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Agricultural Education Courses Taught in Across the United States

Joseph Jones, Ami Harrington, Mary Logan Tostenson, Barry Croom

In recent years, there has been a decrease in the number of students that know what field of work they want to pursue upon graduating high school (Brand, 2009). Vocational Agricultural Education has a positive impact on students' college and career readiness and helping students form a better understanding of what they want to do in both college and the work force (Marx, Simonsen and Kitchell, 2014). This study primarily focused on Agricultural Education courses currently taught in secondary education throughout the United States, consisting of grades 9th through 12th. Areas of study in high school agricultural education would include Animal Science, Plant Science, and Agricultural Mechanics; subareas are covered within disciplines. The purpose of this study was to complete a census of the curriculum taught in Agricultural Education across the United States. To date, 1118 agricultural courses have been located and recorded, representing all 50 states. After analyzing the data, results led to a better understanding of what states could add to their programs and what states were thriving in all agricultural education areas. Through data collected from each state, we found many states offer more classes in one area of study rather than an equal distribution of classes in all areas of study. The driving idea is we need students who come out of high school that are agriculturally literate and able to understand all parts of agriculture.

Aflatoxin Suppression in Stored Corn by Managing Maize Weevils and Introducing an Exogenous Molecule

Sarah Hobby, Pablo Delclos, Jeff Tomberlin, Michael Toews

Aflatoxin, a carcinogen produced by the fungi *Aspergillus flavus* and *Aspergillus parasiticus*, occurs naturally in stored grains and is a worldwide menace to people and animals. Symptoms of aflatoxin exposure in people and livestock include stunted growth, delayed development, liver damage and cancer. Maize weevil infestations in the stored corn increase moisture and further exacerbate aflatoxin production. Research shows that highly conserved molecules used for bacterial and fungal communication also regulate corresponding behavioral and physiological responses. The objective of this project was to demonstrate how introduction of an exogenous quorum quenching compound (QQC) could prevent expression of aflatoxin in stored maize. Highly conserved exogenous molecules were introduced into glass jars containing high moisture stored corn with or without maize weevils. Treated jars of corn were held in environmental chambers at high temperature and humidity that favor aflatoxin production. Representative jars were removed from the chamber weekly and analyzed for aflatoxin contamination using the AflaTest columns. Results indicate that the presence of weevils and the absence of at least one exogenous molecule significantly increased aflatoxin production compared to jars that did not receive the weevils or the exogenous molecule. These results strongly suggest that aflatoxin production in grain stores could be reduced by managing maize weevil infestations and by use of the QQC.

Cucumber Tolerance to Glufosinate Applied Preplant or Preemergence

T.M. Randell, J.C. Vance, A.S. Culpepper

Cucumber production in Georgia ranks third nationally, with a state value of $70 million and roughly 3,300 ha planted annually. Production is split evenly between plastic mulch and bareground systems, however herbicide options are limited in both systems for preplant and preemergence use. Glufosinate, a broad-spectrum nonselective herbicide, would be a useful tool for producers to achieve weed-free fields at planting if use did not exceed crop injury threshold of 10%. Studies were conducted during 2017 and 2018 to address transplant and seeded cucumber tolerance to preplant and preemergence glufosinate. Experimental design was a split-plot design with glufosinate rate (0, 328, 656, 984, or 1,640 g ai ha^{-1}) as the whole-plot and irrigation option (irrigation following glufosinate application or no irrigation) as the sub-plot. For seeded cucumber, results indicated potential injury could be reduced to less than 10% by irrigation following preemergence glufosinate applications with no subsequent yield reductions. Glufosinate applied one day prior to transplanting cucumber noted injury greater than 10% regardless of irrigation option, with accompanying yield reductions. Additional studies were conducted to investigate if injury to transplanted cucumber could be reduced by extending the preplant application interval to four or seven days prior to planting. Experimental design was a factorial arrangement of three preplant application intervals (seven, four, one day preplant) and three glufosinate rates (656, 1,311, or 1,967 g ai ha^{-1}). Results indicate injury potential for transplanted cucumber was not reduced by extending the glufosinate preplant application interval to four or seven days.

Introgression of A02 top and A03 bottom Genomic Regions from *A. cardenasii* Conferred Disease Resistance to Leaf Spots in Peanut

S. Lamon, D. Bertioli, S. C. M. Leal-Bertioli, C.C. Holbrook, L. A. Guimaraes, Y. Chu and P. Ozias-Akins

Late Leaf Spot (LLS) disease caused by *Nothopassalora personata* (Berk. & M.A. Curtis) U. Braun, C. Nakash, Videira & Crous affects peanut (*Arachis hypogaea* L.) all around the world. Up to 80% yield loss in LLS infested fields has been reported. Chemical control is expensive, and can be difficult to apply in small-scale farms, particularly in developing countries. One effective solution to overcome these problems is the employment of resistant cultivars. IAC 322 breeding line has alien introgressions on the top and bottom parts of A02 and bottom part of A03 chromosomes from *A. cardenasii* Krapov. & W.C. Gregory, a wild diploid relative of peanut. Progenies from 'TifNV-High O/L' x IAC 322 cross were genotyped and selected based on the introgressed segments they retained, then phenotyped for LLS resistance under both *in vitro* and field conditions. IAC 322-derived progenies were found to have varied levels of resistance to LLS. The segments on the top part of A02 and the bottom part of A03 chromosomes accounted for the majority of LLS resistance, while the segment in the bottom part of chromosome A02 was dispensable. Highly positive correlations were detected among LLS resistance traits in the *in vitro* experiment such as lesions and sporulating lesions, defoliation and infected leaf area whereas, they were negatively correlated with incubation period. Highly positive correlations were found between the progression of LS infection at two field locations (Gibbs and Lang-Rigdon farms, UGA Tifton Campus, Tifton, GA), and between *in vitro* and field experiments. LLS lesions and sporulating LLS lesions at late stages of LLS infection and incubation period of the *in vitro* experiment should be preferentially selected for phenotyping LS resistance under field conditions. In addition, late stages of LS infection were representative of the entire LS infection progression both under *in vitro* and field conditions.

Using An Unmanned Aerial System To Collect Mid-Season Multispectral Data For Estimation Of Plant Nitrogen Status In Cotton

D.W. Daughtry, W.M. Porter, G.H. Harris, J.L. Snider

Managing nitrogen (N) in cotton is critical for optimizing the ratio of vegetative and reproductive growth throughout the growing season, which maximizes the subsequent yield. At the field level, spatial variability of soil texture can lead to varying levels of nutrient uptake by the cotton crop. Unmanned Aerial Systems (UASs) have the ability to provide quick and efficient ways to detect spatial variability of N status to aid making in-season management decisions. This study was conducted during 2017 and 2018 on a research site in Tifton, GA. The main objective of the study was to correlate varying levels of plant tissue nitrogen (N) obtained from cotton tissue samples with vegetative indices (VIs) generated from multispectral imagery acquired with an UAS. Six N treatments consisting of 0, 34, 67, 101, 135 and 168 kg/ha rates were applied to attain varied levels of N in the tissue samples. Tissue samples were collected during the first, third, fifth, and seventh weeks of bloom to quantify N tissue levels temporally as a response to the applied N rate. Leaf blade and petiole tissue samples were collected and separated such that analyses provided leaf blade N (%) and petiole N (ppm). Multispectral imagery in the wavelengths of 550 nm (green), 660 nm (red), 735 nm (red-edge) and 790 nm (near infrared) was acquired during the cotton growth stages at the same time the tissue samples were collected by utilizing a commercially available quadcopter equipped with a high-resolution multispectral camera. Two vegetative indices (NDVI and NDRE) were analyzed for correlation with leaf blade and petiole tissue N levels at each sampling date and tracked temporally. Regression equations correlating the VIs to actual N levels were generated to evaluate the use of different VIs for accurately measuring N levels in the crop at the selected growth stages.

Genetic Diversity of Muscadine Grapes (*Vitis rotundifolia*) Using SSR Markers

S. Cao and P. Conner

Muscadine grape (*Vitis rotundifolia*) was the first native North American grape to be domesticated. Over the last century breeding programs have created a large collection of muscadine cultivars. In this study, simple sequence repeat (SSR) markers were used to access the genetic diversity of muscadines. With 20 SSR markers, a total of 161 alleles were amplified for 71 muscadine cultivars producing an average of 8.1 alleles per marker. The analysis of genetic diversity was conducted at four levels: all muscadine cultivars, historical muscadine cultivars, current muscadine cultivars and wild relative accessions. While sharing the similar average *Ho* (observed heterozygosity), both the average alleles per marker and the number of private alleles (alleles detected only in the group) for wild muscadines (8.4 and 65) were higher than that for cultivated muscadines (8.1 and 58). It indicated that eight wild muscadines convey a higher level of genetic diversity than 71 cultivated muscadines. Although elite cultivars tend to be used excessively in recent muscadine breeding programs, the data proved the set of current cultivars also has substantial diversity and there is no inbreeding depression observed. The Principle Coordinate Analysis (PCoA) shows clear separation among wild accessions, *Vitis* cultivars, and cultivated muscadines with PCoA1 and PCoA2 explaining 11.1% and 9.3% of the total variation respectively. Funding Source: Southern Region Small Fruit Consortium

Development of Grazing Recommendations for Managing Alfalfa-Bermudagrass Mixtures in the Southeastern U.S.

K.R. Groce and J.J. Tucker

Recently there has been growing interest in interseeding high-quality legumes, like alfalfa, into existing bermudagrass stands as a step towards improving forage, animal, and ecosystem stability in the Southeast. Current work evaluating these mixtures has been focused on management and production of stored forages (i.e. dry hay/baleage), and limited work has evaluated the use of alfalfa-bermudagrass mixtures under grazing conditions. It has been noted that both grazing intensity and frequency impact overall stand production over time. The objective of this research is to evaluate the effect of harvest height and frequency of newly established alfalfa interseeded into an existing bermudagrass stand, and begin to develop grazing recommendations for management of these mixtures. In 2018 thirty-six alfalfa-bermudagrass plots were established at 2 locations across Georgia (Watkinsville, Tifton), using a randomized complete block design with four replications (at each location). Alfalfa varieties were selected for suitability to location and were either 'Bulldog 505' or 'Bulldog 805' interseeded into existing hybrid bermudagrass sods. Treatments included combinations of harvest frequency (2, 4, or 6 weeks) and harvest height (5, 10, 15 cm), and plots were evaluated for their influence on sward yield, persistence, stand density, botanical composition, nutritive value, and change over time. In Georgia, 'Bulldog 505' treatment harvested every 6 weeks at 15 cm has the lowest yield (6019 kg ha^{-1}), while the 'Bulldog 805' treatment harvested every 6 weeks at 15 cm has the greatest yield (14577 kg ha^{-1}) during the 2018 growing season. Additionally, botanical compositions showed that alfalfa composition decreased throughout the season due to increased weed pressure and insect damage. Another year of data collection is necessary to evaluate the effect of these treatments on stand persistence and longevity of these mixtures. This study is supported by funding from the USDA-NIFA-Alfalfa Forage Research Program (2017).

The Influence of Environmental Conditions on the Germination and Vigor of Three Peanut Cultivars

C.C. Weaver, W.S. Monfort, C. Pilon, T.L. Grey, and S. Tubbs.

High germination and vigor of peanut seeds are important constituents to overall successful peanut production. Exposure of seeds to unfavorable conditions of temperatures and relative humidity (RH) over time can result in loss of germination and vigor. The objective of this experiment was to determine the effects of storage environment on germination and vigor of runner-type peanut seed. The experiment was conducted at the University of Georgia Coastal Plain Experiment Station in Tifton, GA in 2018. Four storage environments were evaluated in this study: two storage environments had extreme diurnal fluctuations in temperature and RH and two had a more stable temperatures and RH. Seed from three cultivars (GA-06G, GA-09B, & GA-14N) were maintained in each respective storage environment for one month. Sub-samples of each cultivar were taken from each storage environment starting at 30 days after initial storage and continued every 14 days for a total of 4 sampling dates. The sub-samples were maintained in a cold room until germination and vigor measurements were taken. Seed germination and vigor were evaluated using a thermal gradient table with temperature ranges of 13 to 32.5 °C. Seeds were placed in Petri-dishes and incubated for a total of 7 days. The number of germinated seeds were counted daily up to five consecutive days starting on day three. Storage environment affected peanut seed germination. Seeds stored in temperature ranges of 17 to 42 °C experienced higher diurnal fluctuations and RH compared to seeds stored in more controlled environments. Seeds stored in more consistent environments for temperature and RH had the highest germination percentage throughout the four sample dates. This study suggested that storage environments having extreme diurnal fluctuations negatively affect germination and vigor over time when compared to more consistent storage environments.

Assessing the Impact of the G137S Substitution in *Venturia Effusa* on Qoi Efficacy in Commercial Pecan Orchards

K.P. Herrington, K.L. Stevenson, J.R. Standish, T.B. Brenneman

Every year Georgia pecan growers lose millions of dollars to pecan scab, caused by *Venturia effusa*. Scab management relies heavily on fungicides, including the quinone outside inhibitors (QoI; FRAC group 11). Recently, reduced QoI efficacy has been observed in a few Georgia orchards and previous research revealed that an amino acid substitution from glycine to serine at position 137 (G137S) within the *V. effusa cytochrome b* gene leads to partial QoI-resistance. However, the effect of G137S on QoI efficacy in the orchard is unknown. Thus, field trials were conducted in 2018 across six locations in southwest Georgia to determine the impact of G137S. At each location, individual terminals were treated biweekly with Abound (azoxystrobin) at a rate of 0.88 L/ha, for 10 applications/year. Nut scab severity was evaluated in August and approximately 20 isolates were collected from unsprayed portions of trees at each location to screen for mechanisms of resistance. Percent control of nut scab ranged from 25.7 to 75.2% in 2018 and G137S was found in three of the six orchards, ranging in incidence from 0.0 to 30.8%; no other mechanisms were present. Percent control decreased linearly with increasing G137S frequency, indicating that the reduced QoI efficacy may have been a result of a greater number of G137S isolates in the population. Monitoring Georgia pecan orchards for isolates harboring G137S could allow for the detection of major shifts in efficacy before they occur.

Insect Populations in Peanut Shelling Facilities

L.M. Perez and M.D. Toews

Temperature and seasonal changes can have a significant impact on insect species composition and abundance in their environment. Further, insects that immigrate into food production facilities may stay active later into the winter months due to optimal food resources, increased temperature and artificial lighting. These conditions favor insect population growth that may contribute to contaminated finished products, customer complaints, and financial losses. There is a lack of knowledge on insect population biology and ecology in peanut shelling facilities. We placed pheromone baited insect traps in two of these facilities and serviced the traps weekly for six months. Captured insects were enumerated, identified to species and then the data were analyzed to understand changes as a function of time and trap location. Results show that cigarette beetle and red flour beetle were the most abundant species. Although pest populations significantly decreased over the winter, they were not eliminated. There were significantly more captures near the point of incoming farmer stock peanuts compared to where finished product was stored. These data indicate that managers need to focus on exclusion technologies and improve sanitation levels to suppress insect populations. This work is broadly applicable to all food processing and storage environments in subtropical climatic zones. Findings will be disseminated through peer reviewed manuscripts and cooperative extension publications.

Seedling Peanut (*Arachis hypogaea*) Physiological Response to Flumioxazin

N.L. Hurdle, T. Grey, C. Pilon, E.P. Prostko, W.S. Monfort

Over 50% of U.S. peanut production can be credited to Georgia. The growing season for peanut can extend up to 150 days, it is essential to manage weeds in such a manner as to achieve maximum yield potential. This includes applications of PRE herbicides. Numerous PRE herbicides are registered for peanut including pendimethalin, diclosulam, and flumioxazin. Emerging peanuts will inevitably come into contact with these PRE applied herbicides. A study was performed in Ty Ty and Plains, GA in order to record the physiological effects of emerging peanut to PRE herbicides. A 3x2 factorial RCBD comprising of 3 herbicide treatments and 2 seedling germination rates with 4 replications was utilized at both locations in the 2018 growing season. Treatments included a nontreated control, 107 g ai ha^{-1} of flumioxazin PRE, and diclosulam at 27 g ai ha^{-1} PRE. All plots received an application of pendimethalin at 4480 g ai/ha. Physiological measurements included photosystem II efficiency, photosynthesis, and electron transport using a Li-COR 6800 to record these measurements. Peanut stand counts and diameter measures were also recorded. Data was analyzed by location in SAS 9.4. Both Ty Ty and Plains had treatment differences in electron transport, but no trend was noted. Plains also had a difference in treatment by seed vigor. Intercellular CO_2 differences were noted in Ty Ty by plant date and by seed vigor. Plains had no differences in intercellular CO_2. PRE applications of flumioxazin do affect emerging peanuts physiologically, but are not detrimental to early crop growth with no differences in stand establishment and early season growth.

The Walking Dead: Resurrecting Researcher Engagement in Face-to-Face Survey Data Collection

A. Harrington, A. Wheeless, L.Brock, and A.M. Yopp

The process of face-to-face survey data collection can be a difficult experience for many novice researchers (Peredaryenko & Krauss, 2013). Historically in data collection, researchers have focused on characteristics associated with external participants: how the participant engages, perceives the study, and ultimately how and if they decide to respond. However, this study sought to improve components of internal validity by increasing the researchers' interest and motivation in the data collection process. In the fall of 2018, a group of undergraduate and graduate researchers collected consumer behavior data utilizing face-to-face survey methods at two major state events, an agricultural exposition and a state fair. In an effort to incentivize student researchers and appeal to their competitive nature, the lead faculty researcher designed an experience to increase student engagement in collecting high-quality data within the context of a zombie apocalypse. With gamification theory as the basic framework, the design enlisted a set of criterion, zones of safety, and a host of "zombie-specific" characteristics to keep in mind during the event-wide outbreak (Landers, Auer, Collmus, & Armstrong, 2018). Survey participants were required to meet a predetermined set of qualifications, reducing bias by limiting "zombie" participants from being heavily collected. By facilitating data collection as a game and overall learning experience, we observed a shift in undergraduate and graduate engagement; students either met or exceeded the quota set through the design of the zombie apocalypse and viewed the experience as more engaging than previous data collection activities.

Monitoring Diamondback Moth Resistance in Georgia

J. Bennett and D.G. Riley

In recent years, there has been severe outbreaks of insecticide–resistant diamondback moth (DBM) in Cole crops, such as cabbage, collards, leafy greens, broccoli and cauliflower, in Georgia and Florida. We estimate that annual losses from this problem exceeded 10% of the Farm-gate value of this crop group valued at $129 million in 2014 or -$12.7 million in Georgia alone. We are currently providing better regional documentation of insecticide resistance based on rapid, field-specific resistance monitoring methods to support short-term pest control decisions and support regionally based insecticide resistance management (IRM). The critical dose data will be supplemented in the coming months with standard LC50 assessments for selected DBM populations to characterize resistance levels to multiple insecticide active ingredients across multiple modes of action (IRAC groups).

The insecticide commercial products (common name and IRAC group in parenthesis) that our survey has identified as having high levels of DBM resistance this spring are Rimon (novaluron, group 15) and Coragen (chlorantraniliprole, group 28). The best products for DBM control this spring listed in in decreasing levels of efficacy are: Dibrom (naled, group 1B), Harvanta (cyclaniliprole, group 28), Torac (tolfenpyrad, group 21A), Proclaim (emamectin benzoate, group 6), Exirel (cyantraniliprole, group 28), Radiant (spinetoram, group 5), Xentari (Bacillus thuringiensis, group 11B), Lannate (methomyl, group 1A), Brigade (bifenthrin, group 3), and Avaunt (indoxacarb, group 22). We are coordinating with the Georgia Cooperative Extension Service for the insecticide resistance monitoring to not only warn growers of resistance levels in their specific fields, but also to increase the understanding of how DBM-crop-insecticide interactions contribute to the resistance outbreaks in vegetable crop systems in Georgia.

Optimizing Durum Wheat Cultivation in Northern Italy: Integrating Proximal Sensing and Crop Modeling For Variable Rate Application of Nitrogen

M.A. Bruce, G.Vellidis, F. Morari

The high spatial variability observed in the North Italian fields presents the potential for employing precise field management techniques such as the variable rate application (VRA) of fertilizer during durum wheat cultivation. The first objective of this experiment was to employ non-destructive methods of indirectly analyzing nitrogen (N) content of plants such as proximal and remote sensors to calculate vegetation indices (VI). All devices and corresponding VI were assessed for accuracy in indicating the N uptake dynamic of the durum wheat (*Triticum durum* Desf. var. Biensur). Additionally, the identified correlations between N uptake and normalized difference vegetation index (NDVI) from a Trimble Green Seeker device were assessed against data collected from previous years (2011, 2012, and 2013) to produce a significant regression model that may allow for future real-time assessment of N content at field scale by means of proximal sensing. The second objective was to conduct a variable rate field experiment using proximal sensors and a real-time crop model with medium weather forecasts to predict crop nitrogen uptake and improve nitrogen fertilization of the wheat. Post-harvest evaluations showed marginal gains in yield quantity and a lower coefficient of variation of the wheat grain in the VRA zones as compared to the conventional fertilization zones.

Cotton Seedling Vigor as Affected by First True Leaf Physiology under Different Field Conditions

G. Virk, J. Snider, and C. Pilon

Rapid development of the first true leaf has been suggested as a reliable indicator of seedling vigor in cotton, yet studies demonstrating a relationship between the photosynthetic response of the first true and early season seedling growth are limited. A study was conducted to evaluate the contributions of the first true leaf to cotton seedling vigor under different field conditions. Two Upland and one Pima cultivar were planted in April, May and June of 2017 and 2018 to generate different field conditions, especially differences in growth temperature. Plant samples from 2-m sections within each plot were destructively harvested and general crop growth analysis (number of plants, plant height, number of nodes, first true leaf area (FTLA) and total dry weight of plants) and physiological processes (net and gross photosynthesis, dark respiration, electron transport rate (ETR)) of the first true leaf at 21 and 35 DAP were assessed. Initial data analysis results for both years, showed differences in seedling growth parameters with planting dates. Overall, cotton planted in May showed the maximum seedling vigor, and the first true leaf of cultivars planted in April exhibited higher gross and net photosynthesis as compared to the cultivars planted in May and June. The study suggests that field conditions were more favorable for high first true leaf area which promoted seedling vigor. Interestingly, cultivar differences in seedling vigor (plant dry weight) on earlier planting dates were associated with greater FTLA, but not photosynthetic activity. This study will contribute to our understanding of the importance of the first true leaf in determining early season growth and allow for a more detailed understanding of the underlying component processes contributing to early season vigor in cotton.

Comparing and Developing Molecular Methods for Identification of *Fusarium* Wilt of Watermelon

O. Hudson, S. Waliullah, L. Wang, P. Ji, and E. Ali

Fusarium oxysporum f. sp. *niveum* is a fungal pathogen that causes significant loss of the watermelon crop across the world. There are four races of this pathogen that vary in their aggressiveness on watermelon cultivars and no commercial watermelon cultivars are resistant to all the races. Molecular detection methods for differentiation of the races are not available, and existing molecular methods for the detection of the pathogen have limitations such as low sensitivity. In this study, we compared the strengths and weaknesses of various traditional and molecular detection methods for this pathogen including pathogen morphology, conventional polymerase chain reaction (cPCR), quantitative polymerase chain reaction (q-PCR), and loop-mediated isothermal amplification (LAMP) assay. Here we showcase some of the improvements we have made to existing methods and new ones we are developing. Our initial findings indicated that LAMP assay was the fastest and most sensitive compared to other traditional and molecular methods. Detection was carried out rapidly (~30-60 min) with minimal equipment (a water bath or heated block). These results are expected to accelerate plant disease detection efforts and contribute to the Coastal Plain Experiment Station's strategic priority for food production.

Comparing the Virulence of Genetically Distinct *Xylella fastidiosa* Isolates Causing Bacterial Leaf Scorch of Blueberry

D.D Genova and J.E. Oliver

Bacterial leaf scorch is a significant disease affecting southern highbush (SHB) blueberry production in the southeastern United States. Symptoms include marginal leaf scorch followed by defoliation and eventual plant death (often within 1-2 years). This disease is caused by the xylem-limited bacterium *Xylella fastidiosa* (Xf), which is vectored from plant to plant by sharpshooter insects. Xf is an important bacterial pathogen on numerous tree and fruit crops worldwide, and the species consists of at least three distinct subspecies which differ genetically and in terms of host pathogenicity. Most Xf isolates from naturally infected blueberries are purported to be Xf subsp. *multiplex* (Xfm) intersubspecific recombinants, but recently described isolates from naturally infected blueberry plants in southeastern Georgia were found to belong to Xf subsp. *fastidiosa* (Xff). Previous greenhouse studies that used Xff isolates from grapevine to compare the virulence of Xff and Xfm on blueberry indicated that Xff isolates are significantly less virulent on blueberry; however, Xff isolates from naturally infected blueberry have not been previously compared. In this study, we evaluated the relative virulence of genetically distinct Xff and Xfm isolates originally obtained from symptomatic blueberry plants in southeastern Georgia. These isolates consisted of three distinct genetic variants (one Xfm and two Xff). Two replicated greenhouse experiments were carried out using SHB cultivar 'Rebel.' Isolates were grown on periwinkle wilt media and then used to needle-inoculate plants. Symptom development in inoculated plants was monitored over a period of 5 months. The results of these experiments indicated that Xff isolates from blueberry were comparable in virulence to Xfm isolates in terms of symptoms produced, timing of symptom development after infection, and ability to infect SHB blueberries. These findings indicate that Xff isolates have the potential to impact blueberry production, disease management, and resistance breeding efforts in the southeastern United States.

Insecticide Efficacy for Whiteflies in the Greenhouse

T. Sparks and D. Riley

Sweetpotato whitefly (*Bemisia tabaci*) is a metropolitan pest of numerous food and ornamental crops. This polyphagous insect feeds on the phloem sap of plants, reducing plant vigor and transmitting diseases such as cucurbit leaf crumple virus and cucurbit yellow stunting disorder virus. These two newer viruses have devastating effects on squash and snap beans. In the fall of 2017, whitefly populations exploded across South Georgia and incidence of crop disease along with it. In cotton, yield losses in cotton just due to direct whitefly damage (not virus) averaged 32% in research plots in Tift County. Extrapolating that to just Tift County losses in cotton, which produced $18,707,746 in cotton in 2014, the estimated loss in 2017, was about $6 million in Tift County alone. In response, the Georgia legislature passed additional funding for whitefly research which partially supported this project.

Controlling whitefly populations in vegetables requires multiple sprays of insecticides, while in cotton, you are usually, economically limited to two sprays. This means that knowing insecticide efficacy before you begin a control program is vitally import. Insecticide resistance has been detected in Florida and other areas of the country, but very little such work has been done in Georgia. This study was performed in order to observe the effectiveness of six insecticides commonly used in whitefly control. Coragen, Exirel, Knack, Venom, Admire, and Sivanto were used on infested plants and the counts of eggs, nymphs, and adults were taken from leaf samples. Our results found the newer diamides, Coragen and Exirel, were most effective at reducing adults on plants and all treatments significantly reduced adult counts. All insecticides reduced egg and nymph numbers, but further tests will be needed to say which is the most effective across multiple whitefly populations across Georgia.

Trophic Interactions Shaped by Cover Crops and Seasonality in Cotton Agroecosystems

C. Bowers, M. Toews, J. Schmidt

Winter cover crops promote multiple ecosystem services in agricultural systems, and may facilitate biocontrol by strengthening populations of generalist predators. Prior to crop production, covers provide both food and shelter for generalist predators which are likely essential in suppressing early season pests in agroecosystems. However, the effects of cover cropping on predation of pests and trophic structure of many systems is largely unknown. Therefore, we investigated the effects of common cover crops on trophic interactions in a Georgia, U.S.A. cotton system. We established 0.4 ha replicated cover crop treatments (crimson clover, rye, a mixed legume and cereal and no cover crop) in the fall of 2017 and 2018, terminated covers in spring, and sampled predators at six key cotton stages each year. Over 3100 predators were collected using suction sampling. We conducted molecular gut-content analysis on whole body DNA extractions of predators using multiplex PCR for eight different prey groups including major cotton pests, minor pests and alternative prey. Results suggest that cover crops such as rye significantly alter trophic interactions through a shift in alternative prey consumption. Our study shows clear benefits of cover crops for the provisioning of early season predator communities through predation on alternative and pest prey. Late season differences in trophic interactions among treatments were minimal, although within-season differences in interactions emerge as cotton habitat develops. This evidence suggests cover crop type is an important factor influencing trophic dynamics and pest predation early season, while late season pest control is relatively unaffected by cover crop use or selection.

An Economic Analysis of Cover Crop Utilization in Georgia Cotton and Peanut Production

G.A. Hancock, Y. Liu, A.R. Smith, A. Plastina

Georgia is the second largest producer of cotton and largest producer of peanuts in the United States. These crops add approximately a total of $1.5 billion to the state's economy annually. As natural resources become more threatened, cotton and peanut industries have faced increasing challenges to improve their environmental sustainability. There are numerous documented farm and environmental benefits of cover crop utilization in cotton and peanut production systems. However, only a small portion of farmland devoted to cotton and peanut is planted after a winter cover crop. One of the major barriers to cover crop use is farmers are faced with conflicting information regarding to the economic impact of planting cover crop.

This study will utilize focus groups, farm surveys, and partial budgets to identify the individual cost and revenue changes resulting from cover crop use. Data that has been collected from focus groups and farm surveys will be used to estimate how cover crop use directly impacts farm profitability. Additionally, this research will seek to identify the benefits and challenges of using cover crops in production systems. Specifically, this project will seek to identify all the changes in farming practices that a farmer considers when adopting alternative production systems by using cover crop and the economic values of these changes.

Cane diseases of blackberry: Identifying the cause of blighted canes

W. Hemphill, P. Brannen, and J.E. Oliver

The warm, humid conditions in the southeastern U.S. allow for many pests and pathogens of blackberries to thrive. In recent years, blighted blackberry canes have been observed in increasing frequencies in the field. This directly impacts yield and poses a serious threat to producers. Symptoms include cane dieback that originates from cane tips or wounds and spreads to the plant crown. These symptoms resemble a known disease of blackberry, cane blight, caused by the fungus *Leptosphaeria coniothyrium*. In the fall of 2017 and in the spring, summer, and fall of 2018, field surveys were conducted to identify pathogens causing cane dieback of blackberries in Georgia. Blighted cane samples were collected within Berrien, Lanier, Irwin, and Oconee counties. Cane samples were surface sterilized and placed on AqPDA media for fungal isolation. Isolates were identified by morphological characteristics and genetic characterization using primers ITS1 and ITS4. A total of 61 fungal isolates were identified, representing 21 different species. *L. coniothyrium* was not observed among the isolated fungi. Eighty-four percent of the identified isolates belonged to either the Botryosphaeriaceae family (28%), *Pestalotiopsis* spp. (23%), *Fusarium* spp. (20%), and *Neopestalotiopsis* spp. (8%). The pathogenicity of the identified isolates was examined in three trials with container blackberries conducted in the summer and fall of 2018 and in winter 2019. Isolates of *Fusarium oxysporum*, *Pestalotiopsis microspora*, *Neofusicoccum kwambonambiense*, *Neofusicoccum parvum*, and *Lasiodiplodia theobromae* were determined to cause significant cane dieback. These results suggest that other fungal organisms besides *Leptosphaeria coniothyrium* may be capable of causing cane dieback in commercial blackberry production in Georgia. Since all of these fungi are often present on the same cane, a disease complex may be involved in the observed symptomatology in the field. Further characterization of these isolates will allow for the development of appropriate management strategies.

Predicting Soil Nitrogen Availability for Corn with a Simulation Model

A. Toffanin, G. Vellidis, M. Borin, M. Cabrera, A. Orfanou, B. Ortiz, D. Pavlou, and M. Tertuliano

Corn (*Zea Mays L.*) is the world most productive crop in terms of yield; however, it relies on several inputs, with first of the mineral nutrients being nitrogen. Uptook by corn in form of nitrate or ammonium, is often a limiting factor because of its dynamic nature. Several processes in the soil utilize and transform nitrogen making it unavailable for crop absorption; thus, nitrogen fertilization management is challenging. Models are inexpensive decision support system tools for farmers to increase nitrogen fertilization efficiency, but most of the models used in the United States of America are adapted just for the mid-west, which is the leading area of corn production in the country. The objective of this research is to adapt, calibrate, and validate a model for the Coastal Plain soils of Georgia to predict soil nitrogen availability. The model STICS (Simulateur multidisciplinaire pour les Cultures Standard) will be calibrated and validated with data from an experiment conducted in three fields cropped in peanut-corn-cotton rotation with three replications of nine treatments. The initial step in adapting the model is the parameterization of plant, soil and crop management parameters, and the input of initial soil conditions and weather data for one of the plots; therefore, calibration using soil volumetric water content (VWC) and soil N content data (NO_3^- and NH_4^+ forms) for the 2018 growing season is performed. During 2019 the model will be further calibrated and validated in two steps: 1) with 2018 data from the remaining eight treatments and 2) in real-time during the 2019 growing season from March to August. Good performances of the model will lead to the implementation of this tool into a smartphone application for farmers to be easily aware in real-time of what is happening in their soils.

Effects of Potassium Application and Harvest Regime on Forage Yield, Nutritive Value and Stand Persistence of Established Alfalfa in South Georgia

B.M. Thinguldstad, J.J. Tucker, L.L. Baxter, and J.R. Segers

Potassium fertilization and harvest timing can both impact the stand life of alfalfa (*Medicago sativa* L.). Current nutrient management and harvest recommendations for alfalfa are generated from research conducted in northern climates with different varieties. The objective of this trial was to determine the impact of potassium fertilization and harvest regime on stand persistence, forage yield and nutritive value of 'Bulldog 805' alfalfa in the Southeast. This study was conducted at the Coastal Plain Experiment Station in Tifton, GA on a two-year-old stand of 'Bulldog 805' alfalfa planted fall 2015. Plots were randomly assigned using a split block design. Main plots were stages of growth including: bud stage, and 10, 30 and 50% bloom. Plots were subdivided to examine K fertilization at rates of: 0, 67, 101, 134 and 168 kg ha^{-1}, split applied 3 times across the season. At each harvest plots were visually assessed to determine alfalfa cover and confirm percent bloom. Fifty shoots were collected to evaluate leaf:stem ratio and mass $shoot^{-1}$, and yield was determined through mechanical harvest using a Swift Forage Plot Harvester IV. Grab samples were collected for nutritional analysis using near-infrared reflectance spectroscopy (NIRS). Data were analyzed using PROC MIXED in SAS v9.4 (SAS Institute, Inc., Cary, NC) with an AR1 covariance structure at $\alpha = 0.05$. Potassium treatment only influenced nutritional value parameters ($P < 0.01$). Growth stage affected all parameters except for leaf:stem ($P = 0.32$). Yield and stand persistence parameters were generally greater for 30% and 50% bloom treatments than bud and 10% bloom. As expected, nutritive value declined as alfalfa maturity increased. Data from this evaluation confirm that current recommendations for harvest timing (10% bloom) and potassium application (greater than 168 kg K ha^{-1} rate) should be maintained to achieve desired performance from alfalfa in Georgia. Funding for this project was provided by USDA-NIFA-AFRP grant #2016-70005-25653.

Effect of Fungicide Programs on Plant Health, Maturity, Yield, and Quality of Two Peanut Cultivars

M. Stuart, W.S. Monfort, C. Pilon

Peanut (*Arachis hypogaea* L.) plants are susceptible to several diseases during the growing season. Different fungicides have been used to provide control to these diseases. It is important to implement sound fungicide programs to keep peanut plants healthy and protect yield; however, information on the effects that commercially-available fungicides have on pod maturity and quality of peanuts is scant. A field experiment was conducted on the University of Georgia Ponder Farm in Tifton, GA in 2018 to determine the effects of different fungicide programs on peg strength, pod maturity, yield, and quality of two peanut cultivars across four harvest dates. Fungicide programs consisted of a low-input control with Bravo Weather Stik (chlorothalonil), Bravo Weather Stik plus Tebuconazole, and Elatus (azoxystrobin, Solatenol). The two cultivars evaluated were Georgia-06G and Georgia-09B. The four harvest dates were determined by adjusted growing degree day units of 2400, 2500, 2600, and 2700 GDD's. All treatments were replicated four times and arranged in a randomized complete block design. Height and width were measured 24 days after planting (DAP) and 50 DAP. Leaf spot occurrence was recorded 113 DAP and at the digging of each harvest date. Tomato spotted wilt virus and southern stem blight were also assessed prior to harvest. Pods samples were collected and assessed for peg strength, maturity, yield, and grade at each of the four harvest dates. Preliminary analysis of the results suggested that fungicide programs influenced yield and the overall health of the crop throughout the growing season. The Elatus program seemed to provide higher disease control than the two other fungicide programs, resulting in higher yield and lower disease incidence. Harvest date resulted in variations among grade, maturity, peg strength, and disease severity, and 2500 GDD indicated to be the most suitable for a high yield and low disease incidence.

Evidence of Pepper Weevil Overwintering in Southern Georgia, 2019 Pheromone Trap Data

R. Weredyk, J. Kichler, S. Hollifield, T. Torrance, J. Shealey, A. Sparks

The pepper weevil, *Anthonomus eugenii*; is the key pest in peppers wherever it occurs. This pest lays eggs inside the pepper where they hatch and develop into larvae and are protected from insecticides. Larvae cause blooms and small fruit to abscise and can remain in harvested large fruit. Only the adult stage is accessible to insecticidal control and has developed resistance to pyrethroid insecticides, making management of this pest extremely difficult. Pepper weevil has previously been considered to not overwinter in southern Georgia with sporadic isolated infestations attributed to localized introductions. Widespread infestations in the fall of 2017 brought this assumption into question. Studies conducted during the winter of 2018-2019 involved placing pheromone traps in multiple pepper fields in South Georgia and monitoring them for weevils until growers began planting. Another study was done where field collected weevils were placed into two boxes, one with food and one without to compare survival rates. While weevil populations declined through the winter, adult weevils were collected in all fields monitored throughout the period, including after commercial growers began transplanting in the Spring. Adult weevils with food showed 38 percent survival at 84 days after test initiation, with 100 percent mortality of starved adults at 32 days. Results indicate that pepper weevils are overwintering in South Georgia.

Role of Micronutrients on Systemic Acquired Resistance in Watermelon against *Fusarium oxysporum* f. sp. *niveum* and *Meloidogyne incognita*

K. Karki, A. Hajihassani, T. Coolong, B. Dutta

Fusarium oxysporum f. sp. *niveum* (FON) and southern root-knot nematode (RKN, *Meloidogyne incognita*) are devastating soil pathogens of cultivated watermelon in the southeastern United States. The role of controlled micronutrient feeding [iron (Fe), manganese (Mn) and zinc (Zn)] via hydroponics on genes related to systemic acquired resistance [salicylic acid (SA) pathway genes (PR1, PR5, NPR1) and jasmonic acid (JA) pathway genes (VSP, PDF and LOX)] in watermelon seedling was investigated. Micronutrients were fed to the plants at higher (3X) and lower levels (0.5X) of recommended dose (X= recommended dose) for 7-days and the expression levels of the above-mentioned SAR genes were evaluated. A sub-set of micronutrient-fed plants were later inoculated with either FON or RKN or both and they were re-evaluated at 3 day post inoculation for above mentioned genes. Two independent trials were conducted with three replications per treatment. Our results showed that JA-pathway genes (VSP and LOX) were upregulated in plants that were fed with micronutrients for 7 days. However, expressions of other SAR-related genes were downregulated and significant differences among treatments was only observed with PR1 expression. Upon pathogen inoculation (FON or RKN or both), expression levels of JA and SA genes varied considerably for different micronutrient treatments. These observations indicate that micronutrient feeding in watermelon for 7-days can induce SAR genes and expression of JA or SA pathway genes can potentially be affected when either FON or RKN or both are present, irrespective of nutrient feeding.

Evaluating Planter Downforce in Varying Soil Textures for Maximizing Crop Emergence in Cotton

S. Virk, W. Porter, P. Sapp, R. Barrentine, S. Hollifield, and J. Porter

Correct selection of row-unit downforce during planting is critical for achieving uniform and consistent seed depth throughout the field. Varying soil conditions, especially soil type and texture, can produce differences in crop emergence and could affect yield significantly if not properly addressed. On-farm research trials were conducted at five locations in Southern Georgia to evaluate the effect of soil texture on planter downforce while trying to maintain the desired seeding depth for planting cotton. Soil electrical conductivity (EC) was mapped to delineate EC zones within each field prior to planting. Field trials consisted of planting test strips in the field with nominal planter setup (metering unit, seed depth, seeding rate, downforce etc.) as utilized by the grower across the delineated soil EC zones along with two additional downforce settings (relatively lower and higher than nominal) with the similar planter setup. Post-emergence data collection consisted of stand counts at 1, 2 and 3 weeks after planting within each EC zone in the field. Results from the study indicated that crop emergence was influenced by the planter downforce setup, and optimizing planter downforce for varying soil EC levels could be beneficial as higher emergence rates (80-90%) were observed in the heavy textured (loamy clay) soils in the fields when higher than nominal downforce was used. Contrarily, crop emergence (58-75%) was reduced in sandy or sandy-loam soils by utilizing higher than nominal downforce. It was observed that some growers could benefit from utilizing lower downforce than nominally used in sandy or sandy-loam soils to maximize emergence as higher downforce exhibited reduction in crop emergence in these soils. The study emphasized that growers should consider the soil variability present in the fields when selecting planter parameters such as depth and downforce for planting cotton in order to attain early uniform crop emergence throughout the field.

Evaluating Yield, Nutritive Value, and Storage Length of Tifton-85 Bermudagrass and Tifton-85 Bermudagrass-Alfalfa Mixtures as Baleage

T.J. Hendricks, J.J. Tucker, D.W. Hancock , M.K. Mullenix, J.R. Segers, and R.L. Stewart, Jr.

Interseeding a legume, such as alfalfa (*Medicago sativa* L.), into bermudagrass (*Cynodon dactylon* L. Pers.) for baleage production can both improve forage nutritive value and minimize weather risks associated with harvest, however there are concerns associated with long-term storage of baleage because of potential declines in quality. The objectives of this research are to: 1) compare the nutritive value and yield of bermudagrass with and without interseeded alfalfa, and 2) determine if storage length affects the nutritive value of baleage. This study utilized an established field of 'Tifton 85' (T85) bermudagrass at the University of Georgia Coastal Plains Experiment Station. Ten 0.2-ha plots were randomly assigned to either T85 or T85 interseeded with 'Bulldog 805' alfalfa (T85+Alf) on 19 February 2016. T85 received N fertilization (84 kg N ha^{-1}) four times throughout the growing season. Plots were harvested at early bloom stage every 28 to 35 days, baled at 40-60% moisture, and individually wrapped. At each harvest, plots were evaluated for botanical composition and forage yield, and bales were sampled prior to wrapping for nutritive value analysis. Additionally, bales were sampled at 6-weeks and 9- and 12-months post-harvest to determine changes in nutritive value over time. Although seasonal yields were greater in the T85+N during year 1, alfalfa-bermudagrass plots produced additional harvests each season, leading to greater ($P < 0.01$) cumulative yield in T85+Alf (33,230 vs. 23,430 kg ha^{-1}, respectively) over the study period. Analyses of nutritive value show that CP and in-vitro true digestibility (IVTD) were greater ($P < 0.01$ and $P = 0.03$, respectively) in T85+Alf than T85 (184 vs 119 g kg^{-1} CP and 798 vs. 732 g kg^{-1} IVTDMD, respectively). During storage, CP of T85+Alf decreased ($P < 0.01$) between harvest and fermentation (6-weeks), but not between 9- and 12-months; CP of T85 did not change. Funding for this project provided by GACC-Beef.

Effect of Low Density Polyethylene Mulch on Fomesafen Dissipation

K.M. Eason, T.L. Grey, and A.S. Culpepper

Plasticulture is a favorable management practice for Georgia vegetable producers. In these systems, producers typically use a combination of raised beds, drip irrigation, and plastic mulch. To ensure efficiency the plastic mulch is used multiple times, meaning weed suppression is crucial. Herbicides can be utilized under plastic but herbicide persistence in the soil is a major grower concern. Therefore, analytical studies were conducted to establish information about fomesafen dissipation when applied to bare soil and soil under low density polyethylene (LDPE) mulch. Trials were conducted in Ty Ty, Georgia on Tifton loamy sand soil. Fomesafen was applied at 141, 282, and 561 g ai ha^{-1} and multiple soil samples were taken over and up to 150 days after application. Fomesafen was extracted from each soil sample and analyzed using a tandem high performance liquid chromatography (HPLC) and mass spectrometry (MS) system. Data indicated that fomesafen dissipation was rapid for bare soil as compared to soil under LDPE mulch. The half-life (LD_{50}), as defined in time for 50% dissipation, for fomesafen on bare soil was 2 days and soil under LDPE mulch was 58 days. This indicates that LDPE reduced dissipation and could extend weed control for crop registrations. From the data, using fomesafen on bare soil can result in loss of residual weed control.

Identification of Potential Overwintering Host of Cotton Leaf Roll Dwarf Virus (CLRDV) in Georgia

N. Sedhain, S. Bag, J.R.Whitaker, P.Chee, P. Roberts, R.C. Kemerait,

Cotton leafroll dwarf virus (CLRDV; family Luteoviridae, genus Polerovirus) is a serious economic pest of cotton associated with Cotton Blue Disease. This virus is exclusively transmitted by aphids (*Aphis gossypii*) in a persistent, circulative and non-propagative manner and is restricted to the phloem cells of the host plant. Besides cotton and some other cultivated plant species belonging to Malvaceae, Solanaceae, Cucurbitaceae, and Asteraceae family could be serving as a potential reservoir of CLRDV inoculum for continuing disease cycle. During 2018-19, CLRDV has been reported from the southern belt of the United States including Alabama, Florida, Georgia, Mississippi, and South Carolina. Since January 2019, in coordination with UGA-Extension, an extensive survey is initiated in GA to investigate the overwintering/alternate hosts that could potentially act as a green bridge. Different weeds commonly found in GA including HeinBit deadnettle (*Lamium amplexicaule*), Mouseear chickweed (*Cerastium vulgarium*), Purple cudweed (*Gnaphalium purpureum*), Curly dock (*Rumex crispus*), Carolina Geranium (*Geranium corolinianum*) and Wild radish (*Rhaphanus raphanistrum*) were collected randomly from commercial cotton fields of thirteen different counties in Georgia. In addition, cotton stalks and leaves regrowth from the remains of previous year crop were also sampled. The samples were analyzed using RT-PCR followed by cloning and sequencing to detect the presence of the virus. Among the weeds tested, CLRDV was detected from Henbit deadnettle and perennial peanut (*Arachis glabrata*) collected from the cotton field in Tift County. In addition, CLRDV has also detected from several ratoon cotton. This report suggests that Henbit deadnettle, Perennial peanut, and ratoon cotton has the potentiality to serve as an over-wintering alternate host for the virus and the aphid vectors. In addition, this report warrants further study on the role of that specific weed in this emerging viral disease epidemiology.

Effects of Milk Replacer Feeding Rate on Cortisol and Metabolic Responses during an ACTH Challenge of Preweaning Dairy Calves during Summer

R.M. Orellana Rivas and S. Tao

To evaluate if milk replacer (MR) feeding rate influences cortisol and metabolic responses to an Adrenocorticotropic hormone (ACTH) challenge, 39 Holstein calves (body weight [BW] = 40.8 kg) were randomly assigned to three treatments: control (0.57 kg/d of a 20% crude protein and 20% fat MR), intermediate (0.68 kg/d of a 26% crude protein and 17% fat MR [26:17]), or high (0.79 kg/d of 26:17) at 2 d of age. Milk replacer was offered twice daily (12% solids) until d 42 when MR was fed once daily until weaning at d 49. Plasma was collected throughout the experiment for analysis of cortisol. A subset of calves (n = 8/treatment) was subjected to an ACTH challenge at d 40. Plasma was collected from -30, to 120 min relative to ACTH infusion (0.125 IU/kg of BW) for analyses of cortisol, insulin and metabolites. The average temperature-humidity index was 75 and the calf average rectal temperature was 39.6 °C indicating consistent exposure to heat stress. Treatment did not influence ($P > 0.13$) plasma cortisol concentrations during the experiment or the ACTH challenge. The ACTH infusion decreased insulin concentration and increased non-esterified fatty acid concentration ($P < 0.01$). After ACTH infusion, the plasma glucose concentration of high calves was greater than control and tended to be greater than intermediate ($P = 0.08$). Insulin concentrations were greater for high than control and intermediate ($P = 0.03$). Plasma non-esterified fatty acid concentrations of control calves were greater than high and tended to be greater than intermediate at 15 min and were greater than intermediate at 45 min following infusion (treatment × time, $P = 0.02$). Increasing MR allowance had no effect on cortisol biology, however, higher MR allowance may alter metabolism during acute stress.

Cereal Rye Cover Crop and Herbicide Application Method Impacts Cotton Stand, Palmer Amaranth Control, and Cotton Yield

L.C. Hand, R.L. Nichols, T.M. Webster, A.S. Culpepper

Six on-farm studies determined the effects of a rolled rye cover crop, herbicide program, and planting technique on cotton stand, weed control, and cotton yield in Georgia. Treatments compared four systems: (1) rye drilled broadcast with 19 cm row spacing and a broadcast herbicide program, (2) rye drilled with a 25 cm rye-free zone for cotton planting and a broadcast herbicide program, (3) rye drilled with a 25 cm rye-free zone for cotton planting with PPI and PRE herbicides banded in the cotton planting row, and (4) no cover crop with broadcast herbicides. At two locations, cotton stand was lowest in plants ha^{-1} with rye drilled broadcast; at these sites, stand increased with the addition of a rye-free zone. At a third location, cover crop systems preserved soil moisture more effectively than the no cover system resulting in a more uniform stand in the cover crop. Treatments did not influence stand at the other three locations. Palmer amaranth was controlled equally at three locations but differences were observed at the three locations having higher glyphosate resistant plant densities. For these locations when broadcasting herbicides, 82 to 86% fewer Palmer amaranth plants were present in the broadcast rye and rye-free zone systems compared to the no cover system at harvest. The system with banded herbicides was nearly 21 times less effective than the similar system broadcasting herbicides. Cotton yield was influenced by Palmer amaranth where treatment differences were noted. At these locations, the rye broadcast and rye-free zone systems with broadcast herbicides yielded 9 to 16% higher than the no cover or the rye-free zone with banded herbicide systems. A rolled rye cover crop can reduce weed emergence and herbicide selection pressure while improving weed control and cotton yield but herbicides should be applied broadcast to effectively combat glyphosate-resistant Palmer amaranth.

Physiological Traits as Components of Genotypic Variability of Peanuts under Drought Conditions

L. A. Moreno, C. Pilon, B.S. Fabreti, A.C.C. Lara-Fioreze, and C.C. Holbrook

In breeding programs, one of the most common methods of selection for drought tolerance is based on yield. In addition, physiological and metabolic mechanisms could be identified as components for development of peanut cultivars with enhanced drought tolerance. The objective of this study was to identify physiological mechanisms as relevant components of genetic diversity among peanut genotypes under drought conditions, which could potentially be used as a selection tool for cultivars with improved drought tolerance. Ten runner-type peanut genotypes were planted under field conditions at the University of Georgia, Tifton Campus in 2018. The genotypes included commercially-available cultivars and lines from USDA-ARS. Irrigation treatments consisted of a well-watered control and drought stress levels imposed at two different developmental stages of the plants, onset of flowering [34 days after planting (DAP)] and peak flowering (76 DAP). Water was withheld for 40 and 21 days for the first and second stress levels, respectively. Drought stressed plots were covered with a rainout shelter to prevent rain/irrigation on stressed plants. Measurements of gas exchange and chlorophyll *a* fluorescence were performed at the last day of the stress periods and leaf samples were collected for analysis of pigments and enzymatic antioxidants from the defense system pathway. Among the 19 traits evaluated, chlorophyll *a* content as well as fluxes, quantum yields and efficiencies of the transient rise of chlorophyll *a* fluorescence induction were the traits with higher contribution to the genotypic diversity within the environments studied. The genotypes were ranked according to their responses to 13 and 10 most relevant traits under stressed and irrigated conditions, respectively. Under stressed environment, Florida-07 stood out by its improved photosynthetic efficient, whereas under irrigated environment, A100 indicated higher efficiency. Further investigation is ongoing to validate the contribution of these traits to genotypic diversity of peanuts under drought stress.

Characterizing a Peanut Chromosome Segment Substitution Line Population Using High Throughput Phenotyping

D.M. Gimode, Y. Chu, S. Bertioli, D. Bertioli, C. Holbrook, J. Clevenger, L. Lacerda, D. Daughtry, D. Fonceka, W. Porter, and P. Ozias-Akins

Currently, high throughput genomics aided breeding is being tested in peanut research. This has been facilitated by the recent development of high quality genomic resources, a phenomenal feat considering the genetic heritage of cultivated peanut. Its recent polyploidization, self-pollinating breeding system, and domestication bottleneck have resulted in a crop with reduced diversity. To harness polymorphism from its wild relatives, a chromosome segment substitution line (CSSL) population was created via the tetraploid route to interspecific hybridization. The 58K and 48K peanut Affymetrix SNP chips were used to characterize the genetic makeup of the population. To associate the genotypic differences with specific traits, phenotype data was manually collected in 2017. In 2018, field based high throughput phenotyping (HTP) techniques were deployed to alleviate some of the drawbacks of manual phenotyping such as labor and time intensiveness. Sensors mounted on an unmanned aerial vehicle (UAV) were used to acquire data on various vegetative indices as well as canopy temperature. A combination of aerial imaging and manual scoring showed that CSSL 100, CSSL 84, CSSL 111 and CSSL 15 had remarkably low *tomato spotted wilt virus* (TSWV) incidence, a devastating disease in South Georgia. CSSL 100, CSSL 84, and CSSL 111 also performed well under early leaf spot (ELS) pressure. The vegetative indices strongly correlated with the disease scores, indicating that aerial phenotyping is a reliable way of selecting under disease pressure. In addition to being potentially resistant to foliar diseases, the latter three lines also had high plot pod yields comparable to the cultivated check Tifguard. Using a CSSL population, this study has enabled us to propose that chromosome segments from peanut wild relatives may be a potential source of valuable agronomic traits.

Incidence, Abundance and Distribution of Plant-Parasitic Nematodes in Vegetable Systems of Southern Georgia

J. Marquez and A. Hajihassani

Plant-parasitic nematodes (PPN) greatly affect vegetable crops, yet no survey on PPN has been conducted in Georgia, USA. Therefore, 29 vegetable producing counties were randomly sampled in 437 vegetable fields of southern Georgia during the 2018 spring and fall cropping season. Soil samples consist of 30-40 soil cores collected every 3-4 m in a diagonal transect of the field. PPN were identified to the genus level based on variations of morphological features. Ten genera of PPN were detected consisting of root-knot (*Meloidogyne* spp.), stubby-root (*Paratrichodorus* spp.), ring (*Mesocriconema* spp.), spiral (*Helicotylenchus* spp.), root lesion (*Pratylenchus* spp.), lance (*Hoplolaimus* spp.), reniform (*Rotylenchus* spp.), cyst (*Heterodera* spp.), stunt (*Tylenchorhynchus* spp.), and dagger (*xiphenema* spp.). By far, root-knot nematode (RKN) incidence (66.7%) and abundance (number of nematodes/100 cm^3 of soil) greatly exceeds the other PPN genera in vegetable fields ($P<0.05$). RKN abundance (2-14,144 infective juveniles/100 cm^3 of soil) was greater in fields of eggplant (*Solamum melongena*), tomato (*Solanu lycopersicum*), pepper (*Capsicum annuum*), beans (*Phaseolus vulgarisi*), cucumber (*Cucumis sativus*), and cantaloupe (*Cucumis melo* var. *cantalupensis*) compared to watermelon (*Citrullus lanatus*) and onion (*Allium cepa*) ($P<0.05$). This may explain a higher abundance of RKN distributed in the southern most counties which are known to be major producers of these vegetables. Though RKN is the most important PPN in vegetable fields, *Paratrichodorus* spp., *Mesocriconema* spp., and *Heliocotylenchus* spp. may also affect vegetable production.

Development of a Technique to Estimate Stand in Peanut (*Arachis hypogaea* L.) for Replant Decisions

S. Pelham, S. Monfort, V. Liakos, and S. Tubbs

Poor stand in peanuts (*Arachis hypogaea* L.) can be caused by multiple factors including drought and diseases which lead to a reduction in yield and ultimately a loss of revenue to the grower. Due to lost revenue, it is important to establish uniform plant stand. Considerable research has been conducted to identify the ideal plant stand and the official recommendation from The University of Georgia is a seeding rate of 19.7 seed/m to obtain a final stand of 13.1 plants/m. However, research has shown that yield potential can be maintained at reduced plant stands. These contrasting studies show that the decision to replant a field is extremely difficult for the grower to make. The purpose of this study was to determine whether unmanned aerial systems (UASs) could be beneficial in this decision. This study utilized a UAS to collect stand count data from a trial conducted at the Sunbelt Agricultural Expo. This trial consisted of 4 treatments of 6.6 seed/m, 13.1 seed/m, 16.4 seed/m, and 19.7 seed/m in a randomized complete block design with four replicates. Images were collected starting at 8 days after planting (DAP) and continued every other day for 6 weeks. Stand counts were collected manually once a week for 3 randomly selected 10m sections of each plot. Images were stitched together using Pix4Dmapper Pro and then analyzed in ArcMap 10.5. Images were analyzed by using an unsupervised classification to separate soil pixels from plant pixels. Analysis showed that 14 and 28 DAP yielded the highest Pearson correlation coefficients between in field stand counts and aerial stand counts with values of 0.885 and 0.635 respectively. Therefore, coupled with a threshold for replant, the use of an unmanned aerial system could automate the process to help the grower make an informed management decision.

HYDRUS-1D for Simulating Water and Nutrient Movement

D. Pavlou, A. Orfanou, M. L. Cabrera, G. Harris, G. Hoogenboom, R.D. Lee, R.L. Noland, W.M. Porter, D.E. Radcliffe, and G.Vellidis

There is a great concern about the impact of agriculture on the environment. Most farmers' goal is to achieve the highest possible yield. In Georgia, a relatively small group of farmers have been able to achieve corn yields of around 31000 kg/ha (500 bu/ac). In addition to better varieties and the use of irrigation, higher yields are often pursued by adding more agrochemicals and more specifically, higher rates of fertilizers. The use of high rates of fertilizers can result in unintended environmental consequences as unused fertilizers can move from the soil to groundwater with leaching and to streams and rivers with surface runoff. The impact on the environment has been documented by researchers for at least the past 50 years. As farmers pursue higher yields, the threat to the environment may increase. Previous studies have tried to find ways for better management practices which could possibly minimize the environmental problems. This three-year study focuses on identifying the environmental effects, regarding water quality, of pursuing high corn yields in Georgia. Groundwater and surface runoff samples are being collected throughout the year and analyzed in the lab for nitrogen, phosphorus, and other parameters. The data will be used to calibrate and validate Hydrus – 1D in order to understand how the system responds to different management practices used to achieve high corn yields. Moreover, the model will be used for simulating a wide range of management scenarios in order to identify the practices which result in the highest yields with the lowest adverse environmental effects.

DSSAT-CERES-Maize Model for Identifying the Limiting Factors in Corn Production

A. Orfanou, D. Pavlou, G. Vellidis, K. Boote, M. L. Cabrera, G. Harris, R.D. Lee, R.L. Noland, and W.M. Porter

Corn yield can be affected by numerous factors and because every field is different, increasing corn yield across all environments is not easy. It is crucial to implement a proper soil fertility program that will be the foundation for achieving high yields. Nitrogen (N), phosphorous (P), potassium (K), and micronutrients should be applied at the right time and right amounts to ensure no in-season deficiencies arise. Moreover, tillage method, planting date, population, and proper rotation are factors that can keep yields consistently high. There are studies that have aimed to increase corn yield around the world by considering these variables. Moshia et al. (2008) tried to assess the influence of variable rate manure applications on grain yield by using three different management zones in northeastern Colorado. Another study showed that optimized irrigation can have positive results in increasing corn yield (Li & Sun, 2016). In this three-year study the objectives were to measure the agronomic response of corn to high yield management practices and use crop simulation models to evaluate additional management scenarios. The main goal of this study was to determine the effect of high fertility management strategies on corn in Georgia. Two treatments regarding high fertilization rates were tested in a 1.78 ha field, located in Tifton, GA. Conventional management practices were implemented during the first year of the project while intensive ones were implemented the following two years. Soil samples were collected before and after each growing season, while tissue samples were collected during multiple growing stages from V3 to R4. The field data are being used for calibrating and evaluating the DSSAT CERES Maize model. The model is being used to conduct sensitivity analyses to identify the limiting factors in corn production and inform Georgia growers on how to sustainably intensify corn production.

Using an Exploratory Landscape Analysis to Determine Driving Factors of Peanut Burrower Bug, *Pangaeus Bilineatus* (Hemiptera: Cydnidae), Distribution in Southeast United States Peanut Systems

B.L. Aigner, M. Abney, and J. Schmidt

The peanut burrower bug, *Pangaeus bilineatus* Say (Hemiptera: Cydnidae), is a serious economic pest of peanut, *Arachis hypogaea* L., in the Southeast U.S. Native to the US, the insect has become a significant pest throughout the Southeast without a clear explanation of factors driving its distribution. Since 2010, annual losses have been reported in the region, especially Georgia. A record of all peanut burrower bug injury occurring in the 2016-2018 crop years was acquired from the Georgia Federal-State Inspection Service. These data were used to conduct a preliminary buffer analysis with ArcGIS and R using 115 field locations with varying levels of burrower bug injury in 2016. Using the 2016 USDA cropland data layer, agriculture and non-agriculture land use within 1 km of each field location was assessed to determine significant links between land use types and peanut burrower bug injury. Preliminary results suggest that surrounding land area in peanut, cotton, and wetland have strong positive correlations with peanut burrower bug injury. Grower survey data consisting of detailed production practice history of individual fields will be assessed along with soil data from the USDA web soil survey. Relationships will be characterized with an associated burrower bug risk index (given a value of 0-1, Lo-Hi) to develop a preliminary risk assessment model that will be validated by sampling commercial peanut fields with various levels of calculated risk. Once optimized, the model will be developed into a tool for peanut farmers in the form of a cell phone application. Ultimately, the goal of this work is to reduce the incidence of peanut burrower bug injury in Georgia by raising grower awareness of important risk factors and facilitating informed management decisions.

Autonomous Cotton-Picking Robot Using a Stereo Camera

K. Fue, W. Porter, E. Barnes, and G. Rains

Small rovers are being developed to pick cotton as bolls open. The concept is to have several of these rovers move between rows of cotton, and when bolls are detected, use a manipulator to pick the bolls. To accomplish this goal, each cotton-picking robot needs to accomplish three movements; rover must move forward/backward, left/right and the manipulator must be moved to harvest the detected cotton bolls. Control of these actions can have several states and transitions. Transitions from one state to another can be complex but using ROS-independent finite state machine (SMACH), adaptive and optimal control can be achieved. SMACH provides task level capability to deploy multiple tasks to the rover and manipulator. In this research, a cotton-picking robot using a stereo camera to locate rows and cotton bolls are developed. The robot harvests the bolls using a 2D manipulator that moves linearly horizontally and vertically. The boll 3-D position is determined by calculating stereo camera parameters, and the decision of the finite state machine guides the manipulator to the destination. Error modeling is done by smoothing the parameters using a moving average.

Harnessing the Wild Side of Peanuts: Morphological and Reproductive Characterization of Wild Peanut Relative-derived Synthetic Tetraploids

M. L. Chandler, Y. Chu, P. Ozias-Akins C. C. Holbrook

Peanut cultivar improvement is limited by peanut's narrow genetic base, yet wild peanut relatives with diverse and strong resistances can be used as donors in breeding programs. To introduce genetic resources from these wild peanut relatives into peanut breeding programs, crosses were made among A-genome wild relatives (male) with several B-genome wild relatives (female) and the genomes of these materials were then doubled to produce four different synthetic tetraploids (*IpaDur*, *IpaCor*, *IpaSten*, and *ValSten*). This study seeked to characterize these materials to assure efficient utilization of these materials when they are released to breeding programs. Therefore, selfed seed from these synthetic tetraploids along with two peanut breeding lines, and F_1 progeny made from crosses between the breeding lines and one synthetic tetraploid (*IpaCor*), were grown in the field in a randomized complete block design. Morphological and reproduction characterization included flower measurements (hypanthium area, banner area and pigment absorption, wing area, and biweekly flower counts), main stem height, average internode length on primary laterals, reproductive vs. vegetative node ratio, plant body weight, leaf measurements (area, dry and fresh weight, and pubescence density), and pod and seed measurements (presence/absence of seed beak, 100 pod and seed weight, and pod and seed count). For most traits, one or more synthetic tetraploid was significantly different from one or both of the cultivated lines. In general, synthetic tetraploids had larger flowers, longer average internode lengths on primary laterals, greater leaf pubescence density, and smaller seeds than peanut breeding lines. These traits should be considered when using these materials in breeding programs to assure maximum effectiveness of breeding efforts.

Dynamics of Fungicide Sensitivity in *Venturia effusa* and Fungicide Efficacy under Field Conditions

J. R. Standish, T. B. Brenneman, K. L. Stevenson

Venturia effusa, which causes scab, the most damaging disease of pecan, has developed resistance to fungicides that were once very effective. A 2-year study was conducted to explore the relationship between laboratory-based sensitivity to fentin hydroxide (TPTH) and tebuconazole (TEB) in *V. effusa* and the efficacy of these products in managing scab under field conditions. Scab epidemics were monitored on trees each receiving ten applications of TPTH (Super Tin 4L), TEB (Orius 3.6F), azoxystrobin (AZ; Abound), AZ + TEB, TPTH + TEB, or no fungicide (NTC). Sensitivity of *V. effusa* on leaflets from treated trees was assessed in June and September of both years. In 2016, mean relative germination (RGe) on 30 μg/ml TPTH was 11% and 41% (June and Sept., respectively), and in 2017, RGe was 4% and 1%. Mean relative growth (RGr) on 1 μg/ml TEB in 2016 was 46% and 35%, and 69% and 56% in 2017. Leaf and nut scab intensity were significantly lower in both years on trees treated with AZ, AZ + TEB, or TPTH + TEB when compared to NTC and TEB-treated trees. Compared to the NTC, TEB did not significantly reduce leaf scab in 2017 or nut scab in either year, indicating that an RGr value between 46% and 69% is likely to result in a control failure on TEB-treated trees. Although better control was expected, TPTH reduced scab with RGe values between 1% and 41%. These results will be valuable in developing critical fungicide sensitivity thresholds to better predict fungicide performance.

Inheritance and Mapping of Albino Virescent-Leaf and Lutescent-Leaf Traits in Peanut

N. Brown and W.D. Branch

Two chlorophyll-deficient leaf mutations have been identified in advanced peanut (*Arachis hypogaea*, L.) breeding lines at the University of Georgia. The Lutescent-Leaf mutant, which causes a yellowing of the leaf, mid-rib and leaf margins was previously shown to be controlled by recessive alleles at 2 genes (lut_1 and lut_2). A newly described, Albino Virescent-Leaf mutant, the seedlings and new leaves of which begin as albino, then gradually accumulate chlorophyll until they become green with age, is controlled by recessive alleles at a single locus. These two mutants were hybridized to evaluate potential allelism at the causal loci. The resulting F_1 was a normal green plant. However, segregation in the F_2 and F_3 populations suggest that the Albino Virescent parent used in crosses was homozygous recessive for one of the two Lutescent loci, resulting in a segregation ratio of 9 (Green): 4 (Albino Virescent): 3 (Lutescent) in the F_2 population. Bulked segregant analysis (BSA) was carried out on pooled leaf tissue to identify the region(s) responsible for these simply inherited mutations. A strong signal was identified on Chr.10 for Albino Virescent-Leaf spanning a ~2Mb region. The Lutescent-Leaf trait mapped to a diffuse region on Chr.02, encompassing essentially the entire chromosome.

When a Plan Comes Together: New Strategies for Mitigating Aflatoxin Contamination Using Biotechnology

J.C. Fountain, P. Ozias-Akins, and B. Guo

After more than 50 years of awareness of the threat posed to US and global crop production and food safety by aflatoxins, much has been accomplished related to enhanced screening and testing for the presence of these carcinogenic toxins in the food supply. Traditional and molecular breeding efforts have also been successful in producing varieties with some degree of reduced contamination. However, there remains much to be understood about the interaction between important host plants such as corn and peanut, and the pathogen *Aspergillus flavus*, particularly under aflatoxin-conducive, drought stress conditions. Our research has sought to understand both the responses of host plants to drought stress, as well as the responses of *A. flavus* to related oxidative stresses in order to identify key components of this interaction to improve host resistance. Using novel "omics" technologies including transcriptomics, proteomics, metabolomics, and genomics we have identified an apparent link between these organisms related to antioxidant signaling under stress conditions. These signals are suspected to regulate both stress responses and development in both organisms and the production of aflatoxin in *A. flavus*. Given this potential link, here we discuss the application of genetic transformation and genome editing to modify corn and peanut antioxidant gene expression under stress in an effort to mitigate aflatoxin contamination. Applications for next-generation genome sequencing to better understand variation in stress responses and aflatoxin production among diverse field isolates of *A. flavus* will also be explored.

Abstract #45

Agricultural Education Partners for Pollinators

Ashton Wheeless, Ami Harrington, Barry Croom

Monarchs face many risks that are resulting in declining populations in both the eastern and western parts of their North American range. The largest impact is recognized as the loss of habitat for breeding, migrating, and overwintering (Flockhart et al., 2017). Throughout the project the team at the University of Georgia and citizen scientists are partnering with agricultural education programs across the state to develop and implement native milkweed production by utilizing school greenhouses. Over the course of the project, lesson plans, experiential learning activities, and science projects for students enrolled in middle school and high school agricultural education programs were developed by the University of Georgia. The partnership utilized a unique combination of resources to accomplish these purposes. Many agricultural education programs in the state have greenhouse facilities. These greenhouses provide lab space for students to conduct research projects related to plant science and soil science. Middle school and high school teachers utilize this research space in their greenhouse laboratories to produce native milkweed plants for transplanting in the appropriate ecoregion and native plant communities. The production of these native milkweed plants are useful Agricultural Science experiential learning projects for students. In addition to the lesson plans produced, the project includes train-the-trainer workshops for citizen scientists, agricultural educators, and young farmers so that they may train others in their communities. This project partnered teachers and the university's team with citizen scientists who have been tracking the migration of monarch butterflies for decades by utilizing social exchange theory (Emerson, 1976). By providing the materials and lesson plans to agricultural educators, they are able to focus their time on creating the monarch habitat despite their extensive workload. This partnership ensures that habitat is created by balancing the reward of habitat development and the effort required to achieve it for all participants.

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