



**GEORGIA DEPARTMENT OF AGRICULTURE  
2014 Specialty Crop Block Grant Program  
Final Performance Report  
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# **1. Center for Applied Nursery Research- *Investigating Bloom Period and Insect Tolerance of Azalea Cultivars to Expand Market Potential* – Final Performance Report**

## **Project Summary**

Azaleas are one of the largest single crops grown by nursery producers in the southeast, generating over \$4 million USD in sales in Georgia and \$39.5 million USD in sales across six southeastern states ([Census of Agriculture, 2007](#)). Being the largest flowering woody ornamental crop group grown in the southeast, maximizing flowering potential and plant production is extremely important to the profitability of commercial growers. New plant introduction and integration into production systems continues to be a challenge for growers due to the sometimes-overwhelming number of cultivars available on the market. The requirements of the market compound these challenges due to the short sales window that is often influenced by spring weather/climate. In recent years, the market for azaleas has been transformed with the introduction of a plethora of new cultivars, bringing a new interest in this specialty crop. There are now 66 cultivars of re-blooming azaleas available along with over 100 commonly available traditional spring only blooming cultivars. This increase in cultivars and the challenges of the marketplace have created a need for better information. Due to the nature of the nursery industry, producing and publishing information based on their own observations, reliable standardized information of cultivar characteristics is not available. This study was designed to address three primary needs; (1) to develop information needed for producers and consumers/end users to be able to evaluate and choose the best cultivar(s) to meet their needs, (2) to identify pest-resistant cultivars that will thrive in landscape environments, and (3) to find ways to manipulate the bloom period of azaleas in order to speed or delay flowering to coincide with the desired market window.

The objective of the project was to allow CANR to address the aforementioned needs. The first of these needs, to develop the information needed for growers, retailers, landscape contractors, and consumers/end users to be able to evaluate and chose the best azalea cultivars to meet their needs, was approached using several techniques. CANR secured and trialed 150 cultivars of azaleas at CANR, representing re-blooming azaleas and the most common commercially available traditional spring-only flowering azaleas. These cultivars were evaluated for timing of flower, flower size, and color under the same environmental conditions, to develop a true comparison of flowering period. Longer term growth habit and cold hardiness for each cultivar was researched from external authoritative sources. This information will allow professionals and consumers to make informed choices on which cultivar(s) fits their needs. The project also provided for the evaluation and identification of cultivars with lower levels of azalea lace bug and strawberry root weevil damage, therefore requiring less intensive pest management and therefore a greater profitability for the producer and more

environmentally friendly option for the consumer. The project allowed CANR to consolidate this information into easy to understand publications that are available in a digital format free for download and use from the CANR website. Additionally, posters have been printed and will be distributed at meetings of the Green Industry for use by professionals to increase the visibility of this information to the consumer.

The last objective of the project was to determine methods to manipulate the bloom period of azaleas in order to speed or delay flowering to coincide with the desired market window (thereby increasing demand and profitability to producers). In order to accomplish this goal, CANR ran a series of trials to look at dormancy and chemical plant growth regulator (PGR) manipulation of flower timing. CANR performed a replicated study looking at the interaction of temperature in the root zone and air temperature and their effect on plant growth and flowering. The information from this study has allowed a better understanding of what environmental factors cause plant growth and flowering. Additionally, CANR ran a series of trials using available PGRs to determine their effect on flowering and growth in an outdoor setting in order to determine the potential to use PGR treatments to modify the timing of flowering. PGR trials were not successful in manipulating peak bloom period for a specific sales window. There was still valuable information gained from this project, including a better understanding of dormancy in azaleas and the interaction of available PGRs on dormancy in azaleas. The information learned via this project will also help in developing potential methods for bloom period modification in other crops in the future. Dr. Chappell (University of Georgia, Horticulture Department) is currently working on the publication of the results from the temperature modification trial in horticultural journals, and a discussion of results from both trials can also be found on the CANR website.

### **Project Approach**

*Evaluation of 150 re-blooming azaleas and commercially available traditional spring flowering azaleas for bloom period, flower color, and growth habit:* CANR researched common spring-only flowering cultivars of azaleas by taking the availabilities of multiple nurseries and finding the common cultivars grown over the range of growers, these cultivars were then sourced from the growers. All of the re-blooming cultivars we could source were included in the trial group. This process took a bit longer than we had anticipated, however, the growers were very supportive and we were able to in some cases get plant material and materials at a reduced or no cost from the growers, saving us about \$7,000 in costs over our initial projections. Our target was 150 cultivars and we collected a total of 153 cultivars. Three cultivars were lost (due to mortality), leaving us with our target of 150 cultivars at CANR as of 11/1/2016. All plants were repotted into a three gallon pot to ensure plants were uniform in condition. We begin taking flower data in March 2015 by taking weekly pictures to track bloom periods. Flower size

data was collected spring of 2017. Data on the plant hardiness and mature size of the cultivar was sourced from web sites during the winter and spring of 2017 for inclusion in our published results. Our Project partners from UGA contributed many hours of assistance in analyzing all of the data and designing the posters.

*Insect preference survey:* All 150 cultivars obtained were treated when received to eliminate any insects, in order to begin the evaluation 'clean'. Plants were placed in screened houses and Azalea Lacebug and Strawberry Root Worm insects were introduced into the houses. Both of these insects were allowed to establish over 2016. Azalea Lacebug preference was measured in late fall 2016 by taking leaf samples and counting frass on the underside of each leaf, which research has shown is an appropriate measure of insect preference (Chappell et al., 2005). Strawberry Root Worm preference ratings were conducted in summer 2017 as a visual rating of foliar damage. The data collection took a great deal more time than expected, our project partner, Dr. Chappell and help from UGA were critical in making these measurements and categorizing the preference levels. Our Project partners from UGA contributed many hours of assistance in analyzing all of the data and designing the posters.

*Determine the interaction of temperature in the root zone and air temperature and their effect on plant growth and flowering:* Temperature modification chambers were constructed to initiate flowering based on a modified root or air temperature. Three chambers were constructed, one for air temperature modification, one for root temperature modification, and a control. Five plants of three different cultivars were placed in each chamber and temperature was kept at 77°F in the modified areas. We found a significant difference in plant growth and flowering in various treatments. Plants in the high air temperature treatment (with ambient temperature root zone temperature) bloomed a month earlier than those in the high soil temperature treatment (with ambient air temperature). This project was repeated over two growing seasons to confirm results. Our Project partners from UGA contributed many hours of assistance in analyzing all of the data and are now working on publication of the results.

*Plant growth regulators to determine their effect on flowering and growth in an outdoor setting:* The initial project was set up in spring 2016 to identify PGRs that caused the greatest level of growth modification. Configure<sup>®</sup>, Piccalo<sup>®</sup>, Florgib<sup>®</sup>, Citadel/Dazide<sup>®</sup>, and Concise<sup>®</sup> were applied twice at labeled rates to five plants of five cultivars. Our initial trial indicated the Piccalo<sup>®</sup> showed the greatest potential for growth reduction and Florgib<sup>®</sup> showed the best potential for inducing growth. In fall 2016 we set up for more extensive trials of these two products, on more cultivars, to look at their interaction and the ability to modify bloom timing. Plants were treated with Piccalo<sup>®</sup> and Florgib<sup>®</sup> in spring 2017, however we were not able to achieve any statistical difference in blooming, only vegetative growth differences were

achieved. We believe there is potential to achieve bloom timing modification in an open, non-greenhouse environment, however not with currently available plant growth regulator.

### **Goals and Outcomes Achieved**

*Create a standard evaluation of 150 reblooming azaleas and commercially available traditional spring flowering azaleas for bloom period, flower color, and growth habit:* Our goal was to survey the 150 most commonly available azaleas, by trialing at CANR, with trials beginning by March 2015, to identify cultivars that reliably flower during peak market demand. CANR researched common spring only flowering cultivars of azaleas by taking the availabilities of multiple nurseries and finding the common cultivars grown over the range of growers, these cultivars were then sourced from the growers. For re-blooming Azaleas we took the view that as many of these cultivars as we could source needed to be included since they are becoming a larger percentage of total Azalea sales, there are many new cultivars being released whereas spring flowering cultivars are becoming fewer and there is less know about them in the market. This process took a bit longer than we had anticipated. Our target was 150 cultivars and we collected a total of 153 cultivars. Three cultivars were lost (due to mortality), leaving us with our target of 150 cultivars at CANR as of 11/1/2016. All plants were repotted into a three gallon pot to ensure plants were uniform in condition. Our target was to take data on flower period, size, and color from 2014 - 2017. The delay in sourcing all of the cultivars delayed data collection by 12 months. We began taking flower data via pictures on March 20, 2015, a total of 17,115 images were captured over the course of the project to track flowering. We concluded our data collection on July 28, 2017. These pictures were then evaluated for beginning, peak, and end of bloom. Data on the plant hardiness and mature size of the cultivar was sourced from web sites during the winter and spring of 2017 for inclusion in our published results. The final outcome of this work is a listing of cultivars and their associated flowering and growth characteristics that is available on-line in Adobe pdf format and in poster format. Outcome benchmarks from the stated goal were to be measured by the creation of web page on the CANR website in 2015 and publication of results on the CANR web site in 2016 and 2017. Unfortunately do to the delay in getting cultivars and the enormous amount of data generated from this project publication of the results was delayed to fall 2017. Additionally, our benchmark called for, the published results and posters will be distributed to the Georgia Cooperative Extension Service, Master Gardeners, and Green Industry groups with a target of 1,000 distributions and 5,000 web page hits for 2017. With the large amount of data we wanted to include on the posters we decided to do a two poster set, 500 of these sets have been printed and will be distributed fall 2017 and winter 2018. We have just now finished the modifications to the web site with the addition of a page containing the results of this project, <http://canr.org/plantevaluations/azalea.html> so no page hits have been seen as of yet. Do to the delays in finishing the project we were unable to meet our goals within the grant period in

2017, however, we have sent out a newsletter to our 450 plus contact and posted on Facebook to increase awareness of this information being available. We have also begun distribution of the 500 poster sets, and we are working on publication of the results in journals. We also made this project the focus of our 2018 Wintergreen booth at the GGIA tradeshow attended by an estimated 2,800 industry professionals. We believe we will hit the 5000 web page hits over the next 12 to 18 months, successfully meeting all stated goals.

*Insect preference survey:* All 150 cultivars obtained were treated when received to eliminate any insects, in order to begin the evaluation 'clean'. Plants were placed in screened houses and Azalea Lacebug and Strawberry Root Worm insects were introduced into the houses. Both of these insects were allowed to establish over 2016. Azalea Lacebug preference was measured in late fall 2016 by taking leaf samples and counting frass on the underside of each leaf, which research has shown is a appropriate measure of insect preference (Chappell et al., 2005). Strawberry Root Worm preference ratings were conducted in summer 2017 as a visual rating of foliar damage. The data collection took a great deal more time than expected, Dr. Chappell and help from UGA were critical in making these measurements and categorizing the preference levels. Our Benchmark was publication of initial ratings in October 2015 and final rating in October 2016. Results have been published on the CANR website and distributed to the Georgia Cooperative Extension Service, Master Gardeners, and Green Industry groups with a target of 1,000 distributions and 5,000 web page hits for 2017. Unfortunately, with the large amount of data collected and processed we were delayed in finishing the publication of this work until the end of the project timeline. The rankings have been incorporated in the posters and 500 of these sets have been printed and will be distributed to the Georgia Cooperative Extension Service, Master Gardeners, and Green Industry groups fall 2017 and winter 2018. We have just now finished the modifications to the web site with the addition of a page containing the results of this project, <http://canr.org/plantevaluations/azalea.html> so no page hits have been seen as of yet. Do to the delays in finishing the project we were unable to meet our goals within the grant period in 2017, however, We have sent out a newsletter to our 450 plus contact and posted on Facebook to increase awareness of this information being available. We have also begun distribution of the 500 poster sets, and we are working on publication of the results in journals. We also made this project the focus of our 2018 Wintergreen booth at the GGIA tradeshow attended by an estimated 2,800 industry professionals. We believe we will hit the 5000 web page hits over the next 12 to 18 months, successfully meeting all stated goals.

*Interaction of temperature in the root zone and air temperature and their effect on plant growth and flowering:* Temperature modification chambers were constructed to initiate flowering based on a modified root or air temperature. Three chambers were constructed, one for air temperature modification, one for root temperature modification, and a control. Five plants of three different cultivars were placed in each chamber and temperature was kept at

77°F in the modified areas. We found a significant difference in plant growth and flowering in various treatments. Plants in the high air temperature treatment (with ambient temperature root zone temperature) bloomed a month earlier than those in the high soil temperature treatment (with ambient air temperature). This project was repeated over two growing seasons to confirm results. With this research we have achieved an increase in awareness of the mechanism for inducing and restricting growth and flowering of azaleas and thereby have achieved our objective for this project. Our BENCHMARK will be publishing of results from this trial in 2015 and 2016 on the CANR web site. We have just now finished the modifications to the web site with the addition of a page containing the results of this project, <http://canr.org/plantevaluations/azalea.html> so no page hits have been seen as of yet. Do to the delays in finishing the project we were unable to meet our goals within the grant period in 2017, however, We have sent out a newsletter to our 450 plus contact and posted on Facebook to increase awareness of this information being available. We have also begun distribution of the 500 poster sets, and we are working on publication of the results in journals. We also made this project the focus of our 2018 Wintergreen booth at the GGIA tradeshow attended by an estimated 2,800 industry professionals. We believe we will hit the 5000 web page hits over the next 12 to 18 months, successfully meeting all stated goals. Dr. Chappell from UGA is currently working on the publication of the results from the temperature modification trial in horticultural journals, this will expand the visibility of this work beyond our original expectations of only web site publishing

*Plant growth regulators to determine their effect on flowering and growth in an outdoor setting:* The initial project was set up in spring 2016 to identify PGRs that caused the greatest level of growth modification. Configure<sup>®</sup>, Piccalo<sup>®</sup>, Florgib<sup>®</sup>, Citadel/Dazide<sup>®</sup>, and Concise<sup>®</sup> were applied twice at labeled rates to five plants of five cultivars. Our initial trial indicated the Piccalo<sup>®</sup> showed the greatest potential for growth reduction and Florgib<sup>®</sup> showed the best potential for inducing growth. In fall 2016 we set up for more extensive trials of these two products, on more cultivars, to look at their interaction and the ability to modify bloom timing. Plants were treated with Piccalo<sup>®</sup> and Florgib<sup>®</sup> in spring 2017, however we were not able to achieve any statistical difference in blooming, only vegetative growth differences were achieved. We believe there is potential to achieve bloom timing modification in an open, non-greenhouse environment, however not with currently available plant growth regulators. A discussion of results and pictures from this trial can also be found on the CANR website. The output benchmarks of zero azalea PGR trials conducted in 2014 by CANR, 5 treatments in 2016, and 5 treatments in 2017 were met, however we delayed publication due to the inconclusive and ultimately failure of the desired results due to a lack of PGR effect. While we believe there is potential to achieve bloom timing modification in an open, non-greenhouse environment the outcome of this goal to increase the awareness and the ability to utilize plant growth regulators

to control flowering in an outdoor setting was not met. A discussion of results and pictures from this trial can also be found on the CANR website, <http://canr.org/plantevaluations/azalea.html>.

## **Beneficiaries**

The beneficiaries of this project are all individuals associated with the Green Industry in Georgia and across the Southeastern United States. We have or will shortly have directly touched the 450 plus contacts through email, 500 poster set recipients, and thousands more through journal publications. We also made this project the focus of our 2018 Wintergreen booth at the GGIA tradeshow attended by an estimated 2,800 industry professionals. This includes nearly 450 commercial growers in the state of Georgia and potentially the millions of consumers who purchase plant material and research plant material on the web. It is our intention to provide unbiased information, noting that information empowers all individuals to make more informed decisions. Unfortunately, the economic impact is nearly impossible to measure. However, azaleas are one of the largest single crops grown by nursery producers in the southeast, generating over \$4 million USD in sales in Georgia and \$39.5 million USD in sales across six southeastern states ([Census of Agriculture, 2007](#)), so a modest projection of sales increases due to this project of 10% would result in increased profits of \$400 thousand USD in GA and \$4 million USD across the southeast. Additionally, cultivar evaluations for insect resistance/tolerance has the potential to reduce costs associated with commercial nursery and home chemical use, reducing environmental impacts and increasing grower sales and profit by:

- More efficient cultivar selection
- Reducing insecticide use in production and home landscapes.
- Increasing consumer awareness of resource-efficient plant material.
- Higher quality of plant material available to the end user, consumer
- Reducing losses due to plants not finishing on time
- Reduced cost of production
- Increasing sales due to new plant introductions.

## **Lessons Learned**

Our most significant challenge throughout this project was meeting the ambitious timeline we had developed; we had delays in beginning the project due to sourcing of cultivars. When developing the timeline we could look at availabilities and easily find a number of cultivars, however by the time the project was awarded and we began sourcing cultivars these

availabilities had changed, and cultivars were either not available or they were scattered between distant locations which made it challenging to get the plants shipped to CANR. The amount of data the project generated and the time it took to process this data was also something we underestimated, this delayed the publishing of the data until the end of the project and has caused us to not be able to quantify our benchmarks as well as we should have been. While this is a short term problem with the reporting period of this project, we have confidence we will meet and exceed our benchmarks over time and are willing to submit an addendum with this information in 12 months if GDA feels this would be beneficial. The best way to address these issues is to plan to have delays in the initial development of the project. We believe the overall project was a success, however one part of the project, the plant growth regulator study to determine their effect on flowering and growth in an outdoor setting did not work out as we hoped. We believe this shows the benefit of a multifaceted project in that if one aspect does not work out as planned we still have several very successful aspects we did achieve. One aspect that worked out better than we had hoped was the Interaction of temperature in the root zone and air temperature and their effect on plant growth and flowering. The results were so dramatic that we replicated the project and will publish this work in a scholastic journal which will expand and extend the reach of this work.

### **Contact Person Information**

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### **Additional Information**

Citations: Chappell, M. and C. Robacker. 2005. [Leaf Wax Extracts of Four Deciduous Azalea Genotypes Affect Azalea Lace Bug \[\(\*Stephanitis pyrioides\* \(Scott\)\] Survival Rates and Behavior](#). J. American Soc. Hort. Sci. 131:225-230.

## **2. Children's Museum of Atlanta-*Eat a Georgia Rainbow Program and Georgia Farm Exhibition* – Final Performance Report**

### **Project Summary**

The Children's Museum of Atlanta (CMA) received funding for two key initiatives for the 2014-2015 grant year. *Eat a Georgia Rainbow* is the Museum's first initiative, designed to educate children and their adult caregivers about Georgia grown fruits and vegetables and teach healthy

eating habits in order to combat the epidemic of childhood obesity. CMA serves children ages 0 to third grade, and these years are when children build lifelong habits of good nutrition. Weekly programming educates visitors about fun ways to eat healthfully using seasonal Georgia specialty crop fruits and vegetables. *Eat a Georgia Rainbow* includes cooking classes and a school outreach program, “Georgia Grown Specialty Crops.”

The second initiative was a key part of the CMA’s capital renovation of Museum spaces. The Children’s Museum of Atlanta was twelve years old when the renovation began, and as a hands-on minds-on museum, was due for a capital refresh. Goals of the *Georgia Farm* refresh included helping children understand where food comes from, how it grows, and what life is like on a farm, all while having hands-on fun. The development of the exhibitions in the *Georgia Farm* was guided by educators, representatives from the Georgia Department of Agriculture and key Georgia crop commissions, such as the Georgia Grown Commission. The Farm now features new exhibits on Georgia Specialty fruit and vegetable crops, such as an interactive video on “How Seeds Grow” as well as current favorites like the Museum’s farm stand featuring specialty crops grown in Georgia. The Farm is a core part of our Fundamentally Food section, which guides children in learning the food path from Farm to Table.

### **Project Approach**

*Eat a Georgia Rainbow* is designed to educate children and their adult caregivers about Georgia specialty grown fruit and vegetable crops and teach healthy eating habits to combat the ongoing epidemic of childhood obesity. Georgia has the second highest rate of overweight and obese children in the nation with almost 40% of children ages 10-17, and nearly 30% of children ages 2-5 are considered overweight or obese. In 2012, Governor Nathan Deal responded to this crisis by launching an initiative to address childhood obesity through government, philanthropic and academic efforts. Excess weight impacts a child's physical and mental well-being and is associated with serious health risks including asthma, type 2 diabetes, sleep apnea, liver disease, and high blood pressure. Obese children are more likely to become obese adults leading to continued risk factors and disease, and rising medical costs. Obesity related hospitalizations of children in Georgia cost over \$2 million per year and this cost is expected to rise. It is surmised that this latest generation of children may be on track to have a shorter lifespan than their parents. In Georgia and nationwide, minority children have even higher rates of obesity, and this ethnic disparity has grown significantly in the past several years. Parents and childcare providers must be responsible for making health, nutrition and fitness a priority for children. CMA's goal is to educate caregivers by providing accessible solutions and tools for permanent lifestyle change.

CMA serves children ages 0 to third grade, and these years are key developmentally. During these ages, with the help of their adult caregivers, children can build lifelong habits of good nutrition. Weekly *Eat a Georgia Rainbow* programming educates visitors about fun ways to eat healthfully using seasonal Georgia fruits and vegetables. In the winter months, children and their adult caregivers work with the Museum’s actor/educators to create healthy snacks from Georgia specialty grown fruit and vegetable crops, such as a vegetable wrap. In the summer,

the healthy snack might be a blueberry/beet smoothie. The Museum partners with Specialty Crop Commissions to feature crops such as Georgia Peaches. The *Eat a Georgia Rainbow* initiative includes a cooking class series called “Cooking with Colors” both in the Museum and in low-income schools, and a school outreach program, “Georgia Grown Specialty Crops.” The objectives of these programs include introducing adult caregivers to new recipes and fun ways to get children engaged with eating more fruits and vegetables. Evaluation of the program has provided the Museum with positive statistical evidence of the program’s impact.

The second initiative was a key part of the CMA’s capital renovation of museum spaces. CMA’s Fundamentally Food area is one of the Museum’s most popular exhibitions and educates children on the food path from Farm to Table. Goals of the *Georgia Farm* refresh included helping children understand where food comes from, how it grows, and what life is like on a farm, all while having hands-on fun. The development of the exhibitions in the *Georgia Farm* was guided by educators, representatives from the Georgia Department of Agriculture and key Georgia crop commissions, such as the Georgia Agricultural Commodity Commission. The Farm features new exhibit areas, such as an interactive game “Run the Farm,” which will teach children about the different jobs.

The science of farming is featured in an interactive station, where seeds from different Georgia specialty crops are held in plexiglass cubes. As the cube is inserted into a station, a video illustrates what and how each seeds grows and is harvested. The Farm includes key Georgia specialty crops, such as a peach tree and Vidalia onions, peanuts, peppers and many more. All the video comes from the Department of Agriculture, or the Georgia Farm Bureau. The Museum plans to rotate the “crops” seasonally as much as possible, featuring such items as carrots in the winter and pumpkins and other squash in the fall. To help children follow the path from Farm to Table, there will be a sorting station, where children place different fruit and vegetable crops in the right bins, and ship them to the Grocery.

### **Goals, Outcomes and Beneficiaries**

Eat a Georgia Rainbow Program:

The *Eat a Georgia Rainbow* is designed to educate children ages 1 year to 9 years and their adult caregivers about Georgia specialty grown fruit and vegetable crops and teach healthy eating habits to combat the ongoing epidemic of childhood obesity. The Specialty Crop Grant Block Funding for this program covered September 2014-September 2015.

CMA serves children ages 0 to third grade, and these years are key developmentally. During these ages, with the help of their adult caregivers, children can build lifelong habits of good nutrition. Weekly *Eat a Georgia Rainbow* programming educates visitors about fun ways to eat healthfully using seasonal Georgia fruits and vegetables. In the winter months, children and their adult caregivers work with the Museum’s actor/educators to create healthy snacks from Georgia specialty grown fruit and vegetable crops, such as a vegetable wrap. In the summer, the healthy snack might be a blueberry/beet smoothie. The *Eat a Georgia Rainbow* initiative includes a cooking class series called “Cooking with Colors” both in the Museum and in low-

income schools, and a school outreach program, “Georgia Grown Specialty Crops.” The objectives of these programs include introducing adult caregivers to new recipes and fun ways to get children engaged with eating more fruits and vegetables. Evaluation of the program has provided the Museum with positive statistical evidence of the program’s impact.

The chart below shows the progress as of September 2015 on the Eat a Georgia Rainbow programming both in the museum and in the community (this is the year funded by the Specialty Crop Grant we received).

Goal	Activity	Outcome Measures	Outcomes Achieved
<p><b>Educate families and children about the variety of Georgia fruits and vegetables</b></p>	<p>Cooking with Colors and Eat a Georgia Rainbow</p>	<p>3,174 families and children to be reached</p>	<p>26 Eat a Georgia Rainbow Cold Cooking Demonstrations have been held, reaching over 3,500 children and families. This exceeded our goal of 3,174.</p> <p>81% strongly agreed the program gave them ideas about how to include vegetables and fruits in their children’s diet.</p> <p>89% strongly agreed their child learned something new about vegetables or fruits during the activity.</p> <p>83% strongly agreed they learned something new about vegetables or fruits during the activity.</p>
<p><b>Conduct “Georgia Grown Specialty Crops” to school children and educate them on plants, fruits, and vegetables</b></p>	<p>Outreach program for Georgia Grown and Eat a Georgia Rainbow with Imaginators</p>	<p>75% of children attending the outreach program will learn a minimum of five Georgia plants, fruits and</p>	<p>Children learned about blueberries, peaches, corn, watermelon, apples and green beans.</p> <p>All children showed increased knowledge in pre/post assessments on questions</p>

Goal	Activity	Outcome Measures	Outcomes Achieved
	going to local schools	vegetables	related to blueberries, corn, watermelon, apples and green beans.
<b>Educate children and their adult caregivers about the importance of Eating a Rainbow of Georgia Fruits and Vegetables</b>	50 Eat a Georgia Rainbow program to reach 500 children and caregivers	65% of caregivers polled will indicate an increased knowledge of Georgia grown fruits and vegetables and good ways to include them in their diet	<p>1,183 children (23 shows, 61 classes) saw a performance, exceeding the goal of 500.</p> <p>88% of educators strongly agreed that the children learned something new about Georgia fruits and vegetables.</p> <p>75% of educators strongly agreed that the children learned something new about ways to incorporate Georgia fruits and vegetables in their diet.</p>

Georgia Farm Exhibition:

The second initiative was a key part of the CMA’s capital renovation of museum spaces. After three years of fundraising and planning, the Museum began its renovation on August 1, 2015 and completed the entire renovation by December 12, 2015. The *Georgia Farm* exhibition opened that day to the general public.

CMA’s Fundamentally Food area is one of the Museum’s most popular exhibitions and educates children on the food path from Farm to Table. Goals of the *Georgia Farm* refresh included helping children understand where food comes from, how it grows, and what life is like on a farm, all while having hands-on fun. The development of the exhibitions in the *Georgia Farm* was guided by educators, representatives from the Georgia Department of Agriculture and key Georgia crop commissions, such as the Georgia Grown Commission. The Farm will feature two new exhibit areas, such as the educational computer interactive “Run the Farm.” This interactive will teach children about the different jobs farmers tackle. The interactive includes short video clips about the following farm jobs:

- 1) Raising Animals
- 2) Planting
- 3) Testing Soil
- 4) Planting Seeds
- 5) Harvesting
- 6) Food Safety

Videos were provided by the Georgia State Department of Agriculture, among other sources, including the Georgia Farm Bureau.

In addition, there is a Plant a Seed educational computer interactive, which illustrates how seeds related to different specialty crops grow. The featured seeds include: grass, pine, blueberries, peaches, onions, and peanuts. The computer interactive relates to planting and harvest areas in the *Georgia Farm* exhibition, where children will be able to “plant” potatoes, carrots, onions, and harvest corn. In addition, in the middle of the *Georgia Farm*, there is a “peach tree” that children can harvest.

Since the museum’s re-opening in December 2015, we have had more than 202,000 visitors. Over 16,000 of those were school field trip visitors. 9,000 visitors came from low-income families on our Target Free Second Tuesdays. We are very pleased and excited about our attendance with the re-opening and the fact that our families and children love the *Georgia Farm*.

### **Lessons Learned**

*Eat a Georgia Rainbow* continues to be a highly popular and well-received program, serving over 3,000 visitors this past year on Sunday afternoons, as well as an additional 2,000 children through outreach programming. The program’s impacts continue to show great impact year over year and we plan to keep it in place and find funds to support the programming.

*The Georgia Farm* is currently being evaluated to improve its impact on our visitors. Families love the interactives and spend a lot of time at them and use our tractor, but the planting beds are quickly empty of vegetables once children enter the museum! We are planning to create new exhibits to help children track the Farm to Table pipeline from our *Georgia Farm*. We will be working with an advisory group on creating additional interactive exhibitions to improve the “stay time” in the exhibition.

### **Contact Person**

Karen M. Kelly, Director of Exhibits & Education, Children’s Museum of Atlanta

### **Additional Information**

None

### **3a. Eastern Cantaloupe Growers Association-Addressing Risk Management Needs of Cantaloupe Growers in Preparation of the New FSMA Guidelines – Final Performance Report**

#### **PROJECT SUMMARY:**

With the advent of the new Food Safety Modernization Act (FSMA) regulations, cantaloupe growers have had special risk management training needs which required a good understanding of consumer trends following two major foodborne illness outbreaks. This project had three objectives to address the needs of Georgia cantaloupe growers. The primary objective was to update growers on the latest research regarding good agricultural practices in production and safe handling of cantaloupes in both the field and in packing facilities. The second objective was to train growers in the communications and processes required in the event of a recall. The final objective addressed a critical consumer trends study to help growers improve product marketing: This study identified those consumer trends which affect consumer buying habits – food safety concerns – price – production location (local vs. imported). Armed with this information, growers can better address a marketing program.

#### **PROJECT APPROACH:**

There were three GOALS for this project.

GOAL #1 – Educate Georgia cantaloupe growers on the most current and applicable food safety research so they can fully employ ‘best practices’ in their operations and comply with the national cantaloupe guidance document.

This goal increased the knowledge and understanding of cantaloupe food safety procedures for farm and packing facilities by bringing together food safety experts with the most current research findings. The project coordinated a 1 ½ day seminar that brought together growers with the most current research finding being presented. One of the activities for GOAL #2 was communication training for industry leaders. Both of these workshops were to be scheduled at a very critical point in the land preparation and planting cycle. To overcome the time sensitivities and increase attendance a combined conference with both media/recall ready training along with a research update was scheduled.

On February 23-24, 2015 participants met in Atlanta, Georgia for the ECGA Annual Conference and Research Update (Attachment 1: *Available from GDA upon request*). The media training (held on 2/23/15) and recall ready (held on 2/24/15) components of the program are outlined below.

Speakers for the Research Update included,

Dr. Cathy Webb, UGA

Update on four research projects that effect food safety practices for eastern cantaloupe growers.

Charles Hall, Executive Director, ECGA  
Presentation on best practices for ECGA certification program criteria.

Beth Oleson, Executive Director, Produce Food Safety Services  
Update on FSMA, status of comments and regulation concerns.

A good way for additional information distribution was support of researchers to present at the 2016 ECGA Annual Conference. On February 18, 2016 a one-day seminar was held to update growers on the latest findings as it relates to water issues (*Attachment 5: Available from GDA upon request*). In addition, participants at the meeting heard a final summary report on the consumer trends as it relates to food safety (GOAL #3) and they heard a report on the latest FSMA regulations.

GOAL #2 – Provide growers education and communication training should the grower have a cantaloupe recall and a crisis communications plan is immediately needed.

The second goal for the ECGA 2014 SCBG provided educational sessions to prepare growers for crisis communications and operational procedures should they have a cantaloupe recall.

In reviewing effective media training workshops it was determined that ‘on camera’ practice interviews were the most effective. Due to the time the workshop was only provided to the ECGA Board of Directors this year. Possibly providing this to all members in the future would be an option. The media training workshop was held on February 23 and presented by Amy Philpot of Watson Greene, a public relations and crisis communications firm in Washington, DC.

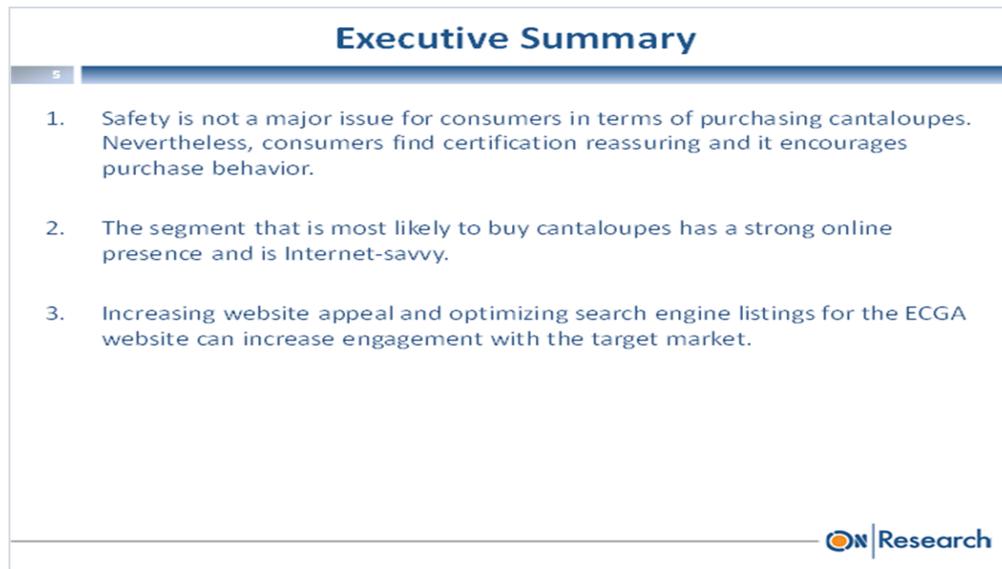
The next day a Recall Ready workshop (*Attachment 1: Available from GDA upon request*), was also lead by Amy Philpot, to be sure growers had all their systems in place for both internal and external communications before, during and after a recall. Ms. Philpot was also available for private discussions with growers in the afternoon to answer any confidential questions growers had which could not be asked in an open workshop.

GOAL #3 – Conduct a consumer perception research study, identifying consumer trends for their purchase of cantaloupes. The study would identify those factors that affect consumer buying habits and is food safety a major consumer concern.

The ECGA staff team issued an RFP to several consumer research firms. Following a review of the proposals received staff conducted telephone interviews. OnResearch, Inc. from Toronto, Canada was selected to conduct the study.

Work on the quantitative online survey began in mid-February 2015. The survey reached 1,000 U.S. consumers in various demographics - gender, age, income, # in household, presence of children in household, education, employment, race/ethnicity, type of area, state, level of contribution to grocery shopping.

Results were reported in late May, 2015 (Attachment #2: *Available from GDA upon request*) and two Infographics were developed, one for growers (Attachment #3: *Available from GDA upon request*) and one for retailers (Attachment #4: *Available from GDA upon request*). The Key findings were:



### **Significant Contributions and Role of Project Partners**

The project partners played a significant role in the success of this project. As noted above there were three goals to the project as it relates to grower education, grower communication and consumer perception as related to cantaloupe food safety. Listed below are the project partners and the significant contributions they provided,

- University of Georgia -speaker (Dr. Cathy Webb) to provide food safety updates on the latest research efforts at UGA and other institutions to growers attending the 2015 annual conference. This helped increased the knowledge and understanding of cantaloupe food safety procedures for farm and packing facilities
- Produce Food Safety Services - speaker (Beth Oleson) provided operational practices for growers to understand the latest food safety guidelines.
- Watson-Green - speaker (Amy Philpot) trained the association leadership on media relations and led a Recall Ready workshop to be sure growers had all their systems in place for both internal and external communications.

- OnResearch, Inc – conducted consumer research with key finding shown above. Representatives from the firm presented results at the Annual Meeting and helped ECGA develop an infographic on the findings for both growers and retailers.

Other partners included: Georgia Fruit and Vegetable Growers Association, Georgia Farm Bureau and Georgia Watermelon Association that assisted in distributing promotional and marketing flyers for the annual meetings.

**GOALS and OUTCOMES ACHIEVED:**

GOAL #1 – Educate Georgia cantaloupe growers on the most current and applicable food safety research so they can fully employ ‘best practices’ in their operations and comply with the national cantaloupe guidance document.

Pre and post tests were given to participants to measure the knowledge of the attendees before and after attending the Conference and Research Update. According to the pre-survey, when asked to estimate their knowledge and understanding of ‘best practices’ for cantaloupe production and distribution the attendees said,

Limited or very limited knowledge	7%
Moderate or good knowledge	68%
Excellent or Expert knowledge	24%

Following the research update, 97% of the attendees said the information presented increased their knowledge and understanding of cantaloupe food safety practices. The TARGET for the Research Update was to increase the knowledge of at least 80% of the attendees.

For the Food Safety update and FSMA workshop held in February 2016, pre- and post- tests were given to participants to measure the knowledge of the attendees before and after attending the workshop. When asked to estimate their knowledge and understanding of the Produce Safety and Preventative Control FSMA Rules, the attendees said,

	<u>Pre-wkshp</u>	<u>Post-wkshp</u>
Very little or Limited knowledge	30%	15%
Moderate knowledge	42%	44%
Good or Excellent knowledge	28%	41%

While the scoring for 'moderate knowledge' increased 2%, the 'good or excellent' category increased 13% in the post workshop questionnaire.

With regard to 'good food safety practices' participants said the information presented increased their knowledge and understanding of cantaloupe food safety practices as good or excellent by 91%. The TARGET for the Research Update was to increase the knowledge at least 80% of the attendees. In addition the attendees estimated the value of the information received as 'good or excellent' for their operations at 97%.

GOAL #2 – Provide growers education and communication training should the grower have a cantaloupe recall and a crisis communications plan is immediately needed.

The TARGET for GOAL #2 was to increase the knowledge and understanding of at least 80% of the participants in the two workshops.

For the MEDIA TRAINING participants when asked, 'do you feel more knowledgeable and confident in your ability to talk with the media?' 88.8% of the participants said yes. This EXCEEDED the target goal for this session of 80%.

For the RECALL READY communications workshop, when asked, 'did the information presented increase your knowledge to make your organization READY should you have a RECALL?', 97% of the participants said yes, EXCEEDING our target goal of 80%. In addition, 97% of the participants said the value of the information received was 'good or excellent' to use in their daily operations.

GOAL #3 – Conduct a consumer perception research study, identifying consumer trends for their purchase of cantaloupes. The study would identify those factors that affect consumer buying habits and is food safety a major consumer concern.

The TARGET for this study was to identify the reasons consumers 'buy' and 'don't buy' cantaloupes, and is 'food safety' an issue in their decisions. As noted on the 'infographics', the primary factors influencing consumer purchase of cantaloupes is taste, quality, and cost. Concern about food safety is at the same level for cantaloupes as it is for watermelons, blueberries, apples and oranges.

### **Comparison of Actual Accomplishments with Goals Established:**

Outlined below are the targets established for each of the GOALS as noted in the project application.

#### **GOAL #1**

Goal Established:

Increase knowledge and understanding of at least 80% of participants at the research annual meeting measured by pre-and post- testing for the conferences in 2015 and 2016.

Actual Accomplishment:

2015 - **97% of the attendees** said the information presented increased their knowledge and understanding of cantaloupe food safety practices.

#### **GOAL ACCOMPLISHED**

2016 - Participants said the information presented in 2016 increased their knowledge and understanding of cantaloupe food safety practices as good or excellent **by 91%**.

#### **GOAL ACCOMPLISHED**

#### GOAL #2

Goal Established:

GOAL #2 was to increase the knowledge and understanding of at least 80% of the participants in the two workshops.

Actual Accomplishment:

For the Media Training when asked, 'do you feel more knowledgeable and confident in your ability to talk with the media?' **88.8% of the participants said yes.**

#### **GOAL ACCOMPLISHED**

For the RECALL READY communications workshop, when asked, 'did the information presented increase your knowledge to make your organization READY should you have a RECALL?', **97% of the participants said yes.**

#### **GOAL ACCOMPLISHED**

#### GOAL #3

Goal Established:

To identify the reasons consumers 'buy' and 'don't buy' cantaloupes, and is 'food safety' an issue in their decisions.

Actual Accomplishment:

The consumer survey and research determined the primary factors influencing consumer purchase of cantaloupes is taste, quality, and cost. Concern about food safety is at the same level for cantaloupes as it is for watermelons, blueberries, apples and oranges.

**GOAL ACCOMPLISHED**

**BENEFICIARIES:**

The beneficiaries of this project were the approximately 250 specialty crop farmers in Georgia who are growing cantaloupes. In 2014, these growers planted more than 3,100 acres of cantaloupes with a farm value of \$19.8 million.

**LESSONS LEARNED:**

No operational lessons learned. The projects came together as expected and we were very pleased. A second research conference was able to be funded and a new project entitled, 'Cantaloupe Variety Taste Evaluations.'

**CONTACT PERSON:**

Charles Hall, Executive Director  
Eastern Cantaloupe Growers Association  
251 S.L. White Blvd.  
Lagrange, GA 30241

**ADDITIONAL INFORMATION:**

We have provided five ATTACHMENTS (*available upon request from GDA*) that provide background information, on the Research conferences, consumer studies, and crisis communication workshop.

**3b. Eastern Cantaloupe Growers Association-Variety Taste Evaluations-- Final Performance Report**

*There were remaining funds after the original project was finished. With GDA and USDA's approval of a scope and budget change in May 2017, the following new project was completed.*

**PROJECT SUMMARY:** Cantaloupes are a significant vegetable commodity in Georgia. They are grown on roughly 3100 acres and produce a farm-gate income of nearly \$20 million. While most eastern cantaloupe varieties have superior flavor and aroma, the limited shelf life of these varieties are of concern to retailers and consumers. During the summer of 2016, Dr. Tim Coolong conducted a variety

evaluation focusing on the eastern shipping melons as well as long shelf life melons. The 2016 study provided growers with data concerning production, yield, sugars, firmness and other postharvest shelf-life qualities. Prior to this study no consumer evaluations had been conducted as to taste, texture and aroma of the traditional eastern cantaloupe or the eastern long shelf life melon.

The objective of this evaluation was to determine, by statistically valid consumer taste test methodology, if the overall preference of the traditional eastern cantaloupe variety and the new longer shelf life variety, is significantly higher or lower than that of the industry standard 'western shipper' varieties.

**PROJECT APPROACH:** The taste evaluation was conducted under ATSM compliant standards for paired taste testing. Proper food safety standards were followed regarding chilled storage, washing product prior to cutting, maintaining proper fruit temperatures, food handling procedures, etc. A total of 200 samples (100 traditional eastern and 100 longer shelf life) were to be paired against the industry standard 'western shipper' variety. Unfortunately at the time (June) of the taste testing the Eastern LSL (Longer Shelf Life) was not available. The samples were changed to have the traditional eastern variety paired against a 'western shipper' variety and the new western LSL' variety. For Test #1 (Eastern vs. Western Shipper) a total of 113 paired samples were tested. For Test #2 (Eastern vs. Western LSL) a total of 115 paired samples were tested. The screening criteria for the consumers were ages 18-64, with positive cantaloupe acceptance (like or like very much) and interest in participating in evaluation (interested or very interested). The taste testing was conducted on June 28<sup>th</sup> thru June 30<sup>th</sup>, 2017 at Downtown Cross in Gaithersburg, MD. This was a downtown location with residences, shops, and restaurants, as well as community events such as summer concerts and farmer's market.

**GOALS and OUTCOMES ACHIEVED:** The goal of this study was to determine consumer preference for cantaloupe taste, firmness and aroma between the traditional eastern, the long shelf life and western standard varieties. The key findings showed the traditional Eastern variety tested very well against the Western Shipper cantaloupes. Consumers preferred the eastern cantaloupes 36% over 23% on overall flavor liking, 60% over 27% on texture and 58% over 42% in overall preference. It is unfortunate the Eastern LSL was not available to be compared to the Western. The traditional Eastern tested lower than the Western LSL in taste and texture. This information will help Georgia specialty crop growers determine which varieties they should grow in the future to help increase their profitability.

**BENEFICIARIES:** The beneficiaries of this project were the approximately 250 specialty crop farmers in Georgia who are growing cantaloupes. In 2014 these growers planted more than 3,100 acres of cantaloupes with a farm value of \$19.8 million.

**LESSONS LEARNED:** The primary lesson learned is one that could not be controlled or predicted in the future. The Eastern LSL melon was not available due to growing conditions this year. There was not enough product on the market in Maryland due to weather conditions to have the Eastern LSL in the testing.

**CONTACT PERSON:**

Charles Hall, Executive Director,

Eastern Cantaloupe Growers Association

251 S.L. White Blvd.

LaGrange, GA 30241

**ADDITIONAL INFO:**

none

**4. Georgia Agritourism Association-*Increasing Profitability and Productivity Of Specialty Crop Agritourism Producers through Education and Educational Tools*– Final Performance Report**

**PROJECT SUMMARY:** Specialty crop agritourism is the convergence of two vital industries in Georgia: specialty crop agriculture/processing and tourism. This also allows farms producing and processing specialty crops to diversify their income streams by adding services, experiences and value-added products to their offerings. Keys to the development of specialty crop agritourism are: 1) educating specialty crop producers interested in entering the agritourism marketplace with knowledge about the start-up and operation of this kind of enterprise; and 2) facilitating the growth and expansion of existing specialty crop agritourism producers with educational workshops to stay ahead of consumer demands.

**PROJECT APPROACH:** The approach of the project was to implement delivery venues that would insure the goals of the project were accomplished. This project provided specialty crop producers in the agritourism industry educational opportunities including:

1. A two-day conference,
2. One-day workshops,
3. FAM Media Tour to create marketing opportunities for specialty crop agritourism operations across the state via online website, e-blasts, blogs, and/or print media,
4. Educational tools for specialty crop agritourism producers to distribute to children visiting their farms in order to learn about the production and nutritional aspects of specialty crops

**Significant Contributions and Role of Project Partners**

There were lots of Project Partners who played significant roles to enable the grant projects to come to fruition. From private partners such as Georgia Agritourism Association general members, Board of Directors, and industry friends to state partners like the Georgia Departments of Labor, Agriculture, and Economic Development, this was definitely a team effort. Below is an overview of each grant project broken down by areas.

1. **The 2015 GAA Annual Conference** was coordinated and executed by the Georgia Agritourism Association staff, Board of Directors, and conference committee.

- a. **Farm Tour** – The following project partners volunteered to allow 2015 GA Agritourism Annual Conference attendees to visit their farm, provide an insiders tour, share their stories of how they got started, how their agritourism operation and services have evolved and why, as well as any future aspirations or plans they cared to share. At each stop, each project partner voluntarily provided refreshments and/or samplings of their goods. All attendees were able to walk freely, take photographs, ask questions, shop (if a store front was available), and network with other attendees.
    - i. Raisin’ Cane, Valdosta
    - ii. Thompson Farms Smoke House, Dixie
    - iii. Frogtown Winery, Hahira
    - iv. Gin Creek, Hartsfield
    - v. Ochlockonee Ridge Farms, Moultrie
    - vi. Sparkmans Cream Valley, Moultrie
    - vii. Horse Creek Winery, Sparks
  - b. **The Educational Program** was coordinated by the Georgia Agritourism Association staff, Board of Directors, and conference committee. The following project partners provided educational content regarding risk management, marketing, legal and/or regulatory issues, as well as good business practices for specialty crop agritourism operations.
    - i. GA Dept of Labor
    - ii. UGA SBDC
    - iii. James-Bates-Brannan-Groover, Macon, GA
    - iv. GA Dept of Agriculture
    - v. Alston & Bird, Atlanta, GA
    - vi. GA Dept of Economic Development, Tourism Division
    - vii. Full Media, Gainesville, GA
    - viii. Rock Ranch, The Rock, GA
    - ix. Bagwell Insurance, Gainesville, GA
2. **The November No Bus Tour** was coordinated by the Georgia Agritourism Association staff, Board of Directors, and tour committee. The following project partners allowed attendees to their farm, provide an insiders tour, share their stories of how they got started, how their agritourism operation and services have evolved and why, as well as any future aspirations or plans they cared to share. At each stop, each project partner voluntarily provided refreshments and/or samplings of their goods. All attendees were able to walk freely, take photographs, ask questions, shop (if a store front was available), and network with other attendees.
- a. White Oak Pastures, Bluffton, GA
  - b. Quail Country Plantation, Arlington, GA
  - c. Still Pond Vineyard, Arlington, GA
3. **The FAM Media Tour** was coordinated by the Georgia Agritourism Association staff, Board of Directors, and FAM committee.
- a. **The FAM Coordinators** spent countless hours reviewing and vetting potential writers and bloggers to increase specialty crop consumption and education through exciting their readership with their review of agritourism operations across Georgia. They also created an amazing FAM Tour to showcase Georgia’s agritourism industry and the wide variety of specialty crops and activities provided in Georgia.

- i. Anna Messer, Rock Ranch
    - ii. Cyndie Dickey, Dickey Peaches
    - iii. Wendy Barton, Lane Southern Orchards
    - iv. Caroline Lewallen, Jaemor Farms
  - b. **The FAM Farm Hosts** allowed attendees to come to their farm, provide an insiders tour, share their stories of how they got started, how their agritourism operation and services have evolved and why, as well as any future aspirations or plans they cared to share. At each stop, each project partner voluntarily provided refreshments and/or samplings of their goods. All attendees were able to walk freely, take photographs, ask questions, and shop (if a store front was available). Those operations with restaurants showcased their food fares (cost carried by Georgia Agritourism Association, not this grant) as it is all part of the allure of the agritourism operation.
    - i. Southern Belle Farm, McDonough, GA
    - ii. Farmview Market, Madison, GA
    - iii. Mitcham Farms, Oxford, GA
    - iv. Berry’s Christmas Tree Farm, Covington, GA
    - v. Yule Forest, Stockbridge, GA
    - vi. The Rock Ranch, The Rock, GA
    - vii. Dickey Farms, Musella, GA
    - viii. Lane Southern Orchards, Fort Valley, GA
  - c. **FAM Media Bloggers** are well known social media professionals and/or bloggers. They were allowed the time to have “insider” discussions, quiet/alone time at each agritourism operation to take photos, create social media posts and teasers, as well as provide an overview of the day from their specific “blogger” perspective reaches each blogger’s audience in unique ways. Each of these bloggers were challenged to write posts to entice their readership not only to visit the FAM Farm Hosts but to go visit a specialty crop agritourism operation in their community. Most of the FAM Media Bloggers had some degree of food review. They were able to showcase the different specialty crops grown at each operation as well as served in the restaurants.
    - i. Sherry Coleman Collins, Southern Fried Nutrition
    - ii. Diane Hoffmaster, Turning the Clock Back
    - iii. Toby Bloomberg, Diva Foodies
    - iv. Ashley McLure, Ashley's Random Blog
    - v. Sue Rodman, 365AtlantaFamily.com
    - vi. Charlotte Cruce, Peachy Queen
4. **The Educational Activity Sheet for Children** came out of a membership request for educational “take home” materials to provide to school aged children who visit specialty crop agritourism operations. The following project partner worked with Georgia Agritourism Association staff and the Board of Directors to narrow down the large number of specialty crops represented in the agritourism industry as well as how to meet Georgia Dept of Education’s Core Curriculum standards for each grade level. These materials are made available to anyone on the Georgia Agritourism Association website, [www.georgia-agritourism.org](http://www.georgia-agritourism.org). All requests must answer specific questions such as how they plan to use the materials, the number and age of children who may be provided these handouts, etc.
- a. Content Coordinator/Designer – Caroline Lewallen, Jaemor Farms

**GOALS and OUTCOMES ACHIEVED:** The primary goals of this grant were to:

1. Educate specialty crop producers interested in entering the agritourism marketplace with knowledge about the start-up and operation of this kind of enterprise; and
2. Facilitate the growth and expansion of existing specialty crop agritourism producers with educational workshops to stay ahead of consumer demands.

These goals were achieved through the following projects:

*The 2015 Georgia Agritourism Annual Conference*

The 2015 Georgia Agritourism Annual Conference was held February 16-18 at the Rainwater Conference Center in Valdosta, Georgia. There were 125 attendees who were offered 23 hours of educational sessions (see attachment, *2015 GAA Conference Educational Program: Available from GDA upon request*).

The GOAL was to increase attendees’ knowledge and potential competitiveness of specialty crop agritourism practices. The TARGETS were exceeded by 4.5% as 89.5% of attendees indicated their knowledge of specialty crop agritourism practices and management techniques increased and 89.5% of attendees also rated the amount of educational information presented as significant or moderate.

<u>Performance Measurement:</u>	<u>2015 Georgia Agritourism Annual Conference</u>	
	<u>2015</u>	<u>TARGET / GOAL</u>
Attendance	125	
Knowledge of specialty crop agritourism practices	89.5%	+ Exceeded goal by 4.5%
Amount of educational information presented (Significant or Moderate)	89.5%	+ Exceeded goal by 4.5%

Attendees verbalized the 2015 Conference was probably one of the best Conferences offered up until that time. The problems seemed to be three-fold and they were not part of the block grant measurable but are points of interest that GAA Staff and the Board of Directors will use in future plans.

*1. Funds to market the Conference and its offerings*

The content offered at the 2014 and 2015 Conference was top notch and attendees verbalized it rivaled national agritourism industry meetings. However, due to the lack of funds of the organization and the marginal income produced by the Conference, there was very little money to market/promote the Conference outside of electronic means. While

many different support organizations helped spread the word, the lack of varied marketing mediums such as a “save the date” postcard or flier hurt the attendance.

2. *Lower than expected attendance*

Valdosta is in South Georgia yet surrounded by agritourism venues. However, after the site was chosen, contracts signed and registration was opened, it became apparent that most north Georgia industry operators felt it was too far to travel. Part of this view point stemmed from the fact the North Georgia agritourism industry was more established and mature than the budding South Georgia agritourism ventures. This was a newly discovered phenomenon within the state organization. As the overall state industry develops, it's the hope of the GAA Staff and Board this barrier can be broken.

3. *Speakers being very generous by not charging for their travel expenses*

Almost all of our speakers donated their time and expenses for the good of the industry and sponsors covered expenses for the good of the Conference. Only one speaker asked for reimbursement for a rental car. There were industry sponsors who volunteered to cover conference expenses such as programs and some educational handouts leaving extra funds in the Supplies Budget for the Conference.

*Two One-day Regional Agritourism Workshops*

The first regional workshop was conducted at Watermelon Creek Vineyards in Glennville, Georgia on December 10, 2014 (See attachment, *GAA December Workshop - 12.10.2014: Available from GDA upon request*). The workshop was built around the presentation “Going Beyond the Post” by Guerry Norwood of Full Media (See attachment, *12.2014 Going Beyond the Post – PPT: Available from GDA upon request*). The 28 registrants had the opportunity to understand the more advanced features of Facebook, Twitter, Vine, Pinterest, and other social media platforms as a marketing tool. This was followed by a lengthy “Best Ideas Round Table Discussion” where attendees were able to share their “best” practices of managing their operations as well present issues and ask for insight. The day was capped off with a very informative tour of Watermelon Creek Vineyards including a complimentary tasting of wine and other products.

The GOAL to increase attendees’ knowledge and potential competitiveness of specialty crop agritourism practices by at least 25% was exceeded as respondent’s indicated their knowledge increased by 41.6%. An interesting note from the workshop was most attendees were only utilizing Facebook to market their operations via social media. The post conference survey results indicated an increase in knowledge of using other social media outlets as marketing tools by 46.7% and 86.7% of respondents are considering using other social and/or online media tools (compared to Facebook).

None of the post-survey responses included names or contact information which does not allow GAA staff to contact specific attendees to report on implementation. However, the top three responses to “after this workshop, are you considering other social and/or online media outlets to market your specialty crop agritourism operation” were utilizing Pinterest, using more Hashtags, and starting Instagram accounts.

Performance Measurement:     Watermelon Creek One-Day Regional AgT Workshop

	<u>ACTUALTARGET / GOAL</u>	
Knowledge of specialty crop agritourism practices	41.6%	+ Exceeded goal by 16.6%

The second regional workshop entitled, November ‘No Bus’ Farm Tour, took place Tuesday, November 10, 2015 in southwest Georgia (see attachment *November No-Bus Tour: Available from GDA upon request*). The twenty-two (22) registrants toured three agritourism operations to learn about the following: on-farm lodging; farm-to-table dining programs, including how to source specialty crop fruits and vegetables when on-farm supplies were running low; organic compost production; pasture/grass management; timberland and plantation management; Muscadine production; the regulatory issues when considering beginning an on-farm winery; as well as the history of all the farms.

The GOAL and TARGET were exceeded after evaluating the pre- and post- workshop surveys with over 63.3% of attendees indicating their knowledge of grass/field management increased and 51.6% indicated their knowledge of timberland/plantation management increased. The post-conference survey results indicated that 40% of participants increased their knowledge of specialty crop practices and/or are considering implementing some of the information they gained at the workshop.

Performance Measurement:     November No-Bus Farm Tour One-Day Regional AgT Workshop

	<u>ACTUALTARGET / GOAL</u>	
Knowledge of specialty crop agritourism practices	40%	+ Exceeded goal by 15%

Agritourism operators thoroughly enjoyed the Watermelon Creek Vineyards workshop and the November No-Bus Farm Tour. The information presented was very well received. However, both locations were fairly remote...even for agriculture. We had a great turn out at both events which shows us most people will travel for good content. Staff and the Board of Directors felt if the locations would have been more central the attendance would have been higher. The “rock and hard place” of having a higher attendance is losing the intimate feel of the tour and the ability to share freely with a crowd smaller than 25 people.

*Enhancing Profitability of Specialty Crops through Online and Print Consumer Engagement*

On August 29-30, 2017, the GAA FAM Committee hosted six (6) official bloggers and one (1) guest on a two-day Familiarization (FAM) Media Tour for the expressed purpose to increase exposure, education, and ultimately promote increased purchase and consumption of specialty crops. There were no local tourism bureaus or school teachers/administrator in attendance. The group traversed the state in a 15-passenger van and visited eight (8) agritourism operations. Each stop was slightly different but the FAM Media Tour had the opportunity to meet the owners and operators of each specialty crop agritourism farm, hear their story and history, receive a tour and overview of the current business and

eat/taste/sample the goods from each farm (see attachment *GAA FAM Media Tour AGENDA: Available from GDA upon request*).

Bloggers and Committee alike were overwhelmed by the hospitality of the agritourism operations and the wonderful experience they offered these writers. Each writer was challenged before they attended the FAM Tour to not only write about the unique highlights of the specialty crop commodities, production, harvest, and nutrition they experienced on specialty crop agritourism operations, but also write to encourage their readership to get out of their routines and find an agritourism operation near them. The entire experience from corn maze and pumpkin patches, to the meals and food, to the value-added products such as jellies and salsas, to the you-pick was all part of the tour; it was all part of the experience; it was all part of the allure these bloggers have written about.

We've included the attachment *Social Media STATS-GAA FAM Tour 2017 (Available from GDA upon request)* to showcase the social media activity created by these bloggers while they were on the FAM Tour. The GOAL was accomplished to orchestrate online blogs, articles and social media for the purpose of increasing visits, purchases, consumption, and nutritional education on specialty crop agritourism farm operations. GAA staff have posted links to all articles and blogs on the GAA website (see attachment *GAA FAM Tour Newsletter: Available from GDA upon request*). The blog posts to date are as follows:

- <http://mypeachyqueendom.com/2017/09/fall-for-agritourism-in-georgia.html>
- <http://www.southernfriednutrition.com/farm-to-fun/>
- <https://www.turningclockback.com/how-to-support-local-farmers-georgia-agritourism/>

The PERFORMANCE MEASURE was the number of consumer comments/"likes"/shares for blog and online articles. The original TARGET has proven difficult to measure which was to have:

- 1,200 consumer comments/"likes"/shares for online articles and blogs,
  - The attachment (*Available from GDA upon request*) Social Media Stats shows there were 72 original posts from 20 original users on Twitter and Instagram
  - The posts including #gaagitourism reached 195,521 consumers while the posts including #exploregorgiafarms reached 191,176 consumers
  - This equated into 1,070,265 impressions with the #gaagitourism and 1,091,149 impressions with the #exploregorgiafarms on screens across the United States
  - From the list of "Recent Users" GAA Staff recognizes Rock Ranch, Farm View Market, Lane Southern Orchards, and Southern Belle Farms as agritourism farm stops on the FAM Tour that were reposting and sharing blogger posts and comments on their agritourism farm social media pages to engage their followers. There were other non-FAM tour agritourism farms who also followed the social media posts and reposted/re-tweeted for their followers. One example is Calhoun Produce.
- An average of 1 social media post per week reposting and/or linking to specialty crop specific agritourism articles/posts, and

- This will be limited as GAA will not be able to achieve 1 social media post per week over the course of a year. However, GAA will continue to follow up with the bloggers and continue to post blogs, comments, and any other relevant information on the GAA website and Facebook page.
- Two articles in print media.
  - There were no print media writers on the FAM tour. Therefore, there will be no print media.
- The PERFORMANCE MONITORING PLAN will be to have bloggers and online media groups report consumer comments/"likes"/shares for specialty crop specific agritourism articles on a quarterly basis.
  - GAA will continue to follow up with the bloggers regarding consumer comments/likes/shares.

Another part of this project was the development of an activity sheet most of the specialty crop agritourism operations could use either with school groups as they attended and educational tour or to pass out to families and groups with general attendance. There were five (5) activity sheets created (see attachments *Activity Sheet – All Commodities, Apple, Honey Bee, Pumpkin, and Strawberry: Available from GDA upon request*). They are all print ready files with a section at the top for the agritourism farm to be able to insert their logo. They can be used as a flat piece of paper or as a tri-fold brochure.

All activity sheets are based on educational standards from the Georgia Department of Education which is shown on the attachment *Activity Sheets GDoED K5Standards (Available from GDA upon request)*. This is provided to the specialty crop agritourism operations as well as any educators who are bringing school groups for educational tours.

The activity sheets are available for on the GAA website. Anyone who requests the print ready file must answer a few questions before receiving the free file. That form and questions are shown on attachment *Activity Sheet GAA Website and Question (Available from GDA upon request)*. In addition to contact information, they are asked:

- How will this educational tool be used?
- How many children to expect to utilized this tool?

Many of these activity sheets have been printed at cost by GAA and handed out at GAA Board meetings, membership meetings, annual conferences, agricultural industry trade shows, and several. While those numbers are impossible to measure, we can measure the number downloaded.

Performance Measurement: Educational Activity Sheets

Number Downloaded                      36

How many children do you expect to utilized this tool?                      Approx 18,000 in a 12-month period

How will this educational tool be used?

- Places in teacher resource bags

- Take home resource from field trips
- Promote Ag Literacy in elementary schools
- Help continue to educate children about different agricultural commodities produced in different parts of Georgia in Banks County Schools.

The main lesson learned is there is a lot of work that goes into ensuring the selection of the right bloggers/media personnel. Staff and committee spent hours reviewing blogs, posts and articles; reviewing each person's followership; then breaking up the invitation list into carefully selected lists of "GAA's First Preference to Attend", "GAA's Second Preference to Attend", etc. Most "social media influencers" as they are often referred to, have products they promote or represent. Often our invitation was followed up with a phone call overview of the tour, what we would be doing, what they would experience, and they then had to figure out if this was worth their time and coverage for their name/blog, products, and followers.

GAA staff felt the time line for planning from beginning to end was a bit rushed. After talking to the committee that handled the majority of the coordination, they felt the time would have been rushed regardless of the planning time frame. With the activity sheets, GAA staff have heard rave reviews from the folks using them. The problem is the same as other lessons learned which is getting the word out and putting the file in people's hands. Once they have it, they love it. They have also found it helps "market" their educational field trips to teachers interested in going to an agritourism operation since it's all based on educational standards.

**LESSONS LEARNED:** Hindsight is always the best sight. We learned lessons for each project as well as from the overall grant application. For the 2014 GAA Conference, I would have requested money specifically for marketing and promoting the Conference. I would have also started marketing the conference 2-3 months earlier to try to increase attendance. For the regional workshops, they could have been more centrally located in the state but they were outstanding workshops regardless of their location. For the activity sheets, we simply need more commodities developed. We continue to hear from agritourism operators they need more commodity specific educational materials for kids and for teachers to prepare for or follow up from a farm visit with students in the classroom. And with the FAM Tour we learned we should have requested additional funding to hire a marketing firm to help identify and select the bloggers. While the FAM Tour was an invaluable learning experience and we continue to see positive results from it, the time, money, and effort would have been better spend focusing on getting even more results, articles, etc. from the attendees.

The overall lessons learned were more related to writing a grant for a new, relatively unknown organization and industry. The projects were solid and very much needed. The lessons learned included what categories money needed to be budgeted and the ancillary needs of the projects such as marketing funds.

**BENEFICIARIES:** The beneficiaries of this project are the Georgia and southeastern specialty crop agritourism operators, managers and staff that have more education, training, communication and management tools that were developed from this grant. These tools will help improve their competitiveness and increase market share for them. These tools will help improve their competitiveness

and increase market share for them. In addition, consumers were educated about their food and how it was produced through the activity sheets and the FAM blog posts.

This project reached, educated, supported and provided knowledge to,

- Over 125 specialty crop agritourism operators at the Georgia Agritourism Annual Conference,
- 32 growers attending workshops
- 36 specialty crop operations who have downloaded and are currently using the educational activity sheets
- Approximately 18,000 children who would be attending agritourism operations and receiving the educational activity sheets.

**CONTACT PERSON:**

Beth Oleson  
Executive Director  
Georgia Agritourism Association  
P.O. Box 2945  
LaGrange, GA 30241

**ADDITIONAL INFO:**

None

**Project 5. Georgia Blueberry Growers Association-*Biology and Management of Spotted Wing Drosophila, a Major Threat to Profitability of Blueberry Growers in GA*– Final Performance Report**

**Project Summary**

Blueberries are the biggest fruit crop in Georgia with an annual GA Farm Gate value of \$325 million and economic impact of over \$1 billion on the state economy. Spotted wing drosophila (SWD), an invasive pest of Asian origin, has recently emerged as a major threat to blueberry production in Georgia. Since its first introduction in Georgia in 2010, SWD infestations have led to a 15-20% loss of blueberry crop annually. The zero-tolerance policy by marketers has led growers to make weekly applications of broad-spectrum insecticides, which may be reapplied in the event of rain leading to significantly higher cost of production and lower profitability. Frequent insecticide applications will also limit Georgia blueberry growers' ability to access export markets due to issues with residue tolerances, and lead to resistance development in SWD rather quickly and threaten the sustainability of SWD management programs. Because SWD is a recent pest in Georgia, very little is known about its biology which is extremely important to develop more sustainable management programs. Major goal of this project was

to investigate biology and ecology of SWD specifically under Georgia conditions and use that information to help blueberry growers implement more sustainable strategies to effectively manage this devastating pest.

In this project, studies were conducted to investigate seasonal biology and population dynamics of SWD in Georgia. Results showed that adult SWD were active year-round in major blueberry producing counties within the state of Georgia and number of flies captured in traps were higher in the wooded areas surrounding blueberry orchards than the blueberry fields. SWD population levels varied significantly between different months of a year. The number of flies captured in traps were inversely correlated with maximum daily temperature. The adult fly populations were higher during the fall and winter months as compared to the summer months when temperatures were higher. Further studies were then conducted to characterize potential alternative host plants occurring in the wooded areas surrounding blueberry orchards that might serve as viable hosts of SWD and sustain SWD populations in the wooded areas. Results showed that several species of wild plants commonly occurring in the wooded areas around blueberry orchards can serve as viable hosts. The most notable species include beautyberry, wild blackberry, common pokeweed, deerberry, elderberry, evergreen blueberry, hillside blueberry, and large gall berry. Several studies were conducted to optimize effectiveness insecticides and introduce more reduced-risk options into SWD management programs. Results showed that season-long management programs with reduced-risk insecticide such as Delegate were just as effective as programs based on all broad-spectrum insecticides. Delivering effective insecticide residues on the target fruit via excellent spray coverage and maintaining those residues on fruit surfaces were identified as key factors to protecting fruit from SWD infestations. These findings were used to develop SWD management recommendations which were disseminated to blueberry farmers and other stakeholders through research and extension publications, presentations, and web-based resources, such as UGA Blueberry Blog ([www.blog.caes.uga.edu/blueberry](http://www.blog.caes.uga.edu/blueberry)), webinars, and MyIPM App to educate them on how to implement those strategies. As a result of this project, fruit growers are able to assess the risk of SWD infestation in their orchards using monitoring tools and implement effective management strategies developed in this project to protect fruit from SWD infestations and save millions of dollars in crop losses and increase their farm income significantly, which is estimated to be approximately \$15-20 million annually.

### **Project Approach**

*Seasonal Biology and Population Dynamics of SWD:* In order to determine seasonal biology of spotted wing drosophila (SWD), we ran a monitoring program in major blueberry producing counties including Appling, Bacon, Brantley, Clinch, Coffee and Ware county. In this monitoring program, the SWD populations were monitored by placing 32 ounce traps containing 150 mL of yeast:sugar:water based bait at three locations at each site: 1) in the blueberry orchard, 2) at the border between orchard and adjacent wooded area, and 3) in the woods. The traps were

changed and flies were counted every week. The results showed that adult SWD were active year-round in major blueberry producing counties within the state of Georgia and number of flies captured in traps were higher in the wooded areas surrounding blueberry orchards than the blueberry fields (Fig. 1). SWD population levels varied significantly between different months of a year. The number of flies captured in traps were inversely correlated with maximum daily temperature (Fig. 2). The adult fly populations were higher during the fall and winter months as compared to the summer months when temperatures were higher. Specifically during the field season, SWD populations were generally low during southern highbush blueberry harvest and slightly increased with the occurrence of rainfall events during the rabbiteye harvest season. Interestingly, the fly counts were higher in wooded traps as compared to the traps placed in blueberry orchards. These results indicate that there are some alternative hosts present in the wooded areas that SWD adults can feed on and oviposit in. Based on these results, further studies were conducted to characterize potential alternative host plants occurring in the wooded areas surrounding blueberry orchards that might serve as viable hosts of SWD and sustain SWD populations in the wooded areas. Results showed that several species of wild plants commonly occurring in the wooded areas around blueberry orchards can serve as viable hosts (Fig. 3). The most notable species include beautyberry, wild blackberry, common pokeweed, deerberry, elderberry, evergreen blueberry, hillside blueberry, and large gall berry.

*Impact of Heat Stress on SWD Development and Activity:* Studies were conducted to evaluate effect of higher temperature that we typically experience during the blueberry harvest season in major blueberry producing counties in Georgia on SWD biology. Adult SWD flies were exposed to 24, 27, 30, and 33 °C and observed for various parameters of reproduction and development. All of the flies exposed to 33°C died within one week of exposure and reproduction was completely abolished. Average life span for flies exposed to 30°C was much shorter (20-25 days) than for flies exposed to 24 and 27°C (45-50 days). Oviposition, pupation, and adult eclosion were significantly higher for flies exposed to temperatures of 24 and 27°C than for flies exposed to 30°C (Fig. 4). These results show that higher temperature significantly disrupts development and reproduction of flies and the fly populations in blueberry orchards will drop significantly when higher summer temperatures prevail.

To further understand impact of heat stress on SWD development and reproduction, another study was conducted where newly eclosed adult flies were exposed to 28, 30, 32 and 34°C and observed for various parameters of development and reproduction. The progeny of the treated flies significantly decreased as temperature increased from 28 to 34°C regardless of whether males, females, or both sexes were treated (Table 1). However, the impact of short-term heat stress was not permanent and there was no difference on oviposition in flies exposed to different temperatures after 8 days of removal from the heat stress (Fig. 5). These results show

that even if potentially lethal temperatures are observed during the hottest parts of the day during blueberry production season on Georgia, these flies can survive by resting in somewhat cooler spots in the field or in wooded areas and resume their activity when temperatures are ambient.

We conducted another study to further investigate timing and location of the fly activity in blueberry orchards during a 24-hr daily cycle (specifically during the hot parts of the day when temperatures are potentially lethal to flies). Here we monitored fly populations in blueberry orchard, at the border between orchard and wooded areas, and in the woods for a 6-hr period during dawn, day, dusk, and night. Results showed that significantly higher number of flies were active in blueberry orchard during dawn and dusk periods of the day. These results suggest that growers should make insecticide spray applications during dawn and dusk periods when flies are most active in the blueberry orchards (Fig. 6). It will help maximize efficacy of insecticide sprays to control this fly.

*Strategies to Optimize Effectiveness of Season-long SWD Management Programs:* In order to develop effective control programs for SWD, studies were conducted to evaluate season-long management programs for SWD. The programs were design for both southern highbush (Table 2) and rabbiteye blueberries (Table 3) based on needs of growers such as short pre-harvest interval, export-friendly, reduced-risk, resistance management, and organic. In southern highbush studies export-friendly, short pre-harvest interval, and reduced risk programs provided significantly higher mortality of SWD than untreated check throughout the season until 3 DAT (Table 4). However, residual efficacy of Imidan, Mustang Maxx, and Danitol lasted for up to 7 DAT. The SWD mortality in organic program was statistically similar to untreated check except for Entrust at 1 DAT in Week 3. In rabbiteye trials, overall short pre-harvest interval program provided significantly higher mortality of SWD than other programs consistently throughout the season. The majority of the other programs except Organic 1 and 2 provided significant SWD mortality at 1 DAT, and some programs caused significant mortality at 3 DAT but none of the programs was effective at 7 DAT (Table 5). However, residual efficacy of Imidan and Mustang Maxx in various programs lasted for up to 7 DAT. The mortality in organic programs was statistically similar to the untreated check except for Entrust at 1 DAT in Week 5. These results show that there are effective chemicals available to control SWD, however, growers will need to be proactive in implementing these programs to ensure complete protection of their fruit.

In order to further improve currently used control programs for SWD, trials were conducted in both southern highbush and rabbiteye blueberries to evaluate season-long management programs for SWD. The goal was to incorporate more reduced-risk insecticides into SWD management programs to help broaden the range to export markets for Georgia blueberries. In

these trials, two management practices were compared each year and those were farmers' management practice (FMP) and improved management practice (IMP). Results showed that SWD management programs based on improved management practices were just as effective as currently used farmers' management practices. Throughout the harvest, significantly fewer flies were caught in the traps in both programs (Table 6 and Table 7), however, the residual efficacy dropped at 7 days after treatment (Fig. 7 and Fig. 8). These results show that Georgia blueberry growers can adopt improved management practices to take advantage of a wide range of export markets and increase profitability.

In order to implement these chemically-based control programs, blueberry growers employ a wide range of technologies to apply insecticides but the level of coverage achieved by those specific technologies has yet to be evaluated. In order to optimize effectiveness of insecticide applications against SWD, it is extremely important to understand the level of coverage achieved by those technologies and whether or not it is sufficient to protect fruit from SWD infestation. We conducted studies to compare spray coverage achieved by sprayers most commonly used by blueberry growers, residue deposition on the fruit, and effectiveness of the spray residues against SWD. The four types of sprayers evaluated in this project included airblast, airtec cannon, overhead boom, and electrostatic sprayer. Spray coverage was uneven in different sections of the blueberry bush canopy in all treatments (Fig. 9a & 9b). The electrostatic sprayer deposited less residues on the fruit surface (Fig. 10) and resulted in lower SWD mortality in semi-field bioassays as compared to airblast, air cannon, and overhead boom sprayer (Fig. 11). These results show that spray coverage needs to be improved which can be achieved by frequent calibration. Specifically, educating growers on how to properly calibrate and use new spray technologies such as electrostatic sprayers will be extremely important. Since these findings surfaced, a field day is conducted every year to educate growers on how to accurately calibrate sprayer which directly leads to increase in coverage and effectiveness of spray applications.

The amount and frequency of insecticide applications needed to maintain a continuous protection of the fruits may depend on a variety of factors including the level of rainfall. Studies were conducted to determine the effects of simulated rainfall (0, 0.5, 1.0 and 1.5 inch) and adjuvant – Nu Film (with and without) on the residual efficacy of commonly used insecticides against SWD. Results showed that 1.0 inch and higher rainfall caused a significant reduction in SWD mortality in all chemical treatments. Addition of adjuvant, Nu Film 17, significantly increased mortality at 3 DAT in zeta-cypermethrin treatment at 25 mm simulated rainfall while the addition of NuFilm P increased the mortality at 1 DAT in spinetoram, spinosad or malathion treatments (2015) at 12.5 mm or 25 mm simulated rainfall. These results suggest that although frequent rainfall incidents increase the need for more frequent spray of insecticides, addition of adjuvants may help to prolong the residual efficacy of some insecticides.

*Disseminate Findings to Educate Blueberry Growers on How to Implement SWD Management Programs:* Findings of this project were disseminated to blueberry growers, pest management consultants, county agents and other stakeholders through presentations at several grower meetings in the state and conferences at the at regional, national, and international level including Southeastern Regional Fruits and Vegetable Conference, Southeastern Professional Fruit Workers Conference, Georgia Entomological Society, Entomological Society of America, International Congress of Entomology, International IPM Symposium, etc., online via webinars, UGA Blueberry Blog, Georgia Blueberry Growers Association Newsletter – Dixie News, UGA IPM Newsletter, MyIPM App, and peer reviewed publications.

### **Goals and Outcomes Achieved**

The ultimate goal of this project was to increase farm income of blueberry and other fruit growers in the state by minimizing crop losses due to SWD, decreasing production cost, and enhancing their ability to access export markets by using more ecologically sound approaches to monitor and manage SWD.

In order to achieve this goal following activities were performed:

- 1) We ran a monitoring program in major blueberry producing counties including Appling, Bacon, Brantley, Clinch, Coffee and Ware county. In this monitoring program, the SWD populations were monitored by placing 32 ounce traps containing 150 mL of yeast:sugar:water based bait at three locations at each site: 1) in the blueberry orchard, 2) at the border between orchard and adjacent wooded area, and 3) in the woods. The traps were changed and flies were counted every week.
- 2) Studies were conducted to evaluate effect of higher temperature that we typically experience during the blueberry harvest season in major blueberry producing counties in Georgia on SWD biology.
- 3) Another study was conducted to further investigate timing and location of the fly activity in blueberry orchards during a 24-hr daily cycle (specifically during the hot parts of the day when temperatures are potentially lethal to flies). In this study, we monitored fly populations in blueberry orchard, at the border between orchard and wooded areas, and in the woods for a 6-hr period during dawn, day, dusk, and night.
- 4) In order to develop effective control programs for SWD, studies were conducted to evaluate season-long management programs for SWD. The programs were design for both southern highbush (Table 2) and rabbiteye blueberries (Table 3) based on needs of growers such as short pre-harvest interval, export-friendly, reduced-risk, resistance management, and organic.
- 5) In order to further improve currently used control programs for SWD, trials were conducted in both southern highbush and rabbiteye blueberries to compare farmers'

management practice (FMP) with the improved management practice (IMP) developed as a result of this project.

- 6) In order to optimize effectiveness of insecticide applications against SWD, studies were conducted to compare spray coverage achieved by sprayers most commonly used by blueberry growers, residue deposition on the fruit, and effectiveness of the spray residues against SWD.
- 7) Studies were conducted to determine the effects of rainfall and adjuvant – Nu Film (with and without) on the residual efficacy of commonly used insecticides against SWD.
- 8) Findings of this project were disseminated to blueberry growers, pest management consultants, county agents and other stakeholders through presentations at several grower meetings in the state and conferences at the regional, national, and international level including Southeast Regional Fruits and Vegetable Conference, Southeastern Professional Fruit Workers Conference, Georgia Entomological Society, Entomological Society of America, International Congress of Entomology, International IPM Symposium, etc., online via webinars, UGA Blueberry Blog, Georgia Blueberry Growers Association Newsletter – Dixie News, UGA IPM Newsletter, MyIPM App, and peer reviewed publications.

As detailed under approach section, studies conducted under this project have helped us understand several aspects of biology and management of this pest specifically in blueberry producing counties of Georgia. Findings of this project clearly show that unlike other states in the northeast and pacific northwest, SWD adults are active year-round in Georgia blueberry producing counties most likely due to mild winters we experience. A number wild host plants in the wooded areas surrounding blueberries can serve as viable hosts of SWD and sustain SWD populations during fall and winter when blueberries are not present in the field. Growers therefore need to monitor SWD at their farms using 32 oz plastic cup traps before blueberries start to ripen and implement management programs as soon as the first fly is trapped. Growers should carefully select one of the recommended season-long management programs keeping in mind their target market. While a number of chemicals are effective, growers are encouraged to incorporate reduced-risk programs to increase the number of target markets (export markets) and minimize the non-target impacts on beneficial organisms in the system.

Through extensive educational activities conducted as part of this project, growers are now able to implement effective management strategies in a timely manner to minimize crop losses due to SWD damage and increase their profitability. At the beginning of this project grower surveys indicated that approximately 15-20% of the blueberry crop was lost due to SWD damage and several farmers had their fruit rejected at the packing sheds due to SWD infestations. As a result of research and educational efforts conducted under this project, the crop loss due to SWD infestations has significantly decreased and the reports of fruit rejections

at the packing sheds due to SWD infestation are very rare. In fact, there wasn't even a single report of fruit rejection at the packing sheds due to SWD infestation over last year from the blueberry farmers who implemented management recommendations developed as a result of this project. This translates into approximately \$15-20 millions in increased profitability of blueberry farmers.

*Beneficiaries:* The primary beneficiaries of this project are over 500 producers of commercial blueberries in Georgia. The growers of other small and stone fruits including blackberries, cherries, raspberries, strawberries, grapes, and peaches who own or manage over 2500 farms within the state of Georgia also benefitted from information generated in this project. Blueberries alone have a farm gate value of \$325 million with over a \$1.0 billion impact on the State's economy and are the largest fruit crop in the State. All of the SWD host crops in the State of Georgia represent over \$600 million in farm income.

As a result of this project, fruit growers are able to assess the risk of SWD infestation in their orchards using monitoring tools and implement effective management strategies developed in this project to protect fruit from SWD infestations and save millions of dollars in crop losses and increase their farm income significantly, which are estimated to be approximately \$15-20 million annually. The other groups and operations that benefitted directly from this project include pest management consultants, county extension agents, fruit packing sheds, and fruit processors. Although the primary targeted beneficiaries are located within the state of Georgia, the spillover benefits of this project transcended state and national boundaries to fruit farmers and pest management professionals in other state states and countries via online publications, blogs posts, presentations at regional, national, and international conferences, and webinars which were attended and viewed (post-delivery) by hundreds of stakeholders worldwide.

### **Lessons Learned**

While working on this project, we learned that there is very little to no biological control of SWD in the field. It is understandable because SWD is an invasive pest of Asian origin and natural enemies present in Georgia agroecosystems (beneficial insects including predators and parasitoids) have not evolved to utilized SWD as a prey or host. This means that further research is needed to investigate impact of existing natural enemies in SWD populations in Georgia and assess feasibility of introducing beneficial insects (natural enemies) in Georgia to enhance biological control of SWD. This will further reduce reliance on insecticide sprays which are currently necessary to ensure protection of fruit from SWD infestation.

Another lesson we have learned that the incidences of secondary pest outbreaks have significantly increased in blueberry production systems. Currently, the most problematic secondary insect pests in blueberries include scales, gall midge, and thrips. Although it is unclear as to what might have caused this recent increase in secondary pest outbreaks, we

suspect that the use of broad-spectrum insecticides to control SWD since its introduction may have played some role in it. Further research should focus on developing management programs for those secondary pests.

### **Contact Person**

Ashfaq Sial Ahmad, Assistant Professor, Department of Entomology, University of Georgia, Athens, GA 30602

### **Additional Information** (*Available from GDA upon request*)

1. Names of graduate students trained under this project
2. Research Publications consulted
3. EXTENSION PUBLICATIONS: \_Technology and Social Media Tools Developed: UGA Blueberry Blog (<http://blog.caes.uga.edu/blueberry/>) and Blueberry Integrated Pest Management App – ‘MyIPM-SEP’ (Developed to help blueberry growers learn about insect pest problems and their solutions right at their cellular devices. It’s available for both Android and iPhones).
4. Regional IPM Guides Updated Annually
5. Georgia Blueberry Growers Association Newsletter
6. University of Georgia IPM Newsletter
7. UGA Blueberry Blog
8. Research & Extension Presentations
9. *Tables and Figures:*
  - Figure 1. Seasonal phenology of SWD
  - Figure 2. Correlation between SWD trap captures and daily high temperature
  - Figure 3. Development of SWD in berries collected from wild plant species
  - Figure 4. Effect of Temperature on reproduction and development of SWD
  - Figure 5. Proportion of fertile eggs laid at 2 and 8 days after heat stress treatment
  - Figure 6. Mean number of SWD captures at different times of the day
  - Figure 7. Mean SWD mortality at 0 and 7 days after treatment in southern highbush blueberries
  - Figure 8. Mean SWD mortality at 0 and 7 days after treatment in rabbiteye blueberries
  - Figure 9a and 9b. Spray coverage achieved by different sprayers: a) left-side of the sprayer and b) right-side of the sprayer
  - Figure 10. Zeta-cypermethrin residues when applied using different sprayers
  - Figure 11. SWD Mortality as a result of zeta-cypermethrin application using different sprayers
  - Table 1. Progeny per female (number of adult progeny per female  $\pm$  SE) by temperature treatment and gender treated.
  - Table 2. Insecticides used in weekly rotations in each of the season-long programs for southern highbush blueberries
  - Table 3. Insecticides used in weekly rotations in each of the season-long programs for rabbiteye blueberries
  - Table 4. Percent Mortality of SWD
  - Table 5. Percent Mortality of SWD
  - Table 6. Mean number of SWD trapped at weekly intervals in southern highbush blueberries
  - Table 7. Mean number of SWD trapped at weekly intervals in rabbiteye blueberries

## **6. Georgia Green Industry Association-Marketing Support for the Georgia Nursery Industry– Final Performance Report**

### **Project Approach**

The nursery industry is a leading commodity among Georgia’s agricultural economy. However, nursery producers and growers of ornamental plants do not have a direct relationship with the buying public because of the structure of the market. Growers and producers sell almost exclusively to garden centers, home improvement centers and landscape contractors. At no point in the past has there been a coordinated effort by the growers of ornamental plants to tout their benefits. This project sought to reverse that fact by providing outreach direct from the producers of ornamental plants to the buying public in the form of a website ultimately meant to encourage the consumer/public to change their buying habits, recognizing the many benefits of ornamental plant thereby leading to increases in sales of ornamental plants.

Georgia’s ornamental plants industry has also been hard hit over the last ten years by the great recession and historic droughts. While other sectors of the economy have shown improvement since the great recession, sales of ornamental plants have lagged and have not recovered as quickly. Reversing this trend and providing a much-needed shot in the arm to increase sales was a primary objective of this project.

*Project Partners:* These included members of the University of Georgia Cooperative Extension as well as Georgia growers who provided expertise in content development as well as online content on a wide variety of gardening and landscape topics. The combination of content developed along with linking information allowed for the development of different pages within the website targeted to users with varying levels of experience and expertise in plants, landscapes and gardening topics. This was an integral part of the development of the web pages. There are endless websites containing gardening information but compiling and assembling references to pages with Georgia specific content will allow Plantsomething to serve as a unique and focused web resource for users seeking gardening knowledge in Georgia. Users are then encouraged to put their new-found knowledge into action by completing their own gardening projects with plants produced by Georgia growers.

### **Project Summary**

This grant project’s major focus was to provide increased consumer awareness of the economic and environmental benefits of ornamental plants and landscapes. The principal driving focus of the project was the creation of a website entitled [www.plantsomethingga.com](http://www.plantsomethingga.com). The plant something movement began in Arizona and now includes over 20 states that utilize the plantsomething platform which provides consumers with how-to information, information on the benefits of plants and sustainable landscapes and a searchable database of suppliers of

ornamental plants and landscape services. While each states website is different and there is no centralized plan for the overall effort, all of the various sites have these similarities.

The goal of the plantsomething initiative is to increase market and sales opportunities for commercial growers of ornamental plants by highlighting to the consumer the value that plants and landscapes can bring to their quality of life. An informed public who understands these attributes will then seek to purchase more plants and services thereby growing revenues for the producers.

Other activities included in the project were designed to encourage industry members participation in development of the plantsomethingga website, and to promote the website and its features to both the industry as well as the general public.

Several problems arose during the execution of this project. First and foremost, the author of the proposal and Executive Director of the Georgia Green Industry Association left her position very early in the project. As we sought to get the project back on track, we were greatly hindered by the withdrawal of the website developer contracted to build the website after months of meetings and work were conducted to develop the concept, design and content of the website. At the time of their withdrawal, the deadline to have work completed was fast approaching. We quickly sought to find another website development firm and can happily report that the website is almost 100% complete and will be up and running and available to the public before the end of 2017.

### **Goals and Outcomes Achieved**

While these were significant setbacks, there were great strides made in accomplishing the other features of the grant project. The Wintergreen Conference produced by the Georgia Green Industry Association has seen significant growth during the last two years. This conference and tradeshow is the largest event for Georgia's nursery industry and provides a unique opportunity for growers of ornamental plants to showcase their goods to buyers from garden centers, home improvement centers and landscape contractors. The grant allowed for an increase in marketing which resulted in gains in attendance of 20% in 2016 and 24% in 2017. An additional 3,000 brochures promoting the Wintergreen event were distributed to a total of 10,000 targeted industry firms across the state. The brochures marketed not only the event itself, but the nearly 250 firms who exhibit and market their plant materials available for sale. Brochures were distributed to a select group of landscape contractors, retail garden centers and re-wholesalers who are apt to look for additional suppliers of plant materials. In addition, GGIA sold more exhibitor spaces for the tradeshow than in any point in the show's 20 year history. In 2016 a total of 236 exhibitor spots were sold, an increase of 16 from the previous year. 2017 saw a total of 248 total exhibitor spots sold, an increase of 12 spots from 2016.the

time of this report, we are pleased to report that we expect a similar increase in 2018 and attribute a substantial portion of the gains to the carry over effect from the increased marketing made available from the grant.

The increase in Wintergreen attendees and exhibitors means that more buyers were connected with more suppliers of Georgia grown plant materials. As Georgia continues to emerge from the recession, this positions Georgia growers to meet the growing demands for plants across the state and the southeast. Farm gate values of horticultural products in Georgia are broken into 3 categories: container grown, field grown and greenhouse grown products. Of the three segments, field grown materials have been the slowest to regain traction and achieve positive growth in sales. Container nurseries have also struggled while greenhouse growers have realized positive growth beginning in 2014. Looking forward, the increase in marketing afforded growers in all 3 categories will result in an expanded market and increased sales.

In addition, the soon to be held roll-out the [www.plantsomethingga.com](http://www.plantsomethingga.com) website will be a banner day for Georgia's nursery industry. The website consists of two major areas of focus. These include the how-to and benefits of plants section and the directory that provides consumers with a searchable database of industry professionals who provide both plants and other landscape services. The site features extensive information on how to plants, plants that perform well in Georgia, plants for specific environmental conditions (dry, wet, sunny areas, shade gardening, pest tolerant) and how to care for plants and landscapes. The section will also include a gardening blog which will be populated in the future with seasonal gardening articles and advice on planting. The content and links to other online gardening information were developed by both GGIA staff along with input from industry members and experts from the University of Georgia Cooperative Extension. The website has received extensive exposure at GGIA events throughout the year but particularly at the Wintergreen conference held each January in which it was featured in the GGIA trade-show booth. The directory portion of the website will allow consumers to search for sellers of plants in their area, sellers of particular plants and landscape service firms who both sell and maintain ornamental plants and landscapes.

### **Beneficiaries**

The concept of pull-through sales is nothing new. Widely known campaigns like "Got Milk" and "Beef, it's What For Dinner" drive commodity sales through increasing consumer awareness. The plantsomething initiative is no different and will provide valuable marketing and awareness for the value of ornamental plants. This will not only provide a boost in sales for Georgia's 800 plus growers (main beneficiaries) but also for thousands of retailers of plant products. This will positively impact retail garden centers, home improvement centers, landscape contractors and

even grocery stores who now sell many ornamental plants. In all, there are over 6,000 dealers with a license to sell live plants in Georgia, all of whom stand to benefit from this project.

*Economic Impact:* Overall, the intent of this project is to increase the sale of Georgia grown plants by providing expanded market opportunities for growers and by providing incentives for homeowners and other gardeners to become more involved with gardening and landscaping thereby resulting in greater sales for these same Georgia growers. According to farmgate reports compiled from the University of Georgia Center for Agribusiness and Economic Development, previous trends of declining sales have begun to be reversed.

2009 was a benchmark year for all three segments of horticulture production with each achieving historical sales.

**2009 Revenues by Segment:**

**Greenhouse Production:** \$363 million

**Container Production:** \$210 million

**In Ground Production:** \$90 million

By 2012, revenue production had decreased substantially in each segment.

**2012 Revenues by Segment:**

**Greenhouse Production:** \$259 million

**Container Production:** \$141 million

**In Ground Production:** \$68 million.

The most recently available figures for 2016 clearly indicate a rebound in production values across the green industry as two of three segments have once again risen to their historical highs.

**2016 Revenues by Segment:**

**Greenhouse Production:** \$428 million

**Container Production** \$151 million

**In Ground Production:** \$90 million.

Forecasts for the future indicate that this momentum can be maintained. This can be attributed to the successful marketing of Georgia's products through the Wintergreen Conference along

with the continually improving economy. The Plantsomething website will afford growers a new opportunity to market their products and encourage consumers to purchase more plant material allowing the positive sales trends to continue.

### **Lessons Learned**

The shortcomings of the project provided ample learning opportunities for GGIA. Our association is made up of over 600 members and governed by a board of directors that includes 30 people. A group that large is not capable of making quick decisions needed for a project as complex as this. With the grant being a multi-year initiative, it also meant that we had a brand-new slate of officers each year charged with carrying out the project with different levels of interest and experience with a project of this scope. In the future, a smaller, more focused taskforce, purposefully chosen with expertise and experience in the project should be utilized. In addition, if our staff is inexperienced with the grant process, we would certainly consider partnering with others who are more used to the requirements of this type of grant.

### **Contact Person:**

Chris Butts

### **Additional Information:**

With the delays experienced in the development of the plantsomething website, there were components of the proposal that were not completed. Frankly speaking, we did not feel it was appropriate to expend grant funds that would not be used efficiently or would not be productively used. Specifically, monies for the 4 scheduled meetings, partnering for content development, and marketing the site were not spent. We did not feel that conducting promotional meetings before the site was completed was beneficial. Likewise, purchasing online advertisements for an incomplete website was also deemed to be unwise.

## **7. Georgia Olive Growers Association-*Research, Education, Training and Solutions for Consistent and Expanded Production of Olives in Georgia and Other South Eastern States*- Final Performance Report**

### **Project Summary**

This grant benefited southeastern and US producers of olives by providing education, research, information dissemination, and marketing to help improve the competitiveness of the crop.

## **Project Approach**

The Georgia Olive Growers Association (GOGA) with the assistance of Georgia Dept. of Agriculture and USDA has made great strides forward in assisting the olive industry to grow in Georgia and the Southeastern United States. During the grant period GOGA completed the following activities:

- Organized and conducted the 2015 GOGA Annual Conference and Workshop with 127 attendees;
- Assisted in creating the research and development and certified oil lab team of University of Georgia staff and growers throughout the state;
- Presented, demonstrated and participated in 16 events;
- Organized and conducted the 2015 GOGA Annual Conference and Workshop with 127 attendees;
- Organized and conducted the 2016 GOGA Pruning Workshop with 27 attending growers;
- UGA Agricultural and Environmental Services Lab received “Approved Chemist” in olive oil analysis through American Oil Chemistry Society (AOCS) and presented a report to members (see attachments);
- GOGA staff conducted 79 olive orchard/farm tours (groups and individual ranging in size from 1 to 70) for over 1,650 people in 2014/2015 and 1232 people in 2015/2016;
- GOGA staff assisting the research and development and certified oil lab team of University of Georgia staff and growers throughout the state through data collection, presentations and team quarterly meetings;
- GOGA staff worked with national support organizations on US education (American Olive Oil Producers Association Annual Conference presenter);
- Promoted international label standards recommendations by participation and encouraging others to participate in the national letter of support campaign by discussing issues and soliciting support from Georgia and US legislators as well as other state leaders;
- Weather station data collection;
- Worked with all forms of national, state and local media, radio, print (magazines and newspapers), and video, for the purpose of creating awareness and educating the public about domestic olive oil in order to expanding the market.

The development of an oil analysis lab was essential for the emerging olive oil industry in Georgia as it has been established as a quality oil producing region. Oil analysis by a certified chemist is essential in establishing quality control. Establishment of an olive oil analysis lab has provided Georgia’s oils with an economic advantage domestically by distinguishing the superior quality and freshness of these locally produced oils, from the inferior oils available at most supermarkets in the United States. In addition, analysis has allowed oil producers in Georgia to monitor their oils year after year and make adjustments to growing practices as needed.

Characterization of the basic growing conditions and how they relate to tree growth, crop yield, and final oil quality are critical to the economic success of this industry. Correlation between environmental factors such as soil chemistry, landscape and latitude position, and weed and pest interactions, and olive trees growth and yield are essential for site and varietal selections, thus reducing the risk of failure for future farmers. As this industry continues to grow, any information that can be used to increase crop yield and production efficiency would provide a tremendous economic benefit to olive growers. Combining the crop yield and oil quality data that was produced during this study has set Georgia up to be a premium olive oil producing region, with economically successful producers.

*PROJECT PARTNERS: roles and contributions*

GOGA and UGA partnered on the *Characterization of Georgia's Olive Oils and Determining the Influence of Environmental Factors on Plant Nutrition, Crop Yield, and Olive Oil Quality: as Pertained to Site and Varietal Selection for Olive Farms in the Southeastern USA* to identifying 6 test orchards with a regional and land character diversification within the growing region to establish a baseline of oil characteristics and the difference this diversification makes on yields and in the chemical make-up of the final olive oil product. Both collected data and samples (fruit, leaf tissue and soil) for testing in order to establish this baseline database for comparative analysis. The University of Florida and Florida Olive Council joined the partnership to broaden the area of sampling to better encompass the Southeastern region. Our 6 test orchards in Georgia were Terra Dolce, Georgia Olive Farms, Roberts Unlimited, Kruger Farms, Savannah Olive Orchard and Luvin' The Farm Orchard which allowed GOGA and UGA unlimited access to the olive orchards for data collection, as well a leaf tissue, soul and fruit samples for testing. American Olive Oil Producers Association assisted GOGA and UGA in arranging tours and meetings with established private olive oil lab Boundary Bend and large established orchards, Seka Hills and California Olive Ranch, in California as well as UC Davis's olive oil lab. The partnership of all organizations and individuals are what has made this project such a success. GOGA and UGA has presented result and made reports available to all partner organizations and to individuals at conference and trade shows via digital media (CD and flash drive) and upon request via email.

Florida Olive Council, Texas Olive Association and American Olive Oil Producers has partnered with GOGA to help broaden our conference attendees by encouraging national participation of GOGA events and sharing . Growth of the overall US olive industry is the objective and can be better served through sharing of information and successful program promotions.

## Goals and Outcomes Achieved

### *1. Characterization of Georgia's Olive Oils and Determining the Influence of Environmental Factors on Plant Nutrition, Crop Yield, and Olive Oil Quality: as Pertained to Site and Varietal Selection for Olive Farms in the Southeastern USA.*

All objectives outlined in the 2014 olive oil block grant proposal have been completed. During the study period the UGA Agricultural and Environmental Services Lab; developed a program for olive oil testing, began participating in proficiency testing through the American Oil Chemistry Society (AOCS), received approved chemist in olive oil analysis through AOCS, collaborated with a certified lab in Australia, and collected olive samples from growers around the state which were analyzed for quality criteria. In addition, due to approve chemist status of the lab personnel, producers can have a lot of confidence in the results the lab produces, and the quality of their olive oils can be accurately compared with others from around the world. Also, now that the quality of the oils being produced in the region have been characterized by an approved chemist, the producers have evidence that they are producing extremely high quality oils which demand the Extra virgin classification and a premium price at market. UGA presented their Status Report at GOGA Conference and national industry meeting (American Olive Oil Producers Association Conference and Southeastern Fruit and Vegetable Conference and was made available to all who requested a copy. (see attached UGA status report and presentation)

GOGA staff and UGA chemist Daniel Jackson visited a private lab in California to gain better insight on setting up and running a successful olive oil lab.

As a goal reached, olive oil producers and olive growers in the region (as well as US) now have access to a lab which analyzes olive oil for key quality parameters needed by the industry. **100% of goals and targeted outcomes were reached on this project.**

### *2. Industry Information 'Clearinghouse' and "Education" Center*

In 2014/2015 GOGA continued to expand the website for growers and producers in order to create better industry communication. We received 652 emails and 627 phone calls for information pertaining to growing olives in the southeastern U.S. The website has had 23,185 page views and 6,975 unique users visit the site since October 1, 2014.

In 2015/2016 GOGA continued expanding its dissemination of information through the website. GOGA currently has 713 "Likes" on the Facebook page (**a 114% increase from the 333 baseline in 2014**), and received 482 email and 416 phone calls for information pertaining to growing olives in the southeastern U.S and tour requests. The website has had 46,877 page views and

10,406 unique users visit the site since October 1, 2014. (See attached analytics for the past 10 months)

These outcomes far **exceed the 10% increase benchmark** set for this project.

We have opened the Blog portal on the website. All members are given a password when membership is confirmed. This has had very little use. It had originally been designed to be members only; however, we are in the process of re-structuring the blog so that anyone can ask questions and it posted after a screening process. We hope this will stimulate members and non-members alike to use this tool. We continue to have a very active Help Desk via phone and email. If a question or help is beyond the knowledge of staff, a grower is contacted to assist

The number of farm tours requests and speaking engagements continue to grow. During the grant period 79 farm tours were given both to large groups and individuals. Group tours were given to civic organizations, church groups, travel groups, seniors/retirement groups, educational groups and governmental groups, 4H and scout groups. **GOGA's target was to conduct 48 farm tours. We exceeded this target by 31 tours.** As a result farm tour request continue to increase and the project has become a permanent part of our scope of work

### *3. Regional One-Day Conference/Workshops*

The 2015 GOGA Annual Conference and Workshop was held on May 14th. The event was rescheduled from fall 2015 and held in May 2015 to coincide with planting, in order to provide current and potential olive producers across the southeast pertinent information about production and cultural practices, orchard implementation, milling and harvesting, as well as to deliver new research and market findings as presented by the University of Georgia staff conducted as part of this project, national industry leaders, as well as introduction of the State and Federal Resource Team. Attendees were questioned via survey regarding their knowledge and opinions of the olive oil industry. From these surveys, GOGA's 2015/2016 Scope of Work was developed. **The response on the Evaluation/Survey forms collected during the conference was an overwhelming 100 % increase in knowledge.**

A goal of this project was to increase attendees from other states by 10%. Our multi-state attendee audience has continued to grow. In 2014 there were 18 attendees from outside the state of Georgia (Florida and South Carolina) increasing to 27 attendees from other states (Texas, California, South Carolina, Florida, Alabama, Australia, and Louisiana). This represents **50% increase** exceeding our 10% target growth. The growth in olive growers increased from 14 to 27 representing a **92% increase.**

In addition, GOGA conducted a 1 day Pruning and Milling Workshop for growers in September of 2016. Jim Rowntree, an international expert on growing and milling, was brought in as the

instructor. (see attached presentation) This workshop was a huge success. To better serve the southeastern region, GOGA will be partnering with the Florida Olive Growers Council on the Annual Conference, alternating locations (Georgia – Florida) each year. To better serve our growers, on the years the conference is in Florida, Georgia will organize a targeted workshop based on need.

#### *4. Competitive Markets for Domestic Grown Olives and Olive Oil*

In order to educate consumers, open up new markets and ultimately create a higher demand for Georgia (as well as all domestic) olive oil, staff has presented, demonstrated and participated in more than thirty events throughout the grant period and been a speaker at multiple civic and religious organization meetings.

Georgia now has 3 bottled extra virgin olive oil labels for retail and wholesale distribution: Georgia Olive Farms, Terra Dolce, and New Era. New Era was added in the past eighteen months. This represents a 30% growth in Georgia Grown brands of extra virgin olive oil offered to the retail and wholesale market. As consumers have gain insight into the benefits of true domestic extra virgin olive oil the demand has begun to exceed the supply even though the agricultural footprint for olive growth has more than tripled. The growth of the olive industry footprint in Georgia, from 130 acres of olive trees on the ground in 2014 to over 2,800 acres to date, is proof of that. During the grant period there was 425 acres of olives planted in Georgia. This represents a **327% growth** rate during the grant period.

The accomplishment of our goal to increase consistent sustainable customers for olive oil produced in the southeast the number of specialty stores and grocery store chains carrying Georgia Extra Virgin Olive Oil had to grow. This was accomplished through awareness and educational campaigns, both demonstrations and dissemination of information at trade shows and within the media both national and regional not to mention the growth in restaurant use throughout the US (Farm to Table initiative). In 2014 Harvey's was the only grocery chain carrying Georgia Grown EVOO and most specialty stores were located in the Southeast. Now, Whole Foods, Target, Winn Dixie, and Kroger as well as online markets such as West Elm and Pottery Barn are carrying Georgia Grown EVOO. The number of specialty food stores carrying the product has also seen a rapid growth. Georgia produced Extra Virgin Olive Oil is now sold from east to west coasts and into Canada. This represents a **600% growth** in the national market.

Consumption of domestic extra virgin olive oil in the US has grown from 1% in 2014 to 3% in 2016 and has been attributed to education of the consumer. The potential for grow in the retail market far exceeds product availability.

## **Beneficiaries**

The beneficiaries of this 2014 SCBG project are consumers and growers alike (growers participation increased from 14 to 27 during grant period). The project's impact reaches far beyond the Southeastern United States: National focus groups and media request for information are on the rise and would not be possible without the elements of this grant and benefits all US growers of olives as US consumption of domestic EVOO increases. Georgia and Florida are working together with GOGA and Florida Olive Council to better serve the regional needs of the specialty crop growers without duplicating efforts. GOGA is now participating as a part of the national research and development team set up by American Olive Oil Producers Association. All information and data collected as a part of this grant and others has been shared to establish the needs on a national level.

TOTAL BENEFICIALRIES: 27 growers

## **Lessons Learned**

There is a direct correlation between consumer education and demand for quality extra virgin olive oil. The growth and sustainability of a specialty crop industry such as olives is dependent on education (public awareness), research and communication.

Another important lesson learned was the need for a Growers Manual which GOGA has included in future plans and are now working on. The support of GDA and USDA through the SCBG program has been crucial to this project's success.

## **Contact Person**

Vicki S. Hughes  
Georgia Olive Growers Association Director

## **Additional Information**

*Attachments available upon request from GDA*

## ***8. Georgia Organics-Reaping Georgia's Organic Yield: A Training Program to Support Georgia's Organic Specialty Crop Producers– Final Performance Report***

### **Project Summary**

Georgia Organics developed and executed a training and marketing program that bolstered the growth of certified organic specialty crop producers in the state of Georgia and enabled these producers to take advantage of unmet demand in the burgeoning organic marketplace. With the Georgia Department of Agriculture as a partner, Georgia Organics provided technical assistance regarding production, marketing consultation, cost-share for USDA organic

certification and other resources to specialty crop growers. The goal of this project was to contribute to an increase in the number of certified organic growers in Georgia from approximately 75 at the beginning of the project period to at least 105 at the end. We are proud to report that Georgia now has 106 certified organic farms.

### **Project Approach**

This project's strategy included three major aspects: Workshops & Online Resource Hub; Marketing; and Organic Certification Cost-share.

This project was accomplished through dedicated outreach, creation of online resources, and one-on-one coaching and technical assistance. A series of workshops were held over the grant period, and these were followed up with email and phone outreach and personal consultations. Georgia Organics provided cost-share to defray the expense of becoming certified organic.

*Workshops & Online Resource Hub:* Georgia Organics created and hosted workshops in February, 2015, on the following topics: crop rotation, business record-keeping, the organic marketplace in Georgia, overcoming organic certification paperwork intimidation, and other aspects of the organic certification process.

Those workshops were recorded, edited, uploaded to the Internet, distributed to growers who expressed an interest in organic certification, and now serve as valuable resources for our online education hub and are especially helpful during the initial outreach phase described in the Lessons Learned section below.

Georgia Organics also developed criteria and protocols to perform additional outreach not originally proposed as part of this grant. These include phone calls and one-on-one consultations, personal touches that have become a vital part of our tool chest to expand the organic agriculture industry in Georgia.

*Marketing:* Language supplied by Spitfire Strategies and improved upon by a team of local pro bono marketing experts provided a foundation upon which one-on-one marketing coaching was provided to a pilot group of 10 organic growers, who first gathered at the February 2016 Georgia Organics Conference. After this first group meeting, the marketing coaches and growers have been meeting, planning, and implementing various marketing techniques to boost specialty crop sales and farm income.

*Cost-Share:* A healthy collaborative relationship with employees of the Georgia Dept. of Agriculture that emerged as a result of this project was critical for our approach on cost-share reimbursements. Jamie Arrington and Mike Evans were very helpful by sharing the names and contact information for farmers who gained organic certification for the first time. Georgia Organics was able to reach out to these newly certified growers and educate them about the

reimbursements that were available from us as well. Some of the growers took advantage of this offer, but not all of the newly certified farmers did. The feedback received suggested that the growers who didn't take advantage of our reimbursements were unfamiliar with Georgia Organics and were skeptical that the offer to reimburse their certification costs was real or trustworthy. Later in the year, a Georgia Organics press release ran in the Market Bulletin, which we hope will raise awareness about the cost share opportunity and encourage more farmers to take advantage of the opportunity. Furthermore, we might ask the Georgia Department of Agriculture to assist us in spreading awareness of all reimbursement opportunities.

### **Goals and Outcomes Achieved**

Through this grant, Georgia Organics has directly increased the number of organic specialty crop producers by providing cost-share and training to 12 farmers who successfully achieved organic certification. The total amount of reimbursements for organic certification costs provided by Georgia Organics to-date is \$2,464.45 (provided by other grant funds). The number of organic farms in Georgia grew from 75 (when this grant started) and the current total of 106, surpassing our goal of 105 certified organic farms. This 40 percent increase marks the largest gain of organic farms in Georgia history.

Georgia Organics held workshops for approximately 100 growers and created online resources on the following topics (click to view):

1. [Our Get Certified Channel.](#)
2. [Why Get Certified?](#)
3. [Organic Certification, part 1](#)
4. [Organic Certification, part 2](#)
5. [Economic Opportunities for Organic Farming](#)
6. [Whole Farm Planning, part 1](#)
7. [Whole Farm Planning, part 2](#)

In addition, Georgia Organics conducted outreach to a total of 216 growers regarding organic certification and cost share.

Also, during the SunBelt Ag Expo, Georgia Organics interacted with approximately 57 farmers, businessmen and women, and other individuals who are interested in transitioning to organic certification. The SunBelt Ag Expo, held each October in Moultrie, Ga., is one of the largest agriculture events in the country, with 80,000 attendees visiting 600 acres of field trials and 1,200 exhibitors over 1.6 million square feet of exhibit space. Ten of those growers we interfaced with are now in a medium- to strong- portion of the outreach spectrum described in the Lessons Learned section

## Beneficiaries

The 12 farmers who achieved organic certification during the project period are shown below:

Farm Name	Contact Last Name	Contact First Name	Acres	Amount GO distributed for certification	Crops	County
Dig In Organics	Lynn	Barry	97	\$137.50	Sweet potatoes	Tatnall
New Communities at Cypress Pond Plantation	Rowe	Sed	50	\$243.63	Squash, Sweet Potatoes, Spinach, Collards, Turnips, Tomatoes, Carrots, Cucumbers	Dougherty
W.C. Bradley Farms	Turner	Ashely	174	\$232.34	Alfalfa, crimson clover, millet, pea, rye, sorghum, Sudan grass	Muscogee
The Anclève Farms	Taylor	Mark	2.6	\$214.95	Sorrell, okra, squash	Wilcox
Let's Gro Co.	Nunez	Pierre	5	\$250	Heirloom tomatoes, kale	Henry
Hunter Farms	Hunter	Chad	1,000	\$212.64	Corn, cotton, peanuts	Early
Ladybug Farms	Jagger-Blincoe	Terri	5	\$205.73	Hay	Rabun
Southern Ground Farms	Dove	Larry	10	\$206.30	Various	Fayette
Homegirl's Heirloom Farm	Evans	Phillip	TBD	\$178.24	Lettuce, kale, broccoli, beets, garlic, onions	Cherokee
Urban Sprouts Farm	Icgoren	Nuri	5	\$250	Strawberries, tomatoes, peppers, lettuces, and other greens such as kale	Fulton

					and arugula	
Gilliam Community Gardens	Gilliam	Jasann	1	\$137.50	Various vegetables	Fulton
Cane Water Farm	Rivers	Rafe	20	\$408.26	Radishes, Arugula, Bok Choy, Scallions, Collards, Kale, Mustard Greens, Mizuna, Sweet Potato Greens, Sweet Potatoes, Okra, Honey, Grits, Cornmeal, Corn Flour, Polenta	McIntosh

A total of 216 individual growers have learned the basics of the organic certification requirements. Those same 216 growers have also learned of the Georgia Department of Agriculture’s Organic Certification Cost-Share reimbursement program. They are growers from across the state with varying ranges of experience, farm size, and crops.

### Lessons Learned

The obstacles to organic certification are many, and we have learned that while many growers have the expertise and knowledge to grow organically, there is a very large hurdle found in the gap between what certifying bodies ask of farmers when they first make contact with farmers and what farmers are expected to do to achieve their certification. The amount of paperwork is a hurdle for farmers to achieve organic certification. The application for organic certification is typically more than 40 pages long. During this project, we have learned that it is much more than just an issue of burdensome paperwork. Farmers need to do more than just fill out papers to make it through to the end of the certification process. They need to learn almost as much about the National Organic Program rules and standards as the certifying bodies and Organic Inspectors. The Organic Foods and Production Act, the foundational rules and laws enacted by Congress that created the National Organic Program, is over 200 pages long, and farmers must gain a working knowledge of the rules in order to obtain certification and maintain certified organic status in order to uphold the integrity of the label.

We have learned and now strongly believe that farmers need to be educated on about a dozen critical parts of the Act that concern organic vegetable operation regulations and have tailored our outreach to reflect this need.

We have also identified a gap between what certifying bodies tell farmers they need to do to achieve organic certification, and what farmers actually need to know. If a farmer were to ask any one of the handful of certifying bodies that operate in Georgia what their first step to become organic would be, the farmers would be told that they should start with the organic certification application – the 40+ page document. But without any familiarity with the National Organic Program rules, the application is a confusing and time-consuming hurdle that makes little sense. Realizing this, we have changed our trainings to provide a general overview of the National Organic Program rules and tie those rules to key parts of the organic certification application. The reaction to this change has been positive: farmers report they are now more aware of how daunting the process can be, but that they are more prepared for the reality of what they are getting into.

A related lesson we have observed is that, some farmers who said they intended to become certified organic simply change their minds and decide the National Organic Program is not for them after they realize how challenging organic certification can be. We view this as a positive development because it serves to strengthen the integrity of Organic Certification while serving that farmer's strengths. It weeds out the farmers who don't have what it takes, in other words. Another brief observation about this subset of growers who changed their minds about going through the certification process: the majority of these growers have said that certification wasn't for them "at this time" and they will consider it later once certain other goals have been met in their farm business. We feel highly confident that these growers will be considering organic certification as their farm operations grow and become more mature.

Lastly, we have learned that a variety of approaches are needed to engage farmers, and that reinforcement of messages over time combined with personal interactions is the most effective strategy. For example, an email blast to our list of 216 farmers who signed up to learn more about organic certification is the weakest form of engagement. On the opposite side of that spectrum, a one-on-one consultation with a farmer is the strongest and most effective form of engagement. Of the methods use to perform outreach in this campaign, we'd like to share our observations on the strong and weak methods in case it is useful to other Georgia Department of Agriculture/USDA partners. The spectrum of outreach methods from weakest to strongest methods are as follows:

- Bulk emails (very weak, but useful for the initial outreach)
- Individual emails (somewhat weak)

- Follow-up individual emails (somewhat weak)
- Individual phone calls (medium)
- Follow-up individual phone calls (stronger)
- Small group workshops and trainings (strong/tied with follow-up individual phone calls)
- One-on-one individual consultation (strongest)

Also, it is important not to dismiss those weak outreach touch points outright. We have learned that some farmers' journey to organic certification began with an initial email, and later their knowledge expanded through each additional outreach efforts, trainings, and one-on-one consultation. Not every email outreach effort led to organic certification, but every successful organic certification began with an email and successive reinforcement and outreach. We find this to be very valuable information for our organic certification work going forward and for many of our other efforts to revitalize rural economies and enrich all of Georgia's communities.

#### **Contact Person**

Michael Wall, Georgia Organics Director of Programs  
 Michael@georgiaorganics.org, 200-A Ottley Drive, Atlanta, GA 30324

#### **Additional Information**

none

### **9. Georgia Peach Council-*Georgia in July*– Final Performance Report**

#### **Project purpose**

Commercial peach growers in Georgia have recognized a problem in having more peaches in July than they can sell at an acceptable price. Every year that this problem is not solved, the Georgia growers lose potential revenue that could ultimately sustain these few remaining farms. While growers in Georgia have some damage to early crops fairly often, the later crops rarely see significant loss or damage. Yields are significantly higher during the peak month of July than varieties harvested in May and June. The volume harvested in Georgia is often significantly higher than any other summer month. There are several factors that make the month of July challenging from a marketing stand point as well. July is also the month many other peach growing regions begin harvesting ship-able volume. States like Missouri, Arkansas, Illinois and Pennsylvania all have some commercial acreage of peaches. Available peach volume is significantly higher during the month of July when Georgia growers are peaking with volume.

A promotional opportunity was recognized with this peak volume of July peaches. In addition to higher yields and peak volume of these July peaches, flavor is also peaking. It is these July peaches that made Georgia the Peach State. These July peaches are all freestone, meaning they pull easily off of the pit. Sizing of these later season peaches is also larger than some of the earlier fruit. The Georgia Peach Council realized an effort was needed to tell the story of these fabulous tasting, large Georgia Peaches harvested in July.

The Georgia Peach Council created a program, which we took to our retail partners, that highlighted the benefits of Sweet Georgia Peaches in July. With the title “Georgia in July” we set out to establish July as *the* month to promote Sweet Georgia Peaches and provide the retailer all of the tools they need to successfully market these premium peaches.

### **Project Approach**

The Georgia Peach Council approached this project with a “grass roots”-type marketing campaign. We set out to tell the story of Georgia Peaches in July. Before we hit the road, however, we felt it important to clearly define exactly why Georgia in July peaches tasted better. Our grandfathers had often spoken of our ridiculous heat compared to other growing regions. Comments like “I wish I were growing peaches in Illinois today” were often heard around the farms. Some of the peach pioneers often said it was our heat that made Georgia Peaches different from just peaches. Our quick research revealed they were correct! The summer nights in Georgia’s peach growing region are markedly hotter compared to the same period in other peach growing regions. These conditions are proprietary by their very nature because they are unique to Georgia:

Searing hot summer nights during harvest = NO rest for the peaches. We are the “hottest” of the major peach growing regions:

San Joaquin Valley, California, -10 degree difference

The Ridge, South Carolina, -5 degree difference

Gloucester County, New Jersey, -9 degree difference

Once the facts were established, The Georgia Peach Council partnered with peach expert Lynn Kilroy of Kilroy Communications to develop the messaging. The message was crafted into a complete program providing retailers an engaging way to carry the message further to their consumers. The tool kit offered to retailers included:

1. Assurance in both supply of July peaches as well as the promised flavor
2. Point-of-sale materials such as high-graphic bin merchandisers, posters, and market bags

### 3. Support from our registered dieticians:

- Why peaches should be a big part of any healthy diet.
- How to include more peaches in your healthy diet: How-to-videos and recipes.
- Ready-to-use blog posts and tweets about Georgia peaches and reminders/tips on how to use those tools.
- Everything a retail dietician would need to promote our peaches to their customers through all means available.

### **Goals and Outcomes Achieved**

#### *Outcome #1: Usage of the “Georgia in July” Marketing Tool Kit:*

The GOAL was to develop a “Marketing Tool Kit” to be used by retailers in order to increase the demand from retailers for Georgia grown peaches, specifically in the month of July. The PERFORMANCE MEASURE was to be the number of retailers who signed-up for the tool kit and promotion “Georgia in July.” The BENCHMARK could not be established, as this was a new promotion, so the benchmark for the number of retailers currently signed up when the project began was submitted was zero. The TARGET was to sign up 8 retailers for the “Georgia in July” program. Performance monitoring of Outcome #1 would come from a list of retailers who used all or portions of the “Georgia in July” toolkit and promoted Georgia grown peaches in July.

As the project got underway, the Georgia Peach Council team visited the following retailers pitching Sweet Georgia Peaches and Georgia in July in particular: Tops Friendly Markets, Hy Vee, Loblaw, H.E. Butt, Hannaford Brothers, Publix Supermarkets, Kroger, Roundys, BJs Wholesale, Trader Joes, Coborns, Schnucks, Dierbergs and Redners. While each of the retailers listed did not participate in the Georgia in July program, Georgia Peaches were featured in every one. Of those listed, Kroger, Coborns, Winn Dixie, TOPS, Hannaford and Redners participated specifically in the Georgia in July program and utilized some or all of the Georgia in July tool kit. Balls Foods also participated while Schnucks and Dierbergs utilized some of the materials of the tool kit but promoted Georgia Peaches in the month of June. Goal 1 was a success as retailers welcomed the idea of knowledgeable growers establishing a program that benefited both the grower and the retailer. We had 7 retailers participate in promoting Georgia Peaches in July while several others used materials created from this grant to promote Georgia Peaches specifically in other months.

#### *Outcome #2: Improve profitably during a historically low-profit period:*

The GOAL was to increase the money farms receive for their peaches in the month of July by increasing the average price per box on 200,000 boxes of peaches. The PERFORMANCE MEASURE was the average f.o.b. pricing for peaches sent to retailers that signed up for the “Georgia in July” program compared to the average market f.o.b. price, reported weekly from the U.S.D.A. during that same period. The BENCHMARK was the weekly U.S.D.A. f.o.b. price averages for the current year during the promotional time. The TARGET was to beat the

average market f.o.b.'s for that period in July by \$2.00. Performance monitoring of Outcome #2 would come from comparing the average f.o.b. pricing that we received from our new retailers participating in the "Georgia in July" program to those of the market f.o.b. posted by the U.S.D.A. during the same period.

Pricing below indicates marketing pricing as provided by *USDA, Market News Report*:

7/02/2015

2 ½" \$12.85 to \$14.85, previous commitments lower

2 ¾" \$14.85 to \$16.85

7/09/2015

2 ½" \$12.85 to \$14.85

2 ¾" \$14.85 to \$16.85

7/14/2015

2 ½" \$12.85 to \$14.85 mostly \$12.85

2 ¾" \$ \$13.85 to \$16.85 mostly \$14.85 to \$16.85 occasional low as \$12.85

7/21/2015

2 ½" \$12.85 to \$14.85 mostly \$12.85 occasional as low as \$10.85

2 ¾" \$14.85 to \$15.85 mostly \$14.85 occasional higher

7/28/15

2 ½" \$12.85 to \$14.85 mostly \$12.85

2 ¾" \$14.85 to \$15.85 mostly \$14.85

Average pricing for the participating retailer listed below for the entire month of July is listed below along with corresponding sizing.

Kroger	\$19.92 (some 2 ½", some 2 ¾")	47,000/cs
TOPS (C&S)	\$17.32 (some 2 ½", mostly 2 ¾")	4,800/cs
Winn Dixie	\$21.20 (some 2 ½" , mostly 2 ¾")	16,000/cs
Coborns	\$20.31      2 ¾"	2,384/cs
Roundys	\$17.62      2 ¾"	6,100/cs
Redners	\$16.09      2 ½"	3,672/cs
	\$16.17      2 ¾"	
Hannaford	\$22.39      2 ¾"	30,500/CS

Grower pricing above for July shows an FOB higher than the proposed \$2 goal above the USDA Market News report. The highest pricing report for Central Georgia, according to the Market News report, for 2 ¾" at any time during the month of July was \$16.85. In many cases, retailers participating in Georgia in July provided a return exceeding \$3 above the Market News report provided by USDA. The outcome of goal 2 was a resounding yes. Growers can fetch more

money in July by aligning themselves with retailers in promoting under the Georgia in July campaign. Volume fell short of the 200,000cs proposed primarily due to the limited volume. Most retailers were only encouraged to promote one week in July rather than the whole month of July.

### **Beneficiaries**

The following were direct beneficiaries of the project:

- (1) The Georgia peach growers who will experience more of a sustainable return for their crop of peaches during their most challenging time of the season: July
- (2) The communities around these farms that depend on them for jobs working directly for the farms and for businesses based on the Georgia peach industry
- (3) Increased revenues, in the produce section and storewide, for the retailers who join us in promoting “Georgia in July”
- (4) The consumers who will be better off including a healthy, flavorful Georgia peach in their diets

### **Lessons Learned**

The 2015 season proved to be challenging in several regards. Peaches were smaller throughout the season than anticipated. The overall crop in Georgia was off from the prior two years. Interestingly enough, peach growers in most other commercial growing regions recognized full crops. When considering the pricing growers received for their July crop in 2015, it is overwhelmingly evident in the value realized in providing resources for promotion as well as promoting during peak periods. Without assistance from the Specialty Crop Block Grant and The Georgia Peach Council, growers would not have recognized the returns they received in 2015.

### **Contact Person**

Duke Lane, President, Georgia Peach Council

### **Additional information**

ATTACHMENTS (*Available upon request from GDA*)

## **10. Georgia Pecan Growers Association-A Campaign to Increase Domestic Pecan Purchasing and Consumption: Improving Awareness of Georgia Pecan Health Benefits–Final Performance Report**

### **Project Summary**

The objective of this grant, as presented in the initially-approved proposal, was to, “Launch and expand marketing and educational initiatives in North America to create domestic demand for Georgia-grown pecans by promoting the health benefits of the nut and nut products.”

In order to create demand for Georgia pecans, the grant established three goals:

- 1) Increase awareness of the health benefits of the Georgia pecans and pecan products in targeted North American markets through the launch of an ad campaign
- 2) Increase awareness of Georgia pecans and pecan products through the development of posters/promotional-educational materials for product promotion that are aimed at both English-speaking and non-English speaking consumers.
- 3) Exhibit at the 2014 Produce Marketing Association Conference (PMA) in Anaheim, California

### **Project Approach**

The Georgia Pecan Growers Association (GPGA) approached the project as a multi-layered marketing plan that would incorporate new media product placement, traditional print advertising, pecan promotional materials for Mandarin speakers and in-person product showcasing to advance the nutritional benefits of Georgia Pecans. GPGA did not use project partners in this particular grant, but the grant was endorsed by the Georgia Commodity Commission for Pecans.

The workplan designated the following project activities over the three-year period:

- 1) Targeted marketing using ad campaigns through various media
- 2) Dual-language product promotional material development
- 3) Exhibition at the Produce Marketing Association’s 2014 Fresh Summit trade show event

The tasks executed for each of the designated activities include the following:

- For Targeted marketing using ad campaigns through various media

**a)** GPGA advertised in New York City’s Times Square on a rolling mega-tron TV for 182 days from April 1, 2015 to June 30, 2015 and from September 1, 2015 through November 30, 2015. (This latter portion overlapped into Year 2 of the grant). The ad ran for 15 seconds per hour, running 20 hours per day and 7 days a week. The ad was able to reach millions of consumers per day in one of the world’s busiest locations.

Why was Times Square selected for Georgia Pecans over traditional print advertisements in targeted markets? For GPGA, after comparing advertising rates and audience reach with such

national publications as *Prevention* magazine, *Reader's Digest*, and *The New York Times*, the advertising package offered by Neutron Media, which managed the rolling mega-tron for GPGA, just could not be beaten.

This marketing strategy was a first-ever for GPGA and was intended to reach the North American market for pecans outside of the American South (where pecans are more traditionally used because they are grown here and not in northern regions). This product placement was also the first time that GPGA has been able to utilize media that was outside of standard print media or our previous standard ad campaigns.

GPGA strategically used the specific timeframes so that advertising 'hit' during major holidays/celebrations where pecans could be enjoyed in a variety of dishes – Easter, Passover, Mother's Day, Memorial Day and then later Labor Day, Halloween and Thanksgiving.

**b)** GPGA advertised in Georgia Grown's Annual Publication with an exciting, full-page color print ad in 2015. This magazine is a substantial publication supported by Georgia's Commissioner for Agriculture. Georgia pecans were a featured product profile that year. Ad design and development occurred during the first and second quarter of 2015 between GPGA and Journal Communications, with publication occurring in fall 2015.

In 2016, GPGA once again advertised in *Georgia Grown Magazine* with a color print advertisement, as well as an additional article featuring the importance of pecans to Georgia's agricultural industry. During 2017, GPGA advertised again in *Georgia Grown Magazine*. This same year, the magazine switched publishers from Journal Communications to *Georgia Trend*.

- For Dual-language product promotional material development

At the time of this grant's proposal (and even to date), Georgia Pecan Growers Association (GPGA) was aggressively marketing to Chinese consumers. However, GPGA did not have any of its own materials translated into Mandarin to reach this market. The cost to develop, design and translate culturally-appropriate materials in Mandarin was cost-prohibitive to GPGA without assistance from this grant.

GPGA was able to print and disseminate 550 posters in Mandarin that demonstrated the many features, uses and varieties of pecans grown in Georgia. GPGA completed Mandarin translation and design during the first grant year so that materials in Mandarin were available in the first year and beyond. In addition, these materials were also printed in English and were disseminated through grant year 3.

- For Exhibition at the Produce Marketing Association's 2014 Fresh Summit trade show event

GPGA completed a successful exhibit in October 2014 at PMA during the first grant year. This venue in Anaheim was a new location for PMA exhibitors, but the PMA Fresh Summit Trade Show always draws significant attention to Georgia pecans. Fresh Summit is an exciting event for GPGA to continue to participate in for market exposure for Georgia pecans and pecan products.

Grant funding from SCBG has supported GPGA for a number of years to exhibit at PMA. However, as a result of successful exhibits over the year, in 2017, exhibition in this forum became self-sustainable for GPGA and no longer requires SCBG funding. GPGA sought out a partnership with the Georgia Commodity Commission for Pecans in order to participate in the event in 2017 and hopes to continue such ventures in the future through self-funding. The outcome of using SCBG funding for PMA participation through this grant and others allowed GPGA to “get a foot in the door” for such a huge showcase that was cost-prohibitive and to learn valuable lessons about displaying and showcasing Georgia pecans in this arena.

### **Goals and Outcomes Achieved**

The first two goals of the grant were accomplished over the three-year period, while the third grant goal (exhibit at 2014 PMA) was achieved during the first grant year.

Results achieved towards the grant’s goals are as follows:

- **For Goal 1** - Increase awareness of the health benefits of the Georgia pecans and pecan products in targeted North American markets through the launch of an ad campaign

As described in the ‘Project Approach’ section of this report, Goal #1 had two activities:

1) Advertising on a rolling megatron in New York City’s Time Square arena in order to reach a national audience and 2) Advertising in Georgia Grown Magazine’s annual agricultural publication to reach a domestic, local audience.

### **Accomplishment of Goal 1 through Audience Reach Estimates**

As explained in an op-ed 2011 article from *Forbes* magazine:

*“[Times Square](#) must surely be the greatest advertising show on earth. To advertise in Times Square is to be an icon in today’s advertising culture.*

*At least that’s what the billboard space owners in Times Square claim. In fairness, what is on sale (if you are lucky to get space) is not a regular old billboard anymore with flashing lights. No, the owners of this space have invested millions of dollars to upgrade the media into rocket propelled digital video screens, the likes of which no one has ever seen before. The quality of the Times Square screen is better than my HD iPad at home...*

*Times Square has some pretty incredible facts going for it. A visit to Times Square in the heart of New York City is one of the biggest draws in the city. It is said that 26 million people visit Times Square each year, [which is] about 50,000 people who go through Times Square every day...*

Source: <https://www.forbes.com/sites/marketshare/2011/02/16/how-to-make-or-break-an-ad-in-times-square/#3006a14e3d3a>

In terms of audience reach of the annual magazine publication *Georgia Grown*, Journal Communications (which published the issue in years 2015 and 2016) wrote:

*“The publication [Georgia Grown Magazine] is distributed by the GA Dept of Ag through their events and trade missions. It is also distributed to legislators, key consumer groups, Chambers of Commerce, libraries and several public places throughout the state. Those entities that choose to advertise also receive copies to use for their own educational and marketing purposes. There are approximately 20,000 copies printed and distributed each year.”*

- Rhonda Graham, Senior V.P. Agribusiness Sales, Journal Communications

For the 2017 edition, the magazine changed publishers to *Georgia Trend*

The printed issue of *Georgia Grown Magazine*, according to *Georgia Trend’s* media kit included, *“20,000 copies of the printed issue, which is free to the public...a digital edition...[and] Both print and digital editions will be promoted on GeorgiaGrown.com, GeorgiaTrend.com, and GeorgiaTrendDaily, a daily e-newsletter distributed to 6,500 opt-in subscribers. Published monthly, Georgia Trend is delivered to more than 50,000 subscribers.”*

#### Accomplishment towards benchmark

The benchmark established for Goal #1 in the approved grant project was to advertise in two media outlets with performance measurement of goal achievement based on, *“Enhanced product awareness through increased product inquiries to GPGA of at least 10 percent over previous years.”* While GPGA achieved the benchmark with the Times Square ad and the Georgia Grown ad, the measurement tool proved to be difficult to record based on several factors. Recording phone calls and product inquiries, as well as watching website traffic, were not efficient and were not adequately recorded due to staff changes and web hosting provider changes during the course of the grant.

Since the 2014 submission, additional SCBG approved for GPGA have had more specific and direct measurements designed to catch and portray goal achievement.

- **For Goal 2** - Increase awareness of Georgia pecans and pecan products through the development of posters/promotional-educational materials for product promotion that are aimed at both English-speaking and non-English speaking consumers.

#### Accomplishment towards benchmark

At the time of the grant application, GPGA did not have any materials to promote pecans in any way to non-English speaking consumers. The benchmark, then, was considered at a base of zero. Now, however, with grant completion, GPGA had one significant piece of pecan promotional information available in both English and Mandarin.

- **For Goal 3** - Exhibit at the 2014 Produce Marketing Association Conference (PMA) in Anaheim, California

As promoted on their website, Fresh Summit claims that the PMA event generally attracts over 20,000 attendees, “with about 80% involved directly with purchasing.”

Goal benchmarking and measurement for this activity in the original proposal included measurement of samples and literature distributed, as well as booth visits. Using a handheld clicker by our staff managing the exhibition booth at that time, notes left within our grant activity folder noted 568 visitors to the booth. The number of samples and product literature, such a recipe cards and nutritional information, which were distributed at the booth, unfortunately, were not adequately recorded. Learning from this experience, however, our later grants included a survey at the booth that visitors could complete when picking up samples and items so that GPGA had some feedback on the marketing we used.

### **Beneficiaries**

The purpose of the Georgia Pecan Growers Association is to encourage research, education and promotion of Georgia Pecans for the estimated 900 pecan growers in our state. Nearly half of these growers are members in our organization, with additional memberships coming from other states’ growers, industry professionals, commercial vendors and researchers. GPGA ultimately seeks grant funding each year to benefit Georgia pecan growers. Our 2014 SCBG was designed to increase demand for Georgia’s pecans and pecan products through increased product marketing. We believe we fulfilled our purpose, and the grant’s goals, due to the fact that the Times Square ads reached millions of consumers, the Georgia Grown Ad over three years and the Mandarin marketing materials reached at least 60,000 consumers, and the PMA exhibition reached more than 500 potential purchasers based on number of visitors to our PMA booth.

### **Lessons Learned**

For future campaigns, we have learned to bid and contract with public relations/advertising firms to handle marketing programs (in the absence of our own in-house marketing professional), which proves to be more cost-effective for GPGA as well as provides us with marketing experts.

### **Contact Information**

Samantha McLeod, GPGA Executive Director  
Mailing Address: PO Box 1367, Tifton, Georgia 31793  
Alternate contact: Amy Howell

### **Additional Information**

None

## **11. Georgia Tech Research Institute-*Developing a Predictive Model for Peach Harvest Dates*– Final Performance Report**

### **Project Summary**

The peach industry is a very important part of the State of Georgia's economy. Peaches are the second most popular fruit in Georgia behind blueberries. In 2015, the farm gate value for peaches was just over \$48.9 million. Harvest dates estimation is an ongoing practice for every peach grower since peach production is a temperature-dependent process. In view of the changing weather patterns the state has experienced in the last few years, it is more important than ever to provide peach farmers with tools that will make predictions of harvest dates timely and accurate. The main difference between the proposed project and the statistical modeling previously done is the inclusion of updated weather data, which will allow prediction of post initial harvest dates. Accurate predictions of harvest dates will help peach growers to schedule labor and farm activities and pre-sell the peach crop at an optimal price. To achieve this goal, this research effort combined meteorological data from the counties where peach farms are located, with peach production and phenological data obtained from peach farms to create statistical regression-based models that will predict first and subsequent harvest dates. The focus of the analysis is on identifying factors such as temperature, growing degree hours, rainfall, etc., that are predictive of bloom and harvest dates for several cultivars. The statistical relationship between a dependent variable (harvest data) and independent variables such as meteorological, phenological, and harvest/production data are identified using statistical analysis software. This tool should enhance the competitiveness of Georgia Peach industry.

### **Project Approach**

The approach for this project was based on several tasks outlined in the original proposal: Task 1 is based on acquisition of historical weather and phenological data from Georgia state meteorological station and peach growers, Task 2 centers on data analysis and creation of a statistical model that predicts first harvest dates for a variety of cultivars, and Task 3 is a combination of research results gathering and dissemination. Task 1 and a portion of Task 2 were completed in 2015. Task 2 was completed in 2016. In 2017 reporting period Georgia Tech Research Institute (GTRI) completed Task 3 of the project and this Final Report.

### ***Significant Contributions and Role of the Project Partners in the Project***

The work on the project was done primarily by the team from GTRI with Georgia Peach Council being the only partner on the project.

Task 1 was a collaboration work of GTRI and Georgia Peach Council. The task was completed by GTRI team of researchers in close contact with Georgia Peach Council, which provided historical data on peach production, harvest dates and other phenological data for the project. GTRI team was responsible for the development of a combined digital database since parts of the data were submitted in paper form. The collaboration with Georgia Peach Council is particularly important for this study because local data allows for better prediction of harvest dates.

Task 2 was completed by GTRI researchers and focused on statistical data analysis, regression-based modeling and creation of a tool that predicts first harvest dates. More thorough description of this work can be found in “Modeling” section of this report. Researchers analyzed many variables that may affect harvest dates including those that were not considered or explored in previous studies which makes this project significant.

Task 3 was carried on by GTRI team and included the distribution of results among Georgia Peach growers. GTRI researchers had a meeting with members of Georgia Peach Council where the software application that allows for prediction of first harvest dates for a selected number of peach varieties was demonstrated. The developed tool proved to be easy to use and has shown the capability to predict harvest dates within the acceptable margin of error (5 days).

#### **Task 1: Data acquisition**

To create prediction statistical models for peach cultivars Georgia Tech Research Institute (GTRI) acquired two sets of data: 1) Historical harvest data compiled by Peach Growers and 2) weather data for Peach County Georgia, where most peach orchards are located.

#### **DATA ACQUIRED FROM PEACH GROWERS**

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Historical data for the peach harvest dates was obtained from the Georgia Peach Growers and include 54 varieties that were grown at 66 orchards. Historical records for peach harvest dates included the period from 1983 to 2014. The majority of varieties/orchards combination has 6 to 16 years of historical data.

Records received from Peach Growers were largely paper based (Figure 1). Consequently peach harvest dates data was digitized and organized in the format conducive to statistical analysis.



## WEATHER DATA ACQUISITION

This task comprised of acquiring relevant weather data sets and calculating peach grower specific derived variables such as Growing Degree Hours, Chilling Hours, and Cold Duration Hours. The dataset was acquired from University of Georgia Weather Network. Figure 2 show the map for University of Georgia Weather Network.

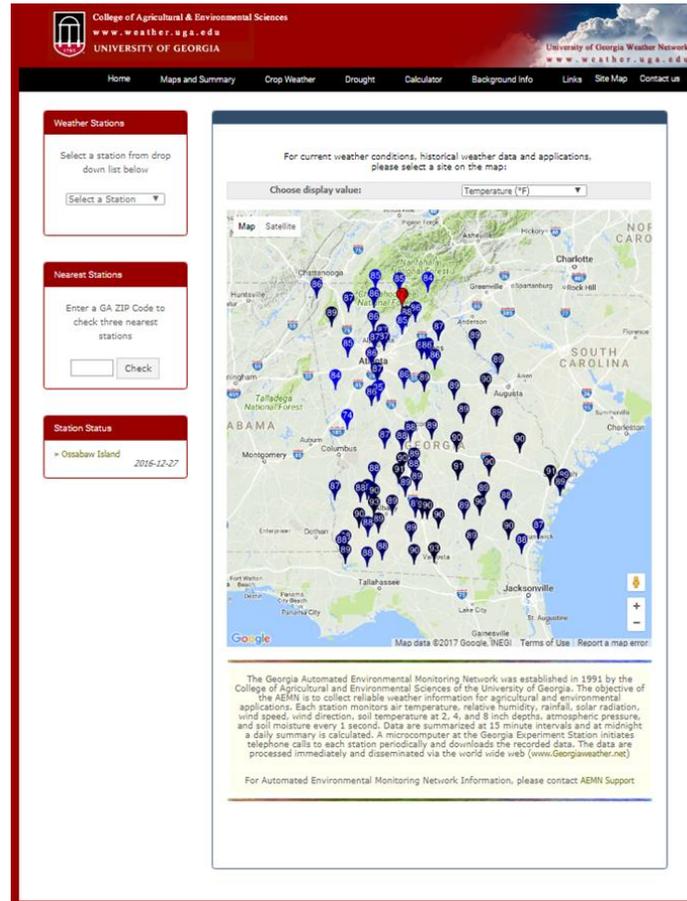


Figure 2 University of Georgia Weather Network map

Listed below are the variables included in the weather dataset:

- Weather Data
- Weather dataset consists of hourly readings for:
- Temperature
- Dew point temperature
- Relative humidity
- Visibility
- Cloud cover
- Precipitation

- Snowfall
- Snow depth
- Wind direction
- Wind speed
- Precipitation
- Evapotranspiration
- Water balance
- Soil temperature for 2, 4, and 8 inch depth

All of above mentioned variables were examined and their predictive ability was estimated. Some of the variables that are useful in predicting peach harvest dates typically represent annual or seasonal accumulations. Those are variables associated with peach growing cycles such as Growing Degree Hours as well as Chilling Hours. Both variables were calculated and appended to the datasets.

Growing Degree Hours (GDH) – are a weighted measurement of the temperatures to which a tree is exposed, based on the idea that trees have an optimum temperature for growth and that temperatures far above or below that optimum temperature have a greater impact than temperatures just above or just below it (UC Davis). Figure 3 shows the Growing Degree Hour Calculator used for this study. Growing degree hours typically calculated for a certain period of time. In this example it is calculated from January 1<sup>st</sup> to May 1<sup>st</sup> for each growing season. To calculate GDH we need to enter beginning and ending date for the investigated period and base temperature which is 60 °F.

Fort Valley, Peach County, Georgia

Growing Degree Hour Calculator

From: January 1 2017

To: May 1 2017

Base Temperature: 60

Disregard Temperatures Above: none

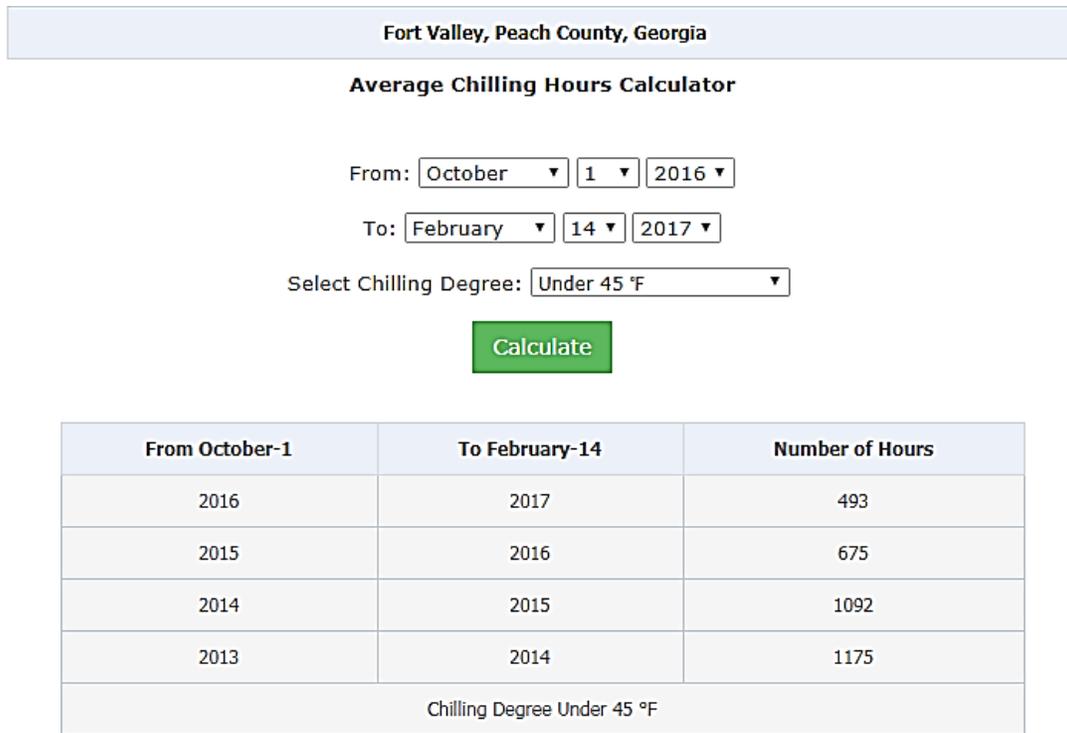
Calculate

From January-1	To May-1	Total
2017	2017	15023
2016	2016	9771
2015	2015	8531
2014	2014	5415
60 <= Temp <= none °F		

Figure 3 Growing Degree Hour Calculator

Chilling Hours (CH)\_ The number of hours of winter temperature below 45 °F. Typically in Georgia peach trees should accumulate roughly 800-850 chill hours after which a tree will blossom.

Figure 4 represents Chilling Hours Calculator used to calculate chilling hours. It includes start date of the chilling cycle, end date of the chilling cycle, and temperature characteristic that is used for calculating chilling hours.

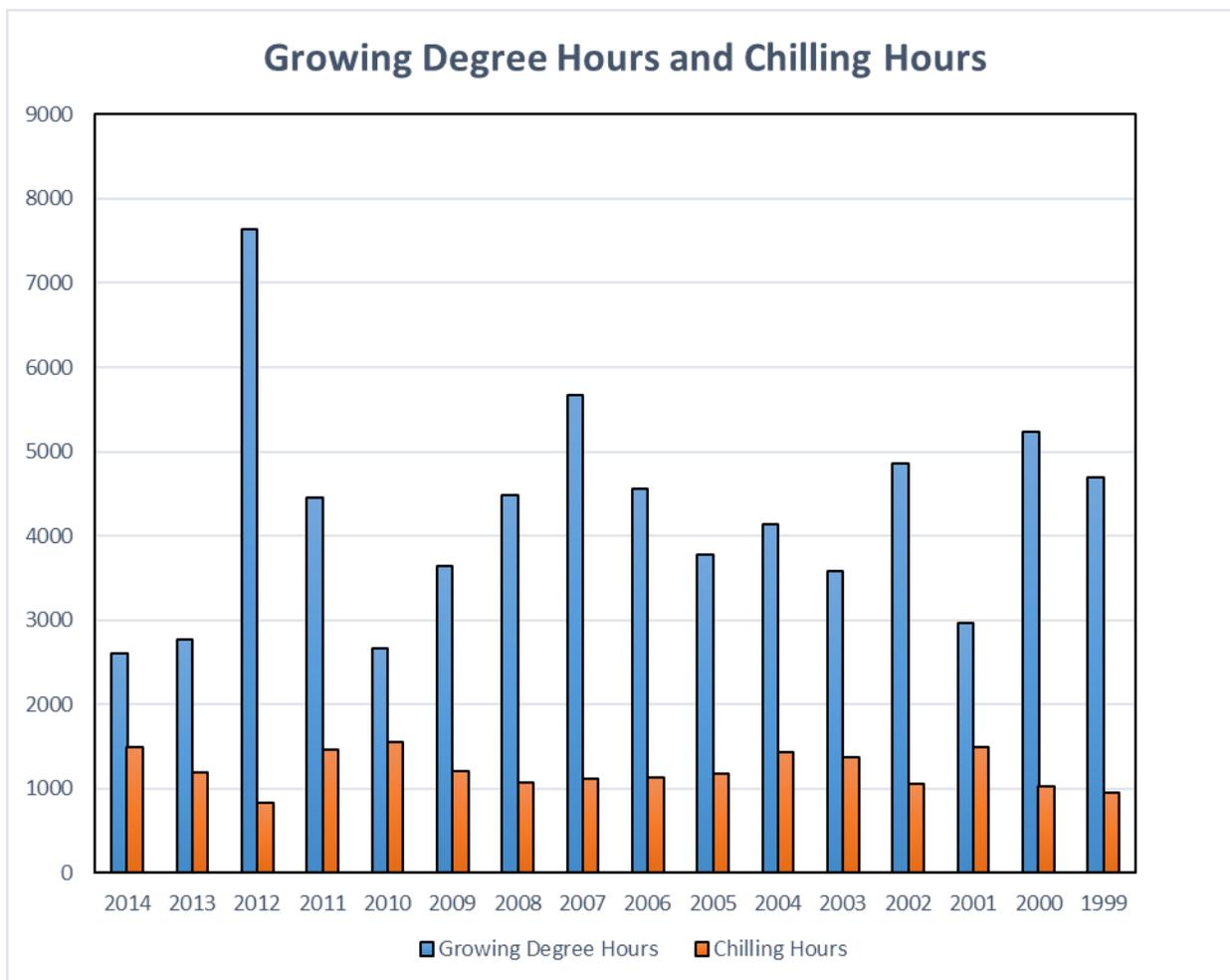


**Figure 4 Chilling Hours Calculator**

Both datasets 1) Peach harvest data and 2) weather data formed a database that was used to create statistical models for predicting peach harvest days for multiple cultivars.

**Task 2: Data Analysis**

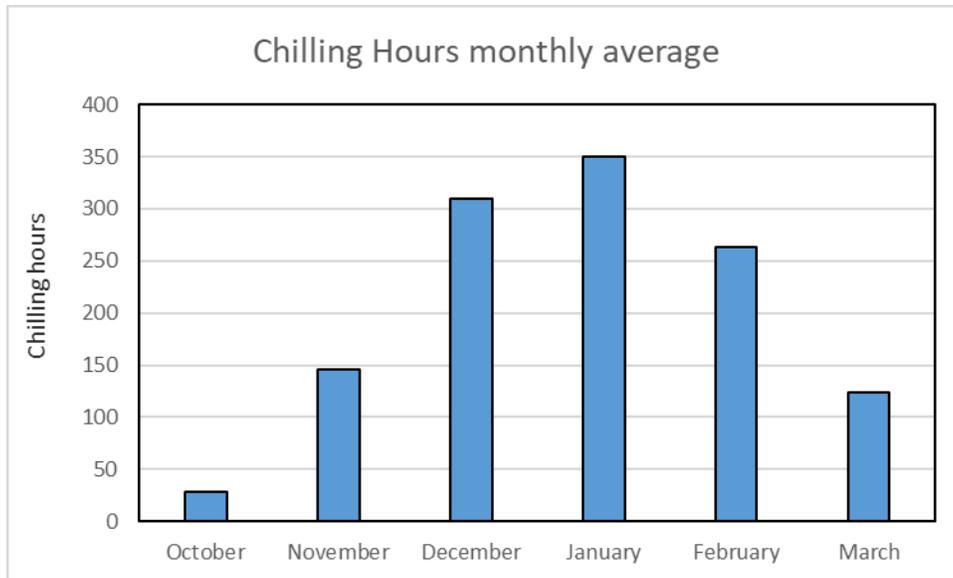
Initial analysis consisted of examination of historical weather patterns, creation of histograms for weather related parameters such as cloud cover and temperature, and analysis of other significant statistical variables such as Chilling hours and Growing Degree Hours. The results were examined to determine if any year(s) data patterns demonstrated unique characteristics which might be helpful in modeling efforts. Annual temperature and cloud cover histograms are shown in the Appendix (*available upon request from GDA*).



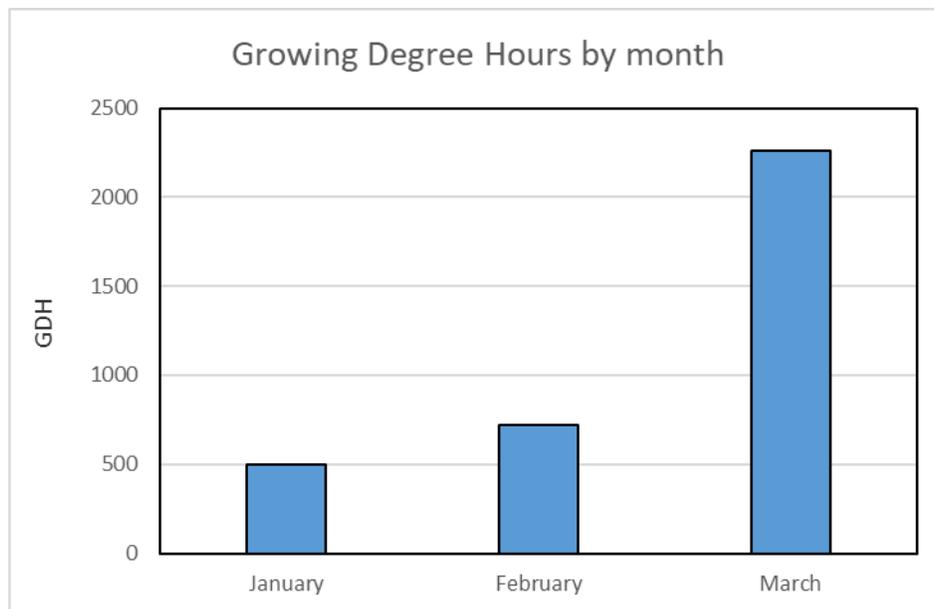
**Figure 5 Historical Growing Degree Hours and Chilling Hours**

Figure 5 shows historical plot for GDH and CH. As it is evident from the chart both GDH and CH are fluctuating year to year which creates unique conditions for each growing season. Fluctuations in GDH are more evident and have higher amplitude. GDH are responsible for growth and therefore differences in GDH will have an effect on bloom and harvest dates. Sufficient CH provides for adequate tree dormancy, 800 – 850 chilling hours should be sufficient for peach varieties in Georgia. It looks like over the analyzed period peach trees received sufficient number of CH.

Next we examined distribution of CH and GDH throughout the year. Figure 6 shows that the majority of CH hours are accumulated in the month of December, January, and February. Most of GDH accumulations come from the month of March. Figure 7 represents GDH distribution.



**Figure 6 Monthly averages for Chilling Hours**



**Figure 7 Monthly averages for Growing Degree Hours**

## MODELING

The standard regression procedure is designed to identify the statistical relationship between a dependent variable and a set of independent variables or “predictors”. In the case of phenological modeling dependent variable usually describes a specific phenological event such as Harvest Date. Harvest date is not fixed and varies from year to year, location to location and

cultivar to cultivar. It depends on GDH (growing degree hours), number of Chilling Degree Hours (CDH) as well as other environmental parameters including soil moisture and temperature, number of raining days, etc. Based on this researches constructed regression models to predict Harvest Dates for a number of selected peach varieties.

JMP Pro 12 software, developed by SAS Institute, was used to develop multiple regression equations for harvest prediction. Possible independent variables included GDH, CDH, Cold Duration Number of Hours (temperature below 32F), Soil temperature for 2, 8, inch depth, etc. while Harvest Date was the dependent variable. Harvest Date variable was transformed to reflect the number of days to harvest from January 1st.

A set of unrelated independent variable was identified by examining a correlation matrix of all predictor variables produced by JMP's Multivariate Methods platform. Best predictors were then ranked using Predictor Screening procedure. A stepwise regression option was used to interactively explore and select best predictors for each model and reduce the variance caused by estimating unnecessary terms. Best models were selected based on change in adjusted  $R^2$  and variable significance. Final models were evaluated for significance and influential cases (outliers) by examining the differences in fit values, leverage plots and residual plots (See Appendix). The absence of non-random patterns in residual plots (See example in Figure 8) indicate that there is no unaccounted relationships, left over correlations or heteroscedasticity present in the model. If influential cases were observed in the model the regression procedure was repeated after deletion of such cases. It was identified that most outliers are a result of transcription errors from the phenological data source.

Models were developed for 13 cultivars, requested by the Peach Growers. Number of data samples of historical data for different cultivars ranged from 6 to 16 years. Number of samples, however, did not improve strength of the models. Models with similar number of samples had different model strength indicated by the  $R^2$  values. Table 1 includes number of sample years and model results for all the cultivars.

Table 1 Summary models table

	<i>Number of Sample Years</i>	$R^2$	<i>Residuals Days <math>\pm</math></i>
<i>FirePrince</i>	12	0.92	3.5
<i>Flavorich</i>	10	0.77	3
<i>GALA</i>	12	0.86	3

<i>GoldPrince</i>	16	0.69	4
<i>Harvester</i>	16	0.7	4
<i>JulyPrince</i>	6	0.91	4
<i>JunePrince</i>	9	0.59	3
<i>Majestic</i>	11	0.52	3
<i>RubyPrince</i>	10	0.8	4
<i>ScarletPrince</i>	6	0.94	3
<i>Springcrest</i>	13	0.63	3
<i>SpringPrince</i>	9	0.82	3.5
<i>SuperPrince</i>	7	0.92	3.5

Different cultivars had models with various strength and with various residuals. Most of the residuals were within  $\pm 3$  days, which means that predicted peach harvest dates by the equation would be within  $\pm 3$  days from actual date when the peaches were picked. This time interval is sufficient for peach growers to schedule activities, facilities, and labor associated with peach harvesting.

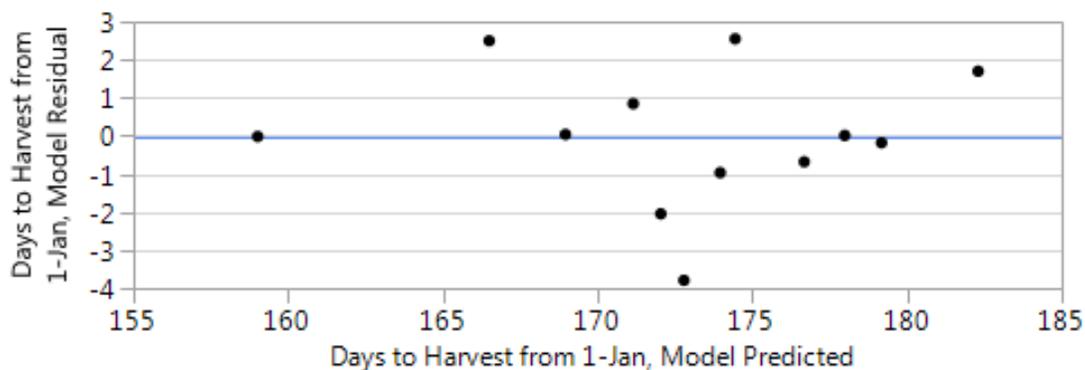


Figure 8 Sample residual plot

### **Task 3: Research Results, Software tool creation, and Result Dissemination**

Task 3 consisted of interpretation of the results from last year's analysis and creation of the software tool that can be used by the Peach Growers to predict peach harvest dates.

Based on data analysis performed in Task 2 two statistically significant variable were identified in predicting harvest dates. They are Growing Degree Hours and Chilling Hours. Those variables were entered into analysis and created a model that estimates peach harvest date for each cultivar.

Software application for 13 modeled varieties was developed and submitted for the use of Peach Growers.

Figure 9 shows a screen shot of the application that was created to assist peach growers in predicting peach harvest dates. The prediction of the peach harvest dates is based on three independent variables: Year, GDH, and CH. By entering those three parameters the application displays a date that is estimated by the model to be a harvest date within the margin of residuals.

The screenshot displays the FLAVORICH application interface. At the top right is the Georgia Tech Research Institute logo. The title 'FLAVORICH' is centered at the top. Below it is a table with three columns: Year (blue header), GDH (green header), and CDH (red header). Each header cell contains a prompt: 'Please enter a Year to be predicted below', 'Please enter Growing Degree Hours below', and 'Please enter Chilling Degree Hours below' respectively. The input values are 2016, 5115, and 820. Below the input table is a large orange box containing the text 'Harvest Date Prediction' and the date '5/16/2016'.

Year	GDH	CDH
Please enter a Year to be predicted below	Please enter Growing Degree Hours below	Please enter Chilling Degree Hours below
2016	5115	820
Harvest Date Prediction 5/16/2016		

Figure 9 Harvest Dates prediction software application

### Goals and Outcomes Achieved

The main goal of this study is to help Georgia peach growers to accurately estimate harvest dates for multiple peach varieties. Harvest dates estimation is an ongoing practice for every peach grower since peach production is a biological system and it is a highly temperature-dependent process. Weather conditions are not constant and changing weather patterns can produce wide variations in pick dates for the growers. At the same time, harvest dates are used to schedule labor and facilities as well as pre-sell peach crop at the optimal price. To help to deal with peach harvest date estimation GTRI created a software tool that uses independent variables such as Year, GDH, and CH to predict harvest dates (Figure 9). This prediction is based

on regression modeling which utilizes historical weather data and harvest data from peach growers. The software application was created with simplicity and usability in mind and it takes just a few minutes to learn and run it. Statistically speaking margin of error varies between  $\pm 3$  -  $\pm 4$  days depending on the cultivar which is quite acceptable to peach growers. To create this software tool GTRI completed several tasks. Table 2 summarizes tasks and activities performed and measurable targets that were achieved.

**Table 2. Summary of Proposed Activities and Outcomes Achieved**

<b>Proposed Tasks</b>	<b>Activities Performed</b>	<b>Outcomes</b>
<p><b>Task 1:</b> Data acquisition:</p> <p>A data acquisition portion of the project will consist of obtaining historical data from the state’s meteorological agencies as well as collecting production and phenological data from peach growers. We propose for this project to collect at least 10 years of historical data; however, it would depend on data availability. Peach growers’ production data will be obtained both in electronic and hard copy format. Hard copy format will be converted to electronic format to use for project activities as well as for farmers.</p>	<ol style="list-style-type: none"> <li>1. A historical data for peach harvest dates was obtained from Georgia Peach Growers and includes 54 peach varieties being grown at 66 orchards. The data has covered harvest dates from 1983 to 2014 and varied by variety and orchard. Only a subset of varieties – orchards combination has 6 to 16 years of historical data. Some of the peach cultivars presently are not in production and thus were not analyzed;</li> <li>2. Meteorological data was acquired from University of Georgia Weather Network;</li> <li>3. Electronic database was developed to combine all available data.</li> </ol>	<p>At least 10 years (even more for selected varieties) of historical meteorological and phenological data was gathered and combined into electronic database.</p>
<p><b>Task 2:</b> Data analysis:</p> <p>After the data acquisition portion of the project is complete, the subsequent task is data analysis. GTRI will use statistical data analysis and regression-based modeling techniques to create a model to predict first and subsequent</p>	<ol style="list-style-type: none"> <li>1. Statistical analysis was performed to identify relationships between peach harvest dates and meteorological data;</li> <li>2. Software application was developed for 13 peach varieties</li> </ol>	<p>Original proposal set a target of 5 days for margin of error to predict harvest dates. GTRI has met and exceeded this goal and created models that predict harvest dates within 4 days.</p>

<p>harvest dates. Historical weather trends including but not limited to ambient temperature readings, rainfall, and number of days below freezing will be analyzed in conjunction with peach production and phenological data such as harvest dates for different peach cultivars. To accomplish this task, GTRI will employ statistical software such as JMP11 powered by SAS.</p>		
<p><b>Task 3:</b> Research results and software tool dissemination:  The results of this work will be disseminated to Georgia peach growers through presentations and transfer of software application. The final report will also be provided to the Georgia Peach Council as well as to other interested parties.</p>	<p>1. The Software application was presented to the members of Georgia Peach Council and submitted for use</p>	<p>In line with proposal's timeline: initial results and model prototype was presented to the members of Georgia Peach Council by February 2015. The final model was submitted for use by 2016 season.</p>

### Baseline Data

No statistical modeling was done previously to predict peach harvest dates for Georgia crop. In 1997 a collaborative study was performed to develop a regional-scale peach phenology models for the southeastern United States. Researches collected the data on eight cultivars from selected orchards located in Georgia, South Carolina and Texas. As a result only two cultivars had first harvest models with error thresholds at or less than the natural harvest date variability which varies from 9 to 10 days. (Schwartz, Carbone, Reighard, & Okie, 1997).

The goal of this project was to create a model of peach harvest dates prediction with margin of error set at 5 days to improve upon existing literature. GTRI has met and excided this goal and created models that predict peach harvest dates within 4 days.

Table 3 provides the data on natural variability of harvest dates for selected cultivars being grown in Georgia. Number of data samples of historical data for different cultivars vary from 6

to 16 years. For some peach varieties the difference between earliest and latest recorded harvest dates may be as large as 29 days (margin of error 14.5 days). Model developed by this project is a significant improvement from the practice of making first harvest day predictions based on historical data since the average error for all selected peach varieties is below 4 days which is much lower than natural variations.

**Table 3. Summary of Proposed Activities and Outcomes Achieved**

	<i>Number of Sample Years</i>	<i>Residuals (from Model) Days ±</i>	<i>Natural Harvest Variability Days ±</i>	<i>Standard Deviation Days</i>
<i>FirePrince</i>	12	3.5	12.5	6.6
<i>Flavorich</i>	10	3	8.5	5.8
<i>GALA</i>	12	3	9	4.7
<i>GoldPrince</i>	16	4	10.5	5
<i>Harvester</i>	16	4	10.5	5.7
<i>JulyPrince</i>	6	4	14.5	9.8
<i>JunePrince</i>	9	3	9.5	4.8
<i>Majestic</i>	11	3	5	2.5
<i>RubyPrince</i>	10	4	9.5	5.5
<i>ScarletPrince</i>	6	3	11	8.5
<i>Springcrest</i>	13	3	7.5	3.6
<i>SpringPrince</i>	9	3.5	8.5	6
<i>SuperPrince</i>	7	3.5	8	5.5

**Beneficiaries**

Completion of this project has benefited all of the peach growers in Georgia and in particular all of the Georgia Peach Council members. This membership includes Taylor Orchards, Pearson Farms, Lane Southern Orchards, Dickey Farms, and Fitzgerald Fruit Farms.

There are 5 farms that produce the majority of the peaches in Georgia, they are listed above. All of those farms benefited from this project.

This project helps peach growers to anticipate big surges in volume and improves the accuracy of and consistency in scheduling pick dates. It is challenging to estimate economic impact at this moment for a couple of reasons: one is that software application was used by the peach growers just for a couple of seasons and during that time here in Georgia we experienced unusual weather conditions including smaller than usual number of chilling hours accumulated throughout the winter and late freezes, which made use of the software more challenging. Undoubtedly this is a very useful tool and it will produce economic benefits for peach growers in the future.

### **Economic Impact of the Project**

Georgia peach industry is ranked third in the nation and produces around 40,000 tons of peaches annually. Georgia Peach industry had a \$48.5 million dollars of farm gate value in 2015. In 2014, fresh peach prices averaged \$1,190 per ton, up nearly 24 percent from 2012, and 2013. Processed peach prices averaged \$363 per ton, up 12 percent from 2012, and up 6 percent from 2013 (NASS, 2015). Even 1 or 2 percentage point improvements in farm gate value can produce up to a \$1 million in economic benefit.

### **Major Successful Outcomes of the Project**

Historical data for the peach harvest dates was combined into electronic database and analyzed, comprising 54 peach varieties that were grown at 66 orchards. The majority of varieties/orchards combination has 6 to 16 years of the, therefore 16 years of meteorological data was also added to the database.

Model developed by this project is a significant improvement from the practice of making first harvest day predictions based on historical data since the average error for all selected peach varieties is below 4 days, which has excided a goal 5 days set in original proposal, which is much lower than the natural variations of close to 10 days on average. Inaccurate harvest dates predictions result in loss of contracts, delayed deliveries, workforce idle time and hence loss of profit. Georgia Peach industry had a \$48.5 million dollars of farm gate value in 2015, therefore even 1 or 2 percentage point improvements can produce up to a \$1 million in economic benefit.

At least five farms located in the central Georgia region and produce about 75% of the crop will use the tool developed under this study to predict first harvest dates for 13 selected most common peach varieties.

**Lessons Learned**

One of the lessons that were learned by the staff is how difficult and challenging it is to collect data at the farm during normal operation and course of action. A lot of wisdom and growing fruits are coming from generations and generations of farmers that came before and a lot of decisions are made base on a feel as oppose to numerical data. The wisdom about what happens with the orchard is sometimes difficult to quantify and thus it is difficult for researchers to use.

Peach growers definitely have a need for a recording tool that will be easy and intuitive to record their observation throughout the year so researchers have more quantifiable data to analyze. Pen and paper may not be the best option in an open-air sometime wet environments.

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**Additional Information:**

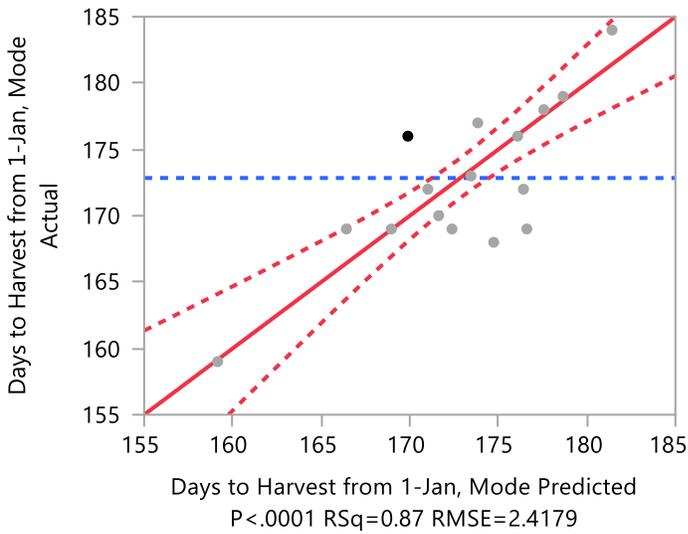
*Example of statistical modeling from JMP12*

**Whole Model**

**Effect Summary**

Source	LogWorth		PValue
GDH 60<=Temp<=none °F	4.592		0.00003
Chilling Hours Temp <= 45 °F	1.581		0.02625

### Actual by Predicted Plot



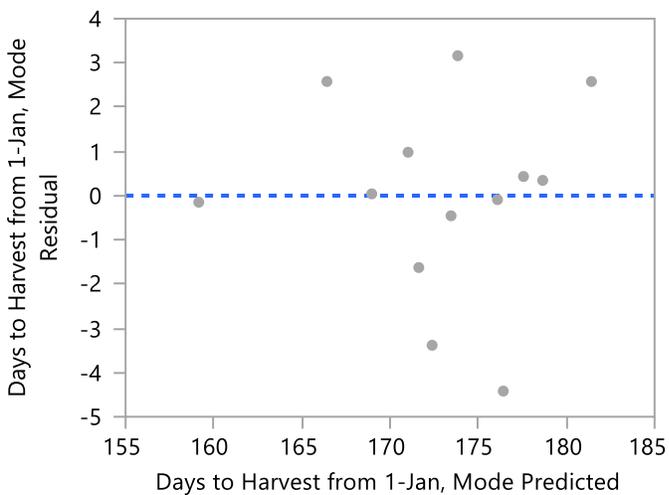
### Summary of Fit

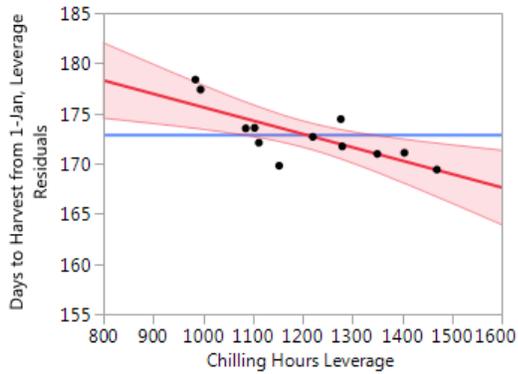
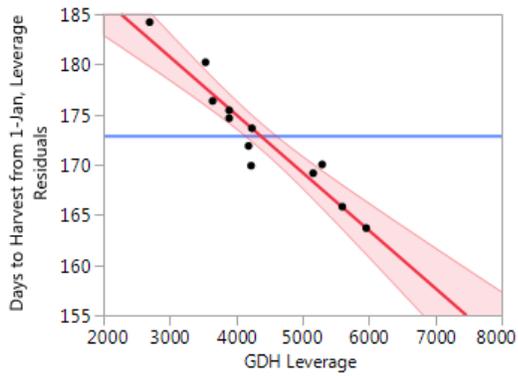
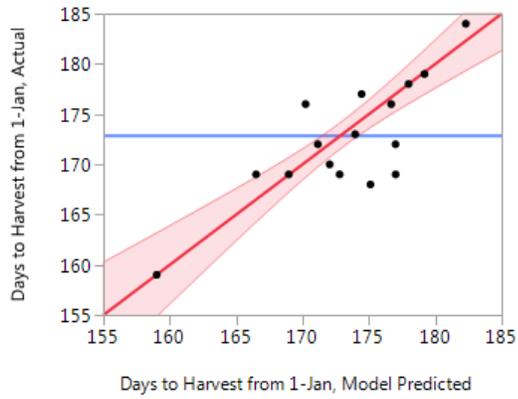
RSquare	0.873374
RSquare Adj	0.848049
Root Mean Square Error	2.417898
Mean of Response	172.8462
Observations (or Sum Wgts)	13

### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	210.75888	8.198796	25.71	<.0001*
GDH 60<=Temp<=none °F	-0.005457	0.000746	-7.31	<.0001*
Chilling Hours Temp <= 45 °F	-0.011985	0.0046	-2.61	0.0263*

### Residual by Predicted Plot





**Prediction Expression**

210.758881754504

+ -0.0054566188972 \* GDH 60<=Temp<=none °F

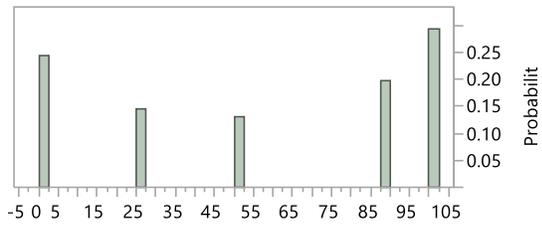
+ -0.0119845171458 \* Chilling Hours Temp <= 45 °F

*Cloud*

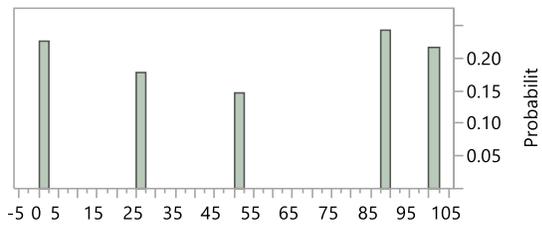
*Cover*

*Histograms*

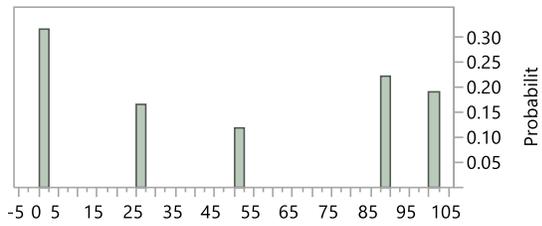
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**Cloud Cover**



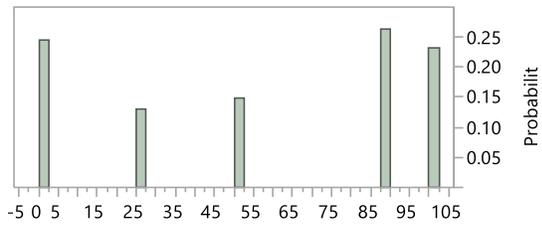
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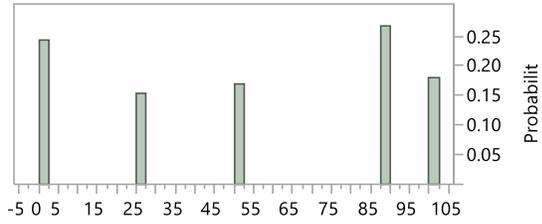
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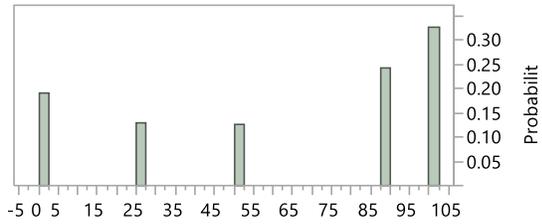
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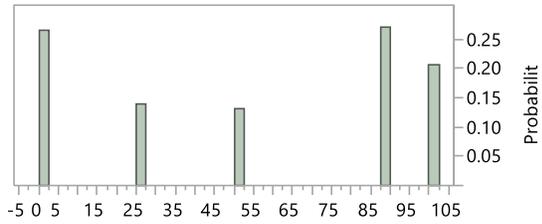
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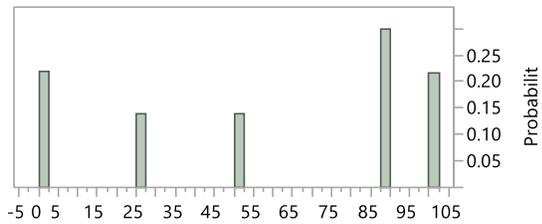
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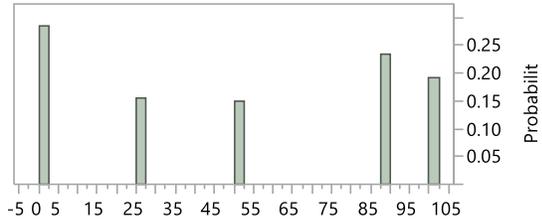
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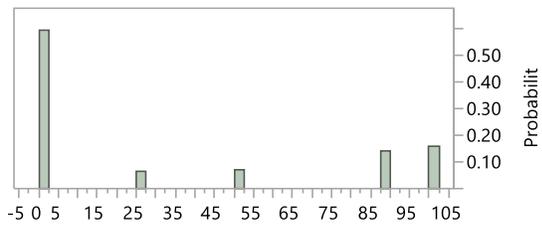
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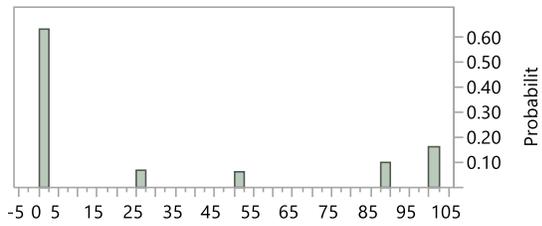
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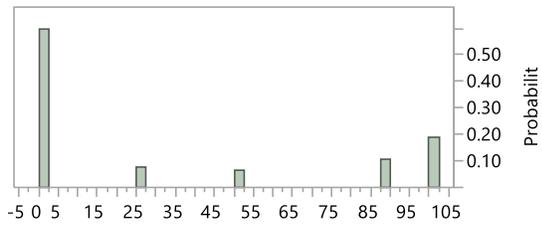
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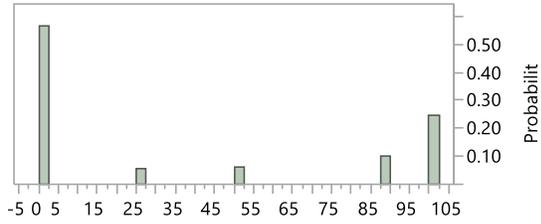
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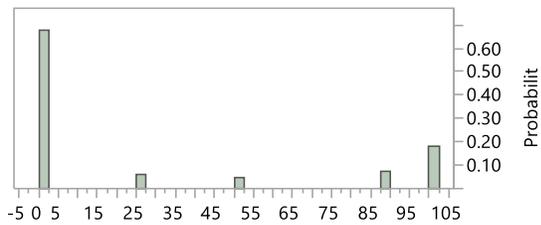
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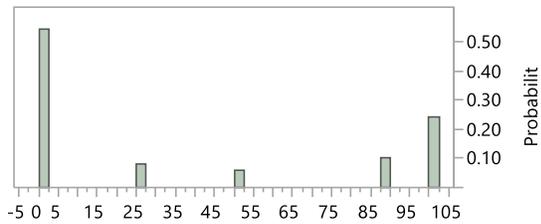
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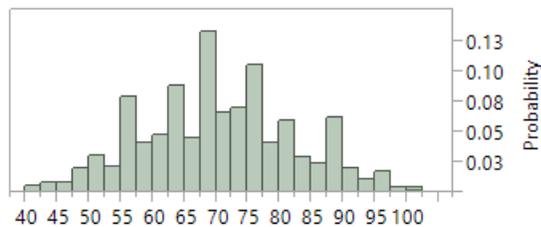
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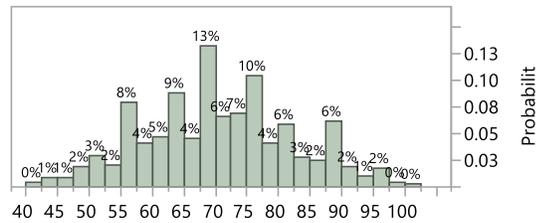
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Cloud Cover**



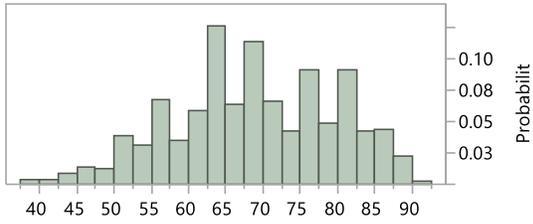
**Year 1998  
Temperature (F)**



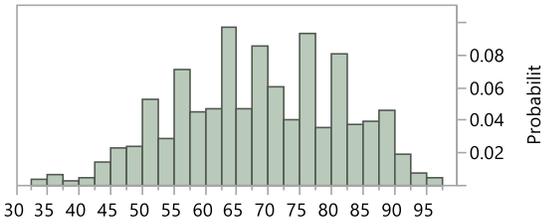
**Temperature Histograms**



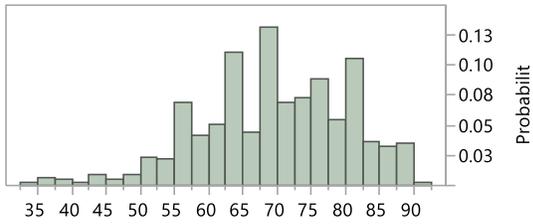
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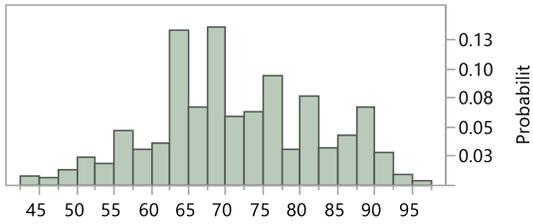
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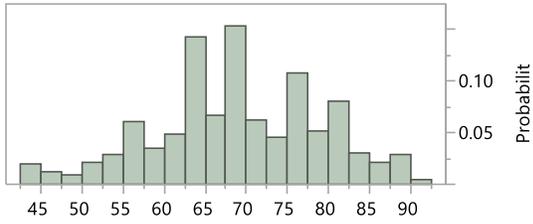
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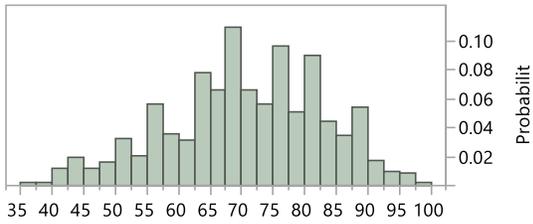
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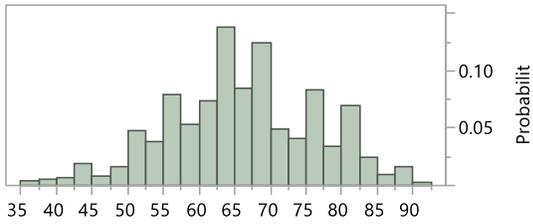
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**Temperature (F)**



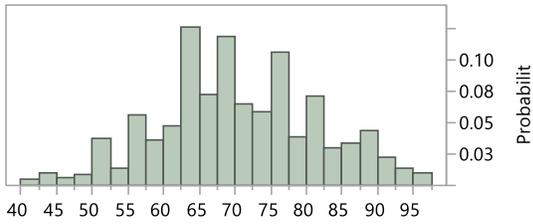
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**Temperature (F)**



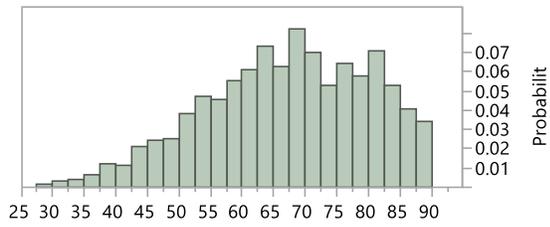
**Year 2005**  
**Temperature (F)**



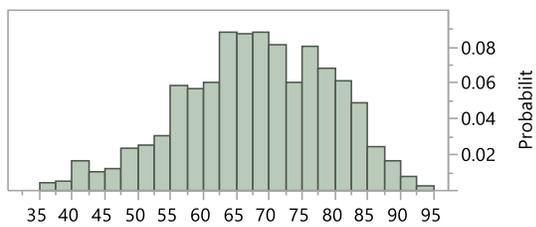
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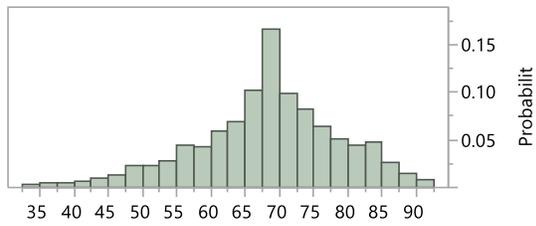
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**Temperature (F)**



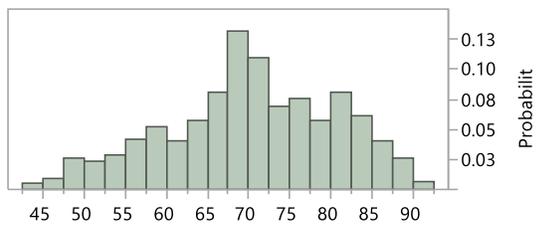
**Year 2008**  
**Temperature (F)**



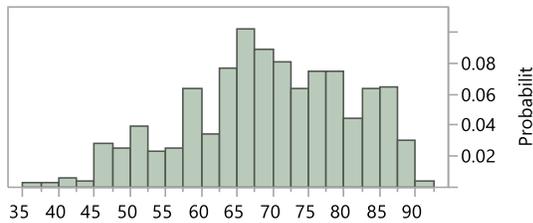
**Year 2009**  
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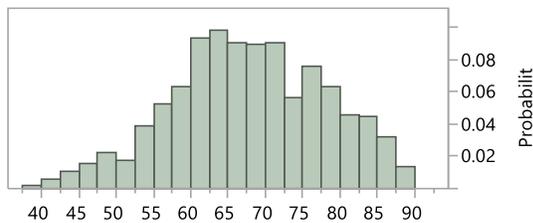
**Year 2010**  
**Temperature (F)**



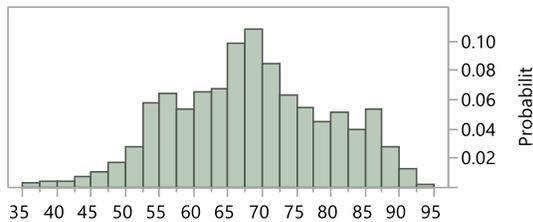
**Year 2011  
Temperature (F)**



**Year 2013  
Temperature (F)**



**Year 2014  
Temperature (F)**



**12. Georgia Tech Research Institute-Implementation and Evaluation of Modern Tools for Pecan Crop Scouting– Final Performance Report**

**Project Summary**

Our goal was to evaluate modern crop scouting techniques as adapted to pecan farming and compare them to traditional approaches. The team built a wearable crop scouting tool that supports hands-free data collection from off-the-shelf software. A drone was planned to be part of the study but changing FAA regulations prevented flying the drone and forced the team to use a focus group approach instead.

Human factors were a major component of this project. The tool development was guided by user-centered design. The project team traveled to the Annual Pecan Growers meeting to meet with Pecan growers to better understand their needs. A set of software was selected that allows the user to take a picture, add an annotation, and to post the result to an online data store.

To support the study, the team created a test course in a pecan orchard with simulated diseases and evaluated the tools with ten pecan orchard crop scouting experts. The drone was evaluated in a focus group setting.

The project resulted in the development of requirements for the implementation of a wearable system for crop scouting pecan trees. Furthermore the project identified ways an autonomous drone could be utilized by pecan growers and the necessary changes in FAA regulations to allow these applications. The findings of this project will inform the design of a wearable crop scouting solution and guide the development of agricultural drone applications.

## **Project Approach**

### **DECEMBER 2014 TO MARCH 2015: PROJECT PURCHASES AND PLANNING**

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**Wearable devices:** The team already had multiple Google Glass units available for the study so no units needed to be purchased. At \$1500 per unit this was a significant cost savings.

**Software:** Since the initial budget was cut by more than 60% the team used the functionality built into Google Glass to simulate a crop scouting application.

**Drone purchase:** A 3DR X8+ quadcopter drone was purchased for the project. This flying platform can lift up to a kilogram and is highly modifiable. It includes a variety of user interface modalities from direct control to a fly-and-forget autopilot mode. It also includes a number of safety features such as automatic return to launch point if the battery voltage drops too low. This drone was selected for ease of use by a population that does not have previous experience with RC aircraft.

### **MARCH 2015: THE 2015 ANNUAL PECAN GROWERS RESEARCH TRIP AND OUTREACH**

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The team visited the Pecan Growers Annual Meeting in Perry, Georgia in March, 2015 where Rasa and Presti presented to the attendees on wearable computing interfaces. The team set up a table to interview attendees on their usage of technology and demonstrate Google Glass devices.

The team learned that the pecan farmers and crop scouts are technologically competent and willing to try new approaches as long as the tools help them and do not get in their way.

#### MAY 2015: THE TEST SITE RESEARCH TRIP

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In May Rasa, Presti, Wells, and Thompson visited the pecan farm test site in Cordele, Georgia to plan the user study. It became clear at this time that attempting to observe the existing diseases would be problematic. There was simply not enough visible disease to provide useful test data. It was during this trip that the idea to simulate the disease effects was conceived. With this approach the test course has a known baseline. The only variable is the technology used by the participants. The challenge is to simulate the disease effects in a manner that reproduced the results of the real diseases.

Also logistics such as power and a location for the initial training (a cabin on the adjacent lake) and necessary supports (table, cooler, shuttle vehicle) were determined at this time (figure 1).

#### JUNE-JULY 2015: PLANNING THE USER STUDY

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The IRB protocol was designed and submitted to the Georgia Tech Human Subjects Institute Review Board. It was at this time that the need for participant payments was recognized. In a study such as this it is necessary to pay the participants for their time to insure that their involvement is completely voluntary. The board recommended that \$20 be paid to each participant. This expense was unfortunately not included in the budget and had to come from another source. Team member Wells located and scheduled 10 professional crop scouts and pecan farmers for the week of the study.

#### *July 2015: User study*

In July the team spent a week on the pecan farm in Cordele, Georgia conducting the study. A minivan was rented to shuttle the participants from the cabin to the test site and back. Also the van acted as a mobile base station containing supplies and a cooler full of cold drinks. This was a necessary precaution considering the study took place in the middle of July in Georgia.

#### *Day 1: Setup*

The first day was dedicated to setting up the test course. On the test course diseases were simulated with the application of acrylic paint and caulk (figure 2, 3). Five diseases were selected due to their prevalence in the area. Pecan scab was simulated with dots of yellow acrylic paint. Case bear was applied by painting the nuts with brown paint. Black aphid was

simulated with black dots on the leaves. Zinc deficiency was created by painting the entire leaf with a light coat of yellow. And spittlebug was created by applying acrylic caulk to a branch.



*Figure 2: Simulated diseases.*

*Top Row: Pecan scab, case bear, and black aphid.*

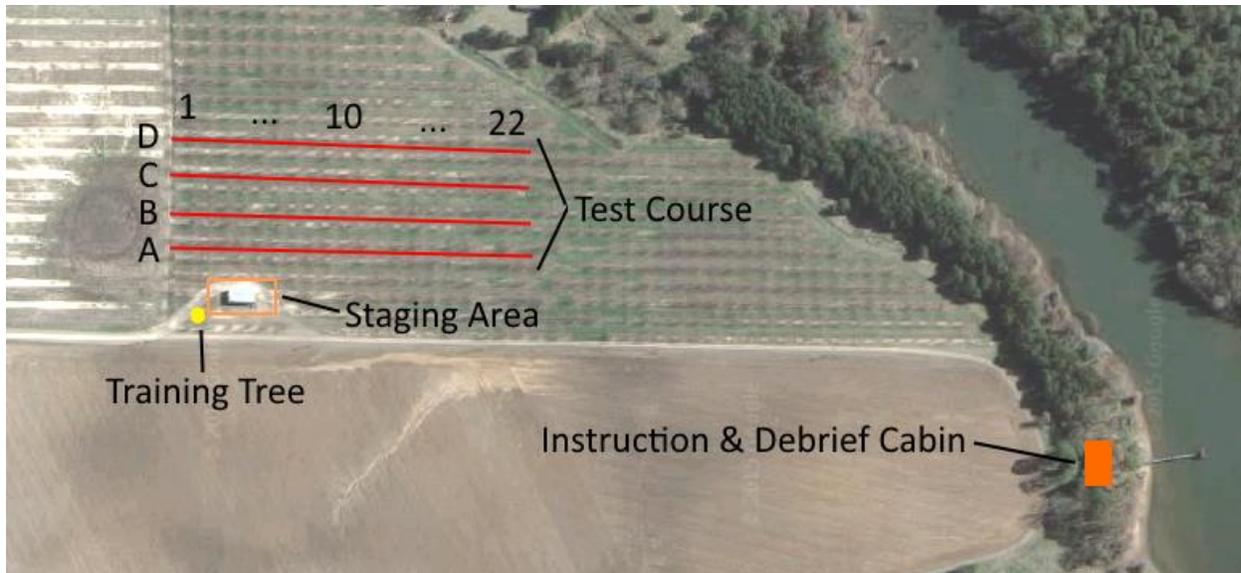
*Bottom row: zinc deficiency and spittlebug.*

A random distribution of diseases was generated by a computer. Each tree was assigned zero, one, two, or three diseases. This guided the team who carefully applied the correct synthetic disease(s) to each tree.



Figure 3: Materials used to simulate diseases.

In order to individually identify the trees, each user test row was identified with a letter (A, B, C, or D) and each tree in the row was identified by number (1 to 22) (figure 4). The tree row and number was marked on a wooden stake at the base of each tree. It should be noted that while the trees were numbered 1 to 22 there were actually anywhere from 19 to 22 in the row due to missing trees.



*Figure 4: Test site layout.*

#### *Days 2-4: Study*

The user study began on the second day. The participants initially met at the cabin. The team explained the project, what would be needed from the participants, and IRB paperwork was signed. Next the participants were instructed in the use of Google Glass (figure 5).



*Figure 5: A team member instructing the study participants in the use of Google Glass.*

The participants then traveled to the test site and gathered around the training tree. All five diseases were applied to this tree for the purpose of allowing the participants to practice with the tools. The participants were instructed in how to recognize each disease and report their findings.

Next each participant was assigned a row. The participant was randomly asked to use either the traditional paper method of crop scouting along with a camera or to crop scout with the Google Glass wearable computer.

Once complete the participant performed a NASA TLX survey (a survey instrument measuring perceived work load) and was asked to relax in the shade and drink water or a sports drink if they desired.

For the second pass, each participant used the other method of crop scouting. If the participant used paper and camera on the first run, they used Google Glass on the second. If they used Google Glass on the first run, they used paper and camera on the second. Once finished they performed a second NASA TLX.

The participants then returned to the cabin for a debrief session. Finally the drone was brought out. The team described the capabilities of the drone and possible usage scenarios. Participants were encouraged to provide potential applications of the technology and to brainstorm how they would use it on their own farms.

Finally participants were provided \$20 gift cards for their participation and thanked for assisting on the project. (This was a requirement of the Institute Review Board for engaging user study participants and was not paid for with grant funds.)

## **Goals and Outcomes Achieved**

### *Goals Review*

*1) Integrate a wearable system which to evaluate the needs of pecan farmers performing crop scouting with the assistance of technical aides. Synchronize data from the wearable application with existing cloud-based media sharing tools to allow the grower and crop scout to visually re-view and track the health of the pecan orchard.*

The team created a wearable system for crop scouting comprised of off-the-shelf software. The crop scout used the picture and voice-recognition note taking functionality of Glass to make notes. The images and notes were uploaded to a Google+ image stream via a linked cellphone's data connection. The Google+ image stream allowed the remote expert to review the images.

*2) Evaluate the use of agricultural drones for use in crop scouting pecan trees. Generate the requirements for an appropriate drone for this purpose and determine user acceptance of the devices.*

This goal was challenged by changing FAA rules for commercial research with drones. The team performed a focus group type evaluation of agricultural drones to determine user requirements and evaluate the user acceptance of the devices.

### *Targets Met*

1) Number of images and notes made: Compared to the baseline, the app user will capture 50% more notes and >90% more images.

The participants recorded an average of 16 notes with the paper-based note system and 13 notes with the Glass-based note system. The Glass app user collected 19% fewer notes than the paper user. However the participants took an average of 17 pictures with the Glass device and 7 with the hand-held camera. The Glass users captured 142% more images than the traditional note-taking system. It is possible that the Glass user substituted a recorded image instead of taking a note given the difficulties with the speech recognition system.

2) Number of problems discovered with each method: Compared to the baseline, the app and drone user should discover more problems than traditional methods.

The paper users found 66% of the diseases while the Glass users found 55%. Broken down into first and second passes, the participants found the same average percentage of diseases on the course with the wearable device used for the first pass. For the first-pass, both paper and Glass users found 69% of the diseases.

3) User acceptance: the users will indicate the features that will drive acceptance of the system by the target population.

This data was collected and listed in detail in the Lessons Learned section at the end of this report.

### *Conference Report*

Of the nine conference attendees that completed our survey about their technology use and first impressions of Google Glass, six were male. These respondents were primarily white, native English speakers between the ages of 26 and 70 (average ages being in the range of 40-51 years). Only one respondent was retired, while all others were active full-time workers in the pecan agricultural field. Nearly all respondents held at least a Bachelor's degree in Science, Agriculture, or Marketing. Current occupation titles included farm manager, farmer, crop insurance sales and service. Half of the respondents have worked in their position for 2-6 years, while the other half had worked in their position between 25 and 57 years. All respondents had positive views of computers and technology, with all but one selecting the answer "computers and other technologies are exciting and I'm interested in learning to use them". Respondents

were moderately tech savvy, with the majority having laptops and smartphones. Overall, they enjoyed their experience with the Google Glass demo at the conference and cited enjoyment of the voice commands, simple interface, and hands-free nature. The most common criticism of using Glass was it not sitting well with their prescription glasses.

### *User Study Report*

Ten participants began the study and nine completed all the tasks. One participant realized after the first pass that he had to be at another meeting across town. He was provided the participant payment per IRB protocol and left the study without completing the second task. This participant's data is not included in the results.

The simulated disease approach meant that a remote expert would not have actual diseases to identify in the images. To emulate this part of the process the images captured were uploaded to a web stream in real time and later checked if the simulated disease effects could be identified. There were no problems identifying the simulated disease in these images.

### *Demographics*

Of the 10 participants that initially entered the study, all were male and were between the ages of 26 and 70. The average age range being between 41 and 50 years. Most participants had some college experience, with five holding Bachelor's degrees in Agriculture or Business. All participants were white, native English speakers working full-time in the pecan agriculture industry. The average time spent in their current position was 13 years (range from 1 to 30 years). All participants expressed interest in how computers and technology could integrate into their personal and professional lives. All participants were generally tech savvy with almost all having smartphones and most possessing tablets, like iPads, and laptops.

### *Quantitative findings summary*

At first glance the paper users appeared to be more accurate. The paper users found 66% of the diseases while the Glass users found 55%. However there seemed to be an effect as the users tired of walking the course in the July heat. Broken down into first and second passes, the participants found the same average percentage of diseases on the course with the device used for the first pass. Both the first-pass paper and Glass users found 69% of the diseases. However on the second pass the paper user dropped to 60% discovery while the Glass users dropped to 43%.

The number of pictures taken was an average of 17 with the Glass device and 7 with the hand-held camera for the paper users. Broken down by first versus second pass to account for the participant tiring, the first-pass Glass users took an average of 23 pictures, while the first pass paper and camera users took an average of 11 pictures. On the second pass, the Glass users took 12 pictures and the paper and camera users took an average of 1 picture.

Both paper and Glass users had similar levels of accuracy on the first pass. *Glass users consistently took more pictures regardless of whether it was the first or second pass.* One user even admitted that he forgot that the camera was in his pocket as he walked the field with his paper tablet.

There is clearly an effect due to the participants tiring in the summer heat. Also frustration with an unfamiliar device may have further impacted the Glass users on the second pass.

#### *Qualitative findings summary*

Overall, attitudes were mixed with our sample of 10 participants on the use of Google Glass to support scouting of issues within a pecan orchard. The primary challenge to participants was the Glass software not being specific to the actions they needed to perform in their scouting work. Our recommendation would be to design custom software that would streamline reporting, annotating, and sharing pictures. In fact, participants were most excited about the usefulness of Glass to create and maintain records of orchard diseases, in addition to the ability to share those records with outside parties, like extension professionals. Because scouting procedures are relatively straightforward and involve few main components (primarily taking a picture, annotating it, saving, and sending), creating custom software to specifically process this actions would not be difficult.

Participants cited that they liked how Glass kept their hands-free, which would be an advantage over the traditional pen-and-paper method. One participant said that, if they used Glass to scout in their professional work, they would want to take more pictures around the farm – including scouting, but also of irrigation fixes or other issues that need attention. Participants understood and liked the usefulness of Glass to take pictures and notes to be later sent to an extension specialist for further action.

Many participants had difficulty with the voice recognition software of Glass not recognizing their speech. For example, “aphid” spoken would be turned into “apron” by Glass. This could be because Glass software is expecting to hear “apron” more often than “aphid”. Again, custom

software with a specific agricultural vocabulary list would be a helpful addition to solve the voice recognition issue.

As measured by the NASA-TLX, using Glass felt more effortful than using the traditional method in scouting. Participants felt more frustrated and felt less successful scouting when using Glass over pen-and-paper. This information coupled with their qualitative end-study survey comments, suggest *much of the frustration comes from the faults in the voice recognition and issues with navigating software not optimized for the task*. Our expectation is custom software designed specifically for agricultural scouting and further training would reduce this perceived effort in using Glass.

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#### WHAT DID YOU THINK TRYING GOOGLE GLASS HERE TODAY?

- Takes getting used to
- Don't think it's practical for my use
- Glass slowed me down, I don't take notes when scouting – just pictures
- Want to see top of tree
- Good idea but product needs a lot of work
- Frustrating but great possibilities
- Easier to use than previously thought, also thought I looked like a dork
- Liked trying it, thought it could be useful on the farm
- Good idea, needs voice recognition improvement
- Good tool because it's hands-free, glasses weren't comfortable

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#### WHAT WAS EASY ABOUT USING GOOGLE GLASS?

- Nothing easy (blames self)
- Wasn't easy, needs tweaking
- Hands-free
- Comfortable to wear
- Hands-free, voice recognition
- Comfort, software was easy to navigate

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#### WHAT WAS HARD ABOUT USING GOOGLE GLASS?

- Voice recognition
- Didn't fit over prescription glasses

- Problems with software
  - Navigating menus
  - Editing captions

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#### CAN YOU IMAGINE HOW GLASS MIGHT HELP YOU EITHER IN YOUR PERSONAL OR PROFESSIONAL LIFE?

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- Prefers traditional methods
- No, but if it were easier to use
- Could be useful if coupled with using the drone to scout
- Not impressed, couldn't see the benefit to farmers
- Would use it to take more pictures around the farm (scouting, irrigation fixes, other issues that need attention)
- Take orchard pictures when there's a problem and send it to the extension specialist to know what to do about it
- Useful to get info to customers he scouts for

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#### HIGHEST NASA-TLX SCORE CATEGORIES – PAPER

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- Mental (mean = 22)
- Temporal (28)
- Effort (38)

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#### HIGHEST NASA-TLX SCORE CATEGORIES – GLASS

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- Mental (31)
- Temporal (44)
- Performance (42)
- Effort (56)
- Frustration (50)

Glass felt more effortful than traditional paper notetaking.

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#### OTHER OPTIONS

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- Suggests truck-mounted camera. High quality camera. They want something to stay out of the heat.



*Figure 6: 3DR drone purchased for the project.*

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#### DRONE FOCUS GROUP RESULTS

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The focus group on autonomous drones was held at the end of the session. Below are participant comments on the use of drones in a pecan orchard.

##### Thoughts on drones

- Participants currently use binoculars to study the leaves near the top.
- “Use thermal images to identify nitrogen levels.”
- “You have to collect a certain leaf in the middle of the branch.”
- One participant already uses a drone. He admitted that he skirted the FAA rules by not charging for the service, hence it was a hobbyist use.
- Suggested method of grabbing leaves at top of tree to gather samples.
- Like autonomous mode (select locations on map, let drone fly on its own).
- Want it to be as automatic as possible.

## Negative

- “It's not practical for me, really.”
- “Normally, if you find some black aphids, you're gonna find some more.”

## How many trees per orchard do you think you'd check?

- “Depends on if I find anything.”

## *Problems and Challenges*

### RESEARCHING DISEASES IN THE FIELD

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Agricultural diseases are difficult to research in the wild. In a controlled setting the diseases can be introduced to the plants and studied but it is not possible to do that in the wild without risking containment. Furthermore, finding a farmer who will allow the introduction of diseases to his drop is a challenge.

Therefore the team decided to simulate the effects of the diseases on plants to produce a controlled test. A pecan orchard expert was consulted on the type of diseases that would be representative of the area. Each disease effect was created to be as realistic as possible. As a test the crop scouts were asked what each simulated disease represented before being told what the team expected. Most experts immediately guessed four correctly with the zinc deficiency being the most misidentified.

### FAA DRONE REGULATIONS

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2014 and 2015 were a confusing time for drone operators. It was initially perceived that the FAA would cover business use of unmanned aircraft under the hobbyist exception. This states that as long as the drone user kept the aircraft below 400 feet and away from restricted airspace such as airports, drone flights are allowed.

Then in the summer of 2014 in an effort to clarify rules for unmanned drones, the FAA fined two businesses \$10,000 each for flying drones without the proper pilot's licenses. These fines were the FAA clearly stating that business uses of drone aircraft needed to follow the same requirements as commercial aircraft. This requires that the pilot have a current FAA medical certification and follow all other rules as would be necessary of a small aircraft pilot. The FAA makes no distinction between a 60 pound medium sized drone and a 1 pound RC drone. Both require the same licensing procedures.

The FAA did outline a process where the drone user could apply for an exemption on a case by case basis. This exemption is specific to a particular business and geographical location. At the time of the project initiation only one exemption had been granted. It was to an oil pipeline company in the wilds of Alaska.

In the spring of 2015 the FAA began to loosen up the rules. The waivers could be issued without a specific geographic location. This allowed Hollywood movie production companies to obtain a waiver for filming movies on location with drones. The process still requires a great deal of paperwork to obtain the clearances.

Also in spring of 2015 the FAA released a set of proposed rules that address this problem. These long-overdue regulations would allow commercial use of drones with a service ceiling of 300 feet. They also allow autonomous drones as long as the operator has been through a training.

Navigating this red tape has been a challenge to this project. If the proposed rules become official regulations, they will allow researchers to operate drones without excessive regulations and farmers to use the tools to increase their productivity.

### **Beneficiaries**

The project reached out to the pecan growers and crop scouts at both the 2015 Annual Pecan Meeting in Perry, Georgia and through interactions during the user study. Consumers were not reached during the project.

The user requirements developed in this project are applicable to crops other than pecan that require field scouting. The requirements are similar among multiple crops and more closely tied to the user demographics and affinity with technology.

### **Lessons Learned**

#### **A CUSTOM CROP SCOUTING SOLUTION**

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The software used in this study was assembled from off-the-shelf applications. This suboptimal implementation may have colored the opinions of the test participants in this study. However the tool did yield insight into how a purpose specific wearable crop scouting tool would work.

- 1) The tool should require as little human interaction as possible. One of the complaints of the tested solution is that it required too many button presses and swipes. Seven taps plus a narrated comment were necessary for each annotated picture. The optimal tool

would require one tap to take a picture and maybe one more to save a comment. The rest should be automated.

- 2) The speech-to-text dictation is conspicuously inaccurate. Any specialized system that utilizes speech to text should use a task specific dictionary to avoid transcription errors. An auxiliary microphone located near the user's mouth may improve recognition rates, especially in windy conditions.
- 3) Integrate prescription lenses. The bands used in the Glass interfered with the user's glasses. The solution is that each user have a personal Glass unit complete with prescription lenses.
- 4) The results of a crop scouting mission should be easy to deliver as a report for the professional crop scout. Do not require any extra steps to create the report. Powerpoint or PDF output is preferred.
- 5) Internet connectivity must be maintained for speech-to-text dictation on the current version of Glass. Loss of a network connection in rural areas should not prevent the tool from operating.
- 6) Implement a leaf clipping attachment for the drone. This will allow collection of leaves near the top of the tree.
- 7) Implement a thermal camera on the drone. Use it to monitor nitrogen levels at the top of the canopy.

#### **Contact Person Information**

Peter Presti, Senior Research Scientist, Interactive Media Technology Center, Georgia Institute of Technology

#### **Additional Information**

None

### **13. Georgia Watermelon Association-*The Importance of Following Good Food Safety Practices in Handling and Preparing Watermelons*– Final Performance Report**

*Project 1: Provide Consumers with Information which communicates best practices in the purchasing, storage and preparation of watermelons*

As the new Food Safety Modernization Act (FSMA) regulations are implemented in 2015, there will be a lot of public media focused on the importance of food safety on the farm. To ensure market sales do not decrease due to perceived unfounded concerns, this project will provide consumers, at their point of purchase, with information on safe practices in the handling and preparation of watermelons. Under this grant the Georgia Watermelon Association (GWA) will conduct in-store demonstrations for consumers on safe handling practices. Consumers will be provided information on the good agricultural practices specialty crop producers are using to grow, harvest, pack and ship watermelons.

*Project 2: Provide the latest ‘best practices’ information to Georgia Watermelon Growers on Production procedures related to pest management, irrigation, food safety or others.*

Often, when new regulations regarding food safety or labor are issued there can be confusion and uncertainty among those who must follow those regulations. In addition to addressing the complexities of the new regulations, growers continue to have production and pest management challenges. This project provided growers with a ½ day workshop on the latest and most current ‘best practices’ for watermelon production.

#### **Project Approach**

*Project 1: The GOAL of the project was to perform 22 in store demonstrations and 10 media appearances across the state of Georgia to educate consumers about safe handling of watermelon. Additionally, a second goal was to gain more than 350 clicks on a QR code recipe card. The card contained a recipe and a QR code link to a quick video on how to handle watermelons safely from store to kitchen. (Attachment 3: Available from GDA upon request).*

*Project 2: The GOAL of this project was to host a ½ day educational seminar at the GWA Convention on Saturday, January 31, 2015 that increases grower’s knowledge of pest*

management, production or food safety. The measurable objective of the seminar was at least 75% of workshop attendees would see some increase in their knowledge following the workshop. The program included the following sessions. (Attachment 1: *Available from GDA upon request*):

- Ga Watermelon Variety Trials - Dr. Tim Coolong, UGA, Tifton, GA
- Understand and Manage Fruit Set and Hollow Heart in Seedless Watermelons – Dr. Gordon Johnson, University of Delaware
- Getting Paid for your Produce – Craig Stokes, Stokes Law Office, LLP – San Antonio, TX

### **Goals and Outcomes Achieved For Each Project**

#### *Project 1:*

- In 2015: The GWA spokesperson had completed 5 media appearances and 4 in-store demonstrations in Georgia.
- In 2016: the GWA spokesperson has completed 4 more media appearances and 10 more in-store demonstrations in Georgia.
- In 2017: the GWA spokesperson completed 3 more media appearances, and 8 in-store demonstrations to meet and exceed the original goal to of 10 media appearances and 22 in store demonstrations.

The first goal to achieve 22 in store demonstrations and 10 media appearances with the GWA Public Relations ambassador was achieved and exceeded.

To date, through showing the QR code at stores, to captive audiences at events and through links via the recipe card, we know the [safe handling video](#) has still had roughly 350 views. We did not achieve our goal to increase views to more than 350.

Throughout the project, we realized that the design of the card and marketability of QR codes, though a good idea in theory, were not as effective as we had originally anticipated.

#### *Project 2:*

A ½ day education seminar was held at the GWA Convention on Saturday, January 31, 2015. The program included (Attachment 1):

Ga Watermelon Variety Trials - Dr. Tim Coolong, UGA, Tifton, GA

Understand and Manage Fruit Set and Hollow Heart in Seedless Watermelons – Dr. Gordon Johnson, University of Delaware

Getting Paid for your Produce – Craig Stokes, Stokes Law Office, LLP – San Antonio, TX

Approximately 55 growers attended the seminar. Pre- and Post- surveys were conducted and results reported on Attachment 2 (*Available from GDA upon request*). The goal for this project was to increase Georgia watermelon grower’s knowledge and understanding of best practices for at least 75 percent of the seminar attendees.

When asked following each of the presentations, ‘*Did this workshop increase your knowledge of this subject?*’ The following results were achieved:

<b>Subject</b>	<b>% of Attendees Saying Their Knowledge Increased (TARGET WAS 75%)</b>
GA Watermelon Varieties	100%
Fruit Set & Hollow Heart Disease	95%
PACA Laws and Getting Paid	75%

The goal for this project was achieved.

### **Beneficiaries**

The beneficiaries of these projects are the consumer who will gain knowledge concerning the proper and safe handling techniques for watermelons. Other beneficiaries are the 300 plus specialty crop farmers in Georgia who are growing watermelons. In 2016, these growers planted more than 19,000 acres of watermelons in Georgia with a farm gate value of nearly \$125 million.

### **Lessons Learned**

We learned during this three year grant process that marketing trends and consumer attraction techniques are constantly changing. In 2015, the QR codes seemed to be trending, while in

2016 and 2017, the post cards were never as popular as we hoped they would be. In-person demonstrations and social media interaction, instead helped produce views of the safe handling video and educated consumers on safe handling.

**Contact Person:**

Samantha Kilgore  
GWA Executive Director

**Additional Information**

none

**14a. Georgia Fruit & Vegetable Growers Association-*Increasing Fruit and Vegetable Market Share for Georgia Growers (FRESH SUMMIT)* – Final Performance Report**

**Project Summary:** Over 90% of Georgia’s fruit and vegetable production, more than a billion dollars in farm gate value, is marketed and distributed for the fresh market (versus processing or value added contracts). This project focuses on using the largest trade show in North America to help expand the marketing of Georgia produce and increase the competitiveness of Georgia products.

**Project Approach:** This project was designed to take advantage of the thousands of retail and food service buyers attending FRESH SUMMIT. By increasing the awareness of Georgia Grown quality produce through direct communication with the retail chain buyers we can achieve our goal of getting more produce on the grocery shelves, and with foodservice distribution companies to broaden purchases by institutional establishments and restaurants.

On October 17-19, 2014 the 2014 FRESH SUMMIT was held in Anaheim, CA bringing together over 20,000 attendees from 50 countries. The Georgia Grown pavilion had 1,400 sq. ft. of floor space and 9 exhibiting firms (see ATTACHMENT 1 for photos and ATTACHMENT 2 for booth layout: *Available from GDA upon request*).

The 2014 Georgia Grown pavilion faced several unexpected challenges which are addressed in the Lessons Learned. However, for those firms attending, the 2014 FRESH SUMMIT still brought together produce industry leaders to see new products, strengthen relationships with current suppliers, and gather information for future purchasing decisions. The Georgia Grown pavilion was coordinated by the Georgia Department of Agriculture and the Georgia Fruit and Vegetable Growers Association (GFVGA).

Types of companies and commodities represented in the pavilion included,  
Farms, Growers, Shippers, Processors, etc.  
Vidalia Onions,

Mixed vegetables (peppers, squash, cucumbers, etc.),  
Watermelon,  
Greens,  
Cabbage,  
Sweet potatoes,  
Pecans, etc.

This project did not benefit any non-specialty crop commodity.

**Goals and Outcomes Achieved:** The PERFORMANCE MEASUREMENTS for this project were three new leads per company and \$2 million in new/increased sales. Based on the information reported, the companies that exhibited in the 2014 Georgia Grown pavilion in Anaheim, CA averaged 3.2 new leads/contacts per company and the total pavilion increased 2015 sales by \$ 840,000 dollars. Anytime the PMA FRESH SUMMIT is held on the West Coast many Georgia growers do not attend the show since most of their shipments are east of the Mississippi River. Additionally, poor production prices for the 2014 farm gate year also had an effect and decreased participation in the Georgia Grown pavilion in Anaheim.

#### **Comparison of Actual Accomplishments and Goals Established**

##### GOAL:

The Goal was to have three new contacts/leads per company in the pavilion and generate over \$2.0 million in new sales the following production year(2015)

##### Actual Accomplishments:

During the 2014 PMA in Anaheim the actual accomplishments were 3.2 contacts per company in the pavilion and \$800,000 in new sales the following production year. As noted below in Lessons Learned - With a smaller number of organizations in the GA PAVILLION the total sales generated in 2014 from pavilion exhibitors were obviously reduced. In addition the 2015 had some significant reductions in pricing for product during the harvest season.

##### Successful Outcome of Project:

1. Each Pavillion exhibitors established at least 3 new contacts during the show – this resulted in increased revenue for the exhibitors in 2015.
2. With \$800,000 in new sales in 2015, each exhibitor averaged approximately \$100,000 in additional farm gate revenue in 2015.

**Beneficiaries:** The beneficiaries of this project were the Georgia specialty crop producers that exhibited at the 2014 PMA in Anaheim and on average secured 3.2 new leads during the two day show. But those growers that did not display also received marketing benefits as the GA GROWN logo was broadly promoted to the 20,000+ attendees.

##### Beneficiaries Affected by the Project:

1. There were 9 companies that benefited from the project averaging 3.2 new contacts.
2. The project added over \$800,000 in produce sales to the GA economy and specialty crop growers.

**Lessons Learned:** Due to the challenges noted above, the number of companies/organizations in the Georgia pavilion was reduced by over 50% (from 19 in New Orleans to 9 in Anaheim). With a smaller number of organizations the total sales generated in 2014 from pavilion exhibitors were obviously reduced. This will be the first year in many that the Georgia Grown pavilion exhibitors do not experience over \$2 million in new or 'renewed' sales from the FRESH SUMMIT.

PMA, *Fresh Summit*, continues to be the 'premier' United States trade show to put grower/distributors together with retail and food service buyers. There is no other venue where Georgia specialty crop growers can reach this many potential new customers. We will continue to encourage Georgia growers to participate in PMA.

The unspent funds remaining in the project budget was used to provide other marketing tools via a project entitled, *"Increasing Consumer Knowledge of Specialty Crops to Broaden Marketing Opportunities for Georgia Produce."* A FINAL PERFORMANCE REPORT has also been filed for this project.

#### Contact information

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706-845-8200

**Additional Information:** There are two attachments included with this report that serve as reference material for the information presented, see ATTACHMENTS #1 and #2 (*available upon request from GDA*).

#### **14b. Georgia Fruit & Vegetable Growers Association-Increasing Consumer Knowledge of Specialty Crops to Broaden Marketing Opportunities for Georgia Produce – Final Performance Report (*additional project using excess FRESH SUMMIT funds*)**

**PROJECT SUMMARY:** Two of the primary goals of the Georgia Fruit and Vegetable Growers Association are education and marketing. The organization has been involved in a number of consumer and student educational projects over the past 6-8 years that have also served to market the produce grown by Georgia specialty crop farmers. The development and production of short vignettes featuring specific

specialty crops help showcase the full crop production process and informs the viewer – ‘where their food comes from’. Currently these have also been invaluable educational tools for our ‘Farm to School’ programs as they draw visual appeal and attention from students to Georgia’s produce industry.

In 2014, GFVGA began to create a library of short fruit and vegetable vignettes for teaching resources and consumer education about Georgia produce. These current vignettes include, sweet corn, peaches, strawberries, blueberries, cantaloupe, watermelon, mixed vegetables (cucumbers, squash, pepper and eggplant) and Vidalia onions. This project added two more vignettes: tomatoes and cucumbers. Scroll to the bottom of the page <http://www.gfvga.org/page/EducationalResource> .

**PROJECT APPROACH:** Upon approval of the project, the GFVGA sent out request for proposals to various video production companies in the state of Georgia. During this period, the GFVGA Farm to School project coordinator drafted scripts for both videos. The scripts contain pertinent information on how cucumbers and tomatoes are grown, harvested and taken to stores.

After review of the submitted proposals from the video companies, a studio was selected. The production team was given the script to help with shot selection, and they traveled to farms to film the planting and harvest process.

While the videos were being produced, the GFVGA team gathered email addresses and contact information for educators across the state of Georgia, and created a survey to accompany the video so the usefulness of its content could be gauged. The videos were finalized, and a series of emails went out to both GFVGA’s grower and extension personnel database and the list of educator contacts.

#### **GOALS AND OUTCOMES ACHIEVED:**

The measurable outcomes for this project were twofold.

- 1) **OUTCOME GOAL:** Of the GFVGA members, agribusinesses and extension personnel that watched the video and took the surveys, 25% of the individuals returning the survey would report that the film increased their knowledge of the crop, or that they received new information from the video.

Project Results from survey:

After watching the videos, 99% of respondents surveyed said the videos increased their knowledge of the crop.

- 2) **OUTCOME GOAL:** Of the educator contacts that watched the video and participated in the survey, more than 50% of respondents would rank the video’s effectiveness as excellent or

good. Additionally, there was a goal for 25 requests for a GFVGA created Farm to School lesson plan.

Project Results from Educators:

After watching the videos, 98% of survey respondents ranked its educational effectiveness as excellent or good.

53 of teachers requested the GFVGA Farm to School Instructional lesson plan.

**BENEFICIARIES:** There are several groups of individuals that benefitted from this project.

- 1) The 53 educators who received free teaching resources about Georgia produce.
- 2) With more than 53 educators having the reach of at least 30 students per class, we can estimate that nearly 1600 students will also benefit from this project. They will glean insight and knowledge about the industry and about their food from these videos and from new lesson plans.
- 3) The fruit and vegetable industry in Georgia benefited from putting information about the seed to store process. It has been proven for some time now that consumers want to know more about their food and its origin. By creating these resources to educate the common consumer about the industry in Georgia, this project makes Georgia grown cucumbers and tomatoes more attractive and more likely to be purchased.

**LESSONS LEARNED:** The principle lesson learned are educators are hungry for practical lesson plans that can be used in the classroom and fits in the state's core curriculum plan.

**Contact Information:**

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**15. Georgia Fruit & Vegetable Growers Association-Education-Education-Education: The Key to Increased Productivity and Profitability for Specialty Crop Producers in Georgia– Final Performance Report**

**PROJECT SUMMARY**

This project provided specialty crop producers in Georgia numerous educational opportunities at a four-day conference, one and three-day workshops, communication, and one-on-one farm safety consulting. Additionally, this project provided educational opportunities for Georgia school children and consumers

to learn about the production of fresh fruits and vegetables plus the nutritional and tasty value of these products via blogs, web site postings, and classroom educational materials.

## **PROJECT APPROACH**

The approach of the project was to implement delivery venues that would insure the goals of the project were accomplished. This included,

- Enhancing the competitiveness of specialty crop producers through educational venues that allowed growers to stay up to date on research and production techniques including:
  - the Southeast Regional Fruit and Vegetable Conference,
  - webinars,
  - on farm food safety consultations, and
  - two food safety documentation workshops.
  
- Developing educational materials and blogs which assisted consumers in finding the latest produce nutritional value, Georgia Grown produce information, background and locations with locally grown produce including:
  - The creation of the “Did You Know” produce information blog
  
- Increase the opportunities to support educational programming for the USDA ‘Farm to School’ and the GA Department of Agriculture ‘Feed My School’ program.

### **USE OF FUNDS TO ENHANCE SPECIALTY CROP COMPETITIVENESS**

The funds for this project’s goals were used to enhance the competitiveness of specialty crops by providing educational workshops and sessions that were only directed at specialty crop producers. The educational sessions at the SE Regional Fruit and Vegetable Conference were targeted for commercial growers as it relates to pest management, production operations and marketing.

Specialty crop producers, the crops and the harvest seasons were highlighted to be sure local and Georgia producers benefited from the educational materials and blogs. Finally specialty crop producers benefits from the educational materials provided to school children to learn more about the healthy crops available to them.

### **Significant Contributions and Role of Project Partners**

University of Georgia, Cornell, University of Florida and other Land Grant Institutions – provided speakers and session moderators that helped educate the growers attending the SE Regional Conference and other workshop sessions. Cornell also provided online training for beginning growers.

Produce Food Safety Services provided food safety consultants that offered on the farm food safety consultation for growers and producers.

Food Writers provided expertise and 'followers' to develop the 'Produce Bites' blog that promoted Georgia fruits and vegetables.

## **GOALS and OUTCOME ACHIEVED**

The primary goal of this grant was to help growers with the most current research, production and food safety information and provide consumers with educational information made available via blogs, farm to fork educational materials, and 'know your farmer, know your food' programs. Classroom teachers and general consumers, now more than ever, are searching for information on the origin of where their food comes from. The following six focus components were utilized to accomplish the goals and outcomes for the project.

### **1. Southeast Regional Fruit and Vegetable Conference:**

The 2015 SE Regional Fruit and Vegetable Conference was held January 8-11, 2015 in Savannah, GA with 3,222 attendees. This was a 7% increase in attendance over the 2014 Conference. The Conference had over 85 hours of educational sessions available to the attendees (see ATTACHMENT 1).

The TARGET for the "first goal" was to continue or increase positive responses over 2014 Conference responses regarding 1) the value to cost and 2) the quality/usefulness of education. Responses indicated a decrease in the value to cost of the 2015 Conference at 89.9% (92.5% in 2014) while the quality/usefulness of education presented was increased to 91.1% (88.6% in 2014).

The 2015 post-conference surveys showed a slight decrease with 83.0%\*\* (84.7% in 2014) of respondents indicating their knowledge of specialty crop production practices and/or management techniques increased. The amount of educational information presented as significant or moderate decreased from 98.1%\* in 2014 to 94.1%\*\* in 2015. GFVGA staff were encouraged by the increase in the usefulness of information as it is an indication that the information presented added value to farms and operations and/or gave further instruction or usefulness to information attendees may have gained at other or previous Conferences.

\* In analyzing the data from the 2015 and 2014 SE Regional Conference post-conference surveys relating to the question "Rate the amount of educational information presented", all responses indicating "No new information" was removed as this question was not asking about the type of information but the amount of information presented. The 90.2% originally reported in the 2014 application as rating amount of educational information presented was not

accurately analyzed. After removing “No new information” responses, the 90.2% increased to 98.1%.

The overall low response rate of the SE Regional Conference post- conference survey was a problem. Additionally, GFVGA staff felt the 2015 post-conference survey results were not a true reflection of the majority of attendees.

\*\* Each year approximately 20% of total SE Regional Conference attendees indicate their commodity affiliation with blueberry. This is the largest single commodity representation at the Conference. At the close of the 2015 SE Regional Conference, GFVGA staff became aware of the deficit in content for what growers had come to expect, a large section was dedicated to organic production which is not reflective in the majority interest of Georgia’s blueberry industry, and at least three speakers did not show up. The degree of discontentment was reflected in the 2015 Conference post-conference survey as approximately 30% of total survey respondents were affiliated with blueberry. As a result, GFVGA representatives felt the degree of satisfaction with the educational programs and value of the Conference was skewed and all blueberry data was filtered from overall ratings reported. It is believed the greater population of attendees were satisfied with the scope, structure, and educational offerings of the 2015 SE Regional Conference but the vast majority are not participating in the post-conference survey.

**Performance Measurement: SE Regional Fruit and Vegetable Conference**

	<u>2014</u>	<u>2015</u>	<u>TARGET / GOAL</u>	
Attendance	3,005	3,222	+ Exceeded goal by +7.2%	
Value to Time	94.4%	91.9%**	- Under goal by 2.5%	
	<u>2014</u>	<u>TARGET</u>	<u>2015</u>	<u>TARGET / GOAL</u>
Amount of information presented as Significant or Moderate	98.1%*	98.1%	94.1%**	- Under goal by 4%
Gained knowledge	84.7%	84.7%	83.0%**	- Under goal by 1.7%

Usefulness of Information      88.6%      N/A      91.1%\*\*      + Exceeded goal by 2.5%

## **2. Food Safety Educational Programs and Consultation**

### **Online Training for Small Beginning Growers:**

GFVGA offered a reimbursement stipend to participants who completed the online training modules developed by the National GAPs Food Safety Program through Cornell University. This course is intended to improve attendees' understanding of GAPs and to guide assessment of risks and implementation of practices to reduce risks on fresh produce farms. GFVGA reimbursed a total of ten (10) participants from Georgia vegetable operations who completed the 3-week, online food safety training with a \$140 reimbursement stipend. Participants had to send GFVGA their certificate of completion issued by the National GAPs/Cornell University in order to be eligible for reimbursement.

### **Food Safety Documentation Workshop:**

The "Step-by-Step Food Safety Manual Development Workshop" was held in Moultrie, GA on August 18, 2015 (See Attachment #2, Food Safety E-blast – Workshops). Due to unforeseen budget savings when planning the 2015 workshop, GFVGA offered a second workshop on August 8, 2017 with a focus on organic production and practices. The attendees at the 2017 workshop represented a different population from the 2015 workshop as those at the 2017 workshop represented much smaller farms, the majority were following organic or natural production practices, and none of them had any food safety audit experience.

Both workshops offered attendees physical tools, resources, and handouts to help with additional explanation and guidance with food safety on a farm, training videos, etc. The 2017 audience received many of the same resources but GFVGA was able to provide a few alternative tools to help grow a farming business with food safety in mind, implementing food safety with an organic focus, etc.

The TARGET, to have at least fifteen (15) growers attend the workshop, was exceeded in 2015 with twenty (20) grower participants and just under the target with 14 attendees in 2017. An additional TARGET was for participants to increase their knowledge and understanding of GAPs by 20% which was met as 100% of the 2015 respondents indicated their knowledge and understanding of GAPs increased while 88% of the 2017 respondents indicated an increase.

Pre-workshop surveys showed 35% of 2015 participants and 100% of 2017 participants had "some aspect" (some checklists or documentation but not a full, written food safety program) or "no" documented food safety program before the workshop. Intrigued that 65% of the 2015

workshop participants indicated they had a full food safety program in place, the GFVGA coordinator asked why they attended such a basic workshop. While responses were informal, most centered around the fact their current food safety programs and documents were developed by someone else who had moved to another position within the company or is no longer with the organization. As another point of interest, of the 2015 participants with food safety programs in place, the majority of them indicated they had undergone at least one 3rd party food safety audit, with many having experienced a Global Food Safety Initiative benchmarked audit such as PrimusGFS or Global GAP. Yet with the experience of an audit, these attendees did not feel confident in making changes to or creating food safety documents. After participating in the one-day workshop 100% of the 2015 participants and 88% of the 2017 participants indicated they felt comfortable or very comfortable creating/developing/writing a food safety manual (SOPs, corrective actions, checklists, documentation, etc.).

At the end of the workshop all participants received an overview of an entire GAP food safety plan for a farm operation, an overview to prepare for an audit, and all attendees had started all aspects of a food safety program which they could take home and complete.

**Performance Measurement: 2015 / 2017 Food Safety Documentation Workshop**

	<b>Goal</b>	<b>Actual</b>	<b>TARGET/GOAL</b>	
Number of workshops attendees	15 attendees	<b>2015:</b> 20 <b>2017:</b> 14	+ Exceeded goal by 5 attendees - Under goal by 1 attendee	
		<b>Pre-Test</b>	<b>Post-Test</b>	<b>TARGET/GOAL</b>
Comfort level of creating/developing/writing a food safety manual/program as Comfortable or Very Comfortable		<b>2015:</b> 80% <b>2017:</b> 67%	100% 88%	+ Met goal at 20% + Exceeded goal at 21%
Rate knowledge GAPs as excellent or average		<b>2015:</b> 80% <b>2017:</b> 89%	100% 100%	+ Met goal at +20% - Under goal at 11%
How prepared do you feel to undergo a 3rd party food safety audit?		<b>2015:</b> 75% <b>2017:</b> 33%	100% 75%	Not a goal but preparedness was increased 25% and 42%

**On-the-Farm Consultation:**

One-on-one education and aid in the implementation of food safety programs on farms and in packing facilities continues to thrive through the branded GFVGA food safety program, Produce

Food Safety Services (PFSS). GFVGA/PFSS has been able to expand the food safety services offered to produce growers, packers and shippers such as education and program implementation for Global Food Safety Initiative (GFSI) benchmarked audit standards, adding personnel as needed, and expanding training and program coordination with other grower organizations.

The GOAL was to increase the number of farms/farming operations utilizing services provided by PFSS. The BENCHMARK and TARGET were exceeded with 85 farming operations requesting food safety training, consultation, and program implementation (73 in 2014-2015) which is approximately a 14% increase. Of those, 20 farms had no food safety program in place before beginning to work with PFSS, exceeding the goal.

**Performance Measurement:**

	<u>2014</u>	<u>Benchmark</u>	<u>2015</u>	<u>TARGET / GOAL</u>
Farm and Packing Operations participating in PFSS	73	77	85	+ Exceeded goal by 14%
Consult with farms with no food safety plan	5	10	20	+ Exceeded goal by 50%

*In addition*, GFVGA food safety specialists were contracted to provide approximately 120 mock audits of blueberry farm operations during the fall of 2014 and spring/summer of 2015.

**3. Consumer Knowledge to Empower Efforts to Know Their Food:**

**Creation of a Produce Information Blog**

It is more important now than ever before to answer consumer questions about their food, in particular, their fruits and vegetables. In an effort to establish GFVGA as a resource for solid, reliable consumer information about fruits and vegetables, GFVGA created a blog called '**Produce Bites**' (see ATTACHMENT #3A, 3B, 3C).

The GFVGA team began working on developing the strategy and outline of the blog in April of 2015, and officially launched with '**Produce Bites**' first post in July.

In the original budget for this project, GFVGA anticipated spending approximately \$200 per blog post, with a total of 40 blogs (one per week). As the development process began, the project director realized the budget did not take into consideration the popularity level of the bloggers that would be providing posts. It was quickly determined the more popular the writer, the higher the fee for their guest feature and recipe development. Additionally, researching and finding the right bloggers to contract proved to be an enormous task, so a public relations firm was contracted to help narrow down the large and complex pool of food writers based on several specific criteria. That criteria included region (Georgia specific), expertise, (mom blogger, recipe developer, southern style cooking, nutritional expert, etc.) and focus (fruits and vegetables, healthy eating, etc.).

The end result of this work was a division of the original budget (which was only allocated for blogger contracts) between locating the right bloggers for this project, spending between \$500-\$600 per blogger, and developing the brand and website for Produce Bites.

Under this format, the funding available provided for 8 total posts to the blog from July 1 to August 30. The food writers crafted their recipes based on the time of the year- July 4<sup>th</sup>, the start of school year, National Peach Month, etc. – and in-season Georgia produce. We also had guest blogs from some of our member farms like Southern Valley Produce detailing production techniques and giving on-farm insight.

As outlined in the proposal, the goal of this project was to **get 25 readers a month to our blog**. From July to September 30, the blog had a total of **681 sessions (227 readers/month)** with ‘sessions’ being defined by Google Analytics *as the period time a user is actively engaged with your website, app, etc.* Additionally, Google Analytics reported that the **average time spent on a page during that period of time was 00:02:18**, which indicates that visitors were indeed spending time reading through content on this blog.

**Performance Measurement:**

	<u>Target</u>	<u>2015</u>	<u>+ -REACHED TARGET</u>
Readers	25/month	681 in 3 month or 227 per month	Exceeded GOAL by 808%
Avg. Time on Blog	no goal est.	2:18 min./session	

**Implementation of a Feed My School Essay/Poster Competition:**

After consulting with teachers, school nutrition directors and other individuals involved in Farm to School, GFVGA modified the original competition guidelines to be a video competition rather than an essay/poster competition. The reason for the change was to create more interest and allow for more collaborative work amongst students in the classroom, rather than working on their own essays.

The competition was advertised in fall of 2015, entries were accepted in winter of 2016 and winners were to be selected in spring of 2016. Unfortunately, even with strong marketing and reaching out to the GA Department of Agriculture's 'Feed My School' participants, the number of submissions were too low. There were only 5 videos submitted for the entire contest, which had various age groups and categories. Because of this low participation and the poor quality of the videos, no award was made for the contest in the Spring of 2016.

Due to the lack of adequate participation in the video contest GFVGA then moved back to the original plan of an Essay competition. In consultation with a number of teachers they believe the lack of participation was due to some schools/teachers not having easy access to the technology to create a video. The goal in reverting back to the Essay contest was to allow more students to participate and require less resources for teachers.

The essay contest was again advertised at Farm to School events, school visits, the Georgia Grown Farm to Table Source Show and other farm to school contacts in the spring and fall of 2016 with the deadline for essay submissions being January 31, 2017.

After the original deadline had passed and GFVGA had not received any essay entries, the deadline was extended into February to allow for additional time for entries. Once the extended deadline had closed we had still not received any entries. See #5 below for more explanation regarding 'Lessons Learned'.

The objective of the essay/video project was to increase opportunities and educational programming to students to learn more about where their food comes from. Utilizing the talents of a GFVGA staff member that had credentials to be a Vocational Agriculture educator, GFVGA created a classroom kit and lesson plan for elementary students. This kit included commodity videos produced with funds from another SCBG, along with classroom exercises to fulfill the Georgia Standards of Excellence (GSE) – S5E1b and S3E1bc. These classroom kits were made available and over 53 were ordered in August and September 2017.

**Comparison of Actual Accomplishment with the GOALS established:**

**Actual Accomplishment vs. Goals: SE Regional Fruit and Vegetable Conference**

	<u>2014</u>	<u>2015</u>	<u>TARGET / GOAL</u>
Attendance	3,005	3,222	+ Exceeded goal by +7.2%
Value to Time	94.4%	91.9%**	- Under goal by 2.5%

	<u>2014</u>	<u>TARGET</u>	<u>2015</u>	<u>TARGET / GOAL</u>
Amount of information presented as Significant or Moderate	98.1%*	98.1%	94.1%**	- Under goal by 4%
Gained knowledge	84.7%	84.7%	83.0%**	- Under goal by 1.7%
Usefulness of Information	88.6%	N/A	91.1%**	+ Exceeded goal by 2.5%

**Actual Accomplishment vs. Goals: 2015 / 2017 Food Safety Documentation Workshop**

	<u>Goal</u>	<u>Actual</u>	<u>TARGET/GOAL</u>	
Number of workshops attendees	15 attendees	<b>2015:</b> 20	+ Exceeded goal by 5 attendees	
		<b>2017:</b> 14	- Under goal by 1 attendee	
		<u>Pre-Test</u>	<u>Post-Test</u>	<u>TARGET/GOAL</u>
Comfort level of creating/developing/writing a food safety manual/program as Comfortable or Very Comfortable		<b>2015:</b> 80%	100%	+ Met goal at 20%
		<b>2017:</b> 67%	88%	+ Exceeded goal at 21%
Rate knowledge GAPS as excellent or average		<b>2015:</b> 80%	100%	+ Met goal at +20%
		<b>2017:</b> 89%	100%	- Under goal at 11%
How prepared do you feel to		<b>2015:</b> 75%	100%	Not a goal but

undergo a 3rd party food safety audit?	<b>2017:</b> 33%	75%	preparedness was increased 25% and 42%
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**Actual Accomplishment vs. Goals: – On-the-Farm Consultation:**

	<u>2014</u>	<u>Benchmark</u>	<u>2015</u>	<u>GOAL</u>
Farm and Packing Operations participating in PFSS	73	77	85	+ Exceeded goal by 14%
Consult with farms with no food safety plan	5	10	20	+ Exceeded goal by 50%

**Actual Accomplishment vs. Goals: – Production of Produce Information Blog:**

	<u>Goal</u>	<u>2015</u>	<u>+ -REACHED TARGET</u>
Readers	25/month	681 in 3 month or 227 per month	Exceeded GOAL by 808%!!!
Avg. Time on Blog	no goal est.	2:18 min./session	

**Actual Accomplishment vs. Goals: – Essay/Video Project – Classroom Kit**

	<u>Benchmark</u>	<u># of Kits Ordered</u>
Kits Ordered	Unknown – 1 <sup>st</sup> time for project	53 kits ordered

**BENEFICIARIES**

The beneficiaries of this project as noted below are the Georgia and southeastern fruit and vegetable crop producers that have more education, training, communication and management tools that were developed from this grant. These tools will help improve their competitiveness and increase market share for them. In addition, consumers were educated and answered their questions about their food and how it was produced. Through 40 different blogs, consumers learned safe handling practices,

nutritional value, recipe preparation, local harvest seasonality, and much more. Unfortunately the learning that was targeted to school children was not successful.

#### **Number of Beneficiaries Affected by Project's Accomplishments:**

This project reached, educated, supported and provided knowledge to,

- Over 3,200 growers and agribusiness individuals at the SE Regional Conference,
- 10 beginning farmers on food safety practices,
- 34 growers attended workshops to create their Food Safety Farm Manuals,
- 85 growers received on-the-farm food safety consultation,
- 20 growers with no food safety plan received assistance in developing their farm plan.
- The 'Produce Bites' blog averaged over 227 readers per month in 2015,
- Over 53 classrooms utilizing an educational packet on 'where my food comes from.'

#### **LESSONS LEARNED**

##### **SE Regional Conference**

There are many wonderful resources available to help with attendee survey collection but growers and general conference attendees are not interested in participating. Even when Conference organizers put brief paper surveys for individual, well attended sessions on chairs for attendees to complete and leave in chairs, the return rate was very low.

With the implementation of "gaming" on the Conference app, participants have the "reward" of earning points and listed on a points leader board depending on their engagement within the app. This seemed to engage some of the middle aged and younger population who are competitive. Conference organizers included session survey participation in this "gaming" competition. Their ratings/responses remained anonymous and were not tied to "gaming" points. It is not clear how many or if any additional attendee surveys were complete due to this "gaming" competition but it seemed like a fun way to engage attendees and potentially add a few survey results that would not typically be sent in.

Since the 2015 Conference, Conference organizers have kept a close eye on the blueberry conference to ensure the quality and substance of this conference matches the maturity and sophistication of Georgia's blueberry industry. As new state specialists or new educational conference coordinators come on-board, Conference organizers are working closely with them to ensure those educational conferences and the industries they stand for are well represented by the content, speakers, etc.

### **Feed My School Essay/Poster Contest**

After having low participation in both a video contest and essay contest we reached out to teachers, school administrators and nutrition directors to see what contests might find success in the classroom. We discovered that most teachers are not able to implement certain activities in the classroom because they do not align with the Georgia Standards of Excellence for education. In order for a contest that required student involvement during the school day to gain participation, it would have to be written into a lesson plan that met the common core standards. This would be easier for teachers to implement, and would not require additional work to figure out how to incorporate it into their lesson plans or for them to develop new lesson plans solely to participate in the contest. If we do essay or video projects in the future we will develop a lesson plan around the common core standards.

#### **CONTACT PERSON**

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Georgia Fruit and Vegetable Growers Association

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#### **ADDITIONAL INFORMATION**

None

### **16. Georgia Public Broadcasting-*Pick, Cook, Keep—Farmers Markets*– Final Performance Report**

#### **Project Summary**

The 2014 Specialty Crop Block Grant (SCBG) funded a comprehensive program educating Georgians about the vast resources available at local farmers' markets. Using multi channels in a program called *Pick Cook Keep – Farmers' Markets*, we continued our quest from the initial 2010 SCBG funded project to educate Georgians about Georgia Grown Specialty Crops through the creation of vignettes. The 2010 grant provided monthly in season crop information including a brief history of each crop, its growth location within Georgia and an introduction to

a local grower/family who raised and harvested the crop. The 2012 and 2013 grants continued using the same specialty crops, and provided strategies to demonstrate their ease of use in easy-to-prepare demonstrated recipes, including correct storage tips so the crop could be used at a later date and still retain freshness.

This 2014 SCBG continued Georgians' education about Georgia Grown Specialty Crops from the perspective of acquiring the items at local farmers markets. Again, we highlighted Georgia Grown Executive Chefs who then showed/explained the nuances of each seasonal crop: why to select this Georgia Grown item for a specific recipe; demonstrated the use of the item in an easy-to-prepare recipe cooked on site at the farmers market; and tips for safe handling of the item. This grant allowed us to connect Georgians to their food source through selection of local in season produce from a local farmers market. Farmers market access is trending up across Georgia, keeping dollars in local communities, providing a large selection of produce, and increasing support for neighbors, the local farm families. As in past grant cycles, we provided information through multi channels about: (Pick) how to select the perfect produce item from the many types available for a healthy, easy-to-prepare recipe; (Cook) how to use each seasonal item as demonstrated by a Georgia Grown Executive Chef in an easy-to-prepare recipe; and (Keep) tips for safe handling and cooking of fresh produce.

This grant included eight Georgia Specialty Crops as selected by the Georgia Department of Agriculture (GDA) featured during their months of peak perfection from February through September. The schedule of crops was as follows: February – Honey; March – Greens; April – Onions; May – Strawberries; June – Blueberries; July – Peaches; August – Tomatoes; and September - Apples. Each month during the eight month campaign, multiple channels promoted seasonal crops using extensive communication resources. Georgia Public Broadcasting (GPB) used the 9 station television network, 17 Station Radio network, web support including the *Pick Cook Keep* web pages, e-blast to members and supporters, and social media. GDA used print in the *Farmers & Consumers Market Bulletin* and *Consumer Q's*; this information was sent to local media outlets as well as shared digitally. There was also web support through social media, the web site and e-blasts. The UGA Extension Service with a presence in all Georgia counties promoted *Pick Cook Keep* and Georgia Grown materials through their press releases to media outlets, through 4-H Demonstrations, Camps with 5<sup>th</sup> and 6<sup>th</sup> graders as well as through 288 classes and demonstrations provided by local county agents throughout Georgia.

Using the power of multi channels and a strong partnership between two state agencies and the state university, in season Georgia Grown produce and products were promoted monthly as they became available. This grant educated Georgians about Georgia Grown Specialty Products, Farmers Markets, and helped them connect with their local food sources while becoming informed consumers valuing Georgia Grown products in the market place.

### **Project Approach**

We continue to believe that today's consumers are media savvy regardless of their educational background, age, gender or ethnicity. They need to receive information in a sophisticated manner because their experience shows that the veracity of information directly correlates to the quality of the presentation. Therefore, all the information about Georgia Grown Specialty Crops in the *Pick Cook Keep* series is of the highest quality, to exceed the recipient's standards and continue the trust of the provided content. The *Pick Cook Keep* approach that had been established during past grants was again followed, and these new vignettes mirrored that style and quality, building upon existing materials. We again provided quality content on multiple platforms to continue the education of Georgians about the ease and advantages of consuming Georgia Grown Specialty Crops.

We created 8 three-minute vignettes showcasing Georgia Grown specialty crops selected by GDA. The vignettes were shot at the Auburn Avenue Curb Market, a Farmers Market located in Downtown Atlanta in the Destiny Organics space and in the middle of the Market. The host of each Vignette and each cooking demonstration was a Georgia Executive Chef, from a program created by the GDA to partner with the Georgia Restaurant Association for statewide promotion of Georgia Grown Produce and Products, thus fostering relationships between chefs and farmers.

All *Pick Cook Keep* information was broadcast on GPB's Television Network and archived on a dedicated *Pick Cook Keep* web site as part of GPB's robust web presence. The site includes tabs for each aspect of the project: Episodes, Recipes, Chef Bios, Crop Calendar, Join Georgia Grown, and Partners. Additionally, each month as vignettes were broadcast to television audiences during the GPB Cooking block of programming on Saturday afternoons or during a Prime Time rotation in the evenings between 8 p.m. and 11 p.m., the information about "in season" crops was reinforced through GPB's Network Radio and GPB web links, E-Blasts to members and through our GDA and UGA Partner resources including print, web, events and

social media, the *Farmers & Consumers Market Bulletin* and Consumer Q's, etc. This project had the full support of the Georgia Department of Agriculture and UGA Extension Service.

### **Goals and Outcomes Achieved**

The **goal** of this project was to integrate specialty crop information into curriculum to increase the number of students receiving information about specialty crops, as well as increase the students' knowledge of specialty crops.

The **target** was to increase the number of students receiving information about specialty crops to 4,500, including the 4-H and FFA, and to increase the students' knowledge of specialty crops by at least 25%.

GDA and UGA integrated the vignettes through contact with these organizations reaching middle school students and high school students taking part in 4-H and FFA programs. These students used the vignettes and information as they conducted outreach within their schools and communities.

After completion of the project, the number of students who received information about specialty crops was approximately 10,000; this result far exceeded our target of 4,500.

Our student goal was achieved through our association with 4-H and Cloverleaf Camp at Rock Eagle 4-H Center. The 4-H members learned about specialty crops and explored food and nutrition practices including understanding the food groups in MyPlate and Choose My Plate, government resources that can be found at ChooseMyPlate.gov. Additionally, they learned about dairy foods and how they fit into a daily food plan including basic nutrition and information. The 4H'ers demonstrated best practices in food safety in the preparation of their food and shared all this information with peers through their demonstrations and the creation of their smoothies as the culmination of this unit. Throughout all of these lessons, 4H'ers integrated concepts about food fitness as related to caloric intake, exercise, foods and nutrition.

GPB Television was projected to reach 1,734,000 Adults 18+ and we reached 1,984,635 Adults 18+ based upon Nielsen ratings for 48 broadcasts of Vignettes; 6 broadcasts during Prime Time and 42 during the Saturday afternoon cooking block of programs over 8 months from February through September. Additionally, Ag Georgia Farm Credit ran 5 (:15) spots during High School Football games and reached 130,500 Adults 18+.

GPB Radio Network was projected to reach 3,080,000 Adults 12+ and we reached 3,441,400 Adults 18+ based upon Nielsen ratings for 280 spots; 96 broadcasts during AM Drive, 111 during Mid-Day and 73 during PM Drive.

Our web impressions reached 1,655,017 including GPB.org home page, landing pages, web ads, Social Media, E blasts, GDA’s web site, specialty pages, on-line publications, and UGA Extension Service’s Web Support. These numbers continue to grow as materials are archived for visitors to view.

The UGA College of Agriculture and Environmental Science was tasked with an evaluation/survey of the Georgia Grown promotional tools to measure consumer awareness. A total of 484 Georgia residents 18+ were asked questions in categories concerning their choices. The implications were that once consumers are informed or aware about Georgia Grown, they are likely to purchase food products which have that designation. Ninety-six percent of respondents were “likely” to purchase a food product with Georgia Grown labeling in the future and of that number 66% of them would be “very likely” to do so.

<b>Georgia Department of Agriculture - Impressions 10.01.14 - 12.31.15</b>					
<b>Channel</b>		<b># Delivered</b>	<b># per Unit</b>	<b>Total #</b>	<b>Sub total</b>
<b>GPB Television</b>	<b>48</b>				
Prime Time		6 Vignettes	61,538	369,228	
Cooking Block		42 Vignettes	38,462	1,615,404	
<b>Sub Total Adults 18+</b>		Delivered 48			<b>1,984,632</b>
Ag Georgia Farm Credit	3	:15	25,800	77,400	
	1	:15	27,300	27,300	
	1	:15	25,800	25,800	
<b>Sub Total Georgia Adults 18+</b>					<b>130,500</b>
<b>Radio</b>	<b>280</b>				
		AM Drive - 96	15,300	1,468,800	

		Mid-Day - 111	10,800	1,198,800	
		PM Drive - 73	10,600	773,800	
<b>Sub Total Adults 12+</b>		Delivered 280			<b>3,441,400</b>
<b>Web</b>					
GPB run of site Ad		GA Grown		712,748	
GPB.org Pick Cook Keep web site	landing page		3,000	3,000	
GPB E blasts	Members	1	130,000	130,000	
GPB Facebook	Web	3	12,000	36,000	
GDA Newsletters	Web	3	26,632	79,896	
GDA Facebook	Web		76,685	76,685	
Market Bulletin	Web	26	4,488	116,688	
<b>Sub Total Impressions</b>					<b>1,155,017</b>
<b>Print</b>					
Market Bulletin		26	39,797	1,034,722	
Consumer Q		2	50,000	100,000	
GDA to news partners	2 times	24	20,000	960,000	
UGA Press Releases Specialty Crops/GA Grown	19 times	10,000	800 media outlets	15,200,000	
<b>Sub Total Subscribers</b>					<b>17,294,722</b>
<b>Outreach</b>					
Georgia National Fair/Perry	Ga Grown Bldg.			501,000	
Sunbelt Expo/Moultrie	Ga Grown Bldg.			77,000	
UGA Agent Demos	Specialty Crops	288	20	5,760	
UGA Extension Camp	5th & 6th Graders	strawberry smoothies		10,000	
4H Demonstrations		150	20	3,000	
<b>Sub Total</b>					<b>596,760</b>

<b>Attendees</b>					
<b>Total Impressions</b>					<b>24,603,031</b>

## Beneficiaries

Using the power of Multi Platforms and all possible Channels including all the assets of Georgia Public Broadcasting, the Georgia Department of Agriculture and UGA Extension Service, the beneficiaries of this project have been and continue to be Georgians who receive information leading them to become better educated consumers. Information was provided to Georgians where they “live, work, and play” helping them make informed selections from Farmers Markets about why to choose one item over another for easy-to-prepare dishes. Georgians who watched GPB Television, visited the GPB web site, received E-blasts from GPB Member Services, received Social Media, received print publications from GDA, local newspapers containing materials sent out by the GDA, visited the GDA web site, received information from UGA Extension press releases, extension agent classes/demonstrations and from 4-H presentations, received Chef newsletters with Georgia Grown Specialty Crop information about fresh, assessable Georgia Grown Produce and products were informed about the in-season crop available at Farmers Markets and local grocery stores across Georgia.

As a bonus we reached over 17 **million** in print with outreach from the *Farmers & Consumers Market Bulletin*, Consumer Qs and GDA news partners. The print included: The Times – Gainesville; Lincoln Journal – Lincoln; Jackson Progress Argus; Statesboro Herald; Advocate Democrat – Crawfordville; The Herald Leader – Fitzgerald; Oglethorpe Echo – Lexington; Walton Tribune – Monroe; Times-Herald – Newnan; Clayton News – Daily; Henry Herald – McDonough; Cordele Dispatch; Miller County Liberal – Colquitt; The Chattanoogan – Chattanooga; Times-Enterprise – Thomasville; Herald Journal – Greensboro; Americus Times/Recorder; Rome News/Tribune; Monticello News; Donalsonville News; Lake Oconee News – Eatonton; Courier Herald – Dublin; Pierce County Press; Thomaston Times; and UGA press releases to over 800 media outlets 19+ times.

We also reached 578,000 attendees with the vignettes broadcast in the Georgia Grown Building at the Georgia National Fair in Perry and in the Georgia Grown Building at the Sunbelt Expo in Moultrie.

*We are very proud to have reached over 24.6 million impressions with Georgia Grown using multi-platforms and Partner support from GDA and UGA Extension Service.*

### **Lessons Learned**

When the best chefs select fresh local produce from the farmers market and present easy-to-prepare dishes in a step by step manner, the audience is empowered to shop at the farmers market and select produce for use in nutritious quick and easy-to-prepare foods for themselves, friends and families. There is magic that happens when our audience for *Pick Cook Keep*, be they viewers, listeners, readers, or visitors, are shown how to select and use Georgia Grown local produce and products.

Information served up through all platforms and channels drive consumer awareness and ultimately consumer behavior and purchase decisions. True education includes the implementation of a comprehensive quantifiable plan leading to increased awareness and increased sales of Georgia Grown Specialty Crops. The power of the media, the power of organizational Partnerships, and the power of quality accessible produce and products continue to lead to the success of the Georgia Grown program.

### **Contact Person**

Carol Danford, Corporate Account Executive,

Georgia Public Broadcasting  
260 14<sup>th</sup> Street  
Atlanta, GA 30318

## **17. Hospitality Education Foundation of Georgia-Careers with Specialty Ingredients Phase 1: Growing Specialty Crops Business– Final Performance Report**

### **Project Summary**

This project focused on cultivating high school students' understanding of specialty crops through partnerships with business experts who utilize specialty crops. By partnering with experts in the field, students discovered diverse careers and learned best practices from Georgia's inspirational industry leaders. An informational video was created to reinforce this information after the initial visits and to sustain and expand the project's footprint.

Passionate culinary students interested in management met with local business leaders and learned best practices. These meetings were designed to build relationships and grow awareness of Georgia's specialty crops. Students then increased their understanding, awareness, and appreciation of specialty crop businesses, the industry leaders, and potential career paths.

Previous projects taught us that repetition garnered greater results and students responded to technology as their preferred medium of learning. Therefore, the educational videos were designed to reinforce the information the students were learning with their industry mentors. Teachers used these videos to train the students in the smaller test program, but the video resources would be used extensively in other classrooms.

The students were self-selected for this project because they aspired to be restaurant owners, foodservice executives, and hospitality managers. Without the knowledge imparted by our program, the major influencer for students are textbooks and fast food restaurants. These impact students' food choices as well as career choices.

While this project focused on high school students learning about business from industry leaders, the final component was asking students to create original recipes that would add specialty crops to the menus of each business. "OUTSTANDING JOB! We at Arby's are very proud of the project's accomplishments and enjoyed working with the students. We are very proud that you choose Arby's to be a part of your project. Job well done!!" said Levelle Harley, Area Supervisor Arby's Restaurant Group.

In Georgia there is a passionate culinary education program and this project supported the program's teachers, mentors, and students by providing an educational resource that was otherwise unobtainable.

### **Project Approach**

The first part of the project was to introduce specialty crop businesses to interested educators. Then, focused classrooms of passionate students began studying Georgia's specialty crop businesses. Each class researched the business, their establishment, and conducted interviews with their staff with the goal of learning about careers, facilities, marketing, production, food & beverage, promotion, purchasing, and management. The students also created original recipes and marketing based on their specialty crop partner. Finally, they presented a written and

verbal presentation at an invitational educational seminar. All the students presented what they learned from their interactions, including original marketing tactics and original recipes for specialty crops. The original sections included their costs, benefits, and the company's feedback on their concepts. A panel of industry professionals evaluated the students to determine if they met the goals of the project. Industry judges rated the students' work, including the original specialty crop recipe and marketing tactics. This was used as the project baseline.

Part two of this project was the development of six instructional videos, averaging ten-minutes each. The overall concept was to produce an engaging contemporary set of videos for the purpose of reinforcing the information the high school students were learning from diverse Georgia's business leaders during their interviews of business that use specialty crops. Recognizable brands including Maggiano's Little Italy, Chick-Fil-A, Arby's Restaurants, Popeyes Louisiana Kitchen, Georgia Department of Agriculture, and Marriott International Hotels were used to help make an impression on students, who are more influenced by 'name recognition'.

The six video chapters focused on specific career in the restaurant industry that were previously agreed upon by the granter: facilities, restaurant management, purchasing, food & beverage, marketing, and promotion through social media. Specialty crop partners requested we also include employability skills. Therefore each section has a few seconds on interviewing, promotability, hygiene, or proper communication.

In addition, each video section contains a cooking segment by Georgia's nationally award-winning culinary students. The students chose the menu, which was inspired by their own experiences with Georgia Specialty Crops. The following specialty crops were used throughout the videos: Bay Leaves, Bell Peppers, Carrots, Celery, Cherries, Cherry Tomatoes, Coriander, Dill, English Cucumbers, English Peas, Garlic, Honey, Jicama, Mint, Nutmeg, Parsley, Pecans, Raspberries, Red Radishes, Sage, Shallots, Spinach, Strawberries, Thyme, Vanilla, Beans, Various Herbs, Vidalia Onions, and Wild Mushrooms.

The final part of the project took place the following year. Educators were introduced to different specialty crop businesses. Their students then studied the new Georgia's specialty crop businesses and conducted interviews with their staff with the goal of learning about careers in facilities, marketing, production, food & beverage, promotion, purchasing, and management. The students also created original recipes and marketing based on their new specialty crop partner. Finally, they presented a written and verbal presentation at a second

Invitational educational seminar. A panel of industry professionals evaluated these students to determine if they met the goals of the project. Industry judges rated the students' work, including the original specialty crop recipes and marketing tactics. The scores were tabulated with a consistent method each year to determine changes in students' understanding and overall skills with regard to the specialty crops and information filmed the Specialty Crop video. A survey was then sent to the participants to determine level of satisfaction of the project. The results of the industry judges and the survey are in the tables below.

### **Goals and Outcomes Achieved**

This project contained the following program goals:

Goal 1: The time invested in specialty crop education will increase; therefore, the increase in knowledge and awareness of specialty crops will increase by 15%.

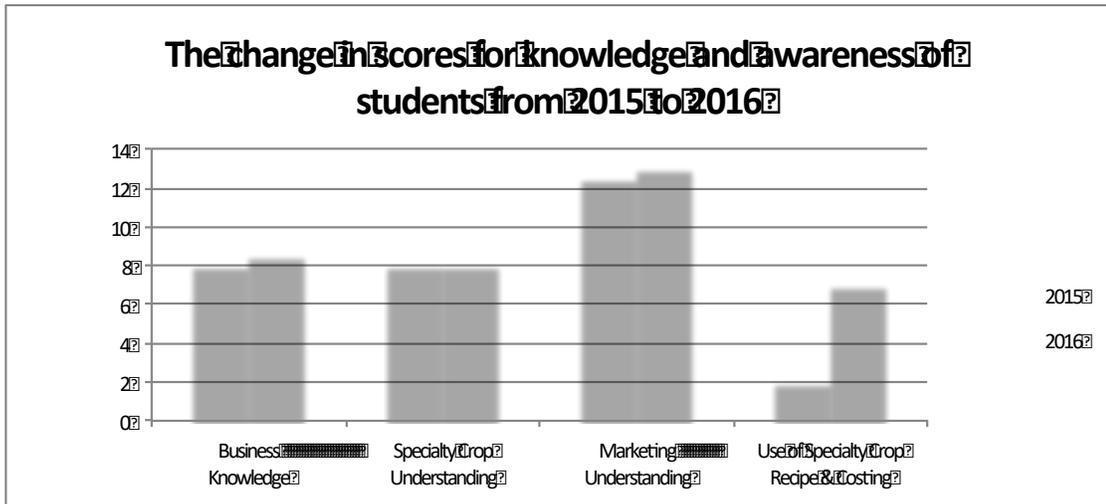
Immediately following the invitational educational seminar, educators, students, and industry were surveyed to evaluate how they felt student's knowledge improved. The results were impressive. 50% of the participating educators 'increased the amount of time spent teaching specialty crops' by 25-50 percent between the project years, and 50% of the participating schools 'increased the amount of time spent teaching specialty crops' by over 15-25% between the years. The amount of time spent on the project varied depending on the school. In 2016, instructors reported spending an average of 30 hours on this project. Their focus was divided between reviewing student work and purchasing specialty crops for preparation for practice or presentation to their industry partners. The instructors reported students spent more than 60 hours or an average of 5 hours per week. 100% of the educators reported using the video, produced as part of this project, throughout all of their classes. This extended the beneficiaries of the project well beyond the students in the seminars. Moreover, the video was distributed to 35 additional educators for use in their classroom as a tool, in the same way that our focus group utilized it.

During their educational seminars, industry professionals rated the students' presentations and written manuals on four major subject areas. The same categories were used in 2015 and 2016.

According to the judge assessments, student knowledge increased in three areas and remained the same in one (see Figure 1). The average increase of all four areas was 16.4%, which was above the project target. (See Figure 2)

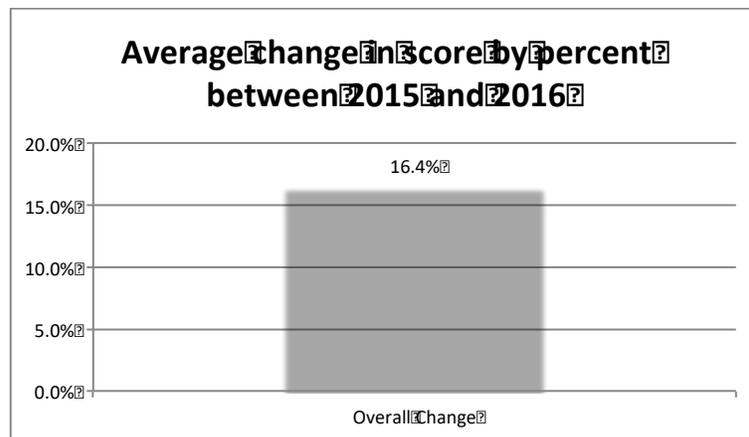
Figure 1

Student Specialty Crop Knowledge



As evaluated by industry experts at educational seminars in 2015 and 2016

Figure 2



The average change in scores by percent between 2015 and 2016

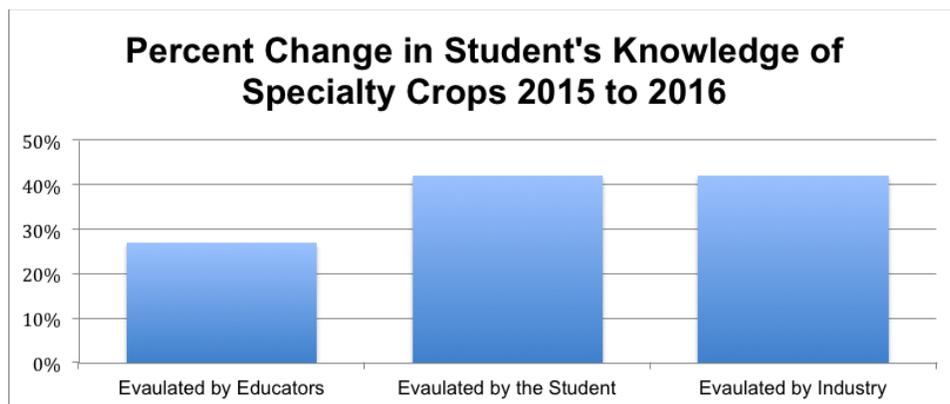
Goal 2: Teams from around the state will successfully host seminars in the Invitational and show an increased awareness of specialty crop practices 25% overall.

Surveys of participants showed students reported their own knowledge of specialty crops increased over 40%. Specialty crop businesses that worked with students also reported students' knowledge increased over 40% from the beginning to the end of the project. Educators reported the lowest gain of 28% increase in knowledge, still exceeding the project goal. (See Figure 3)

Figure 3

Percent Change in Student's Specialty Crop Knowledge from 2015 to 2016

As reported by students, educators, and industry partners

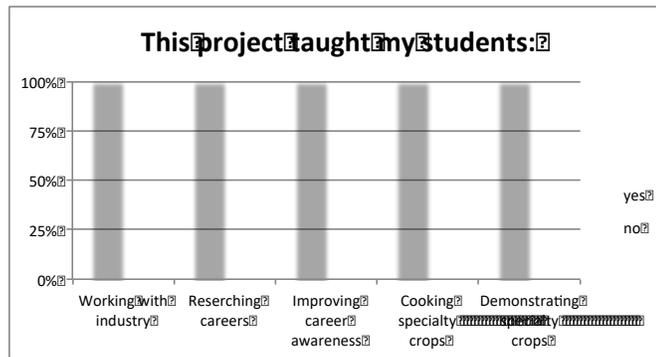


In the survey that was distributed, there were additional questions asked. The responses are detailed below.

- The educators were unanimous in their belief that the project benefited their students in a variety of areas. 100% of the instructors indicated their students were taught in five different areas: working with specialty crop industry, researching careers, improving career awareness, cooking specialty crops, and demonstrating specialty crops. They clarified this by saying the students had no information on the subject prior to starting this project. See

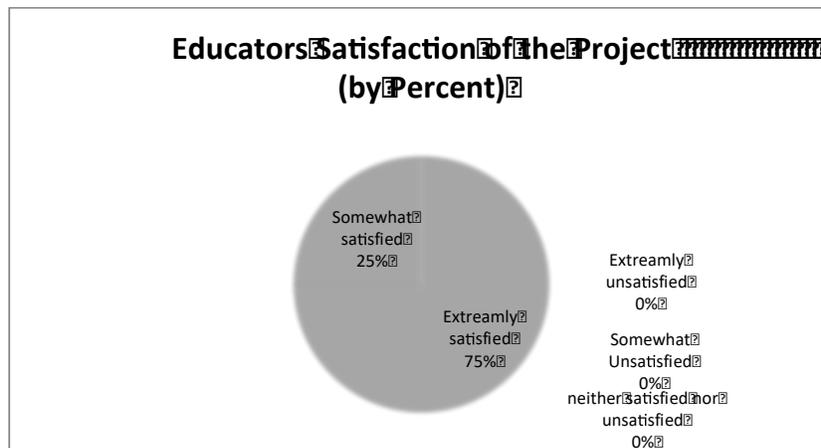
Figure 4.

Figure 4  
 Percent of Educators that believe their students were taught information by this project in 2016



- 75% of teachers were extremely satisfied and none reported being somewhat unsatisfied, extremely unsatisfied, or neither satisfied or unsatisfied. See Figure 5.

Figure 5  
 The satisfaction level of Educators on the project by percent in 2016



#### Industry Partner's Comments

“We worked directly with the student management team members instead of the teacher, held the student’s accountable. We felt this was an important part of the project and we thought the students enjoyed it as well. “

### Educator's Anonymous Comments

"Being able to establish a working relationship with the restaurant. The student's developed an appreciation for the roles and they help each other. It also gave students confidence and it was a great experience when industry communicated with them."

"It was such a great learning experience for my students. They have a group chat where they have continued discussing business ideas through out the summer. They learned how much effort is put into a business and they want to continue. Usually when these are over, they stop. But my students were so inspired by what they saw that the conversation has continued. "

"I feel that is the entire project provided the opportunity to get young people discussing business as a regular part of life. I believe that it aided in their future success."

"I have learned so much. I spent years in a kitchen but never really understood what business entailed. We met with many different departments and did interviews. My students and I talked the entire way home about how much we had learned. I had no idea there was so much going on behind the scenes of a foodservice operation."

"My students have learned so much about how a business is run thanks to this project. A student who graduated and participated in this the first year still discusses decisions she makes by referring to what she learned and people she met in the project."

"I wanted to thank you for being a part of this project. I have enjoyed seeing my students grow in their understanding of restaurant management."

“We didn’t have enough time to go in depth in business and marketing. My students didn’t learn enough”

### **Beneficiaries**

Direct beneficiaries of this project were approximately 240 high school culinary students who worked directly with the specialty crops businesses. Forty students did the final presentations in the educational seminars. Educators reported from the start the project until this final report that approximately 5,800 students viewed the video in their classroom or sent the project’s DVD home with their student to watch as a homework assignment.

### **Lessons Learned**

This project was highly effective in specific areas of foodservice management that were determined at the beginning of the project. The video effectively educated students and educators on careers, employability skills, and marketing of specialty crops. However, the educators wanted more time with the specialty crops partner and it would have been a more effective project if we started each relationship with the specialty crop partner earlier and let it run longer. It was a consistent concern from most educators that it didn’t run long enough. The industry partner did not repeat this concern but it may have been there and not expressed.

We delivered one DVD to each teacher and made the information available on the website. After the project was over we learned that the educators would have liked up to 10 copies of the DVD to allow more students to take the DVDs home overnight. Teachers reported using the DVD as homework. Due to various Internet speeds at student’s homes, the DVD discs were more usable for this purpose. If we were to do this project again, we would give each teacher ten DVDs. This would allow greater repetition of the material.

### **Contact Person**

Lee Gray, Executive Board of Trustees, Hospitality Education Foundation of Georgia, 1579 Monroe Drive, Suite 224 Atlanta, GA 30324

### **Additional Information**

The videos produced for this project can be found at [www.hefg.org/resources/videos](http://www.hefg.org/resources/videos)

## **18. Mustard Seed Projects-Atlanta Veterans Farmers Market Featuring The Veterans Organic Produce Label – Final Performance Report**

### **Project Summary**

The Atlanta Veterans Farmers Market (AVFM) operates an organic produce market selling only produce grown by U.S. Veterans. AVFM, along with 30 small, medium, and large veteran-owned farms provide all the produce for the market. This group of farmers created the Vets Organic Produce (VOP) cooperative and used AVFM to introduce the new VOP marketing program in 2014.

This program addressed many different issues facing the U.S. and Georgia. AVFM was designed to address the needs of our disabled, senior, and urban populations to increase the nutritional opportunities to populations that have very little access to fresh vegetables by utilizing milk crates, pallet boxes, recycled windows, and living garden trays. These units can be placed easily on a balcony, back porch, window or any 3-foot square area available. Their height and width brings gardening up to the level of the disabled and elderly population. These specially designed units can not only increase the nutritional intake of people who lack that access but also can lead to small and large scale vocational opportunities. A 3x3 unit can produce anywhere from \$1,000-\$3,000 in vegetable production. AVFM provided on-site gardening and cooking classes as well as a website and published guides. The goal was to expand to AVFM affiliated farms in the food desert area south of our location between Interstate I-20 and Interstate I-285.

### **Project Approach**

AVFM educated homeless and disabled veterans in organic urban and traditional farming techniques. Included in the curriculum was the development of 3x3 farms, roof top gardens, school farms, farm to table operations, community gardens, and community supported agriculture. Key topics on organic history and philosophy, national organic program regulations, conservation, certification, nutrient management, ecological weed & pest management, organic resources, marketing (GVOP/VOP), farm construction, empowerment, and many other topics were taught.

We also went off site to promote our urban farming system and to train individuals to grow organic produce. Classes took place at the John Hope Community Center, Morehouse College, our sites at 307 Walker St and 13460 Hopewell Rd. We also made presentations to numerous church groups and other civic groups around metro Atlanta. Invitations to speak about the

system came from the VFW, American Legion, Kiwanis Clubs, Chattahoochee Tech, and local high schools.

### **Goals and Outcomes Achieved**

After a site change and awaiting the passing of new Urban Agriculture ordinances by the City of Atlanta, we were finally able to legally farm on site this past May 2015 on our new site at 307 Walker Street Atlanta, GA. Before this, our growing was limited to research and development activities on site and teaching classes. Since the passage of new laws and the issuance of a business permit we have cleared a new 1 acre section to place additional crates for growing. The property was a large tract of vacant land located in a historical district and when we first had access to the property the city of Atlanta had not yet passed these new ordinances needed to operate so activity on the land was limited to research and development as well as teaching classes to veterans and the local community.

We have achieved the goal of clearing formerly vacant land and using our mobile crate farming system while rehabilitating the land, thus proving the viability of our mobile farm. This past summer the garden/farm was used as a summer youth program and this fall the garden is being used as training garden for local senior citizens. Mini gardens have been constructed for disabled veterans in Warner Robins, Marietta, Atlanta, and Alpharetta. Our community extension garden is located at the John Hope Community Center

### **Beneficiaries**

These include but are not limited to disabled veterans, local seniors, local youth, homeless persons, and the community as a whole. The effect on those that we have worked with has been positive and the way our system helps with so many different challenges has amazed us. A few examples are an amputee veteran can use a 4 crate method to grow instead of our traditional 2 crate system due to his 6'4 height. A senior is now able to sit beside her garden (3x3) and have 100% access to the entire garden from any side. A young woman with severe medical problems was able to build a mini farm on her deck to ensure the organic nature and quality of her food source. The kids from John Hope Community Center have a summer and after school gardening program. By using local homeless men to help work the farm, we have been able to utilize horticulture theory to help 2 of the 3 leave their life on the streets. Everything above has benefited the community but the community continues to benefit from a large tract of land which was a blight to the area and when finished will be turned into a community park.

### **Lessons Learned**

- The biggest lesson learned is to be better prepared when working with the local government.
- The delays concerning project placement, historical ordinances along with urban farming ordinances.
- Not doing better research and not understanding zoning rules led to a long delay to the program.
- Most of all I learned I can't do it all myself and surrounding myself with more help has helped move the program forward.

**Contact Person**

Markus Gaffney

**Additional Information**

None

**19. University of Georgia-Reducing Fumigant Exposure to Workers and the Community While Improving Pest Management and Vegetable Yields– Final Performance Report****PROJECT SUMMARY**

Soil borne diseases, insects, nematodes, and weeds have been controlled effectively using methyl bromide as a preplant soil fumigant for over 50 years in vegetable and other specialty crops. Vegetable crops grown in Georgia relying on fumigation have a farm gate value in excess of \$429 million per year. The Montreal Protocol and Clean Air Act classified methyl bromide as a Class I ozone depleting substance in 1990 and called for its removal from the market place which occurred in Georgia during 2014. Alternatives to methyl bromide developed by the University of Georgia (author of grant and co-workers) and Industry have been adopted by growers. However, these alternatives are difficult to apply, are extremely expensive, and often lack weed control during the multi-cropping mulched system that has become a standard in Georgia. The objective to this project was to improve fumigant application methods, especially with fumigant drip injection applications, thereby improving pest management (most notably weed control) while reducing fumigant exposure to workers and the community in a multi-cropping vegetable production system.

**PROJECT APPROACH**

*Activities and tasks performed:*

*Work Plan Objective 1: Determine the effectiveness of fumigants when applied through drip injection when compared to shank injection for the first crop.* Originally this objective included an experiment conducted twice in time. In fact, two experiments were conducted twice in time to address the objective. Detailed information is provided in the goals/outcomes section of this report.

*Work Plan Objective 2. Determine the effectiveness of fumigants when applied through drip injection for crops 1, 2, and 3.* Originally this objective included an experiment conducted twice in time and the experiment was conducted according to plan. Detailed information is provided in the goals/outcomes section of this report.

*Work Plan Objective 3. Conduct on farm study.* Originally this objective included an experiment conducted at one on-farm location. The experiment was actually conducted twice to fully fulfill the objective. Detailed information is provided in the goals/outcomes section of this report.

*Work Plan Objective 4. Fumigant exposure.* This objective was fulfilled as implemented according to the work plan. Detailed information is provided in the goals/outcomes section of this report.

*Work Plan Objective 5. Data dissemination.* This objective was fulfilled as implemented according to the work plan. Detailed information is provided in the goals/outcomes section of this report.

*Accomplishments and Conclusions:* Standard industry recommended drip injection application tactics provided 21 to 56% less weed control when compared to standard shank injected fumigant systems during the first year of this project. Thus, the level of poor weed control observed with drip applications during the first year is prohibitive towards adoption. As defined within the work plan, improvement in drip fumigate application methods occurred during each experiment within this project. By the final year of the project with the on-farm studies, drip inject fumigant applications were greatly improved with a level of control nearly equal to that observed with the shank injected system. Although growers will currently continue to utilize UGA developed and recommended shank injected fumigant systems for the first crop, this research has clearly identified methods and approaches to improve pest management using drip injections for crops 2, 3, etc. growing on the same mulch over time. The overall key to success with all fumigant applications is to place the fumigant at specific depths in the soil profile where the pest is present. Additionally, uniformity in application with two drip tapes

spaced evenly across the bed at a depth of 5 inches allowed effective control of nutsedge, grass, and broadleaf weeds during crops 2 and 3 while maximizing yields.

Greatest levels of fumigants remaining in the soil were noted with shank injected systems followed by the most effective the drip injected systems that included two drip tapes placed evenly across the bed at a depth of 5 inches. Drip injected systems applying the fumigant at a depth of 5 inches as compared to injections at 1-2 inches (standard) provided better weed control and increased fumigant gas levels in the soil (ie less volatiles in the atmosphere).

*Project Partners and Fund Use:* No other partners were included within this project. Additionally, the project only included specialty crops; thus, funding was used only to support this project.

## **GOALS AND OUTCOMES ACHIEVED**

*OBJECTIVE 1. Determine the effectiveness of fumigants when applied through drip injection when compared to shank injection for the first crop.* Two different experiments were conducted during 2014 and again in 2015 to compare a standard fumigant shank injected system developed by the University of Georgia to standard industry fumigant drip injected systems. Experiment 1 focused on Paladin EC drip injected systems (Table 1) and Experiment 2 focused on Vapam drip injected systems (Table 2A and 2 B). Each experiment was conducted twice with treatments replicated 4 times at each location; plot dimensions included 1 bed by 75 feet. Visual estimates of weed control and the number of weeds in each plot were measured throughout the season with late season results reported (Table 1 and 2A). Pepper injury from fumigant systems and pepper heights were measured throughout the season, and the number/weight of jumbo pepper fruit were harvested for each plot and are reported in Tables 1 and 2B. For yield, a grower's local harvesting crew picked jumbo pepper fruit 3 times. Data was pooled over locations within an experiment.

*Fumigation Methods:* At each location land was prepared for mulch installation and fumigation with tillage following standard practices. Shank injected treatments included Pic Chlor 60 applied 10 inches below the bed top with 3 evenly spaced knives (bed was 32 inches wide and 8 inches tall). For drip injected treatments, plastic mulch and drip tape were laid followed by fumigant injection within 72 hours. For those single drip tape treatments, the tape was laid down the center of the bed at depth of 2 inches which is the currently standard practice. For double drip tape treatments, the tape was evenly spaced 16 inches apart or with each tape

being 8 inches from each shoulder at a depth of 2 inches during the first year. Drip fumigant treatments were injected through the drip irrigation system for an hour with another 30 minute flush out period. For each drip injected treatment, calculations of treated land area allowed the exact fumigant amount needed for each treatment to be weighed in individual cylinders to ensure proper use rate. As required by the label, any system receiving Paladin (dimethyl disulfide) used totally impermeable film while the standard low density polyethylene was used for other fumigant treatments.

*Paladin Pic Experiment Results:* Visual estimates of nutsedge control throughout the season (data not shown) and at harvest (Table 1) noted drip injected systems were 21 to 56% less effective than the standard shank injected system. Similar results were noted with the number of nutsedge plants penetrating the mulch throughout the season (data not shown) and at harvest (Table 1). At harvest the non-treated control included an average of 1001 plants per plot penetrating the mulch. The shank injected system consisted of only 15 plants per plot compared to less control observed with all drip injected systems infested with 141 to 343 plants per plot. In general, systems with two drip tapes tended to be more effective than with a single tape and the addition of Vapam following Paladin EC improved control beyond Paladin EC applied alone. Yield was highly correlated with nutsedge management with the highest yielding system including shank injected fumigation. Within the drip injected systems, greatest yield was noted with Palain EC plus Vapam having two drip tapes.

Table 1. Weed and crop response to five fumigant systems as influenced by application method.*								
Fumigant system	Mulch Type**	Drip tape #	Yellow nutsedge (at harvest)		Pepper injury and height		Pepper yield	
			% control	# plant/plot	% injury	cm tall, 48 day	#/plot	lbs/plot
Paladin EC 40 GPA	TIF	1	35 d	343 d	0	23 b	106 d	48 c
Paladin EC 40 GPA	TIF	2	64 bc	256 c	0	23 b	118 cd	47 c
Paladin EC 30 GPA fb Vapam 75	TIF	1	56 c	162 b	0	22 b	149 c	60 c

GPA								
Paladin EC 30 GPA fb Vapam 75 GPA	TIF	2	70 b	141 b	0	21 b	195 b	79 b
Pic Chlor 60 21 GPA plus Vapam 75 GPA	LDPE	1	91 a	15 a	0	23 b	233 a	100 a
Non-treated	TIF	1	0	1001 e	0	30 a	0 e	0 d
*Data combined over Tift and Worth County locations in 2014 and 2015. Letters within a column followed by the same letter are not different at P = 0.05.								
**Abbreviations: TIF = totally impermeable film; LDPE = low density polyethelyene film.								

*Vapam Experiment Results:* Visual estimates of yellow nutsedge control throughout the season (data not shown) and at harvest (Table 2) noted the drip injected systems were 43 to 53% less effective than the standard shank injected system. The number of plants per plot were also counted throughout the season and at harvest. At harvest the non-treated control included an average of 165 plants penetrating the mulch. The shank injected system consisted of only 2 plants per plot compared to 31 to 33 plants per plot in the drip fumigant systems. Palmer amaranth was also present and noted similar results with the shank injected system far superior to the drip injected treatments. Double drip tapes, as compared to single drip tapes, nearly doubled the level of Palmer amaranth control noted in the drip injected fumigant systems. Pepper plant heights were not influenced by treatments during early season; however, yield was highly correlated with Palmer amaranth control (Table 2B). Palmer amaranth had little influence early in the season while becoming established but by late-season the pest was nearly 3 times the size of the crop with tremendous impact on yield. The number of pepper fruit produced and their weights were greater in the standard shank injected system as compared to either drip injected system. When comparing within drip injection systems, yields were greater when using two drip tapes as compared to using a single drip tape.

Table 2A. Weed response to Pic Chlor 60 and Vapam fumigant systems as influenced by application method.*				
			Yellow nutsedge	Palmer amaranth control

Fumigant system	Mulch Type**	Drip tape #	(at harvest)		(at harvest)	
			% control	# plant/plot	% control	# plant/plot
Pic Chlor 60 21 GPA plus Vapam 75 GPA (shank inject)	LDPE	1	98 a	2 a	99 a	0.5 a
Pic Chlor 60 21 GPA shank fb Vapam 75 GPA (drip inject)	LDPE	1	45 b	31 b	45 c	139 c
Pic Chlor 60 21 GPA shank fb Vapam 75 GPA (drip inject)	LDPE	2	55 b	33 b	73 b	64 b
Non-treated	LDPE	1	0 c	165 c	0 d	220 d

\*Data combined over Tift and Worth County locations in 2014 and 2015. Letters within a column followed by the same letter are not different at P = 0.05.

\*\*Abbreviations: LDPE = low density polyethelyene film.

Table 2B. Pepper response to Pic Chlor 60 and Vapam fumigant systems as influenced by application method.\*

Fumigant system	Mulch Type**	Drip tape #	Pepper injury and height		Pepper yield	
			Visual injury (%)	Heights (cm) (51 day)	#/plot	Lbs/plot
Pic Chlor 60 21 GPA plus Vapam 75 GPA (all shank inj)	LDPE	1	0 a	28 a	202 a	96 a

Pic Chlor 60 21 GPA shank fb Vapam 75 GPA  drip inject	LDPE	1	0	30 a	91 b	45 b
Pic Chlor 60 21 GPA shank fb Vapam 75 GPA  drip inject	LDPE	2	0 a	27 a	96 b	51 b
Non-treated	LDPE	1	0 a	30 a	0 c	0 c
*Data combined over Tift and Worth County locations in 2014 and 2015. Letters within a column followed by the same letter are not different at P = 0.05.						
**Abbreviations: LDPE = low density polyethelyene film.						

*OBJECTIVE 2. Determine the effectiveness of fumigants when applied through drip injection for crops 1, 2, and 3.* An experiment was conducted during 2015 and 2016 to compare drip injected systems to a standard shank injected system when producing 3 crops grown in sequence (Table 3). Methods are for mulch installation and drip tape location are identical to the methods provided in objective 1. After each crop, Vapam at 50 GPA was injected to control the previous crop as well as to aid in additional weed control, which is a standard practice. Pepper was the first crop with Broccoli and squash being the 2<sup>nd</sup> and 3<sup>rd</sup> crops (depending on season) in the system.

*Nutsedge control:* Combined over locations, drip injected treatments of Paladin EC was 17 to 24% less effective than the standard shank injected system at the end of year 1 (Table 3). The addition of Vapam to the drip injected system of Paladin EC improved control to 84% with a single drip tape and 94% with two drip tapes. By the end of crop 2, the nutsedge population in the non-treated control had more than doubled when compared to the end of season one. Although overall control was less in crop 2, shank injected treatments maintained 86 to 90% control compared to only 26 to 38% control with Paladin EC and 60 to 70% control with Paladin EC + Vapam. By the end of crop 3, the level of nutsedge infesting the bed had again nearly doubled since finalizing crop 2. As the nutsedge population continued to grow, the fumigant systems became less effective overtime. Control with the standard shank system ranged from

79 to 82% compared to only 30 to 55% with Paladin EC and 40 to 65% with Paladin EC plus Vapam. Control with the drip inject systems noted greater control with two drip tapes compared to one, regardless control was unacceptable. The number of nutsedge plants infesting each bed followed trends in visual weed control and are also available in Table 3.

Fumigant system	Mulch Type**	Drip tape #	Yellow nutsedge (at harvest of crop 1)		Yellow nutsedge (at harvest of crop 2)		Yellow nutsedge (at harvest of crop 3)	
			% control	# plant/plot	% control	# plant/plot	% control	# plant/plot
Paladin EC 45 GPA (inject)	TIF	1	76 c	49 c	26 c	286 d	30 c	435 d
Paladin EC 45 GPA (inject)	TIF	2	83 bc	17 b	38 c	110 bc	55 b	210 b
Paladin EC 45 GPA fb Vapam 50 GPA (inject)	TIF	1	84 b	25 b	60 b	145 c	40 bc	202 b
Paladin EC 45 GPA fb Vapam 50 GPA (inject)	TIF	2	94 ab	6 a	70 b	85 ab	65 b	175 b
Pic Chlor 60 21 GPA + Vapam 75 GPA (shank)	LDPE	1	100 a	1 a	90 a	67 a	79 a	113 a
Pic Chlor 60 21 GPA + Vapam 75 GPA (shank)	LDPE	2	100 a	2 a	86 a	55 a	82 a	102 a
Non-treated	TIF	1	0 d	180 d	0	435 e	0 d	832 e

\*Data combined over Tift and Worth county locations in 2015 and 2016. Letters within a column followed by the same letter are not different at P = 0.05. Vapam at 50 GPA was injected prior to planting crops 2 and crops

3 for all treatments except the non-treated control.

\*\*Abbreviations: TIF = totally impermeable film; LDPE = low density polyethelyene film.

*Palmer amaranth control:* Combined over both locations, drip injected treatments of Paladin EC was 90% less effective than the standard shank injected fumigant system at the end of year 1 (Table 4). The addition of Vapam to the drip injected system of Paladin EC improved control reaching 83 to 90%. Unlike the nutsedge infestation, the population of Palmer amaranth did not grow rapidly over time as this pest does not have the ability to penetrate the mulch and can only emerge from holes in the mulch. By the end of crop 2, shank injected treatments maintained 92 to 97% control compared to only 10% control with Paladin EC (1 or 2 drip tapes) and 83 to 88% control with Paladin EC + Vapam (1 or 2 drip tapes). At harvest time of crop 3, Palmer amaranth control with Paladin EC drip injected treatments was only 15%; the addition of Vapam to the system improved control to 80-85%. However, control with the standard was greater with 93 to 97%. The number of nutsedge plants infesting each bed followed trends in visual weed control and are also available in Table 4.

Table 4. Palmer amaranth response overtime to six fumigant systems as influenced by application method.\*

Fumigant system	Mulch Type**	Drip tape #	Palmer amaranth (at harvest of crop 1)		Palmer amaranth (at harvest of crop 2)		Palmer amaranth (at harvest of crop 3)	
			% control	# plant/plot	% control	# plant/plot	% control	# plant/plot
Paladin EC 45 GPA (inject)	TIF	1	10 c	16 c	10 d	17 c	15 c	17 c
Paladin EC 45 GPA (inject)	TIF	2	10 c	17 c	10 d	13 c	15 c	17 c
Paladin EC 45 GPA fb Vapam 50 GPA (inject)	TIF	1	90 b	2 ab	83 c	5 b	80 b	7 b
Paladin EC 45 GPA fb Vapam	TIF	2	83 b	4 b	88 bc	4 b	85 b	5 b

50 GPA (inject)								
Pic Chlor 60 21 GPA + Vapam 75 GPA (shank)	LDPE	1	100 a	0 a	92 b	3 ab	93 a	2 a
Pic Chlor 60 21 GPA + Vapam 75 GPA (shank)	LDPE	2	100 a	0 a	97 a	0.5 a	97 a	1 a
Non-treated	TIF	1	0 c	25 d	0 d	14 d	0 d	23 d
<p>*Data combined over Tift and Worth County locations in 2015 and 2016. Letters within a column followed by the same letter are not different at P = 0.05. Vapam at 50 GPA was injected prior to planting crops 2 and crops 3 for all treatments except the non-treated control.</p> <p>**Abbreviations: TIF = totally impermeable film; LDPE = low density polyethelyene film.</p>								

*Large crabgrass control:* Drip injected fumigant treatments of Paladin EC provided 40% or less control after the first crop when combined over locations (Table 5). The addition of Vapam to the drip injected system of Paladin EC improved control to 70% with either a single or double drip tape. Both systems were far less effective than the 100% control noted with the shank injected system. By the end of the second crop, shank injected treatments maintained at least 96% control compared to less than 63% control with Paladin EC and less than 76% control with Paladin EC + Vapam, regardless of drip tape number. At the conclusions of the third crop, Paladin EC drip injected treatments provided only 42 to 51% control; the addition of Vapam to the system improved control but only to 65-68%. The level of control with the drip injected systems was far below that observed with the standard shank system (98% control). The number of nutsedge plants infesting each bed followed trends in visual weed control and are also available in Table 5.

Table 5. Large crabgrass response overtime to six fumigant systems as influenced by application method.*					
Fumigant	Mulch	Drip	Large crabgrass	Large crabgrass	Large crabgrass

system	Type**	tape #	(at harvest of crop 1)		(at harvest of crop 2)		(at harvest of crop 3)	
			% control	# plant/plot	% control	# plant/plot	% control	# plant/plot
Paladin EC 45 GPA (inject)	TIF	1	25 c	50 c	34 d	75 c	42 c	60 c
Paladin EC 45 GPA (inject)	TIF	2	40 c	43 c	62 c	65 c	51 c	66 c
Paladin EC 45 GPA fb Vapam 50 GPA (inject)	TIF	1	70 b	18 b	66 bc	20 b	68 b	22 b
Paladin EC 45 GPA fb Vapam 50 GPA (inject)	TIF	2	70 b	15 b	76 b	18 b	65 b	15 b
Pic Chlor 60 21 GPA + Vapam 75 GPA (shank)	LDPE	1	100 a	0 a	96 a	1 a	98 a	3 a
Pic Chlor 60 21 GPA + Vapam 75 GPA (shank)	LDPE	2	100 a	0 a	98 a	1 a	98 a	1 a
Non-treated	TIF	1	0 d	64 d	0 e	112 d	0 d	99 d

\*Data combined over Tift and Worth County locations in 2015 and 2016. Letters within a column followed by the same letter are not different at P = 0.05. Vapam at 50 GPA was injected prior to planting crops 2 and crops 3 for all treatments except the non-treated control.

\*\*Abbreviations: TIF = totally impermeable film; LDPE = low density polyethylene film.

*Yield:* Crop 1 jumbo pepper yields were 25 to 50% less with Paladin EC drip injected systems as compared to the standard shank injected system when averaged over locations (data not shown). Yield was most heavily influenced by Palmer amaranth control and its influence on harvesting. The addition of Vapam into the Paladin EC system noted an increase in Palmer amaranth control and yield. For second and third crops within the multi-crop system, broccoli

and squash crops were harvested 12 to 15 times. Similar to the first crop, yield from the Paladin EC drip injected system noted yields 15 to 44% less than that noted with the standard system. However, the addition of metam with the Paladin EC system improved yields similar to those noted with the standard shank injected systems (data not shown)

**OBJECTIVE 3: *On Farm Studies.*** An experiment including improved drip injected systems (improved through learning with the small plot research) and the standard shank injected system were compared at two locations during 2016 and 2017. The most effective standard system remained the same throughout the life of the project. However, four drip injected fumigants were improved by altering three factors. First rates of the drip injected treatments were maximized for Paladin EC to 50 GPA and for Vapam to 75 GPA, 2) only two drip tapes were laid and they were 3) placed 12 inches apart at a depth of 5 inches (side by side) or they were placed in the center of the bed at a depth 2 inches and 9 inches (Table 6).

*Yellow nutsedge:* Control of 98% was noted at harvest with the shank injected system (Table 6). Control with Paladin EC injected through two drip tapes side-by-side or stacked noted 75 to 87% control; the side-by-side application was more effective. The addition of Vapam to the Paladin EC system improved control to 92 to 98%; again control with the side-by-side drip injected system was the more effective approach with control similar to that noted with the shank injected standard. The number of plants per plot (3 beds by 350 feet) noted 1442 plants per plot on average in the non-treated control. Less than 2 plants per plot were noted with the standard shank injected system and with the drip injected system including both Paladin EC and Vapam applied with the two drip tapes side-by-side.

*Pepper response:* No treatment visually injured pepper. Additionally, no treatment influenced pepper heights 48 days after transplanting. Pepper yields were maximized and similar among all fumigant systems and were greater than the non-fumigant control.

Table 6. Weed and crop response to five fumigant systems as influenced by application method.*								
Fumigant system	Mulch Type**	Drip tape #	Yellow nutsedge (at harvest)		Pepper injury and height		Pepper yield	
			% control	# plant/plot	visual injury (%)	cm tall at 48 day	#/plot	lbs/plot

Paladin EC 50 GPA (inject)	TIF	2 stacked	75 c	40 b	0	23 a	170 a	98 a
Paladin EC 50 GPA (inject)	TIF	2 side- by side	87 b	33 b	0	23 a	187 a	106 a
Paladin EC 50 GPA fb Vapam 75 GPA (inject)	TIF	2 stacked	92 b	7 a	0	21 a	173 a	98 a
Paladin EC 50 GPA fb Vapam 75 GPA (inject)	TIF	2 side by side	98 a	0.3 a	0	21 a	183 a	105 a
Pic Chlor 60 21 GPA + Vapam 75 GPA  (shank)	LDPE	1	98 a	1.8 a	0	21 a	194 a	106 a
Non-treated	TIF	1	0 d	1442 c	0	23 a	119 b	56 b

\*Data combined over Worth County locations in 2016 and 2017. Letters within a column followed by the same letter are not different at P = 0.05.

\*\*Abbreviations: TIF = totally impermeable film; LDPE = low density polyethelyene film; side-by-side includes two drip tapes 5 inches deep 12 inches apart on 32 inch wide bed top; stacked includes two drip tapes in the center of the bed at a depth of 2 and 9 inches.

**OBJECTIVE 4:** *Influence of application method on fumigates remaining in the soil profile.* A direct correlation with fumigant remaining in the soil over time and weed control was identified, ie the longer the fumigant stayed in the soil the better the weed control (Tables 5 and 6). In general, the greatest amount of fumigant remaining in the soil overtime was observed with shank injected systems under TIF film (Table 6). However, the greatest exposure to farm workers and communities actually occurs while standard shank applications are being made. Typically, growers will have at least 12 workers near the fumigant application equipment and this is the time where exposure is of greatest concern. With drip injected systems, no fumigant exposure is observed during the mulch installation process. Rather, exposure with the drip injected system usually occurs after the mulch/drip are installed and

most often consists of 2 highly trained individuals returning to the field site a few days later when other workers are no longer in the area. Although the most effective drip injected system notes slightly less soil retention of fumigants, the process of eliminating farm workers from the treated area is of great benefit. By improving the overall effectiveness of drip applications, growers have the ability to produce more crops effectively on a single laying of mulch thereby reducing the number of times fumigants need to be shank injected in a given field.

Table 6. Fumigant parts per million remaining in soil profile overtime after fumigating.*						
Fumigant system	Mulch Type**	Drip tape #	PPM			
			1 wk	2 wk	3 wk	4 wk
Paladin EC 50 GPA (inject)	TIF	2 stacked	15000 a	4445 b	15 5	3 d
Paladin EC 50 GPA (inject)	TIF	2 side-by side	15000 a	8488 ab	5238 c	1837 c
Paladin EC 50 GPA fb Vapam 75 GPA (inject)	TIF	2 stacked	15000 a	10202 a	7700 bc	7720 b
Paladin EC 50 GPA fb Vapam 75 GPA (inject)	TIF	2 side by side	15000 a	12580 a	12350 b	9445 ab
Paladin EC 50 GPA fb Vapam 75 GPA (shank)	TIF	1	15000 a	15000 a	15000 a	12250 a

\*Data combined over Worth County locations in 2016 and 2017. Letters within a column followed by the same letter are not different at P = 0.05. Gas measurements average over 4 samples per plot and 4 replications with a Mini-Rae 3000; maximum measuring amount is 15000 ppm.

\*\*Abbreviations: TIF = totally impermeable film; LDPE = low density polyethelyene film; side-by-side includes two drip tapes 5 inches deep 12 inches apart on 32 inch wide bed top; stacked includes two drip tapes in the center of the bed at a depth of 2 and 9 inches.

OBJECTIVE 5: *Dissemination of data results.* Results from this project have been shared using a diverse tactical approach and are described in detail as follows:

1. *Georgia Fruit and Vegetable Growers Association Annual Meeting* attended by over 3000 people in each year of the project (2015, 2016, and 2017). Individuals attending the meeting represent over 17 states. During each year, a presentation shared the results of the project (662 attendees). Additionally, in 2017 a poster was also presented.
2. *Extension Agent Trainings* occurred each year (2015, 2016, 2017) and were attended by over 62-68 county extension agents each year.
3. *Extension Grower County Meetings* (Brooks, Lowndes, Echols, Tift, Worth, Colquitt and Decatur) attended by 378 people during 2015, 2016, and 2017.
4. *Field days* 2015/2016/2017: 3 field days each year were held for extension agents, growers, and/or industry with an attendance of 178/93/108 people.
5. *Circulars:* the most effective fumigant systems were printed, laminated, and handed out to over 1000 individuals. The 2017 circular is available at [gaweed.com](http://gaweed.com) (on homepage) or can be provided upon request.
6. *Phone calls:* approximately 795 phone calls with vegetable growers, extension agents, and consultants regarding fumigant treatment applications have been documented over the projects life.

## **BENEFICIARIES**

Replacing methyl bromide has been a great challenge for Georgia vegetable growers as well as for those throughout the country. Growers, extension agents, and consultants have all benefited from this project by better understanding the most effective approaches for drip injected and shank injected fumigant applications. In Georgia, essentially all produce grown on mulch utilizes fumigants. Thus, improving fumigant application methods not only helps each grower operation but benefits their employees, the community, and their clients. Our efforts have not only shown shank injected systems are the most effective approach for the first crop but have improved activity of drip injected treatments for succeeding crops. With improved drip injected systems it may be possible for a grower to produce more crops on mulch prior to

removal. Specific numbers for those impacted by results of our study include the following (repeat of objective 5 below):

1. *Georgia Fruit and Vegetable Growers Association Annual Meeting* attended by over 3000 people in each year of the project (2015, 2016, and 2017). Individuals attending the meeting represent over 17 states. During each year, a presentation shared the results of the project (662 attendees). Additionally, in 2017 a poster was also presented.
2. *Extension Agent Trainings* occurred each year (2015, 2016, 2017) and were attended by over 62-68 county extension agents each year.
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6. *Phone calls*: approximately 795 phone calls with vegetable growers, extension agents, and consultants regarding fumigant treatment applications have been documented over the projects life.

## **LESSONS LEARNED**

The ultimate goal of drip injecting all fumigants in a mulched vegetable operation was simply not achievable in the limited time frame of this project. Shank injected fumigant systems are more effective because they allow us to place the fumigants at varying depths in the soil profile matching the location in which pests are located. Drip injection methods were improved monumentally from the beginning of the project until the conclusion. Improved drip fumigant applications followed the principle of placing the drip tape at the location in the soil that would maximize fumigant exposure with a pest. For the final study, the on-farm experiment, placing two drip tapes evenly spaced across a mulched bed at a depth of 5 inches more than doubled the level of control observed compared to current standard practices noted during the first two

years of the project. This information can be used to improve overall pest control for all vegetable growers using mulched cropping systems.

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**ADDITIONAL INFO**

none

**20. University of Georgia-Using Precision Irrigation Technology to Increase the Economic Competitiveness and Environmental Sustainability of Georgia Floriculture Producers– Final Performance Report**

**Project Summary**

This project was an extension of previous research conducted as part of a USDA-Specialty Crops Research Initiative Project (SCRI) ([www.smart-farms.net](http://www.smart-farms.net)) and a partially-funded 2013 Specialty Crops Block Grant (“Using Precision Irrigation Technology to Increase the Economic Competitiveness and Environmental Sustainability of Georgia Specialty Crop Producers”). The former USDA-SCRI project successfully developed new precision irrigation technology (Sensorweb) that was shown to reduce irrigation in specialty crop production systems by up to 83% (in controlled experiments), while maintaining excellent crop health. In this Specialty Crop Block Grant project, the Sensorweb precision irrigation system was trialed in a commercial floriculture greenhouse (Davis Floral Company, Dewy Rose, GA) to determine what benefits these types of systems may offer herbaceous annual producers. In this study water use, crop quality, and crop growth was monitored. Additionally, grower adoption was monitored with respect to the number of plants/crops that the grower was willing to incorporate into Sensorweb irrigation control. Two cultivars of *Euphorbia x pulcherrima* Willd. ex Klotzsch (poinsettia) and three cultivars of *Pelargonium x hortorum* L.H. Bailey (geranium) were produced in side by side trials over the course of two years comparing Sensorweb controlled irrigation with grower managed irrigation. Plant quality was equivalent between irrigation treatments across five crop cycles over the two years. Differences in average plant size were noted in four of the five trials between irrigation treatments, but in all instances these differences were not judged by the commercial grower to impact marketability of the crop. No reductions in irrigation water use were noted with the Sensorweb system, which differed from previous research in woody ornamental production. Over the course of two years the number

of plants for which Sensorweb controlled irrigation was scaled up significantly at the request of the grower. Managers at the facility found Sensorweb facilitated reallocation of labor from irrigation management, which was especially valuable during peak production periods. These labor savings, which reduced crop management time by 73.5%, were deemed the primary reason that the grower adopted the Sensorweb technology into their growing operation.

## **Project Approach**

### *Commercial partner and plant material*

Davis Floral Company (DFC) was selected to participate in the study based on willingness to adopt new technology, openness to allowing research to be conducted on site, and expressed interest in automated irrigation technology. Davis Floral Company is a commercial floriculture producer that utilizes gutter connected, polyethylene covered houses and produces primarily finished annuals and cuttings for the wholesale market. They are located in Dewy Rose, Georgia at 34° 09' 16.4" by -82° 56' 01.0", in USDA hardiness zone 8A. Five separate trials (e.g. production cycles) were carried out in 2014 and 2015 to compare sensor based automated irrigation to traditional irrigation management. All trials took place in two bays of a greenhouse with each bay measuring 44 m long by 21 m wide by 4 m in height. Plants were produced within the greenhouse either on a pad or on elevated wooden benches 1 m wide by 20 m long. Species trialed included three cultivars of geranium (*Pelargonium x hortorum*), and two different cultivars of poinsettia (*Euphorbia x pulcherrima*). Geranium and poinsettia cultivars were grown in 20.0 cm diam and 16.5cm diam containers respectively. All containers were consumer grade opaque plastic that were loose filled with commercially available peat-perlite based growing media (Metro-Mix 360, Sun Gro Horticulture, Agawam, MA).

### *Irrigation control and environmental data*

A soil moisture sensor based automated irrigation system, referred to as Sensorweb, and similar to systems employed to control irrigation in commercial nursery settings by Chappell et al. (2013), was used in these trials. Five soil moisture sensors (GS3, Decagon Devices, Pullman, WA) were distributed evenly throughout each crop and inserted with the metal prongs aligned vertically downward through the surface of the media. Sensors were connected to wireless nodes (nR5-DC, Decagon Devices) and provided readings of  $\theta$ , bulk electrical conductivity and soil temperature. Each wireless node was also capable of controlling a 12 – V DC latching solenoid valve (075-DV ¾ in. Rain Bird, Azusa, CA) that regulated the flow of irrigation water. Over the course of the 2 years, a total of four nodes were used to monitor and control  $\theta$  for 300 - 450 plants per node. One additional node was deployed as a dedicated weather station, monitoring environmental conditions within the greenhouse. Light levels were monitored using a PYR solar radiation sensor (Decagon Devices) and air movement through the house was measured utilizing a davis cup anemometer (Decagon Devices). Temperature and relative humidity were monitored using an EHT sensor (Decagon Devices) and cumulative

irrigation volume was monitored over the course of 2 years using eight DLJ SJ50 flow meters (Daniel L. Jerman Co., Hackensack, NJ). Nodes collected readings every minute and transmitted the averages back to a centrally located computer station every 20 min using a 900-MHz radio (XSC; Digi, Minnetonka, MN). Sensorweb software, previously developed by Carnegie-Melon University (Kohanbash et al., 2013), was installed on the computer station and provided monitoring and control capabilities. The software utilized a web based graphical user interface (GUI) that should be intuitive to most users and provided access both directly at the computer station and remotely over the internet. The GUI allowed growers to schedule irrigation and view data collected by the network, and is capable of extensive customization to meet business specific growing conditions, irrigation methods, and grower preferences. At DFC, after 7 d of monitoring, growers would establish irrigation thresholds based on sensor readings from the monitoring period, their experience with the crop and guidance from University of Georgia Extension Specialists. When average  $\theta$  readings fell below the programmed threshold, an irrigation event lasting 300 s was triggered. All plants were placed under drip tape rated at 1.36 L/h at 38 cm spacing (Space-It, Netafim, Fresno, CA). Fertilization for Sensorweb controlled irrigation was specific to each crop and was managed by the section grower to reflect fertilization rates of the grower irrigated section. Fertilization for geraniums used 12-2-14 Cal Mag + P (Plantex, Master Plant-Prod Inc., Brampton, ON) at 200 ppm N. For poinsettia production 300 ppm N of 20-20-20 (J.R. Peters Inc., Allentown, PA) was used from transplant until first bract color. Once bracts had colored fertigation was changed to 200 ppm N of 17-5-17 (Plantex, Master Plant-Prod Inc.). Plants were fertilized at every irrigation event triggered by the Sensorweb system utilizing dedicated injectors (DM14Z2, Dosatron, Clearwater FL) set to a 1 to 128 injection ratio.

Initial setup of the Sensorweb system occurred on week 14 of 2014 and was used to monitor but not control irrigation in a 'Fantasia Scarlet Improved' geranium crop. This initial monitoring period allowed growers to become familiar with the functioning of the system, and note soil moisture profiles generated by their irrigation management practices. Irrigation was first controlled by the Sensorweb system starting week 35 of 2014 in 'Prestige Red' poinsettias. Following the initial trial with poinsettias in the fall, three cultivars of geranium were trialed in the spring of 2015 starting on week 6. Poinsettia trials were scaled up and repeated in the fall of 2015 starting on week 35.

### *Data collection*

Growth indexes were calculated by taking the height of the canopy from the soil line and multiplying it by the width of the plant at its widest point and the width perpendicular to that point. Plant quality was assessed on a standardized 1-10 scale that was established at each sampling date, with 1 being a completely dead plant and 10 being a plant with vigorous growth, an attractive symmetrical habit and good foliar tone. Flow meter readings were taken at each sampling period and back calculated to determine total water use. For dry weights, canopies

were cut at the soil line at the end of each trial and dried at 85°C for 72 h and then weighed. For geranium trials, when plants were determined to be market ready by the grower, the number of flower stalks per plant were counted and used to determine the average number of flowers per plant. When poinsettias were deemed market ready, anthocyanin content index was sampled using an ACM-200 plus meter (Opti-Sciences, Inc., Hudson, NH). Bract area was determined at market ready by selecting three of the largest colored bracts per plant and measuring the leaf area using a leaf area index meter (LI-3000C, LI-COR, Lincoln, NE).

#### *Grower interviews and labor calculation*

Throughout the course of the 2 year study, DFC staff behavior and opinions of the Sensorweb system were documented. Semi-structured interviews were conducted at each sampling date with the owner, head grower, and section grower in which their impressions and comments about the system were noted. Two annual presentations were given in which results from the studies conducted that year were discussed and growers were formally asked for their input on the performance of the system. Grower use of the system, including establishment and re-assignment of irrigation thresholds during trials, was tracked. Informal conversations about the Sensorweb system and occasional trouble shooting were carried out on an as needed bases. The amount of labor required to care for plants in the SensorWeb irrigation zone versus the control (standard practices) zone was carried out using a stopwatch system that the grower started and stopped when performing any irrigation duties, which included manually/visually inspecting plants for soil moisture levels, hand-watering dry areas within the crop, monitoring Sensorweb performance via a computer terminal, etc.

#### *Experimental design and statistics*

All trials utilized side by side comparisons of Sensorweb controlled irrigation to that of grower managed irrigation. Irrigation treatments were treated as fixed effects when analyzing for treatment differences. For all trials, sample plots consisting of 125 plants were established in each irrigation treatment, from which 20 were randomly selected for evaluation for plant quality and growth indexes throughout the trial. Evaluations were performed every 14 d after the start of each trial. At market ready twenty plants were randomly selected for additional quality and dry weight measurements. R statistical software (R Foundation for Statistical Computing, Vienna, Austria) was used to analyze all data collected. Geranium flower counts, poinsettia bract size and anthocyanin content index readings, as well as dry canopy weights in all trials were examined using a two-way analysis of variance (ANOVA) comparing irrigation methods. Plant quality ratings and growth indexes were analyzed utilizing two way repeated measures multivariate analysis of variance (MANOVA) over the course of the trials. Irrigation setup was such that single flow meters were used to track water usage in each irrigation treatment for all geranium trials and the 2014 trial of poinsettia so that only direct comparisons of readings could be made. In 2015 expansion of poinsettia trials allowed instillation of

additional flow meters and replication of water use data which was examined using MANOVA analysis.

### **Goals and Outcomes Achieved**

#### *Goals:*

1. Quantify the impact of precision irrigation systems on the growth rate of plants and length of the cropping cycle.
2. Observe the affect on plant quality and marketability when using precision irrigation systems.
3. Determine the economic benefit of reducing production times when employing precision irrigation systems.
4. Evaluate the return on investment for precision irrigation systems.
5. Engage growers and Cooperative Extension agents on the operation, and benefits of precision irrigation systems in floriculture crop systems.

#### *Outcomes Achieved:*

*Note: Because results are intertwined among multiple objectives (above), to improve readability our results and discussion is not broken down by objective.*

#### *Geranium Crop Growth Results*

In all three trials conducted with geraniums in the spring of 2015, irrigation volume (gallons of water applied to a crop) as well as growth indexes were greater with Sensorweb controlled irrigation when compared to grower managed irrigation (Figs. 1, 2). In the first trial of 2015, a 'Fantasia Cardinal Red' crop was produced from week 6 to week 12. In this trial, the greatest differences in irrigation volume applied and growth index ( $p > 0.01$ ) were observed. By the end of the first trial, Sensorweb had used an additional 266.78 gal of total irrigation water, or 0.89 gal per plant (Fig. 1). Growth indexes (plant size) at the market ready stage averaged  $33.63 \pm 0.60 \text{ cm}^3$  in Sensorweb irrigated treatments, compared to  $29.55 \pm 0.51 \text{ cm}^3$  in grower irrigated treatments (Fig. 2). Flowering was also reduced as a result of irrigating with Sensorweb ( $p = 0.02$ ), with  $0.9 \pm 0.18$  flowers per pot produced with the Sensorweb system and  $1.7 \pm 0.27$  flowers per pot in grower irrigated crops (Fig. 3).

Based on results from the first geranium crop, the grower reduced the initial irrigation set point in 2016 crops (Fig. 1). An additional 85.76 gal of total irrigation water, or 0.28 gal per plant, were used by the Sensorweb system to produce the cultivar 'Fantasia Salmon' while an additional 86.26 gal, or 0.29 gal per plant, was used to produce the cultivar 'Fantasia Shocking Pink'. In cultivar 'Fantasia Salmon' (week 15 to week 20) Sensorweb irrigated plants had larger ( $p = 0.04$ ) growth index, averaging  $23.67 \pm 0.27 \text{ cm}^3$  at market ready compared to grower irrigated plants that averaged  $22.58 \pm 0.22 \text{ cm}^3$ . Sensorweb growth indexes were also larger ( $p = 0.01$ ) at market ready in the 'Fantasia Shocking Pink' (week 15 to week 21), averaging  $26.75 \pm$

0.37 cm<sup>3</sup> while grower-irrigated crops averaged and 24.63 ± 0.38 cm<sup>3</sup>. Flower counts were equivalent between the two irrigation treatments in both the 'Fantasia Salmon' ( $p = 0.49$ ) and 'Fantasia Shocking Pink' ( $p = 0.72$ ) (Fig. 3).

#### *Poinsettia Crop Growth Results*

Poinsettia production was trialed in both 2014 and 2015, with 'Prestige Red' used in both years and 'Christmas Day Red' added in 2015. In 2014 the Sensorweb system used 0.12 additional gal of irrigation water per plant, or 43 gal total, when compared to grower managed irrigation water use (data not shown). In 2015 the trial size and number of flow meters was expanded which allowed for statistical analysis of water usage between the two irrigation treatments. The Sensorweb system did not differ in its average water use on a per plant bases (3.10 ± 0.34 gal) when compared to the grower managed section (3.57 ± 0.27 gal) (fig. 4). In both 2014 ( $p = 0.74$ ) and 2015 ( $p = 0.79$ ) 'Prestige Red' poinsettias received equivalent plant quality ratings when comparing irrigation control by the Sensorweb system and the grower. Plant quality ratings were also equivalent in 'Christmas Day Red' poinsettias produced in 2015 ( $p = 0.34$ ). Equivalence of plant quality ratings were confirmed by bract anthocyanin content index readings that were also comparable across all three cultivar and year combinations (data not shown). Growth indexes were similar for 'Prestige Red' in 2014 ( $p = 0.16$ ) and 'Christmas Day Red' in 2015 ( $p = 0.53$ ) (Fig. 5). However, in 2015 the Sensorweb irrigated 'Prestige Red' had a smaller average growth index ( $p > 0.01$ ). At sale, Sensorweb irrigated 'Prestige Red' plants in 2015 had an average growth index of 48.82 ± 0.64 cm<sup>3</sup>, while grower irrigated plants averaged 52.27 ± 0.73 cm<sup>3</sup>.

#### *Water use and plant growth*

Increased water use was observed by the Sensorweb system in all geranium trials as well as the 2014 poinsettia trial (with equivalent water use in the 2015 poinsettia trial). While this was unexpected, it can be attributed to the approach that the grower took to manage irrigation. We allowed the grower to set irrigation thresholds (amounts) and control subsequent adjustments throughout crop development to track adoption and use of the technology. The grower consistently maintained substrate moisture levels in abundance or, in some cases, close to saturation. Interviews with Davis Floral personnel suggest that threshold management practices were the consequence of a combination of historical grower production preferences and a lack of awareness of how the Sensorweb system operated (despite repeated training sessions). Historical preferences for production were to maintain high levels of substrate moisture to act as a buffer against drought stress and to push crop growth. Grower perceptions of the Sensorweb system were such that they believed irrigation thresholds needed to be continually increased to match plant growth. This perception resulted in the continual upward adjustment of irrigation thresholds (and water use) by the section grower throughout crop production in all trials (Fig. 1). This management strategy makes intuitive

sense based on historical behaviors when using timer-based automated irrigation systems. In these systems, the only method of applying more irrigation is to increase the system run-time. The same behavior is not necessary when setting soil-moisture sensor-based automated irrigation. Nemali and van Iersel (2006) demonstrated that a similar soil moisture based irrigation system was able to maintain irrigation control as plants developed and their water usage changed without modification of irrigation thresholds. In previous studies employing the Sensorweb system, researchers controlled irrigation thresholds that were established based on best management practices, substrate physical properties and grower input. Once irrigation thresholds were established they would remain in place for the duration of the production cycle. High irrigation thresholds observed in this study may have contributed to results observed in the first geranium trial (2015) in which increased growth indexes and reduced flowering were observed in the Sensorweb grown crop. Increasing volumetric water content ( $\theta$ ) has been correlated with increased dry shoot weight and a reduction in flowers when combined with high fertility in petunia (*Petunia x hybrida*), (Alem et al., 2015b; Kim et al., 2011; van Iersel et al., 2010). Despite reductions in flowering in 'Fantasia Cardinal Red' and increased water use and growth indexes in all geranium cultivars, marketability of the Sensorweb produced crops was not impacted and plants were sold alongside those produced with grower managed irrigation. Similarly poinsettias produced in 2014 and 2015 by the Sensorweb system were pulled for sale at the same time as grower irrigated plants. Differences in the average growth index between Sensorweb and grower irrigated crops in the 2015 'Prestige Red' were not judged to impact marketability.

Alem et al. (2015) demonstrated that water deficit imposition utilizing a sensor based automated irrigation system could be used to regulate poinsettia height in a controlled setting. Findings from the study indicated that water deficit imposition could be a potential alternative to plant growth regulator (PGR) applications. Precise control of soil moisture contents afforded by the Sensorweb system allow for selection of irrigation thresholds so that mild drought stress could be imposed throughout crop development. In this study, growers established irrigation thresholds based on intuition and experience with the crop, which were too high to restrict crop growth and reduce the amount of plant growth regulator application. In conversations with the owner, head grower and section grower, researchers explained of the mechanisms of control of the Sensorweb system and how low irrigation thresholds could be used for water savings. However, upward adjustments to the irrigation thresholds continued throughout all trials conducted at Davis Floral Company. This is a significant difference in how the system had been used by researchers and how production managers may choose to use the Sensorweb system for irrigation management. This points to the need for an education and/or consulting component to sensor-based automated irrigation setup and operation. Some steps have been taken to provide grower-based knowledge on soil moisture sensor based irrigation systems through the USDA Specialty Crops Research Initiative funded Smart-Farms project (Chappell et al., 2015).

### *Grower perspectives*

At the request of the owner, greater implementation of the system occurred over the course of the two years. In fall 2014, the Sensorweb system controlled irrigation to 300 poinsettias and in fall 2015 this increased to 1800 plants. The owners and growers indicated they would have increased this number much higher, but the irrigation system in place limited the maximum number of plants that could be controlled with the system to 1800. This same trend was seen in the geraniums, with the initial trial controlling irrigation for 300 plants and later concurrent trials controlling irrigation for 1900 plants. This greater reliance on the system to control irrigation was seen as strong evidence of acceptance and successful transfer of the technology. In interviews with the owners of DFC they conveyed that the real value to the company of the Sensorweb system was the ability to free up labor during peak spring production periods, with labor tracking data supporting this claim. Water usage, while a consideration, was not a management priority due to the relatively low cost of water in the region. Moreover, DFC employed a number of efficient irrigation practices prior to this study, producing crops under drip lines in combination with irrigation shut off timers to regulate water application when irrigation was deemed necessary. They noted that section growers were often overwhelmed during peak production and “dry” growing practices that were historically observed were more often the result of neglect than good horticultural practice. The Sensorweb system provided a mechanism to completely automate irrigation, a task normally requiring frequent grower input and observation, allowing for greater distribution of labor throughout the operation. Posadas et. al (2008) reported a similar result when looking at increased automation in horticultural production practices, finding that automation did not lead to a reduction in labor force but instead more efficient allocation of that labor.

### *Economics of Sensorweb Adoption*

While it was somewhat surprising that Sensorweb-based irrigation did not result in water savings, due to the relatively low cost of water this had nominal impact of the system’s return on investment (ROI). In fact, when comparing the Sensorweb-grown plants and conventional irrigation practices-grown plants, there was no difference in any inputs (e.g. fertilizer, pesticides, plant growth regulators). However, there was a significant reduction in labor requirement needed to manage the crops, which is substantial as labor represents the greatest percentage of crop cost. Over the course of the study, labor was recorded in each trial and overall there was a 73.5% reduction in labor when plants were irrigated with the Sensorweb system.

Based on labor cost data provided by DFC, the average wage (including benefits) for a grower (who manages irrigation) is \$14.66 per hour. To standardize the labor required for irrigation management, we calculated labor on a per plant basis. Sensorweb irrigation required 2.3 seconds of irrigation management per plant over the course of a 8 week crop cycle. Over six

cropping cycles annually, this equates to 14.0 seconds. Conventional irrigation practices required 8.8 seconds of management time per plant over an 8 week crop cycle. Over six cropping cycles annually, this equates to 52.8 seconds. When assigning a monetary value to the time savings realized when employing the Sensorweb system in production of poinsettia, we first calculated the time savings per plant (6.5 seconds). Then we multiplied this rate by the average hourly wage (\$14.66) to determine a labor savings per plant of \$0.0265. Calculating per plant savings afforded us the ability to perform sensitivity analysis whereby the number of plants can be scaled up or down to predict cost savings. For example, a small grower would typically grow approximately 1,000 poinsettias (in a single irrigation zone) for holiday sales and at this number of plants the grower would see a savings of \$26.46 annually on this crop alone. However, when accounting for six production cycles annually in that same growing area (other seasonal plants such as geraniums), this number increases to \$151.82 annually. With initial system cost of \$2,500, payback period would be 16.5 years. These numbers can be contrasted with a moderate sized grower, which typically produces 10,000 plants per irrigation zone. In this case, annual savings on the poinsettia crop would be \$264.60. Including six cropping cycles in a single year, total annual savings would be \$1,587.60 and the associated payback period would be 1.57 years (19 months). Considering a conservative lifespan estimate of Sensorweb system components of 7 years, total system return on investment would total \$8,813.20 in the latter case.

### *Outreach*

As part of this project, we were tasked with engaging growers and Cooperative Extension Agents on the operation and benefits of precision irrigation systems. In doing so, we have conducted/participated in the following trainings where results of this study have been presented:

- August 13, 2015 – Georgia Farm Bureau 2015 Commodity Meetings – Update on Research into WSN development and implementation at ornamental producers across GA (poster presentation). Athens, GA.
- September 18-19, 2015 – Southern Region IPM Center, Nursery Crops Working Group Annual Meeting – The benefits of WSN irrigation in floriculture crops, with an emphasis on disease suppression and managing crop growth. Charleston, SC.
- October 14, 2015 – National Science Foundation; Food, Energy & Water Systems Roundtable – Reducing irrigation volumes using an inexpensive technology, and implications for nonpoint agricultural nutrient pollution in the next century. Alexandria, VA.
- December 1, 2015 – Kansas Green Industry Annual Convention (Keynote Address) – The future of water in U.S. agriculture, stretching a dwindling resource using technology. Topeka, KS.

- January 6, 2016 – UGA Cooperative Extension Agent Training - New Horticultural Resources for County Faculty to Assist Horticulture Clients (Growers and Homeowners). Athens, GA.
- March 31, 2016 – UGA Cooperative Extension Agent Training – Troubleshooting Horticulture Management Problems. Athens, GA.
- July 21, 2016 – Southern Region Nursery Crops Team (*On the Road Tour*) – Cultivar trials and maximizing irrigation efficiency in hydrangea crops in the southeast. McMinnville, TN.
- August 2, 2016 – Southern Region Nursery Crops Team (*On the Road Tour*) – Cultivar trials and maximizing irrigation efficiency in hydrangea crops in the southeast. Virginia Beach, VA.
- July 21, 2016 – Southern Region Nursery Crops Team (*On the Road Tour*) – Cultivar trials and maximizing irrigation efficiency in hydrangea crops in the southeast. Raleigh, NC.
- August 8, 2016 – American Society for Horticultural Science Annual Meeting – Precision irrigation in specialty crops: An update. Atlanta, GA.

In addition to formal trainings, we have also developed a number of publications related to precision irrigation technologies. These include:

Refereed Manuscripts:

1. Wheeler, W.D., J. Williams-Woodward, P.A. Thomas, M. van Iersel, and M. Chappell. 2017. [Impact of Substrate Volumetric Water on \*Pythium aphanidermatum\* Infection in \*Petunia xhybrida\*: A Case Study on the Use of Automated Irrigation in Phytopathology Studies](#). Plant Health Progress 18:120-125.
2. van Iersel, M., M. Chappell and P.A. Thomas. 2016. [Optimizing growth, quality, and profits through precision irrigation in ornamental plant production](#). Acta Horticulturae 1131.

Conference Proceedings:

1. van Iersel, M.W., M. Chappell, and P.A. Thomas. 2014. Precision irrigation in greenhouses and nurseries: Improving production and increasing profits. 56th Annual Horticulture Growers' Short Course 2014 Proceedings: 134-135.
2. Lea-Cox, J., B. Belayneh, J. Majsztrik, A. Ristvey, E. Lichtenberg, M. van Iersel, M. Chappell, W. Bauerle, G. Kantor, D. Kohanbash, T. Martin and L. Crawford. 2015. Demonstrated Benefits of Using Sensor Networks for Automated Irrigation Control in Nursery and Greenhouse Production Systems. [VIII International Symposium on Irrigation of Horticultural Crops](#).
3. van Iersel, M., M. Chappell and P.A. Thomas. 2015. Optimizing growth, quality and profits through precision irrigation in ornamental plant production. [3d International Symposium on Quality Management in Supply Chains of Ornamentals](#).

Cooperative Extension Publications:

1. Bayer, A., M. van Iersel, and M. Chappell. 2017. [What is a Weather Station and Can it Benefit Ornamental Growers?](#) University of Georgia Cooperative Extension Bulletin 1475.
2. Owen, J.S., A. LeBude, M. Chappell and T. Hoskins. 2016. [Advanced irrigation management for container-grown ornamental crop production](#). Virginia Tech Cooperative Extension Publication HORT-218P.

Popular Press Articles:

1. Thompson, C. 2015. [The Future is Now](#). (contributor) SouthScapes Spring 2015.

Self-directed Online Learning Modules (Note: these modules were developed as part of a USDA-SCRI Grant, in addition to this project):

1. Belayneh, B.E. 2015. [Sensor Installation and Calibration](#). *In*: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 10, 16p.
2. Belayneh, B.E. 2015. [Network Installations](#). *In*: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 11, 22p.
3. Belayneh, B.E. 2015. [System Maintenance and Troubleshooting](#). *In*: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 12, 11p.
4. Belayneh, B.E. 2015. [Using ECH2O Utility Software](#). *In*: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 13, 14p.
5. Belayneh, B.E. 2015. [Using DataTrac 3 Software](#). *In*: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 14, 20p.
6. Chappell, M., P. Thomas and M. van Iersel. 2015. [What is a sensor network?](#) *In*: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 1, 6p.
7. Majsztrik, J., D King, and E. Price. 2015. [Understanding the public benefits of sensor networks](#). *In*: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 4, 17p.
8. Majsztrik, J., E. Lichtenberg, and M. Saavoss. 2015. [Costs and benefits of wireless sensor networks](#): How a sensor network might benefit your operation. *In*: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 2, 18p.

9. Majsztrik, J., E. Lichtenberg, M. Saavoss, E. Price, D. King. 2015. [Return on Investment: Deciding if a sensor network is right for your operation](#). *In: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 3, 15p.*
10. Majsztrik, J., A. G. Ristvey and J.D. Lea-Cox. 2015. [Production system modeling](#). *In: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 20,15p.*
11. Ross, D.S. 2015. [Basic Irrigation Concepts](#). *In: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 5, 26p.*
12. Ross, D.S. 2015. [Irrigation System Design and Components](#). *In: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 6, 29p.*
13. Ross, D.S. 2015. [Irrigation System Audits](#). *In: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 7, 33p.*
14. van Iersel, M. and M. Chappell 2015. [All about sensors](#). *In: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 8, 17p.*
15. Bayer, A. and M. van Iersel. 2015. [Weather Stations](#). *In: Managing Irrigation through Distributed Networks Knowledge Center, M. Chappell, P. Thomas and J.D. Lea-Cox (Eds.). Module 9, 17p.*

### **Beneficiaries**

There are currently 773 commercial ornamental producers (businesses) in the state, based on live plant licenses issued by the Department of Agriculture. Due to the fact that labor savings was identified as a primary benefit of installing and operating a precision irrigation system, and all growers rely on labor to produce crops, one can assume that all growers have the potential to benefit from this system. USDA-NASS survey data (2012) indicated 8.1 million square feet of floriculture production in Georgia. Making the assumption that one plant is grown per 1.5 ft<sup>2</sup> (a conservative estimate) over 5 annual production cycles, a total of 27 million plants can be grown per year by floriculture growers. Using the per plant labor savings rate of \$0.0265 (see *Economics of Sensorweb Adoption* section above), if only 10% of total production implemented precision irrigation systems, labor savings statewide would total \$71,550 annually. If 50% of growers adopted precision irrigation technologies, annual economic return would total \$357,750. Full (100%) adoption would see estimated statewide economic impact of \$715,500.

### **Lessons Learned**

We encountered no delays with this project. In fact, we completed data collection 10 months ahead of schedule due to our ability to assess four crops annually (we initially thought we would only assess two crops annually). While not a 'lesson learned', from an accounting perspective researchers and the UGA business office had a miscommunication that resulted in a large amount of grant funds going unspent. These funds were allocated toward graduate student salary and as a result could not be reallocated. The UGA-CAES business office is undergoing restructuring, and the UGA Horticulture Department has a new accountant, which hopefully will prevent such things from happening in the future.

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**Additional Information**

*Tables and Figures below*

Figure 1. Comparative total irrigation water use in the production of three cultivars of *Pelargonium hortum* by a soil moisture sensor based automated irrigation system (Sensorweb) and traditional hand irrigation. Cultivars 'Fantasia Cardinal Red' and 'Fantasia Shocking Pink' were grown over 42 d periods while 'Fantasia Salmon' was produced over a 34 d period. Dotted vertical lines represent irrigation thresholds established by the grower. Water usage was not reduced using the Sensorweb system.

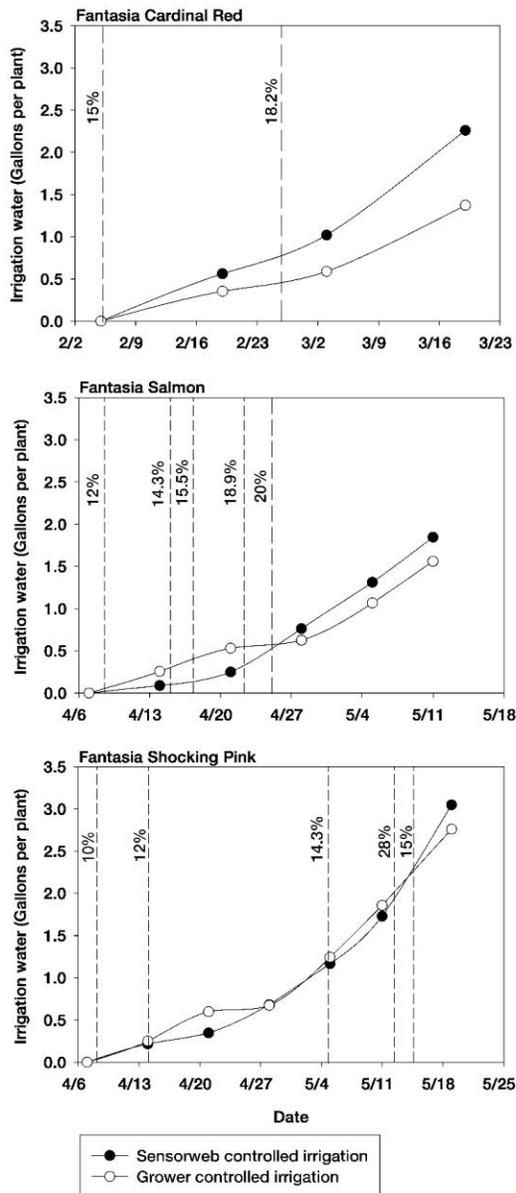


Figure 2. Average growth indexes of *Pelargonium x hortum* cultivars ‘Fantasia Cardinal Red’, ‘Fantasia Salmon’, and ‘Fantasia Shocking Pink’. Cultivars ‘Fantasia Cardinal Red’ and ‘Fantasia Shocking Pink’ were grown over 42 d periods while ‘Fantasia Salmon’ was produced over a 34 d period.

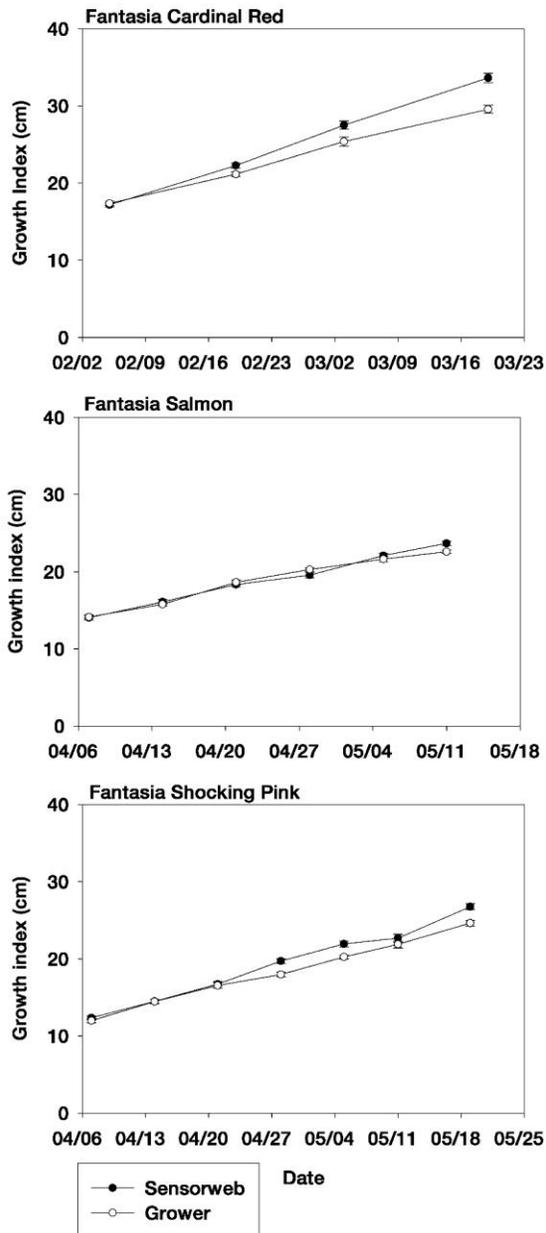


Figure 3. Average number of flowers per pot for three geranium species grown with a soil moisture sensor based automated irrigation system, referred to as Sensorweb, as compared to grower managed irrigation. Cultivars 'Fantasia Cardinal Red' and 'Fantasia Shocking Pink' were grown over 42 d periods while 'Fantasia Salmon' was produced over a 34 d period.

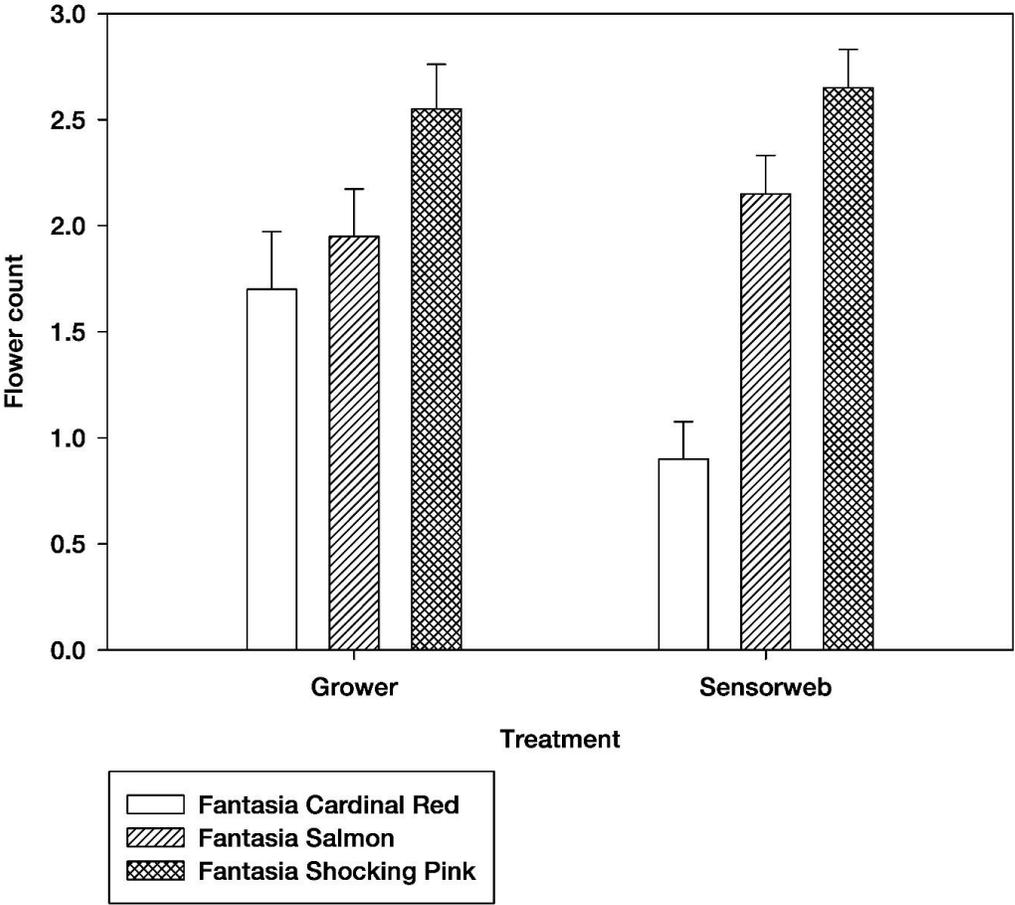


Figure 4. Average cumulative irrigation water usage per plant in the production of *Euphorbia pulcherrima* 'Prestige Red' and 'Christmas Day Red' by a soil moisture sensor based automated irrigation system (Sensorweb) and grower managed irrigation.

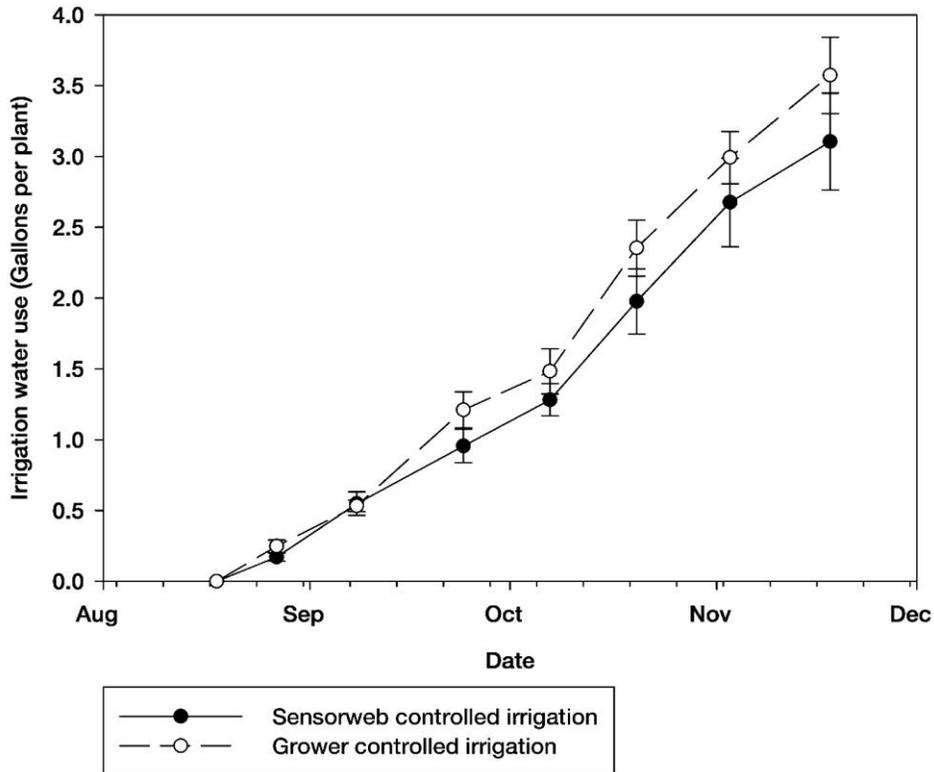
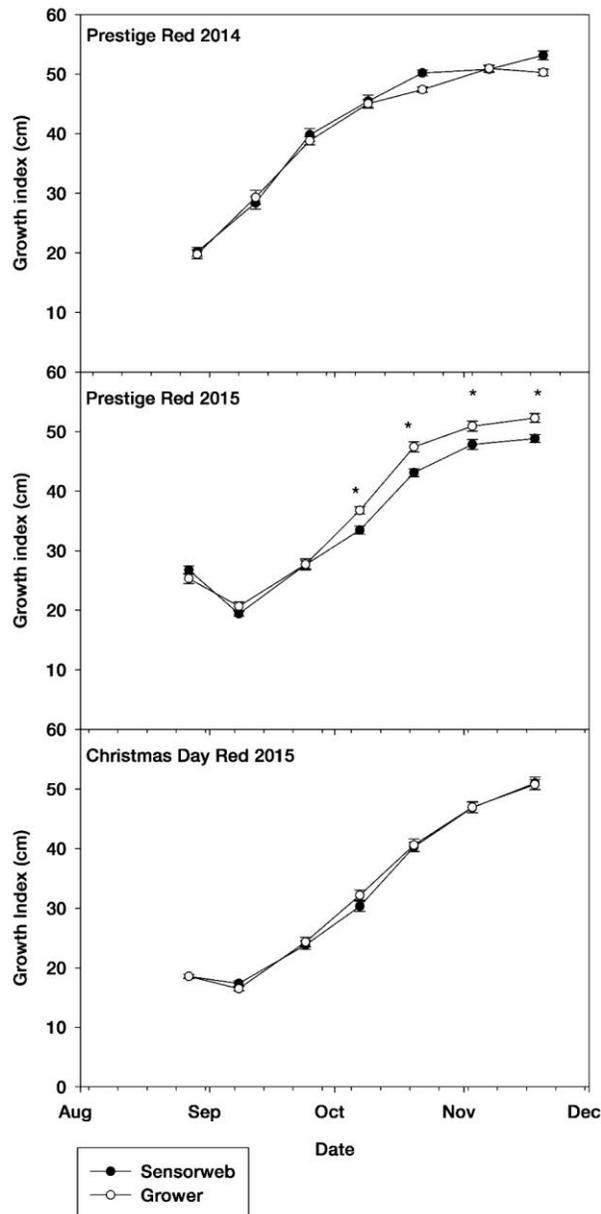


Figure 5. Average growth indexes of *Euphorbia pulcherrima* 'Prestige Red' and 'Christmas Day Red' in 2014 and 2015 grown with a soil moisture sensor based automated irrigation system, referred to as Sensorweb, and traditional section grower controlled irrigation. Growth indexes were calculated finding the product of the height of the canopy from the soil line, width of the canopy at its widest point and the width ninety degrees from that point.



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## **21. Vidalia Onion Committee-*V is for Vidalia*– Final Performance Report**

### **Project Summary**

This grant is Phase I of a two-phase campaign entitled, “V is for Vidalia.” The main objective of this campaign was to reach a younger audience of consumers aged 21-45. Consumer research has revealed that only 8% of consumers age 18-25 have purchased Vidalia Onions in the past year and this has declined by several percentage points since 2006, especially with consumers age 26-45.

The campaign theme and image has been designed to educate the target consumer audience on the benefits and versatility of Vidalia Onions in an effort to increase purchase and build brand loyalty. The Vidalia Onion Committee (VOC) also seeks to provide more tools and resources to retailers in an effort to improve performance at the store level.

This past season’s campaign was very successful in reaching a younger consumer audience. In fact, 61% of the visitors to the VOC’s web site were aged 21-35 and the site had a 21% increase in total visitors this past year with 16% more page views compared to the previous year. The VOC increased its social media fans and followers across all channels from Facebook to Twitter and Pinterest. 43% of Facebook followers to the VOC’s page are now age 18-44.

Last year, the VOC updated the retailer section of the web site adding more information and resources for retailers including merchandising best practices, POS order form, downloadable graphics and category sales data research. The retailer section of the site generated 6,424 page views in 2015 (12% increase from the previous year). In addition, the monthly crop report which is sent to retailers nationwide was viewed by 5% more retailers compared to last year. This includes produce buyers, directors and category managers from both regional and national chains.

### **Project Approach**

The Vidalia Onion Committee (VOC) created a hip, energetic campaign, combined with increased digital and social media activities to reach a younger generation of Millennial and Generation X consumers in order to establish their long-term loyalty for Vidalia onions. Consumer promotions included a season launch event with a Golden Onion Chef competition in which chefs from throughout the state of Georgia competed for a trophy. The event was held

during the annual Vidalia Onion Festival in partnership with Georgia Tourism and the Georgia Restaurant Association.

Additional marketing tactics included a digital coupon and weekly give-a-ways on Facebook (*not paid for with grant funds*); monthly Twitter parties, consumer advertisements including magazines and geo-targeted ads on Facebook, trade advertisements; public relations activities and increased social media outreach via Twitter, Instagram and Pinterest. The VOC also partnered with nine food bloggers from across the country that contributed with over 150 social media posts and 14 blog posts showcasing 13 unique recipes highlighting the versatility of Vidalia onions. A blogger dinner was held in Atlanta with an additional 13 food bloggers who generated 81 social media posts and seven blog posts. A total of six press releases were distributed to the trade and consumer media.

Retailer activities included point-of-sale materials, updating the newly improved retailer section of the VOC's web site, and a monthly crop report which included marketing and merchandising information. In addition, we surveyed retailers from across the country to obtain their feedback and insights regarding Vidalia onion sales performance, merchandising and promotional activities. These insights will be used to drive future retail marketing programs.

### **Goals and Outcomes Achieved**

- 1) Goal: sustain Vidalia onion sales by increasing the number of coupons redeemed.

For the fifth year in row, a coupon was posted to the VOC's Facebook page with \$.50 off 5 pounds or more of either bulk or packaged Vidalia onions. To promote the coupon, geo-targeted ads were posted on Facebook to the target audience of millennial consumers. (*Note that coupons were not funded with grant funds*)

The Facebook page received 12,873 impressions/clicks to the coupon to download it on the page and 6,400 visitors actually printed the coupon. The result is that the VOC redeemed 5,655 coupons in 2014 and this decreased to 5,021 in 2015. As more and more coupons are now being posted online, it's becoming more difficult for the VOC's Facebook coupon to stand out in the crowd. Therefore, the VOC is researching other options for the 2016 coupon program including coupons that can be accessed via mobile phone.

- 2) Goal: Reach a younger demographic on social media and increase social media fans/likes by 5%.

To accomplish this goal the VOC increased its social media efforts on Facebook and Twitter and partnered with food bloggers to have them post on their social media sites. Here are the results and stats:

#### 2015 VOC Facebook Page Stats

- 59,817 page likes/followers - 6% increase over the previous year
- Over 3,000 shares and comments on posts
- Over 4,800 likes on posts
- Over 447,000 consumer impressions
  - 18% of Facebook followers are ages 18-34
  - 25% of Facebook followers are ages 34-44

#### Facebook Advertising

- 15 unique ads were sent during the Vidalia season
- Ads geo-targeted younger consumers age 18-34
- \$1,700 in total ad spend
- Reach of over 58,000 consumers
- For every \$1 spent, 35 people were reached

#### 2015 Twitter Page Stats:

The VOC held four Twitter parties during the season. The parties were hosted by 2-3 bloggers and featured the versatility and benefits of Vidalia onions.

These events had the following results:

- 10% increase in followers compared to the previous year
  - 255 original tweets
  - Over 51,000 organic impressions
  - Approximately 559 per day
  - 364 favorited tweets
  - 336 retweets
  - Reach of 892,900
- 772 mentions by other profiles
  - Reach of 665,800
- Over 2,700 tweets using #VisforVidalia hashtag

- Over 6.9 million impressions
  - The Vidalia Onion Committee partnered with nine individual bloggers during the season. Their total social media stats were:
    - Total Facebook followers: 115,232
    - Total Twitter followers: 36,165
    - Total Pinterest followers: 120,390
    - Total Instagram followers: 21,249
  - The results included the following:
    - Bloggers contributed over 150 posts to their social media sites (see above total stats)
    - Bloggers created 14 individual blog posts to their blog sites
    - They contributed 13 unique recipes
    - All used social media hashtag #VisforVidalia
- 3) Goal: Increase website visitors by 5%. The VOC tracked number of visitors to the website along with the visitor demographics to determine the consumer audience.

To date in 2015, the VOC had a 21% increase in web site visitors with 16% more page views compared to 2014. The younger consumer audience represented the largest number of visitors to the web site:

- 27.5% of visitors were age 18-34
- 33.5% of visitors were age 25-34

In addition, the newly created retailer section of the web site was launched in 2014 to provide retailers with a variety of resources including merchandising tips, sales data research results, a POS order form and downloadable campaign graphics. The retailer section generated 6,424 page views in 2015 (12% increase from the previous year).

- VOC's Crop Report was sent out monthly from April – August to 1,200 retailer contacts. Representatives from the following retail chains opened the report (5% increase in the number of contacts from the previous year).

Kroger Corporate	Wegmans	AWG
Sams Club	Safeway	Marsh
Ahold USA	Ralphs	Roundys
Delhaize	Stater Bros	Brookshires
Hy-Vee	Fred Meyer	Gelsons
Supervalu	Hannaford	Frys
King Soopers	Save-a-Lot	Food Giant
Food Lion	Wakefern	Dahls Foods
Stop & Shop	Dierbergs	Mars Supermarkets
BJ's Wholesale Club	Topco	
Metro Canada	Foodland	

#### Additional Results:

##### Trade and Consumer Public Relations:

- Total of 6 Press Releases Distributed This Season (Consumer & Trade)
- Trade articles were included within the following publications: The Packer, Produce News, Perishables News, Produce Business, Grocery Headquarters, Fresh Plaza
- PR Consumer Newswire Release (June 2015)
  - Distributed on 171 websites
  - Potential reach of 20,240,000

##### Golden Onion Chef Competition

- The VOC partnered with the Georgia Restaurant Association and Georgia Tourism on the 4<sup>th</sup> annual Golden Onion Competition in which chefs from the state of Georgia competed to win the Golden Onion Trophy Award.
- The previous events were too insular and did not engage the consumer audience
- The VOC hired Atlanta based radio and TV personality Mara Davis to be the emcee for the event
- In addition, for the first time, local culinary students competed in a Georgia Mystery Basket Challenge
- For the ticket price of admission, food and open bar (*not paid for with grant funds*) were made available for attendees
- Overall the attendance and feedback from the event was very positive

##### **Beneficiaries**

This project impacted the 100+/- growers and packers of Vidalia onions by providing an efficient, enticing, customer-friendly, integrated retail and consumer marketing program to

promote their product. It also impacted the state, as Vidalia onions are the official state vegetable of Georgia and bring in substantial revenue.

According to The University of Georgia College of Agricultural & Environmental Sciences 2014 Georgia Farm Gate Value Report, the farm gate value of onions did increase substantially in 2014 compared to 2013 as shown by this total comparison

- 2013 Farm Gate Value of Onions – \$93,104,185
- 2014 Farm Gate Value of Onions - \$138,255, 865

This project also impacted supermarket retailers. An online survey was sent out to retailers from across the country. A total of 16 retailers responded and some of their feedback includes:

*“I like the Marketing programs associated with Vidalia onions.”*

*“Love the Vidalia onion marketing campaigns.”*

### **Lessons Learned**

The VOC’s Facebook coupon received a decrease in the number of redemptions compared to the previous year. As more and more coupons are now being posted online, it’s becoming more difficult for the VOC’s Facebook coupon to stand out in the crowd. Therefore, the VOC is researching the option of implementing a mobile coupon in 2016 to not only reach a more targeted audience of consumers but also to increase sales with the total number of coupon redemptions.

For the first time, the VOC hosted the annual Golden Onion Chef Competition during the Vidalia Onion Festival to celebrate the season launch. Although the event was very well received from both the chefs and consumer audience, the VOC has decided not to host this event in 2016. The lesson learned was that the expenditure far outweighed the results in terms of investment in reaching a younger consumer audience. This event also required a lot more planning and staff time than originally anticipated. These funds can be better spent on other marketing activities that will have a greater consumer reach.

### **Contact Person**

Bob Stafford, Executive Director, Vidalia Onion Committee  
100 Vidalia Sweet Onion Drive, Vidalia, Georgia 30475

**Additional Information:**

None

**Vineyard and Winery Association of West Georgia-Vineyard and Winery Initiative for West Georgia– Final Performance Report****Project Summary**

*The purpose of the 2014 SCBG awarded to the Vineyard and Winery Association of West Georgia (VWAWG) was to **continue** the growth of the winegrape industry in Georgia.* We provided educational events for the public who want to get involved in the vineyard and winery industry. Our organization was formed in 2010 as a non-profit agriculture education association to promote winegrape growing in the state. We were able to start this educational service with a 2011 SCBG. With no vineyard experts on the staff at the University of Georgia, we had to bring in experts from across the country for symposiums and field days. Topics for the 2014 events included; selected varieties to grow in different parts of the state, soil preparation, trellises and installation, spraying, pruning, grape processing and wine making. State Revenue Department officials were brought in to go over all the regulations and needed permits at the local, state and Federal levels.

The last three to four years we have seen the impact of our efforts all over the state. Our members and others have planted vineyards from the Tennessee line to the coast near Savannah. Since 2013, there have been 27 new wineries opened in Georgia. The 50 plus wineries now open have an economic impact of \$40 million yearly according to the recent report put out by the University of Georgia.

**Project Approach**

As we got into 2015, we started to change our approach a little on what we did as a result of our early successes: We started having symposiums and field days in 2011 and spent most of our money on bringing experts from all over the country. Due to our early progress in getting members and growers, many non-university experts such as viticulture consultants, winery startup companies and wine making consultants started coming to help cultivate new clients. As the association looked forward to what was needed long term, we decided to focus on outreach opportunities to get in front of more existing farm owners, in particular the ones that might be looking to diversify, such as other fruit growers (blueberry, blackberry, peach, apple, strawberry). We also reminded them that they can take their lower quality fruit not suited for fresh fruit sales and turn that into wine and actually make more from the blemished crop rather than just jelly. We saw the need to get in front of the owners of larger farms that might plant more commercial size vineyards. This is important if we are going to produce enough grapes to grow the industry. Many of our early growers planted only 1 to 4 acres, and are not full time farmers.

We started going to the larger Agriculture shows and conventions with our display booth. This included going to; The Southeast Regional Fruit and Vegetable Conference in Savannah every January and to the Sunbelt Ag Expo in Moultrie, Georgia, every October.

Our best successful example of this outreach approach is our association member in South Georgia near the Florida line that planted 18 acres of grapes a few years ago, and opened his winery this past year.

### **Goals and Outcomes Achieved**

- Our *primary goal* was to provide detailed information to the public to help them make informed decisions about getting into the vineyard and winery business, presenting all the risks as well as potential rewards. We've had over 500 people attend our Southern Winegrape Symposiums. In addition to our annual symposiums, our yearly planting and pruning field days give on farm demonstrations of actual skill sets needed.
- **Number of people attending our educational events:**
  - 524 from 23 Georgia counties and four other states have attended our Southern Winegrape Symposiums.
  - 143 have attended vineyard planting field days.
  - 161 have attended our pruning field days.

Of the number attending the symposium, only about 15% pursued planting vineyards. We consider this a good number because so many came in with the romantic vision of the industry. It is our responsibility to present all the information about startup cost, labor needed, licensing, and pressures from disease, drought and insects.

The above 15% positive response to our efforts confirms our original goal of providing as much total information up front to the public as possible where they can make an educated decision on a somewhat risky venture of large amounts of capital and time.

Our *additional goal* was to continue to provide education to the members who decided to plant vineyards to help ensure their success. We are not about just getting numbers and getting grapes planted. For the industry to grow, these people have to be successful, so long after the vineyards are in production and wineries are open we continue to bring-in needed experts to further our efforts as part of "continued education." Over the last two years we have expanded the symposium to breakout sessions because about 40% of attendees already have established vineyards and many also have wineries, so they needed mostly wine making and marketing information. The other 60% are new so we still present the basic startup presentations for them. *One of our other goals*, along with adding new members and growers, was to involve the whole agriculture related community to help us succeed. As part of our outreach goals, in 2016 we had a booth at the Sunbelt Ag Expo in Moultrie, GA. We signed up five new members, but equally important, we gained three new long term corporate sponsors that sell products our members need (sprayers, pruning tools and chemicals). The association booth has been set up at 15 agricultural events by the Association Executive Director (ED). This is part of what the salary component of the grant was used for. The other salary funds were used to have him organize meetings, lay out booth exhibits and compose handout materials. The ED also helped members locate over 30,000 vines to plant, and found buyers for members, grapes and bulk wine.

The *original long term goal* in forming the association in 2010 was to restart the grape and wine industry here in Georgia. Before prohibition, they were over 20,000 acres of vineyards in West Georgia alone. These contributed to Georgia being one of the top four grape and wine growing states in the country by 1899. The first few years of our association were trying to gauge the interest in this specialty crop. After getting a much larger response than we anticipated, we applied for the 2014 grant to take this initiative up a level. We are not sure if our association efforts are solely responsible for the huge expansion of the wine industry in Georgia but we no doubt had a large impact. We accomplished our goal of restarting the grape and wine industry in West Central Georgia, as five wineries will be open by late 2018. These are the closest group of wineries to Atlanta.

- In 2010 when we started the Association there were 16 wineries in the state and in 2017 there are now 58 wineries in Georgia.
- In 2010 there was a small wine association with 8 members in the mountains. Our first two years as an association we signed up 154 members.
- In 2014 the Vineyard and Winery Association's Executive Director Douglas Mabry co-founded a new Georgia Wine Producers group. In 2015 he also founded the Georgia Trustees Wind Challenge State Wine Competition to bring attention to Georgia wines.

### **Beneficiaries**

The Vineyard and Winery industry has some of the same *economic benefit* as other specialty crops – the start-up cost in plants, equipment and labor. But the one huge additional year-round economic factor that wineries produce for local business is agritourism.

- Vineyard startups are about \$12 - \$14,000 per acre (site prep, vines, posts, wire, irrigation and labor) then the additional cost for a tractor, air blast sprayer, chemicals, ATV type vehicle. All of which is spent with local suppliers. Winery buildings and tasting rooms add a great deal of economic benefits for local building contractors. At an average winery cost of about \$400,000.00 along with the per acre vineyard cost, a great deal of money has been spent getting started with many businesses.
- The Vineyard and Winery Association has spent funds on printing, displays, venue rentals, tasting events and travel expenses for speakers.
- We also sent membership fees into: Georgia Grown, Georgia Wine Producers and Georgia Fruit and Vegetable Growers Association. We have a display both at all these organization conventions, and they in turn all sponsor one of the superlative awards at the state wine competitions banquet. We have cultivated a strong partnership with these groups to help grow the industry.
- The winery business is so new here that only one basic study statewide of the economic impact has been done. The University of Georgia did one in 2015 that showed an economic impact of over 40 million dollars since that report, about 19 new wineries have opened up so that figure would easily be 60 million dollars or more.

- Our association member wineries are so new not much data has been accumulated yet. The one winery we have the most information on is Little Vine Vineyards about 40 miles West of Atlanta. They were the first of our group to open 2.5 years ago. They are open only three days a week but in the past 30 months they have had over 18,000 visitors from 23 states. Many of them staying in local hotels and eating in local restaurants. The winery has live music every Friday and Saturday night and has spent over \$27,000 on local musicians. They also carry cheese from two local national award-winning creameries, as well as local craft beer. The other West Georgia wineries that have opened in the past 14 months also hire the same musical groups and are outlets for the local beer and cheese. Local food trucks now serve these wineries several times a month. Weddings and other special events are starting to be booked more and more, increasing revenue for area caterers. The whole basis of forming the Association in 2010 was to restart the winery business to draw tourists. The Association has reached out to the other area tourism attractions to start promoting tour packages, as we are only forty miles west of 5 million people in Atlanta. Three of the wineries in West Central Georgia are within fifteen miles of the Villa Rica Gold Mine Museum and park, The Southeastern Quilt and Textile Museum, and Historic Banning Mills Executive Retreat and Paper Mill Museum (they also have the world's longest zip-line course). One example of partnering, is Banning Mill has started a package deal that includes lodging, meals, zip-line and a free tasting at a local winery. They call it the "Zip & Sip" package. *It will take another year or so before we have a lot of hard data on the economic impact of our efforts.* From planting to pouring, takes several years, then another year or so to collect total ripple effect numbers. The "ripple effect" of economic benefits to a community with a winery in it, is tremendous.

### **Lessons Learned**

We have learned the needs of our members and our priorities have changed as the industry grows statewide. Dozens of people are planting new vineyards each year and Georgia, on average, is opening 8 to 9 new wineries a year. This is as we learn more and more each year about what strategies and best practices we need to expand on. We have added to our outreach efforts to get in front of more potential growers. Many farms with other crops have no idea that winegrapes will even grow here until we get in front of them at farm trade shows and conventions.

### **Contact Information**

Douglas Mabry  
Executive Director VVAWG

### **Additional Information**

Our original goals and needs shifted as the industry grew each year. The first few years our greatest expense was from flying in top speakers, so our largest budget request was for travel in the 2014 grant. A lot of our expert speakers started realizing the growing potential for vineyard and winery business here. They started becoming corporate members and event sponsors to help cultivate new clients for their services like, viticulture advisors,

winery layout, planning and wine making as well as marketing groups. We did a budget change request in 2017 to shift funds mostly from travel to more outreach expeditors. We also needed a weather station for our experimental vineyards that we partner with on the University of Georgia. We ordered two new pull up banners, a color tablecloth with our logo and name on it, new color brochures, and new display boards, which are for the free exhibit space we have at the I-20 Visitor Center near the Alabama State line. We get free exposure for the Georgia Wine Industry in front of 2.4 million visitors that stop there per year.