughs were formed into a round and transferred to a pan and baked at 375°F in preheated oven for 4 min. Color L*a*b* index, water activity and texture properties (hardness and fracturability/crispiness) were conducted to evaluate the physical-chemical properties, while a 9-point hedonic scale was used to evaluate the sensory attributes (appearance, hardness flavor, texture, mouth-feel, after taste, and overall acceptance).

The A_w of the edamame pizza crust ranged from 0.662-0.882. The addition of cereal flours significantly affected the A_w (P-value <0.0001), higher the cereal flour level had higher A_w value; however, there was no effect of the use of xanthan gum (P-value= 0.4310) and baking powder (P-value=0.3965) on the A_w of the obtained edamame pizza crust. L values ranged from 59.54-69.87 and was significantly affected by cereal flour levels (P-value<0.0001) and xanthan gum levels (P-value =0.0022) but baking powder levels did not affect the L value (P-value=0.3141). Xanthan gum levels and baking powder levels had a significant effect on the hardness (P-values were 0.0003 and 0.0270, respectively), higher levels had lower the hardness, while the addition of cereal flours did not significantly affect the hardness. Other texture properties such as gumminess and chewiness showed a very similar trend as their hardness. When compared to pizza crust made of wheat flour as regular pizza crust, there was no significant different between edamame pizza crust with cereal flours and wheat pizza crust (P-value=0.9693). The average sensory attribute (appearance, flavor, texture, mouth-fell and after taste) value was 6.6 with an overall acceptance value of 6.8.

This is the first time that cookies and pizza crust rich in protein were made from edamame as the main ingredient. These edamame products with high protein, low calories, vegan, gluten-free, and tasty can serve as an alternate enjoyable and healthy snacks and food for a wide range of consumers including obese individuals.

Dr. Navam Hettiarachchy, University Professor of the Dept. of Food Science, Division of Agriculture, led this novel edamame products research in her role as project leader. She outlined and directed the overall studies and provided guidelines and supervision for the management of the works conducted by a Post-doctoral research associate and a BS student, visiting student from Zamorano University. This includes data collection of products optimization and sensory study, data analysis and interpretation, and report writing. Dr. Pengyin Chen (Co-PI), Professor of the Dept of Crop, Soil, and Environmental Sciences provided dry edamame seeds. Dr. Han-Seok Seo, Associate Professor of the Dept of Food Science, assisted for the costumer sensory study.

- Explain how project insured that only specialty crops benefitted if overall scope of project benefitted commodities.

In both products, the main ingredient is edamame flour even though the developed cookies consisted of chia paste, buckwheat flour and butter substitute that contributed less than 50% and pizza crust consisted of cereal flours, which contribute less than 40%. In addition, for higher protein products, the use of edamame that is high in protein is crucial to meet this requirement.

Goals and Outcomes Achieved

As described in the project approach, two edamame products, cookies and pizza crust, were developed and optimized for the amount of the used ingredients (baking powder, chia seed paste, butter substitute for cookies and cereal flours/buckwheat, brown rice and oat flours, xanthan gum and baking powder for pizza crust). The optimization aimed to obtain the products having the best physical properties including color, water activity, texture properties (hardness and fracturability for edamame cookies and hardness, gumminess, and chewiness for edamame pizza crust) and internal sensory acceptability. Based on the optimized processing and ingredients, the products were prepared for consumer sensory evaluation to obtain information about their sensor attributes (appearance, hardness, flavor, texture, mouth-feel, and after taste) and overall acceptance. The measurable outcomes are based on the consumer acceptability of the products as described above. The following claims can be attributed to the products: gluten-free, lactose-free, low cholesterol, Trans fat free, non-GMO, low calorie, high fiber and protein food products with excellent consumer appeal. The goal of this outcomes is to increase the consumption and enhance the competitiveness of the edamame crop, which will benefit the growers in Arkansas.

- If outcome measures were long term, summarize the progress that has been made towards achievement.

This is a one-year project to introduce two edamame product prototypes. However, a long term achievement will be expected to target health conscious consumers who are the connoisseurs of specialty whole and natural food stores and distributed not only through local and regional markets, but also bring visibility to nationwide consumers.

- Provide a comparison of actual accomplishments with the goals established for the reporting period.

The goal outlined in the proposal was accomplished to develop two non-conventional edamame products in this final report. The consumer acceptability of the products was rated quite positively by participants (5.8 for the cookies and 6.8 for pizza crust out of 9-point scale). Based on these ratings, the outcome of products is considered to be promising for further commercialization phase.

- Clearly convey completion of achieving outcomes by illustrating baseline data that has been gathered to date and showing the progress toward achieving set targets

All activities regarding the development of the products proposed were completed. The optimized products and consumer sensory study results described above are the primary overall findings of this project. However, it is still necessary to conduct consumer marketing study to evaluate their visibility from a marketing point of view.

- Highlight successful outcomes of the project in quantifiable terms.

As described in the project approach above, the outcomes of the developed edamame products were evaluated based on their sensory attributes and palatability and consumer product acceptance values. From 49 participants, they rated the acceptability of the edamame cookies and pizza crust to be 5.8 and 6.8 respectively based on a 9-point hedonic scale.

Beneficiaries

- Provide a description of the groups and other operations that benefited from the completion of this project's accomplishments.

We are expecting the edamame growers and local related food company have or will be benefitted/benefitting from these developed edamame products. The American Edamame and Vegetable Soybean Company, AR showed their great interest on some of our edamame products during our internal product showcase. The success of this project can lead to the expansion of Community-Based Food Systems in Arkansas for promotion of locally manufactured and marketed agri-based food products. This can also bring additional visibility and income to the Arkansas agriculture.

- Clearly state the quantitative data that concerns the beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project.

The economic benefits from the success of this project is in the form of supplementary income to the alternate crop growers in Arkansas. The developed edamame products can bring in the concept of safe, inexpensive whole food system approach, with a direct impact on growers. This will have a synergistic effect in marketing products at local and regional levels and provide nutritious foods to consumers. This accomplishment can invite potential entrepreneurs to produce these products into local, regional and farmers' markets for economic development and outreach.

- Please give number of beneficiaries affected by project's accomplishments.

An estimated 65 growers and processors will benefit from this project immediately, and many consumers that are concerned about healthy foods will benefit as new healthy products become increasingly available.

Lessons Learned

- Offer insights into the lessons learned by the project staff as a result of completing this project. This section is meant to illustrate the positive and negative results and conclusions for the project.

As food scientists, we learned many aspects regarding food product developments from a new crop and commodity. Understanding the dough and texture properties of the main ingredient and the use of proper auxiliary ingredients to improve the properties are the key factors for manufacturing and developing novel and innovative food products.

- Provide unexpected outcomes or results that were an effect of implementing this project.

Although we were able to develop the edamame cookies and pizza crust to meet the goals of the project, consumer marketing study and survey are still needed to be evaluated the for potential of product dissemination to local entrepreneurs for commercialization.

- If goals or outcome measures were not achieved, identify and share the lessons learned to help others expedite problem-solving.

For consumer marketing study and survey, it needs a collaborative work with marketing scientist having internet/web basis surveillance system and consumers database to reach appropriate participants.

Contact Person

Dr. Navam Hettiarachchy

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Additional Information

- Provide additional information available (i.e. publications, websites, photographs) that is not applicable to any of the prior sections.



Project 4: Produce Marketing Association Fresh Summit 2016

FINAL REPORT

PROJECT SUMMARY

Six specialty crop companies participated in the Arkansas Agricultural Department's (AAD) booth at the 2016 Produce Marketing Association (PMA) Fresh Summit International Convention and Exposition in Orlando, FL October 15-16. The companies are:

- Mathews Ridgeview Farms
- Old Dominion Produce
- Peebles Organic Farms
- Hawkins Farms
- Eve's Treat
- Little Rock Tomato

Eve's Treat, Little Rock Tomato, and Hawkins Farms were new participants in the AAD booth at the PMA Fresh Summit.

With more than 20,000 attendees and more than 1,000 exhibitors, the PMA Fresh Summit is the largest produce show in the U.S., drawing attendees from around the world. Access to the show is expensive, and attendance can be very costly for medium and small sized specialty crop producers and processors. AAD reduces the cost for attendees by provide space and a booth, enabling Arkansas producers to access sales leads, innovative ideas, and packaging and shipping solutions, which increases their competitiveness.

PROJECT APPROACH

AAD recruited companies through emailing the Arkansas Grown contact list, phone calls, and in person meetings. AAD purchased booth space at the show, and rented the booth structure, utilizing SCBGP funds. All companies attending under AAD's booth paid for their own travel, meals, and lodging.

The participating companies produce the following:

- Sweet Potatoes
- Greenbeans
- Tomatoes

- Cucumbers
- Squash
- Watermelons
- Onions
- Hot Peppers
- Bell Peppers
- Zucchini

These growers are a very broad representation of AR specialty crops. They represent some of our biggest specialty crops, such as tomatoes, watermelons, and sweet potatoes.

This year's booth was the same design as the 2015 booth. Rental costs had gone up on the old (2014 and previous) design so AAD had rented a new but cheaper design to stay within budget in 2015. To reduce costs, AAD rented the same booth for the 2016 show.

Interest in the Arkansas booth was very high. The survey below was sent to all participants after the event:

2016 PMA SURVEY

1. WAS THIS SHOW HELPFUL?

- Yes No

2. WILL YOU RETURN NEXT YEAR?

- Yes Maybe No

3. THE PMA SHOW ACCOUNTS FOR THE FOLLOWING RANGE OF GROSS SALES FOR MY BUSINESS:

- \$0 to \$250,000
- \$250,001 to \$500,000
- \$500,001 to \$1,000,000
- \$1,000,001 to \$5,000,000
- \$5,000,001 plus
- Would rather not say

4. THIS PMA SHOW ACCOUNTED FOR THE FOLLOWING AMOUNTS IN NEW AND/OR RETAINED BUSINESS:

New Business

Retained Business

5. DO YOU THINK ATTENDING "DID OR WILL" INCREASE YOUR SALES?

Yes Maybe No

6. ARE YOU HAPPY WITH THE BOOTH SETUP?

Yes No

7. WHAT CHANGES WOULD YOU LIKE TO SEE DONE TO THE BOOTH?

8. HOW MANY SALES LEADS OR POTENTIAL SALES LEADS WERE MADE?

Sales Leads

Potential Sales Leads

9. HOW MANY CONTACTS WERE MADE?

10. HOW MANY LEADS ARE A:

National Company

Regional Company

Local Company

11. HOW ELSE WAS THIS SHOW HELPFUL?

12. SUGGESTIONS:

GOALS AND OUTCOMES ACHIEVED

AAD achieved its goals and outcomes by constructing a booth at the 2016 PMA show and recording more than 50 (goal was 35 sales leads) potential sales leads as indicated in the survey results below.

Survey Results:

1. 100% answered yes
2. 100% answered yes
3. Between \$1.75 million and \$5 million (based on ranges)
4. \$300,000 plus 3 new customers in new business, while answers for “retained” include \$250,000, 4 customers and “all of our business”.
5. 100% yes
6. 100% yes
7. Comments included: “This years show was very nice. Better than previous years”, “I think the booth represents the State of Arkansas well”, and “maybe just make it slightly more open and user friendly”.
8. Average of 11 sales leads per company
9. More than 120 contacts made
10. N=5, R=5, L=3
11. Comments include:
 - “Really helped us find growers/shippers that will help us get off-season produce to consumers in Arkansas.”
 - “It helped us develop new contacts for shipping produce with freight lines we had not previously done business with. It was extremely helpful>”
 - “contacts!!!”
 - “New ways and ideals to process, package, and market my product.”
 - “It was helpful to meet with other growers and discuss different topics.”
 - “It has been the single most productive thing we have done for business. You get the opportunity to get in front of people that you have never had the opportunity to be in front of.”
12. Suggestions include:
 - “... I feel like taking more aggregators would boost Arkansas’ fresh produce industries.”
 - “The only improvement with our part of the booth would be to have someone who is familiar with A number 1 quality to review the photos to make sure that the produce in the photos are of number 1 top notched produce. The photos showed Number 2 grades, off color and poor shapes which were not a true portrayal of the produce were strive to produce. We fully understand the quality grades for vegetables are not familiar for most of those in Arkansas but if you would like we

can review or assist those choosing the photos which would allow those that visit the booth to see the exceptional produce that we in Arkansas can produce.”
“I think the State should continue to support the PMA for the potential growth in agriculture for the State of Arkansas.”





BENEFICIARIES

Beneficiaries were the specialty crop producers of Arkansas and especially those that attended the show with AAD. When Arkansas has a presence at these national shows all of Arkansas can benefit. Beneficiaries include the 30 booth attendees and guests, as well as the 120 buyers looking for produce that made contact, totaling 150 direct beneficiaries.

LESSONS LEARNED

AAD has been attending this show and constructing this booth for a number of years now and thus most of the problems have been worked out. While AAD has attended the show regularly in the past, this show demonstrated the value of outreach prior to the show, engaging buyers about our producers and their products early. Also of note is the response of those attending with AAD, and how important this show is to their businesses.

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Project 5: Partnering with P. Allen Smith to Build Upon the Sales of Specialty Crops in Arkansas Grown Program

FINAL REPORT

PROJECT SUMMARY

- Importance and timeliness of the project
- Did the project build on previously funded Specialty Crop Block Grant Program projects? If so, how did this project complement and enhance previously completed work?

This project continued the work of informing consumers that local specialty crops are available for purchase in the State of Arkansas. This program will also educate consumers, retailers, and restaurants about the wide range and availability of Arkansas specialty crops and to increase the purchase of these crops. This project continued work with Hortus, the marketing shop of P. Allen Smith, to highlight specialty crop producers in Arkansas and to list where consumers can buy specialty crops.

The project built upon the 2013 and 2014 projects by increasing the dialogue between producers and end users through scheduled events. It also built upon the project by further educating consumers through a vast array of media.

PROJECT APPROACH

- Briefly summarize activities and tasks performed during the grant period, addressing the tasks provided in the project proposal or work plan. Include significant results, accomplishments, conclusions and recommendations, as well as favorable or unusual developments.

Did non specialty crops benefit from the project? If yes, how did the project ensure SCBGP Funds were used solely to enhance the competitiveness of specialty crops?

Detail the significant contributions and role of project partners in the project.

1) P. Allen Smith as “Brand Champion” for the AAD-Arkansas Grown Program (Jan-Dec 2016) (Completed)

- PAS as “brand champion” and “voice” of AAD-Arkansas Grown to establish and grow the Arkansas Grown and brands and to increase awareness and participation, by consumers, growers and retailers through PAS media channels.

- PAS, as talent and personality, to educate and engage consumers and his established PAS audience about AAD-Arkansas Grown programs and where to find and purchase Arkansas Grown products.

2) AAD-Arkansas Grown and P. Allen Smith “Farm Tour” (or “Buy Local Tour” name to be determined) Program

(Cancelled due to scheduling conflicts)

- Promote an Arkansas Grown Day (or month) in late April or early May 2016 – Kick off official opening of Farmer’s Markets around the state

- Request proclamation from Governor to make a certain day or month AR Grown day or month
- Kick off with social media campaign – 7 days of conversations gearing up for the final day/kick off day (or first day of the month)
- Allen to kick off the day/month with an appearance on KATV
- Hortus to produce and provide PSA to local television stations promoting

- Develop monthly content featuring AR Grown participants to highlight their stories (“Farm Tour” or “Buy Local Tour”) and the products they grow (**Mar-Oct 2016**)

o Produce monthly content videos featuring program members (12x per year)

- Farmers
- Chef/Restaurant
- Consumers
- AAD – Arkansas Grown representative featured – talking about the program

o Produce monthly AR only e-newsletter (will distribute to AR Grown members and Arkansas subscribers to PAS e-newsletter) that will feature:

- monthly video interviews
- AR Grown program banner
- AR Grown member highlight
- What’s growing and where monthly feature

3) Local Conversations (Feb 2016) (Completed)

Conduct 3rd Annual Local Conversation co-hosted by P. Allen Smith, Arkansas’s First Lady and Arkansas Agriculture Department for a special gathering of local farmers, farmer’s market managers, merchants with potential customers (chefs and store managers).

4) AAD-Arkansas Grown Engaged within PAS Social Media (Completed)

- PAS and AAD-Arkansas Grown Social Media Contest –Giveaway:

- PAS to create and implement a yearly (in season) social media campaign positioning an AAD-Arkansas Grown Contest-Giveaway.
- Engage followers to make comments about and share images of AAD-Arkansas Grown product they have purchased locally and recipes using those products for a chance to win prizes.

- A monthly contest winner will be randomly selected and the prize “giveaways” are P. Allen Smith items (decks, books, etc.)
- PAS to engage followers on Facebook, Twitter, Pinterest and Instagram with messaging related to Arkansas Grown program initiatives (i.e. community events, recipes or lifestyle-oriented messaging with Arkansas Grown products, etc.)
- Arkansas Grown as topic in PAS Blog or AAD-Arkansas Grown representative as guest blogger on PAS Blog Q&A

5) Farm2Home Blogger Event (Completed)

Conduct 3rd Annual Farm2Home Blogger Event co-hosted by P. Allen Smith and Arkansas Agriculture Department for a gathering of Arkansas bloggers at Allen’s Garden Home Retreat at Moss Mountain Farm for a day of learning about all things local. Opportunity for top level Arkansas Grown members to participate and help educate Arkansas bloggers about their farms and the local produce available to Arkansas families.

6) AAD-Arkansas Grown in PAS Online Media (Completed)

- PAS will design banner for AAD-Arkansas Grown that will rotate seasonally on PAS website
- Banner Ad will link to AAD-Arkansas Grown website (52-wk. schedule) will rotate run-of-site (ROS) on PAS website
- Arkansas Grown program page as PAS Garden Home Partner and one of “Allen’s Picks”: (www.pallensmith.com/garden-home-partners) with links to Arkansas Grown website and list of program member/participants

7) PAS to Contribute to Statewide/Regional Consumer Magazines about the AAD-Arkansas Grown Program (Completed)

- PAS will write and provide images related to the AAD-Arkansas Grown Programs to local (statewide/regional) publications (i.e. AY and Front Porch [Arkansas Farm Bureau] and will credit/resource AAD-Arkansas Grown [topics TBD and in keeping with AAD-Arkansas Grown program initiatives]).

8) AAD-Arkansas Grown as recognized sponsor of the PAS Garden Home Retreat at Moss Mountain Farm (Completed)

- PAS to position/promote the Arkansas Grown program during PAS Garden Home Retreat-Moss Mountain Farm Events. PAS will recognize Arkansas Grown products in use at the PAS Garden Home Retreat)
- PAS will post signage to indicate Arkansas Grown in PAS Gift Shop

GOALS AND OUTCOMES ACHIEVED

- Supply the activities that were completed to achieve the performance goals and measurable outcomes identified in the approved project proposal.

- If outcome measures were long term, provide a summary of the progress made towards this achievement.
- Provide a comparison of actual accomplishments with the goals established for the reporting period.
- Clearly convey completion of achieving outcomes by illustrating baseline data that has been gathered to date and show the progress toward achieving set targets.
- Highlight the major successful outcomes of the project in quantifiable terms.

A final survey was conducted in 2016, indicating eighty-three percent of those surveyed are aware of the Arkansas Grown Program. When asked if they are more likely to buy a specialty crop if it's identified as Arkansas Grown, one hundred percent responded with a "yes".

Goal 1: The goal was to increase the percentage of specialty crop consumers aware of the Arkansas Grown logo by another 15 percent.

Outcome 1: According to the last survey conducted in 2016 by Hortus, 83.3% of respondents reported awareness of the Arkansas Grown program, up from the 2015 results of 69.2%. This barely fell short of our goal of an increase of 15%, coming in at more than 14% increase.

Goal 2: Another expected key outcome was to have 25% growth in the number of Arkansas specialty crop producers and retailers participating in the Arkansas Grown program.

Outcome 2: 126 specialty crop producers and processors became members of Arkansas Grown in 2016. This represents an increase of 19.2% over the baseline of 650 members. Although short of our goal, this represents additional specialty crops growers and processors taking advantage of the benefits offered through the program.

Ultimately, this project was successful in connecting specialty crop producers, processors, and retailers with restaurants, chefs, bloggers, and regular everyday consumers, and highlighting the availability of locally produced specialty crops.

BENEFICIARIES

- Provide a description of the groups and operations that benefited from the completion of project's accomplishments.
- State the number of beneficiaries affected by the project's accomplishments and/or the potential economic impact of the project.

All specialty crop stakeholders in Arkansas, including Christmas Tree producers, nut producers, fruit growers, vegetable growers, horticulture growers, honey producers and all the other producers of products list on the AMS/SCBGP Specialty Crop list, that use the Arkansas Grown label benefited from this project as more customers are made aware of the Arkansas Grown label and how to find Arkansas Grown specialty crop products. We assume that increased marketing of the label will increase sales of specialty crops thus creating a positive economic impact. Beneficiaries include the 776 Arkansas Grown specialty

crop growers as well as the estimated 3,000 consumers reached through the project, totaling 3,776 beneficiaries.

LESSONS LEARNED

- Provide insight into the lessons learned as a result of completing the project.
- Provide unexpected outcomes or results of the project.
- If goals or outcome measures were not achieved, identify and share the lessons learned

This project went as planned, with the exception of the planned “Farm Tour”. There was difficulty in arranging the schedules of all involved. In order to provide as much focus as possible on making the other activities successful, the Farm Tour was scrapped. Other lessons learned include greater understanding of the potential demand for locally sourced specialty crops in Arkansas, and the desire consumers have for engaging with those who grow and make their food.

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