**2018 Gamma Sigma Delta Student Presentation Competition Abstracts**

**Undergraduate Oral**

**Title: Cover Crop Species Influences Mid-winter Canopy Coverage (\*1st place)**

**Authors:** Robyn Mulloy and T.L. Roberts

The primary impairments to surface water systems in the Arkansas delta are sedimentation and turbidity, which are the direct result of erosional soil losses from the landscape. Crop canopies provide protective barriers for the soil surface and can be extremely effective in reducing erosion. The objective of this study was to compare the mid-winter canopy coverage of various cover crop species to winter fallow and winter wheat (*Triticum aestivum* L.). The treatments implemented were; winter fallow, winter wheat (for grain), cereal rye (*Secale cereale*), barley (*Hordeum vulgare*), Austrian winter pea (*Pisum sativum*), black-seeded oats (*Avena sativa*), blue lupin (*Lupinus angustifolius*), Mix 1 (cereal Rye, crimson clover [*Trifolium incarnatum*], 7-top turnip [*Brassica rapa*]) and Mix 2 (black oats, Austrian winter pea). Winter cover crop treatments were planted on silt loam soils at the Vegetable Research Station (VRS) near Kibler, AR, the Southeast Research Station (SEREC) near Rohwer, AR, and the Pine Tree Research Station (PTRS) near Colt, AR. On January 9-10, 2018 the canopy coverage of each treatment was measured using the Canopeo App. Treatments within a location were compared and means were separated using Fishers protected LSD at the α=0.05 level. Cereal rye provided one of the highest canopy coverages across all locations and ranged from 23.4% - 99.5%. Winter wheat and Mix 1 also did well at the VRS and SEREC locations, where the barley and black oats did well at PTRS. These results indicate that cover crop species selection strongly influences canopy coverage and potential reductions in erosional soil losses.

**Title: Assessing the Genetic Diversity of *Cercospora* spp. Associated with Cercospora Leaf Blight of Soybean**

**in North America (\*2nd place)**

**Authors:** Kona Swift and Burt Bluhm

*Cercospora* spp. are plant pathogenic fungi that affect many species of plants. The soybean industry in particular suffers considerable losses each year due to Cercospora leaf blight (CLB) and other diseases associated with *Cercospora* spp. For many years, *Cercospora kikuchii* was considered the sole cause of CLB in the U.S. However, recent studies have suggested that additional *Cercospora* spp., particularly *Cercospora* cf. *flagellaris,* are associated with CLB in the southern U.S. Little is known about the genetic basis of pathogenesis in *C*. cf. *flagellaris*, and genetic resistance is currently unavailable in commercial soybean cultivars. The goal of this study was to collect *C*. cf. *flagellaris* strains from various U.S. soybean production regions and utilize molecular techniques to explore population structure and mechanisms of pathogenesis. During the 2017 growing season, 685 strains of *C*. cf. *flagellaris* were collected from symptomatic soybean leaves from thirty locations within eight states. Additionally, 25 strains were isolated from cotton, basil, watermelon, and mint leaves. Whole-genome resequencing was performed for 30 *C*. cf. *flagellaris* strains, and a customized protocol for restriction site-associated DNA sequencing (RADseq) was developed to analyze 113 additional strains. Comparative and population genomics approaches are being used to determine the genetic diversity of the pathogen, explore the possibility of cryptic sexual reproduction, and identify genes potentially associated with pathogenesis and host specificity. This information will ultimately accelerate the development of conventional and transgenic resistance to CLB in soybean.

**Undergraduate Poster**

**Title: Starch Hydrolysates of Germinated Rices with Varying Amylose Contents under Aerobic and Anaerobic**

**Conditions (\*1st place)**

**Authors:** Emily Wong, Jia-Rong Jinn, Callie Pillsbury, and Ya-Jane Wang

There is an increasing interest in germinated rice for direct consumption and syrup production because it is rich in bioactive components and amylolytic activities. The objective of this study was to characterize amylolytic enzymes and starch hydrolysates from germinated rice cultivars of varying amylose contents under different germination conditions. Four rice cultivars—waxy, short-grain, medium-grain, and long-grain—were germinated under aerobic and anaerobic conditions for 4 days and then mashed at 55 and 75oC. They were analyzed for activities of alpha-amylase, beta-amylase and alpha-glucosidase, and the hydrolysate concentrations and compositions of the resultant mashes. Long-grain rice showed the highest activity of all enzymes, whereas waxy rice exhibited lower activities. Both alpha- and beta-amylases reached maximum activity at the third day of aerobic germination, but at the fourth day of anaerobic germination. Alpha-glucosidase activity remained relatively stable over time under both germination conditions. The amounts of saccharides gradually increased during mashing and were greater at 75oC than at 55oC and slightly greater for anaerobic than aerobic germination. Waxy rice produced the largest amount of total saccharides and long-grain rice produced the least amount. The saccharide composition varied with cultivars, germination and mashing conditions. Saccharides of larger molecular size were observed in mashes incubated at 75oC, but not at 55oC. By understanding the amylolytic activities and saccharide compositions of different rice cultivars under different germination conditions, it is possible to produce value-added rice hydrolysate products without the addition of external enzymes while preserving the nutrients naturally present in brown rice.

**Title: Comparison of Short-grain Rice Cultivars Grown in Japan and the United States (\*2nd place)**

**Authors:** Michiyo Nishiwaki, Eric Lii, Andy Mauromoustakos, and Ya-Jane Wang

Although short-grain rice accounts for less than 2 % of U.S. rice production and grows only in California, the demand for short-grain rice is rising because of increasing popularity of sushi and sake. The objective of this study was to compare the physical, chemical and texture properties of rice cultivars grown in Arkansas versus in Japan and California to characterize their differences. Seven short-grain rice cultivars from the 2016 crop year were collected, including one (RU9601099) provided by Arkansas Rice Research & Extension, one (CH-202) provided by California Rice Experiment Station, and five (Hatsuhimo, Kinuhikari, Koshihikari, Nanatsuboshi, and Yumepirika) grown and purchased in grocery stores in Japan. The rice cultivars were characterized for color, kernel dimensions (length, width, and thickness), chemical composition, starch fine structure, and gelatinization, pasting and textural properties.

RU9601099 was found to have a smaller width and a greater whiteness than the other cultivars. Japanese cultivars were comparable in protein content, while RU9601099 had the greatest and CH-202 had the lowest protein content. RU9601099, CH-202 and Kinuhikari shared similar values of average chain-length of amylopectin and gelatinization temperatures and enthalpy, which were significantly greater than the other cultivars. When cooked, the Japanese cultivars exhibited significantly greater hardness values than the U.S. cultivars. Considering all data, CH- 202 shared similar properties with Kinuhikari, but RU9601099 was distinctively different from other cultivars in most properties. The information obtained from this study will help guide future development of short-grain cultivars and marketing of existing short-grain rice cultivar from Arkansas.

**Title: Introducing STEM Education Through a 3D Printing Demonstration (\*3rd place)**

**Authors:** Kennedy Rickard and Emily Vrbas

This research project investigates the impact of a Science, Technology, and Math (STEM) and 3D printing presentation on a selected population, as well as evaluates the need for further research into 3D printing as an introduction to STEM education. Participants will complete a pre-survey measuring knowledge and interest in STEM education and 3D printing. A PowerPoint presentation will demonstrate the viability of STEM education and careers and show the variety of careers that benefit from 3D printing. After the presentation there will be a demonstration of 3D printed small objects that will showcase a sample of what can be printed with these machines. Each person that participates will receive a “takeaway” of a small 3D printed item. Finally, a post survey to reevaluate knowledge and interest in 3D printing and STEM education will be conducted. After the presentations, researchers will analyze the data from the pre- and post- surveys to expose changes in the participants’ views. The results could show a need for continued research in this area of study and identify a potential STEM education deficit.

**MS Oral**

*Flight 1*

**Title: Evaluation of Sequence CS in Xtend Cotton (\*1st place)**

**Authors:** JT Richburg, JK Norsworthy, ZD Lancaster, and GT Jones

Sequence is a premix of glyphosate and *S-*metolachlor, which provides both foliar systemic activity as well as residual activity. Sequence is only labeled for use in glyphosate-resistant crops. Currently, Sequence is labeled as an emulsion-in-water (EW) formulation; however, a capsuled suspension (CS) is under development. An experiment was conducted at the Northeast Research and Extension Center near Keiser, Arkansas in the summer of 2017 to compare the two formulations of Sequence and evaluation tank-mix options with Sequence in XtendFlex cotton. XtendFlex cotton was planted into conventionally tilled, raised beds at 55,000 seeds/A. Treatments of Sequence EW at 2.5 pt/A, Sequence CS at 3.1 pt/A, Sequence CS at 3.1 pt/A + XtendiMax at 22 fl oz/A, Sequence CS at 3.1 pt/A + Engenia at 12.8 fl oz/A, Sequence CS at 3.1 pt/A + Roundup PowerMax at 10 fl oz/A, and Sequence CS at 3.7 pt/A were applied three weeks after planting. Cotoran at 1 qt/A was applied to the test site at planting.

Injury and Palmer amaranth control were assessed at 7, 14, 28, and 42 days after application (DAA). Treatments containing XtendiMax and Engenia showed the highest injury 7 DAA (12% and 8%, respectively). By 14 DAA no treatment had observable injury. The CS and EW formulations had similar control at 14 DAA (88% and 85%, respectively). By 28 DAA the CS formulation provided higher residual control than the EW formulation (68% and 40%, respectively). Treatments containing dicamba showed both higher initial control and residual control (>90%) up to 63 DAA. The improved control is likely due to dicamba activity on glyphosate-resistant Palmer amaranth. Overall, the CS formulation of Sequence has the potential to reduce the total number of passes needed for adequate weed control in a cotton herbicide program. Further research should focus on other tank-mix options for glyphosate-resistant Palmer amaranth control.

**Title: Tolerance of Inzen Grain Sorghum to Multiple Preemergent and Postemergent Applied ALS-**

**Inhibiting Herbicides (\*2nd place)**

**Authors:** H.D. Bowman, L.T. Barber, and J.K. Norsworthy

A vast amount of Arkansas acres are used for rice and soybean production, this can lead to major issues for growers who wish to rotate or grow grain sorghum. The first, is that rice and soybean both have the possibility of utilizing an ALS-inhibiting herbicide in their weed control program. Typically ALS-inhibiting herbicides will have a 12-18 month plant-back restriction to grain sorghum, meaning that is often not an option for rotation following these crops. Another common issue is grain sorghum’s susceptibility to off target movement of these herbicides. Luckily, DuPont has announced the development of a new trait called Inzen. Inzen grain sorghum has a double mutation in the ALS gene. Val560Ile and Trp574Leu, which results in cross resistance to the ALS site of action. With this new trait field research is needed to verify the spectrum of this cross resistance when ALS-inhibiting herbicides are applied preemergence (PRE) to determine carryover potential or postemergence (POST) to evaluate susceptibility to off-target movement. Currently, the only ALS-inhibiting herbicide to be registered in Inzen™ grain sorghum is nicosulfuron. For these reasons, tests were conducted in 2016 and 2017 at the Lon Mann Cotton Research Station near Marianna, AR, the Arkansas Agricultural Research & Extension Center in Fayetteville, AR, and in 2016 at the Pine Tree Research Station near Colt, AR. Treatments were made either PRE or POST to grain sorghum at a 1X rate for other labeled crop uses. The PRE trial was set up as a split plot with herbicide (22 ALS inhibitors) as the main plot and cultivars (Inzen™ vs conventional) as the subplot factors. There was no visible injury, height reduction, or yield reduction to Inzen™ grain sorghum in the PRE trial, whereas almost all ALS-inhibiting herbicides, except halosulfuron did cause damage to conventional grain sorghum. The POST trial was set up as randomized complete block with one factor, ALS-inhibiting herbicide applied. Generally, no visible injury, height reduction, or yield reduction occurred, except with bispyribac-sodium. These results demonstrate that the cross-resistance of Inzen™ to most ALS-inhibiting herbicides could offer promising new alternatives for weed control in grain sorghum.

**Title: Impacts of Size Fractionation and Processing on Functional Characteristics of Broken Rice Kernels (\*3rd**

**place)**

**Authors:** Rebecca M. Bruce and Griffiths G. Atungulu

Rice flour generated from broken rice (brokens) has inconsistencies in functional properties. This is due to rice processing methods, pre-milling and differences in sizes of brokens used for flour production. Parboiled brokens generated at 12.5% and 18% moisture content (MC) and non- parboiled brokens were obtained from commercial milling streams. Broken rice was generated from six cultivars (2 long-grain pure-lines, 2 long-grain hybrids, and 2 medium-grain) of freshly- harvested rough rice that were dried at 25◦C, 45◦C and 60◦C in the laboratory. The brokens were classified into large, medium and small, using US sieve size 10, 12 and 20 respectively. Comingling of the brokens based on size and cultivar was done. Pasting property of the broken rice flour was determined. Results indicate that MC of rice before parboiling affects the pasting property of the parboiled broken rice flour, thus rice parboiled at 12.5% MC had higher peak viscosity and final viscosity than rice parboiled at 18% MC. Larger brokens had better pasting properties than smaller brokens. Whole kernels had higher peak and final viscosities than brokens across all cultivars. This may be due to higher starch content and different distributions of starch across the rice kernel. Comingling of large and small brokens produced flour that has pasting property similar to that of the medium brokens. Drying temperature affected the pasting property of the broken rice flour. However, the trend is cultivar dependent. The results demonstrate the significance of processing methods and size fractionation to control characteristics of flour produced from the brokens.

\* The following abstracts in this category are in no particular order.

**Title: Return on investment in irrigation practices in response to the rate of adoption on an agricultural**

**landscape**

**Authors:** Kerr Adams and Kent Kovacs

Concerns about groundwater depletion from conventional agricultural irrigation in the Arkansas Delta region have led to technological innovation of more efficient irrigation practices. Research into water conserving irrigation techniques has helped preserve water resources, maintain yields, and maximize farm profits. As groundwater levels in the region continue to decrease, the price of water pumping also increases; making investments in new technologies more attractive to producers. The paper addresses the potential returns on investment in new irrigation practices for furrow irrigated soybeans and flood irrigated rice at the landscape level. More farms that adopt the efficiency enhancing practices has no influence on the return on investment in those practices. Despite positive impacts on farm profits, the new technology has adverse effects on groundwater conservation due to an overall increase in irrigated acres.

**Title: Maximizing Soil Nitrogen Credits through Soybean Management**

**Authors:** C.C. Ortel, T.L. Roberts, R. J. Norman, and K.A. Hoegenauer

Arkansas crop production relies heavily on the soybean *(Glycine max)* rice *(Oryza sativa)* rotation for the benefits provided to both crops. Nitrogen credits supplied from the soybean crop through biological nitrogen (N) fixation reduces the rate of fertilizer-N needed to achieve optimal rice yields, thus reducing the input costs associated with the rice crop. The total amount of N credits may be influenced through soybean management, including maturity group (MG) selection. Four MGs of soybeans with similar genetic traits were grown in a split plot design and measured for total N uptake (TNU) and grain yield. After harvest the soybean residue was spread evenly within each plot and left undisturbed. A single variety of rice was grown the following spring and measured for TNU and grain yield. The 4.7 and 5.4 MG soybeans yielded the highest with 3103 kg ha-1 and 3127 kg ha-1 respectively (*P* < 0.0001). However, the 5.6 MG soybean returned the most biomass N at 217.8 kg N ha-1 (*P* = 0.0113). There was no significant difference (*P*= 0.8067) in plant available-N in the soil between previous MGs the following spring, nor was there a significant difference in rice yield between previous MG (*P* = 0.9583). The N fertilizer recommendation for a rice crop does not appear to be affected by the previous soybean MG after a single season. Understanding how soybean MG influences soil N credits is needed to help producers make the best decisions in regards to variety selection for their whole farm rotation.

**Title: A Portable Impedance Aptasensing System for Rapid Detection of *Salmonella***

**Typhimurium in Poultry Products**

**Authors:** America Sotero, Ronghui Wang, and Yanbin Li

*Salmonella* Typhimurium is considered one of the most dangerous foodborne pathogens. Each year, it causes an estimated 19,000 hospitalizations and 380 deaths in the US. Therefore, there is an urgent need for the development of a rapid and reliable detection method for *Salmonella* in food products. The goal of this project was to develop a portable impedance aptasensing system using an interdigitated microarray electrode (IDME) for the rapid and sensitive detection of *S.* Typhimurium in poultry products.

In this study, the IDME was functionalized with 16-Mercaptohexadecanoic acid followed by surface immobilization with NH2-aptamer specific to *S.* Typhimurium. The IDME was then left to rest for 48 h at room temperature to be ready for use in tests. After sample preparation, 50µl of a sample containing *S.* Typhimurium was dropped onto the IDME’s surface. The impedance change caused by the capture of target bacterial cells by the aptamer was measured in the presence of a redox probe and recorded using a laptop with LabVIEW software.

The results showed that there was a linear relationship with a correlation coefficient of 0.95 between the impedance change and log values of *S*. Typhimurium in a range of concentrations from 1.41×101 to 1.41×105 CFU (50 μl)-1 in pure culture samples.

The developed impedance aptasensor could shorten detection time and have a limit of detection (LOD) comparable to commercial impedance instruments. Due to its shorter detection time, low cost, and portability, the developed aptasensor has the potential to improve in-field or at-line detection of foodborne pathogens.

**Title: Options for rescue treatments in XtendFlex® cotton**

**Authors:** W Coffman, LT Barber, JK Norsworthy, and ZT Hill

The productivity of a cotton crop can be threatened by the rapid growth and interference of weeds like Palmer amaranth (*Amaranthus palmeri*) and barnyardgrass (*Echinochloa crus-galli*), which allows them to compete for water, sunlight, and nutrients, if they are not controlled early season. Because herbicide-resistant weeds are becoming more widespread and timely applications are sometimes challenging due to weather, time, and label constraints, effective postemergence (POST) herbicide control options can be limited. To determine if glyphosate, glufosinate, and dicamba could be used to rescue an XtendFlex® cotton crop infested with weeds commonly found in Arkansas, a field trial was conducted at the Rohwer Research Station near Watson, Arkansas in 2017. Treatments were arranged in a two-factor factorial, with the first factor being herbicide combination and the second being POST timing. POST applications that included glyphosate as Roundup PowerMax (1060 g ae/ha), glufosinate as Liberty (590 g ai/ha), or dicamba as Engenia (560 g ae/ha) were made alone or in combination to non-crop plots infested with 60-cm tall barnyardgrass and 50-cm tall Palmer amaranth, followed by (fb) a second application of the same product(s) either 7 or 14 days later. Weed control ratings were taken three weeks after the final treatment was applied. When dicamba plus glyphosate was applied fb the same treatment 7 and 14 days later, 81% and 75% control were obtained, respectively. However, dicamba alone offered 96% control of Palmer amaranth at both second application timings due to intense competition from barnyardgrass. Acceptable levels of barnyardgrass control were unable to be achieved with any treatment. The highest numerical value for control of barnyardgrass (84%) was shown when dicamba plus glyphosate was applied and fb the same application 7 days later. Although this research demonstrates viable options to control large Palmer amaranth, it is important to continue to use preemergence herbicides and make timely POST applications.

*Flight 2*

**Title:** **Determining Rice Tolerance to Early Season Applications of Acetochlor (\*1st place)**

**Authors:** M.E. Fogleman, J.K. Norsworthy, and G.L. Priess

Grassy weeds such as barnyardgrass (*Echinochloa crus-galli*) and red rice (*Oryza sativa*) continue to complicate weed management efforts for rice farmers in the Midsouth. Evolution of herbicide-resistance among these species has limited farmers to few effective control options, and the need for alternative herbicides is apparent. Scientific literature has shown control of problematic grasses in row crops using acetochlor, a very long-chain fatty acid-inhibiting herbicide (WSSA Group 15). Field experiments were conducted in 2016 and 2017 on silt loam soils in eastern Arkansas to determine the effects of application timing and acetochlor formulation on rice tolerance. Based on previous research, we hypothesized that rice would be more tolerant to acetochlor at later application timings. The experimental design was a three- factor randomized complete block with factors being A) formulation (microencapsulated as Warrant; emulsifiable concentrate as Harness), B) rate (1X and 2X, at 1050 and 2100 g ai ha-1, respectively), and C) application timing (preemergence – PRE, delayed preemergence – DPRE, and early postemergence – EPOST). Overall, rice was more tolerant to acetochlor when applied as Warrant than Harness, likely due to the gradual release of acetochlor in Warrant, and the immediate availability of acetochlor in Harness. In all environments, applications of either formulation at the PRE or DPRE timing resulted in greater injury than when applied EPOST. When evaluated four weeks after flooding, rice injury was ≤12% following all EPOST applications of Warrant, indicating that applications should be delayed until this stage to ensure crop safety if a registration is sought by the manufacturer.

**Title: Elucidating the race population structure of *Cercospora sojina* through genotypic patterns (\*2nd place)**

**Authors:** Wagner Fagundes, Marcio Zaccaron and Burton H. Bluhm

Frogeye leaf spot (FLS), caused by *Cercospora sojina*, is an important and recurrent disease of soybean in many production regions. Since the first report of FLS in the United States, new physiological races of *C. sojina* have emerged, which reflects the pathogen’s ability to overcome genetic resistance conveyed by individual R-genes. The overarching goal of this study was to elucidate the genetic basis of race specificity in *C. sojina*. To this end, a greenhouse screening assay was performed in 240 geographically diverse *C. sojina* isolates on a set of six differential soybean cultivars: Davis, Tracy, Hood, Lincoln, Lee and Blackhawk to define infection responses. A draft genome sequence was obtained for 96 isolates, and single nucleotide polymorphisms (SNPs) were identified. A bulk segregation analysis was performed on two subpopulations defined by differential responses (resistance or susceptibility) on cultivars Blackhawk and Hood to identify SNPs associated with infection phenotypes. Molecular elucidation of the genetic structure underlying race determination in *C. sojina* will accelerate efforts to improve FLS genetic resistance in soybean through conventional and molecular breeding approaches.

**Title: Evaluating Impact of POST-applied Herbicides Following Exposure to Dicamba on Soybean**

**Canopy Development (\*3rd place)**

**Authors:** Castner MC, Priess GL, Norsworthy JK, Lancaster ZD, and Richburg JT

Glyphosate-resistant Palmer amaranth is widespread in the Mississippi Delta region of Arkansas. Because grower’s options are limited, reliance on LibertyLink soybean technology has played a significant role in combatting glyphosate-resistant Palmer amaranth. As herbicide resistance continues to threaten Arkansas soybean production, postemergence (POST)-applied protoporphyrinogen oxidase (PPO)-inhibiting herbicides continue to be an essential resource for growers, especially in fields lacking PPO-resistant Palmer amaranth. Field experiments were conducted in 2017 in Crawfordsville, Arkansas, to further evaluate the impact of combinations of POST-applied PPO- and acetolactate synthase (ALS)-inhibiting herbicides in soybean. A non- sulfonylurea-tolerant, glufosinate-resistant soybean variety was planted and treated with flumioxazin at 71 g ai ha-1 3 days after planting (DAP) to provide preemergent weed control. 21 DAP both trials were exposed to low rates of dicamba from neighboring production fields, all with an unknown, but uniform rate. At 28 DAP, PPO herbicides alone and PPO herbicides with chlorimuron were applied alone or tank-mixed with glufosinate. Injury, soybean canopy formation, height, and width were evaluated 7, 14, and 21 days after treatment (DAT). Injury from dicamba was also measured 14 DAT to determine if any of the treatments influenced the presence of dicamba symptomology. Acifluorfen exhibited the greatest amount of injury from the initial treatments at 14% 7 DAT and 20% 14 DAT, but experienced 12.5% dicamba injury 14 DAT, which was significantly lower compared to other stand-alone treatments. *S*-metolachlor plus fomesafen was the only treatment in which dicamba symptomology was greater than injury from initial stand-alone treatments at 21%. Despite a low dose exposure from dicamba, the addition of glufosinate with PPO herbicides and PPO herbicides plus chlorimuron only demonstrated a slight significant reduction in canopy development in comparison to treatments without glufosinate.

\* The following abstracts in this category are in no particular order.

**Title: Comparing Apples to Oranges: Effect of Serving Temperature on Emotional Responses and**

**Sensory Perceptions of Fruit**

**Authors:** Matthew J. Chapko, Jeffery Burnett, Tyler Butterfield, Lynda Combs, Samantha Findley, Graham

Mitlyng, Emily Wong, and Han-Seok Seo

Consumers generally store fruits in the fridge or at room temperature. While there may be differences in shelf life due to storage conditions, it is possible that the temperature at which fruits are consumed modulates perception and acceptance, which has been shown for other food/beverage products. Seventy-two participants were served sliced apples and oranges at three temperatures: 3, 23, and 35 °C in order to mimic conditions (fridge, counter, and hot day) that fruits may be stored and consumed at. For each participant, each fruit was sliced into 3 sections and served under the three temperature conditions, respectively to reduce variations found between units of fruit. Participants were asked to indicate what emotions were evoked by the fruits using an emotion Check-All-That-Apply ballot. Participants were also asked to rate samples for intensities and liking of attributes such as appearance, aroma, taste, and texture using 9-pt. category scales. Serving order was randomized and balanced for temperature and fruit. Correspondence analysis on the emotion data revealed that cold oranges were associated with active and energetic emotions, while apples were associated with good, calm, and satisfied emotions. Warm fruits evoked disgusted emotions. Fruits were liked significantly more when served cold in regards to texture, flavor, and overall liking. Cold fruits were significantly firmer than warm fruits. Sweetness in apples was rated most intense when served cold. Our finding shows that serving temperature of fruit affects perception and emotions, and should be taken into consideration to enhance positive product attributes and increase overall satisfaction.

**Title: Nitrogen Management in Rice under Suboptimal Soil Conditions**

**Authors:** Rhea, P.S.; Hardke, J.T.; Norman, R.J.; Roberts, T.L.; Frizzell, D.L.; Castaneda-Gonzalez, E;

Plummer, W.J.; and Lee, G.J.

In Mid-South rice (*Oryza sativa,* L.) production, nitrogen (N) fertilizer is often recommended as a single preflood application (SPF) or a two-way split (2WS) application. The majority of N fertilizer is applied at the 4-6 leaf stage onto dry soil and the second application into the floodwater at midseason. Environmental factors often hinder these recommendations. This study was conducted to determine N fertilization best management practices in rice when faced with dry, wet, and flooded soil conditions.

A silt loam soil and a clay soil were used to evaluate N fertilizer treatments. Treatments included a control receiving no N, SPF and 2WS treatments applied to dry and wet soils, and various N applications into flooded conditions. Biomass, total N uptake, plant height, grain yield, and milling yield were determined.

On a silt loam, N treatments applied to dry soil, applied to wet soil with elevated N rates, and applied in multiple applications into the flood (“spoon-fed”) were highest yielding. On a clay soil, N treatments applied to dry soil, applied in single applications of high N rates into flooded conditions, applied to wet soil with elevated N rates, and only one of the spoon-fed treatments were highest yielding. Different soil types and cation exchange capacity (CEC) may help to explain differences in results between locations. Based on 2017 results, N applications made to dry soil were most efficient in producing maximum grain yields, while additional N was needed to produce similar yields in wet or flooded soil conditions.

**Title: Reducing Ultradwarf Bermudagrass Putting Green Winter Injury with Covers and Wetting Agents**

**Authors:** E. J. DeBoer, M.D. Richardson, J.H. McCalla, and D.E. Karcher

As ultradwarf bermudagrass (*Cynodon dactylon* x *C. transvaalensis*) putting green use in the United States moves further north, there is increased risk of sustaining winter injury from desiccation and low temperature exposure. Protective covers are used to reduce winter injury of ultradwarf greens. Installation and removal of these covers to allow for golf during periods of favorable weather is costly and labor intensive. This research aims to define a predicted low temperature threshold for covering ultradwarf putting greens and to quantify the effects of a late- fall wetting agent application on winter survival. Research was conducted on a sand-based putting green with replicated plots of three different widely-used ultradwarf cultivars. Covering treatments were placed on the green at four different forecasted low temperature thresholds and were compared to an uncovered control. A single late-fall wetting agent application was applied as a split plot to each cultivar x cover treatment. Digital image analysis determined, plots receiving cover treatments achieved significantly faster spring green-up than the control but were not significantly different from each other. ‘Mini-Verde’ and ‘TifEagle’ achieved significantly faster spring green-up compared to ‘Champion’ but were not significantly different from each other. During one season, plots receiving a wetting agent application achieved significantly faster spring green-up compared to the control. These data suggest the possibility of reducing the predicted low temperature threshold for covering greens without a significant increase in winter injury severity. This temperature reduction can reduce golf course labor costs and increase revenue with more days open for play.

**Title: Characterization of Soybean Nested Association Mapping population parental lines for**

**physiological traits associated with crop growth, drought tolerance and nitrogen accumulation**

**Authors:** Akshita Mishra, Marilynn K. Davies, Andy King, and Larry C. Purcell

The soybean (Glycine max) gene pool in North America is quite narrow; only 17 accessions contribute 86% to the parentage of modern cultivars. The Soybean Nested Association Mapping population (SoyNAM) was developed by crossing 40 diverse genotypes from maturity groups (MG) 1 through 5 with a common MG 3 parent to develop 40 recombinant inbred populations with the objective of diversifying the soybean gene pool. These populations were genotyped with molecular markers and characterized for yield, maturity, and other important traits. This study focuses on identifying the extreme parental genotypes of the SoyNAM population for yield and drought related traits. The experiment was conducted for 3 years, in Fayetteville, Arkansas with four replications. Canopy coverage was estimated through aerial digital images taken 3-4 until canopy closure. After canopy closure, two biomass harvests were taken at 2 week intervals to determine radiation use efficiency (RUE), N fixation (NFR), and shoot nitrogen (NC) and ureide concentration (UC). Two harvests were taken at mid-R5 and 2 weeks later, to calculate seed growth rate (SGR) and seed fill duration (SFD). Yield and Harvest index (HI) was determined from a bordered section of each plot at maturity. Analysis of these traits indicated that the hub parent and several parents differed statistical. Identification of the most divergent parental lines for such traits will aid in selecting recombinant inbred populations (RIL) populations for future Quantitative Trait Loci (QTL) mapping studies.

**MS Poster**

*Flight 1*

**Title: Comparison of Florpyrauxifen-Benzyl- and 2,4-D-Containing Weed Control Programs for Rice Levees**

**(\*1st place)**

**Authors:** H.E. Wright, J.K. Norsworthy, Z.D. Lancaster, M.E. Fogleman, C.J. Meyer, R.C. Scott, and J.M. Ellis

Weed control on rice levees has become more challenging in recent years due to the increased presence of broadleaf weeds, specifically Palmer amaranth (*Amaranthus palmeri*). Additionally, levees are generally sprayed only once per season, allowing time for new weeds to emerge. The current standard treatment for controlling broadleaf weeds on levees is 2,4-D (WSSA Group 4) alone or with another herbicide. However, 2,4-D use is restricted in certain areas of Arkansas where cotton production is also common, and a permit must be obtained before spraying.

Florpyrauxifen-benzyl is a recently labeled, broad-spectrum synthetic auxin (WSSA Group 4) herbicide from DowDuPont. A field experiment was conducted in 2017 at the Pine Tree Research Station near Colt, AR to compare florpyrauxifen-benzyl- and 2,4-D-containing levee weed control programs in rice. This experiment was a randomized complete block design with a two-factor factorial. Factor A consisted of six commonly used rice herbicides; saflufenacil, propanil, propanil plus thiobencarb, triclopyr, quinclorac, and penoxsulam applied at the standard field rate. Factor B was the addition of florpyrauxifen-benzyl at 30 g ai ha-1, 2,4-D at 1600 g ae ha-1, or no herbicide in a mixture with each of the herbicides in factor A. Palmer amaranth control was improved 10-45% by the addition of florpyrauxifen-benzyl or 2,4-D when compared to herbicide A alone. Preplanned orthogonal contrasts conducted also showed no statistical difference between 2,4-D- or florpyrauxifen-benzyl-containing treatments. These results indicate florpyrauxifen-benzyl will control troublesome weeds on rice levees and provide

a viable control option in areas where 2,4-D is restricted.

**Title: Control of PPO-resistant Palmer amaranth with Residual Herbicides in Cotton (\*2nd place)**

**Authors:** M.M. Houston, J.K. Norsworthy, H.D. Bowman, and W.D. Coffman

With Palmer amaranth (*Amaranthus palmeri*) being the most destructive weed in cotton (*Gossypium hirsutum*) fields throughout the Southeast and Midsouth, chemical weed control is critical for sustained profitability. Over the past 20 years, producers have relied heavily on reactive postemergence (POST) applications for Palmer amaranth control within transgenic cotton. Combined with Palmer amaranth escapes and improper management, this reliance eventually led to glyphosate, acetolactate synthase (ALS)-, and now protoporphyrinogen oxidase (PPO)-resistant Palmer amaranth. To evaluate the POST herbicides still effective on multiple-resistant Palmer amaranth, trials were conducted in both Marion and Crawfordsville, AR in 2016 and 2017. Non-crop plots were established into natural PPO-resistant Palmer amaranth populations, including treatments of fomesafen (263 and 395 g/ha-1), glufosinate (594 and 818 g/ha-1), dicamba (560 and 1,098 g/ha-1), pyrithiobac (73 g/ha-1), diuron (841 g/ha-1), glyphosate

+ 2,4-D (676 + 961 and 942 + 1,244 g/ha-1), and glyphosate (1,547 g/ha-1). Herbicides were applied when the majority of Palmer amaranth reached 7.62-15.24 centimenter in height and were evaluated through visual weed control ratings 14 days after each sequential application (POST 1 and POST 2). Glufosinate, dicamba, and 2,4-D-containing treatments received two applications 14 days apart to evaluate and compare efficacy of POST herbicide programs. At 14 days after POST 1, treatments of diuron and dicamba were significantly higher than treatments of pyrithiobac, fomesafen, glyphosate, and the low rate of glufosinate. 14 days later at the POST 2 rating, both rates of fomesafen, pyrithiobac, and glyphosate all received 0% control ratings. At this rating, glufosinate, dicamba, and the high rate of 2,4- D-containing treatments achieved above 80% control. For effective control of Palmer amaranth, sequential applications of POST herbicides are necessary along with increased rates of herbicides such as 2,4-D.

**Title:** **Evaluation of Red Drupelet Reversion in Blackberries using High-Throughput Digital Image Analysis**

**(\*3rd place)**

**Authors:** Bethany M. Sebesta, Margaret L. Worthington, Renee T. Threlfall, and John R. Clark

Red drupelet reversion is a postharvest disorder which affects consumer perception of fresh- market blackberries. Evaluating fruit for reversion is time consuming, labor intensive, and subject to bias. Both objective and subjective methods were used to quantify red drupelet reversion in twelve blackberry genotypes from the University of Arkansas blackberry breeding program. Two replications of ripe, fully black fruit were harvested on two dates per genotype and placed in ~170-g vented clamshells. Digital images were taken of the blackberries in the clamshells prior to cold storage (~4 °C) for 7 days (original). Additional images of fruit were taken immediately after removal from cold storage (cold) and after berries reached room temperature (RT). Images were analyzed using color thresholds (hue, saturation, and brightness) in ImageJ to generate values for total berry area and red drupelet area from which percent reversion was calculated for each image. Berries were returned to room temperature after cold storage and visually evaluated using two methods, berry count and drupelet count, from which percent reverted berries and percent reverted drupelets were calculated. The berry count method involved counting the total number of berries per clamshell and counting number of berries having three or more red drupelets. For drupelet count method, a subset of five berries per clamshell were randomly selected and total number of drupelets along with number of red drupelets were counted. Significant differences in reversion existed among genotypes using both visual methods (berry count and drupelet count) and all three image-based measurements (original, cold, and RT). Significant main effects for genotype, harvest date (nested within genotype), and temperature treatment were found in all three ImageJ analyses (P<0.01) and no significant interaction was found between genotype and temperature treatment (P>0.05). Estimates of percent reverted berries and percent reverted drupelets were positively correlated with each other (*r* = 0.96) as well as with all three image analysis temperature treatments (original, cold, and RT), ranging from *r* = 0.76 to *r* = 0.88. Percent reverted berries and percent reverted drupelets were more highly correlated (*r* = 0.88 and *r* = 0.87, respectively) with images taken before cold storage than with images taken after cold storage. This suggests reversion began to take place during storage in a cooler in the field before original images were taken. Our study supports the ability of ImageJ to quantify red drupelet reversion, potentially allowing more genotypes to be analyzed without bias within a reasonable timeframe compared to subjective methods.

\* The following abstracts in this category are in no particular order.

**Title: Longevity of Palmer amaranth control achieved by preplant and preemergence soil residual herbicides**

**in soybean**

**Authors:** GL Priess, JK Norsworthy, ZD Lancaster, and JT Richburg

The use of residual herbicides is an essential tool in weed management programs. Residual herbicides reduce the selection pressure placed on weed populations by foliar active herbicides. This slows the evolution of resistance by reducing the number of weeds that needs to be controlled. Application timing is critical when using residual herbicides. Residuals need to be overlapped so there is no high levels of weed seed germination during the critical weed free period. Thus the longevity of residual herbicides needs to be evaluated when applied as a preplant or preemergence herbicide. A three field experiments were conducted at Crawfordsville, Fayetteville and Marianna, AR, to determine the longevity of residual control of common residual herbicide combinations. The trials were conducted as a two factor factorial; factor-A being the application timing (preplant or preemerge), factor-B being the herbicide treatments. Preplant applications were made two weeks prior to planting and preemergence applications were made at planting. Injury ratings and weed control ratings were taken weekly for ten weeks. Weeds were counted and removed from established two .5m2 quadrants in each plot, once every two weeks, for ten weeks. The weed control rating were analyzed through a liner regression analysis, from the analysis number of days above 80% Palmer amaranth control could be determined. The Premergence applications showing better weed control than preplant applications. The application of saflufenacil+ dimethenamid-P+ pyroxasulfone+ metribuzin resulted in the longest residual Palmer amaranth control. The count data collected 4 weeks after planting displayed that the preplant application allowed for the germination of 22 Palmer amaranth per 1m2, while the preemerge application on average allowed 8 Palmer amaranth per 1m2. Sulfentrazone+ metribuzin resulted in the highest level of injury at 85%. The results suggest that longevity of weed control and the risk for injury should be taken into consideration when making an application timing and herbicide decision.

**Title: Touching Tastes: Cross-modal Influences of Hand-feel Touch Cues on Emotional Responses and**

**Basic Taste Associations**

**Authors:** Ragita C. Pramudya and Han-Seok Seo

The complex interaction between the 5 senses is frequently observed in real-world environments. Among the 5 senses, hand-feel touch has received the least attention regarding its influences on product evaluation in the food and beverage industries. Touch has historically been associated with emotional responses. Considering the intimate relationship between emotions and product liking, investigating the effects of hand-feel touch cues on emotional responses and sensory perception is of great interest. As coffee is a popular beverage, this study aimed to capture the cross-modal association of touch cues (via different cup sleeves) with either “imagined” (Study 1) or “tasted” (Study 2) tastes under the context of coffee drinking experience. A total of 170 participants (105

F) from the ages of 19 to 72 evaluated 12 different cup sleeves of various textural characteristics with respect to emotional responses (using a Check-All-That-Apply ballot), degrees of matching to the 4 basic tastes (bitter, sweet, sour, and salty) and to coffee-related flavors (black coffee and creamy). The results showed that hand-feel touch cues could influence cognitive associations with basic tastes and coffee-related flavors, whether imagined or tasted. Specifically, while bitter taste and black coffee flavor were most associated with cardboard sleeves, sweet taste and creamy flavor were matched with towel sleeves. Further, different cup sleeve materials evoked different emotional profiles. As touch cues play a crucial role in product evaluation, food and beverage professionals should have more consideration of incorporating hand-feel textural features to their packaging and container designs.

**Title: Effect of a Combination of Live Yeast and Yeast Cell Wall Products Supplemented before and after**

**Weaning on Immune Function in Heifer Calves**

**Authors:** E. A. Palmer and E. B. Kegley

Heifer calves (n = 95; initial body weight = 165 ± 27 kg) were stratified based on body weight, birthdate, sire, and dam parity; and were assigned randomly to pasture (10 pastures, 9 or 10 cow- calf pairs/pasture). Pastures were assigned randomly to 1 of 2 treatments; 1) no yeast (CON), or

2) the addition of yeast product (YP). Calves were offered creep-feed at 0.5% of body weight for 35 days prior to weaning. The YP creep-feed was formulated to provide 4 g YP/day. After weaning, heifers remained in their pre-weaning groups and were fed 1.8 kg/day of a grain supplement for 42 days; YP provided 4 g of YP/day. Blood was collected for serum haptoglobin concentrations and complete blood cell analyses on day -1, 35 (weaning), 49, and 76. Blood collected on days 35 and 76 was analyzed by flow cytometry to determine phagocytic activity. A treatment effect (*P* = 0.32) was not observed for white blood cell concentrations between CON and YP. Furthermore, there was no difference (*P* = 0.13) in the neutrophil to lymphocyte ratios. Serum haptoglobin concentrations were not affected (*P* = 0.15) by the addition of YP in the diet; however, there was a day effect (*P* < 0.01) on serum haptoglobin concentrations. Furthermore, the percentages of cells that were positive for phagocytic activity were not different (*P* = 0.97) between treatments. In summary, the supplementation of YP had no effect on the measures of immunocompetence that were evaluated in these heifers.

*Flight 2*

**Title:** **Grain Sorghum Bran Polyphenols and Human Gut Microbial Fermentation Patterns (\*1st place)**

**Authors:** D. Ashley, C. Brownmiller, and S-O. Lee

Grain sorghum brans are rich sources of polyphenols that may promote gastrointestinal health by differentially stimulating gut microbiota to produce short-chain fatty acids (SCFA). The fermentation products, SCFA, have been associated with body weight maintenance. The objectives are to measure the polyphenol contents of two sorghum brans and to determine how these extracts affect SCFA production in normal weight (NW) and overweight/obesity (O/O). Phenolic profiles of black and sumac sorghum brans were determined using colorimetric and HPLC analysis. Fresh fecal samples from 12 NW and 12 O/O individuals were incubated with anaerobic media and a blank or one of five treatments: 75 mg well-established prebiotic fructooligosaccharides (FOS), 47 mg black bran extract (B), 26 mg sumac bran extract (S), FOS+ B, or FOS + S. Aliquots were collected at 0, 6, 12, 18, and 24 hours, and SCFA production determined by GC. Sumac was significantly higher in total polyphenols (42.2±1.6 mg/g) than black (28.0±1.6 mg/g), each displaying a unique polyphenol profile (P<0.01). At 6 and 12 hours, addition of S to FOS trended to increase total SCFA production by 24%, and 20% in NW, but only slightly (11%) at 12 hours in O/O. Current nutrition research seeks to identify foods that nurture gut flora and their metabolic processes, which have immerged as key players in human health. Our results indicate that black and sumac sorghum brans may be used to increase health promoting effects, and that sumac polyphenols may positively impact gut fermentation patterns.

**Title:** **A Comparative Study of the Anti-Inflammatory Effects of Berry Phenolics and Volatiles (\*2nd place)**

**Authors:** I. Gu, C. Brownmiller, and S-O. Lee

Berries are rich in natural compounds, such as minerals, vitamins, dietary fibers, and especially phenolics and volatiles. Several studies found significant beneficial health effects of berry phenolics. However, there is limited information available on health-promoting activities of berry volatiles. The objective of this study was to investigate anti-inflammatory effect of phenolics and volatiles using a lipopolysaccharide (LPS)-stimulated RAW264.7 macrophage cell model by measuring the modulation of production of nitric oxide (NO), interleukin-6 (IL-6), and tumor necrosis factor-α (TNF-α). RAW264.7 cells were pretreated with 3 different dilutions (diluted 50, 100, and 200-fold) of six berry (blackberry, black raspberry, blueberry, cranberry, red raspberry, and strawberry) phenolic or volatile fractions for 1h. Cells were then incubated with or without LPS (100ng/ml) for 24h. The NO production was measured by using Griess reaction. The level of IL-6 and TNF-α in the culture media were quantified using ELISA kit. Results showed that there were no significant differences among three different dilutions of berry phenolics and volatiles in the RAW264.7 cells. Berry phenolics and volatiles significantly decreased the LPS-induced production of NO by 62% and 64%, respectively (P<0.05). Berry volatiles suppressed the production of IL-6 and TNF-α stimulated by LPS by 17% and 15%, respectively. These findings showed that volatiles from six common berries have comparable anti-inflammatory activity as berry phenolics through modulating production of NO, IL-6, and TNF-α *in vitro*. Results from this study suggest that berry volatiles may be used as effective prevent inflammatory related diseases.

**Title: Tolerance of rice varieties to early-postemergence applications of HPPD-inhibiting herbicides**

**(\*3rd place)**

**Authors:** M.H. Moore, R.C. Scott, J.K. Norsworthy, M.E. Fogleman, and Z.D. Lancaster

In Arkansas, there are over 20 rice cultivars planted on commercial farms each year. Because of the wide variety of rice germplasm planted, there lies potential for varying tolerance to potential herbicides that could be used in controlling weeds during the growing season. Limited studies have been conducted on the tolerance of rice to the 4-hydroxyphenolpyruvate dioxygenase (HPPD) inhibiting herbicides, especially those currently used in corn, that has shown potential for controlling key weeds in rice. Therefore in 2017 at the University of Arkansas Rice Research and Extension Center near Stuttgart, Arkansas, a field study was conducted to assess the tolerance of 10 commonly planted rice cultivars (Roy J, Diamond, LaKast, Jupiter, Titan, Rondo, CL151, CL172, CLXL745, and XL753) when applied with corn herbicides, topramezone, mesotrione, or tembotrione at the 2- to 3-leaf stage. After application, visual injury was assessed 2 and 4 weeks after treatment (WAT) and grain yield was taken at physiological maturity. Yields were then turned into percent of the nontreated check for each rice cultivar. The cultivar “Rondo” exhibited the most injury with over 90% observed at 4 WAT for all herbicide; yield was also reduced by 75% when applied with topramezone and 100% when applied with mesotrione and tembotrione. “Jupiter” was least affected by each treatment with mesotrione showing the most injury of the herbicides (20%) 4 WAT and less than 10% in yield reduction for all treatments. This data suggests that HPPD-inhibitors may potentially be used on certain rice cultivars, but not all.

\* The following abstracts in this category are in no particular order.

**Title: Assessing toxicity of formulated pesticide mixtures to honey bees, *Apis mellifera* (L.)**

**Authors:** Joseph Belsky and Neelendra Joshi

The overall goal of our research is to examine the toxicity of formulated pesticide chemistries on major species of pollinators. In recent years, the populations of bees have experienced widespread declines, while the usage of formulated pesticide products in agro-ecosystems has dramatically increased. Specifically, the foliar spray ecotoxicology of new 2-in-1 formulated pesticide products (that contain more than one active ingredient) to honey bees, *Apis mellifera* (L.) has not been tested. In these studies, we simulated field realistic levels of direct pesticide exposure to honey bees using a customized spray tower in a laboratory setting. Our results provide a more realistic analysis of worker honey bee exposure to 2-in-1 formulated pesticides than is currently described in the OECD-214 test guidelines for measuring contact toxicity to adult bees. Preliminary results from these bioassays will be discussed and presented.

**Title: Herd Size Management using Cattle Cycle Price Signals and Weather Uncertainty**

**Authors:** Colson Tester, M. Popp, N. Kemper, and L. Nalley

The third most consumed meat around the world is beef. Despite global demand side growth, price cycles related to biological production lags greatly influence cattle markets. These lags and subsequent cycles create variability in cash flow and profitability for producers. Price- driven herd size management strategies thus have received attention as methods to enhance profitability. This study adds to that literature by analyzing both price and production risk using three herd size management strategies: i) constant size – holding herd size constant; ii) dollar cost averaging – keeping reinvestment constant by varying the number of replacement heifers retained at a constant long run average dollar total; and iii) moving average – using an uptrend/downtrend price signal to lower/increase production in anticipation of future price declines/increases. These strategies are evaluated with and without weather induced forage variability that impacts the relative profitability and risk of these strategies over the most recent 2004-2014 cattle cycle. Forage variability was simulated using index values derived from the Normalized Difference Vegetation Index (NDVI). This analysis is useful for decision makers of medium- to large-scale cow-calf operations. Results suggest that price signal-based strategies can enhance profitability but the managerial cost required for this type of herd size management is deemed larger than its benefit. Weather risk did not impact this conclusion.

**PhD Oral**

*Flight 1*

**Title: Soil Activity of Thiencarbazone-Methyl With and Without Common Soybean Residual Herbicides (\*1st**

**place)**

**Authors:** Zachary D. Lancaster, Jason K. Norsworthy, Grant L. Priess, and Jacob T. Richburg

Due to the continual spread of herbicide resistance, growers are increasingly relying on residual herbicides to achieve season long weed control. New residual herbicide options are needed to effectively rotate herbicide mode of action, and slow the development of additional herbicide resistance. Bayer is currently evaluating thiencarbazone-methyl (TCM), an ALS herbicide, which could provide preemergence and postemergence activity on many troublesome midsouth weeds in soybean. A field experiment was conducted at the Agricultural Research and Extension Center in Fayetteville, Arkansas in the summer of 2016 and 2017 to determine the residual activity of TCM compared to several common residual herbicides. The experiment was set up as a two factor, randomized complete block design with factor-A being TCM rate applied and factor-B being tank-mix partner. TCM treatments evaluated were no TCM, 33.5 g ai ha-1 TCM, and 67 g ha-1 TCM. Tank-mix partners evaluated were labeled rates of Dual Magnum, Valor, Zidua, Tricor, and Balance Bean along with a no tank-mix partner treatment. Data were collected on entireleaf morningglory (*Ipomoea hederacea*), broadleaf signalgrass (*Urochloa platyphylla*), and yellow nutsedge (*Cyperus esculentus*) control at 14, 28, 42, and 56 days after application (DAA) for both years with Palmer amaranth (*Amaranthus palmeri*) control evaluated as well in 2015. Overall, TCM provided excellent control of broadleaf signalgrass with 92% and 98% respectively for 33.5 and 67 g ha-1 at 42 DAA. Control of the native ALS-resistant Palmer amaranth population was only 69% with 67 g ha-1 of TCM at 42 DAA in 2015. However, the addition of 67 g ha-1 of TCM to the labeled rate of Tricor resulted in a significant increase in Palmer amaranth control with 84% control from Tricor alone and 96% control from Tricor + 67 g ha-1 TCM. Likewise, the addition of 67 g ha-1 TCM to Dual Magnum increased entireleaf morningglory control from 82% alone to 100% with TCM. This research shows that TCM alone provides excellent residual weed control of broadleaf signalgrass and entireleaf morningglory, with some added Palmer amaranth control (48-69%). Furthermore, the addition of TCM increases the spectrum of activity and length of residual control for many common residual herbicides.

**Title: Zinc Injection as a Novel Castration Method in Beef Bulls (\*2nd place)**

**Authors:** J. J. Ball and E. B. Kegley

Crossbred beef bulls (n = 180) were blocked by initial body weight (337 ± 10.9 kg) and assigned randomly to 1 of 3 treatments on d 0: 1) INJ; received 1 mL (100 mg Zn) of a Zn solution in each testis, 2) BAN; received blood-restrictive rubber band placed around the dorsal aspect of the scrotum, 3) BUL; bulls with testicles remaining intact. Cattle were harvested by block on 3 separate dates when blocks reached similar body weight and visual adipose accretion. Final body weight was greater (*P* < 0.01) for INJ (672 kg) and BUL (686 kg) compared to BAN (611 kg).

Histopathological evaluation (n = 13; INJ = 7; BUL = 6) indicated that INJ testes were degenerative and reproductively non-viable whereas BUL testes were normal. Serum testosterone concentrations on day 168 were similar (*P* = 0.14) between INJ and BUL whereas after day 14, BAN were non-detectable. Serum haptoglobin concentrations were greater (*P* < 0.01) in INJ than BUL and BAN on days 1, 3, 5, and 7. Scrotal circumference (*P* = 0.08) and testis width (*P* = 0.07) on day 168 tended to be greater for BUL than INJ. Hot carcass weights were greater (*P* < 0.01) for INJ and BUL compared to BAN. Percentage of USDA Choice carcasses was greater (*P* < 0.01) in BAN compared to INJ and BUL. Therefore, compositionally, INJ was more similar to BUL than BAN, suggesting limiting efficacy of INJ as a castration method in older beef bulls.

**Title: Irrigation Requirements for Establishing Tall Fescue from Seed (\*3rd place)**

**Authors:** Daniel Sandor, Douglas Karcher, and Michael Richardson

Tall fescue (*Festuca arundinacea* Schreb.) is a widely-used turfgrass species found in residential and commercial lawns, partly due to its ability to be established easily from seed. Previous field studies have observed mature, drought-tolerant tall fescue cultivars can maintain acceptable turfgrass quality superior to other tall fescue cultivars during times of drought stress under various irrigation regimes. As urbanization increases, in addition to the resultant competition for freshwater resources, it is imperative that turfgrass managers make every attempt toward conserving water in their irrigation practices. Current scientific and university recommendations provide generic instructions for irrigating newly seeded turf, such as "keep the soil moist", and other similarly-worded guidelines. Specific irrigation requirements for establishing tall fescue are unknown at the present time, or even if drought-tolerant cultivars can be established using less water compared to drought-sensitive varieties. Therefore, a study was conducted to investigate irrigation requirements for establishing tall fescue from seed. This study was conducted on a Captina silt loam soil using irrigation treatments ranging from 50% to 125% replacement of reference evapotranspiration (ETO). At 28 days after seeding no significant differences in establishment (i.e., turfgrass coverage) were observed between drought-tolerant and drought-sensitive cultivars. Turfgrasses were well-established under the 75 and 100% irrigation deficit level, being 30 and 39% greater in green turfgrass coverage, respectively, than irrigating turf at 50% ETO. Daily irrigation of turfgrass seedlings at 75 or 100% ETO through the first 28 days is a practical way to conserve water while providing acceptable turfgrass coverage during establishment.

\* The following abstracts in this category are in no particular order.

**Title: Surface Imprinted Polydopamine Based Magnetic Separation and Quantum Dots Based**

**Fluorescent Detection of Pathogenic Bacteria in Food Supply Chain**

**Authors:** Xinge Xi, Ronghui Wang, Zhong Chen, and Yanbin Li

Recent outbreaks of foodborne diseases have drawn a great public attention globally. It is highly important to rapidly detect foodborne pathogen in a cost-effective way to ensure food safety. Imprinted polydopamine (PDA) as a specific binding element has been investigated for use in various surfaces, such as films, microspheres and nanoparticles, but the application of PDA-based method for foodborne pathogens detection is rarely reported. This study intended to develop an innovative method for detection of foodborne pathogens using quantum dots (QDs) with an emission wavelength of 614 nm, magnetic nanoparticles (MNPs) with a diameter of 100 nm and pathogen imprinted PDA. *E. coli* O157:H7 was used as a model pathogen. Self-polymerization of dopamine (DA) was applied to create a PDA shell over the MNPs (MNPs@PDA), and target bacteria were worked as template in the formed PDA shell. After the template was removed, the developed MNPs@PDA was able to specifically capture the target bacteria in a food sample. A high gradient magnetic field was applied to collect the captured bacteria. The results showed that the target bacteria were successfully separated and concentrated. QDs were coated with antibodies and attached to the target bacteria as a fluorescent reporter. The preliminary results showed that the proposed fluorescent biosensor was capable of qualitatively detecting *E. coli* O157:H7 with a concentration of more than 103 CFU/ml in 2 h. The on-going research focuses on the optimization of the concentration of self-polymerization and incubation time and the multiplex detection of different pathogens in food supply chain.

**Title: Impact of microwave drying on mechanical and functional characteristics of parboiled rough rice**

Authors: Deandrae Smith and Griffiths G. Atungulu

The volumetric heating phenomenon provided by the use of a microwave offers a means to quickly dry high moisture content (MC) paddy in one-pass with minimal impacts on the kernel quality. The objectives of this research were to investigate the efficacy of an industrial microwave for implementation in parboiling operations. The specific objectives of this research are to investigate the implications of using a 915 MHz industrial microwave process to dry high-MC parboiled rice. Parboiling conditions consisted of soaking temperature 76oC, soaking duration 3 h and steaming durations of 5, 10, 15 and 20 mins. Long-grain rough rice (Cv. Chenier) was dried using a microwave dryer set to transmit energy at power levels that ranged from 1 to 8 kW. The study evaluated the implications of microwave treatments on rice final MC, milled rice yield (MRY), head rice yield (HRY) and pasting properties. Results show that one pass drying of parboiled rough rice was possible (final MC 15% w. b) with minimal impacts on the quality. Additionally, increasing power levels up to 6 kW had minimal effects on the MRY (73%), after which the MRY reduced by 4% point. A similar reduction was seen for HRY. Rice treated at microwave powers <= 6 kW had average HRY of 67%. Beyond 6 kW the HRY reduced by 3, 20, 5 and 11% points for samples soaked for 5, 10, 15 and 20 min duration, respectively.

**Title: Evaluating the mutation efficiencies of two guide RNA in CRISPR mediated transgene deletion in rice**

**Authors:** BHUVAN P PATHAK, S. Zhao, and V. Srivastava

The CRISPR/Cas9 is an efficient and a cost effective gene editing tool that acts through double stranded break repair process leading to a targeted mutagenesis in the genome. We targeted β-glucuronidase (*GUS*) gene deletion by dual targeting in rice. The CRISPR construct involved two different guide RNAs (gRNA1 and gRNA2) at two different target sites in the *GUS* gene. The aim of this study was to evaluate the efficiency of two gRNAs in generating mutations by studying six T0 lines and twenty one T1 lines obtained from three T0 lines. In the T0 lines, no targeting was observed in gRNA spacer-1, while gRNA spacer-2 was mutated either in biallelic or multi- mutations fashion in the five lines. In T1 lines, the overall mutation efficiency for gRNA spacer-1 was 38% and for gRNA spacer-2 was 81%. The mutations observed in gRNA spacer-1 were most likely de novo as Cas9 was inherited in all the T1 studied and their respective T0 were not targeted, while the mutations in gRNA spacer-2 were likely both inherited and de novo as the pattern of mutations were either similar or different than parent. For gRNA spacer-1, 24% T1 plants were monoalleleic, 14% had multiple mutations and 62% had no mutation. For spacer-2, 48% T1 lines were mono-allelic, 9% were either biallelic or multiple mutations and 43% had no mutation. Despite the difference in the efficiency of two gRNAs, we were able to isolate the homozygous excision lines which demonstrate that Cas9: gRNA system could be used to generate a marker-free plant.

*Flight 2*

**Title: Increasing Alpha-amylase Digestion of Potato Starch by Acid Hydrolysis (\*1st place)**

**Authors:** Ana Gonzalez and Ya-Jane Wang

Porous starch prepared by enzyme hydrolysis has attracted much attention for its absorption and delivery properties. Porous starch has been successfully prepared from A-type starch such as cereal starches, but not from B-type starch such as potato starch, which is partly attributed to the absence of surface pores in potato starch. We hypothesized that acid hydrolysis could modify starch surface to facilitate enzymes entrance into potato starch granules, thus producing a porous structure. This study investigated the effect of acid hydrolysis on digestion of common corn (A- type) and potato (B-type) starches by alpha-amylase. Starches were first treated with sulfuric acid to yield approximately 5 and 10% hydrolysis, and then subjected to α-amylase digestion for 5, 10, and 24 hours. The resultant starches were characterized for hydrolysis degree by quantifying soluble sugars, morphology by scanning electron microscopy, and crystallinity by X- ray diffractometry. Starch crystallinity slightly increased with increasing hydrolysis level.

Compared to their native counterparts, the extent of alpha-amylase digestion increased by 10.3 and 30.0% for potato and common corn starches, respectively, at the 5% acid hydrolysis level. The extent of alpha-amylase digestion increased by 31.8 and 75.0% for potato and common corn starches, respectively, at the 10% acid hydrolysis level. A more defined porous structure was observed in potato starch after the combination of extended acid hydrolysis and alpha-amylase digestion. The results indicate that the combination of acid hydrolysis and alpha-amylase digestion was capable of promoting the formation of a porous structure in potato starch.

**Title: Crp1 Controls Pre-Penetration Infectious Development in the Maize Pathogen *Cercospora zeae-***

***maydis* Through Regulation of the Circadian Clock Component Frq1 (\*2nd place)**

**Authors:** John B. Ridenour and Burton H. Bluhm

*Cercospora zeae-maydis* causes gray leaf spot, an important foliar disease of maize. *C. zeae- maydis* enters the host through stomata during the early stages of pathogenesis. Prior to entering the host, *C. zeae-maydis* undergoes pre-penetration infectious development, which includes spore germination, stomatal tropism, and appressorium formation. Pre-penetration infectious development requires light and the photoreceptor/transcriptional regulator Crp1. The absence of light or deletion of Crp1 severely impairs stomatal tropism and appressorium formation, which suggests that light coordinates pre-penetration infectious development through Crp1. However, the genetic network under Crp1 control is unknown. Thus, the objective of this study was to elucidate how Crp1 regulates pre-penetration infectious development in *C. zeae-maydis*. In this study, Frq1, a conserved component of the fungal circadian clock, was determined to be a regulatory target of Crp1. Expression of *FRQ1* was induced by light in a Crp1-dependent manner, and Crp1 was required for the circadian oscillation of *FRQ1* expression. Furthermore, deletion of *FRQ1* impaired aspects of pre-penetration infectious development, including stomatal tropism and appressorium formation, and abolished lesion development. These findings suggest that *C. zeae-maydis* utilizes a circadian clock, mediated by Crp1 and Frq1, to regulate pre- penetration infectious development, a phenomenon that has not been described in fungal foliar pathogenesis.

**Title: Effect of Light Intensity on Efficacy of Dicamba and Glufosinate on *Amaranthus palmeri*** **(\*3rd place)**

**Authors:**C.J. Meyer, J.K. Norsworthy, and M.H. Moore

With the availability of the Roundup Ready Xtend and LibertyLink soybean systems, growers face a decision as to what trait, and thereby what herbicide, they can utilize to control glyphosate-resistant Palmer amaranth in the Midsouth. Prior research has documented glufosinate efficacy is affected by various environmental factors whereas dicamba appears to be less affected. An experiment was conducted at the University of Arkansas Altheimer Lab to investigate the impact of light intensity on efficacy of dicamba (Engenia herbicide) and glufosinate (Liberty herbicide) on Palmer amaranth. Palmer amaranth plants were sprayed with either dicamba or glufosinate at six rates from 1/16X to 2X. The 1X rates for glufosinate and dicamba was 595 g ai ha-1 and 560 g ae ha-1, respectively. Light intensity was varied using a growth chamber (220 or 1050 µmol m-2 s-1) and plants exposed to the appropriate light condition for 48 hours before, and after, herbicide treatment. Percent mortality and biomass data were collected 3 weeks after application and fit to a nonlinear model. A lethal dose for 50% of the population (LD50) was calculated for each treatment. Dicamba LD50 values were not impacted by light treatment, whereas glufosinate had greater LD50 values when applied under high light conditions. For glufosinate, LD50= 0.13X and 0.33X for low and high light, respectively. These results suggest that glufosinate may perform better with some cloud cover than in full sunlight, although solar light intensity is often much greater than that simulated in this experiment.

\* The following abstracts in this category are in no particular order.

**Title: Investigating selectivity of infrared wavelengths to inactivate fungi on food and feed ingredients**

**Authors:** Shantae A. Wilson and Griffiths G. Atungulu

Fungi are associated with enormous diversity of habitats which include grains. Once occurring on grains, the spores easily proliferate on high moisture content grains, increasing the risk of toxin production, and potentially contaminate the grain thereby posing important risk to the public. The objectives of this study was to characterize effects of using selected peak wavelengths of infrared (IR) heat emission, at various intensities regulated by the product-to-emitter-gap (PEG) (11 cm and 44 cm) and for varied durations, on inactivation responses of fungi that colonize corn kernels. Metagenomics techniques were used to identify and quantify the magnitudes of surviving fungi following treatments at IR peak wavelengths that fall in the mid and far IR heating region of the electromagnetic spectrum (3.2 μm and 5.8 μm). Internal transcribed spacer 2 (ITS 1) sequencing was used to characterize the corn microbiome after IR treatments. Fungal diversity was seen in corn samples with 81 operational taxonomic units (OTUs) and 10 genera. After IR treatment, Aspergillus, Meyerozyma, and Penicillium were the most predominant fungi in the corn samples. Compared to the control samples (13%), the relative abundance of Aspergillus decreased when treated at wavelength 3.2 μm (8%) and 5.8 (14%) μm for 180 s at PEG 11 cm, respectively. Similar trends were observed for Meyerozyma, and Penicillium at PEG 11 cm. The relative abundance of Aspergillus after being treated at wavelength 3.2 μm (14%) and 5.8 (13%) μm for 180 s at PEG 44 cm were not significantly different from control samples (13%). Similar trends were also observed for Meyerozyma, and Penicillium at PEG 44 cm. The IR heating process shows potential benefits of fungal inactivation which may help the industry prevent potential toxin development on corn.

**Title: Validation of grain yield QTL from soft winter wheat using a CIMMYT spring wheat panel**

**Authors:** Dennis N. Lozada, R. Esten Mason, Sivakumar Sukumaran, and Susanne Dreisigacker

Validation of quantitative trait locus (QTL) is an essential step in marker-assisted breeding. The objective of this study was to validate grain yield (GY) QTL previously identified in soft red winter wheat (SRWW) through bi-parental and association mapping, in the spring wheat association mapping initiative (WAMI) panel from International Wheat and Maize Improvement Center (CIMMYT) in Mexico. KASP assays *wsnp\_Ex\_c361\_708712* (3A), *wsnp\_Ex\_c13849\_21698240* (4B), and *wsnp\_CAP11\_c3599\_1741800* (6B) developed for the SRWW were significantly associated (*p* < 0.001) with GY, grain number, and thousand grain weight across different environments in the WAMI. Lines possessing the favorable allele for the QTL at the 3A, 4B, and 6B loci (A-C-G allele combination) had the highest mean GY at 4.55 t ha-1. A negative effect for the minor allele observed in both the winter and spring wheat panels for the *wsnp\_Ex\_c13849\_21698240* locus at 4B demonstrated similar selection pressures in both wheat classes for GY improvement. Predicted candidate gene functions for the validated loci at chromosomes 3A, 4B, and 6B included repressor of RNA pol III transcription, regulation of ubiquitin activity, and a transcription factor, demonstrating the multifaceted regulation of GY and yield components. Single nucleotide mutations at these loci could result to missense and/or no amino changes (synonymous) for the corresponding proteins. Overall, these results validate GY QTL across winter and spring wheat through association analysis and demonstrate the potential for pyramiding favorable alleles for the genetic improvement of breeding populations.

**Title: Omega-3 fatty acids decrease appetite and increase postprandial energy expenditure and fat**

**oxidation in normal weight and overweight/obese children**

**Authors:** Aubree Hawley, Elisabet Børsheim, Charlayne F. Mitchell, Sarah L. Russell, Hexirui Wu, Eva

Dehaene, and Jamie I. Baum

Objectives: To determine if increasing O3FA at breakfast increases thermic effect of feeding (TEF) and decreases food intake in overweight and obese children (OW).

Methods: Twenty male and female, normal weight (NW; n=11, age 9.8±0.4 years; BMI percentile corrected for age and sex 49.5±6.9%) and OW (n=9; 10.2 ± 0.5 years; BMI percentile 91.1±1.5%) children were recruited to participate in this randomized, cross-over, double-blind study. Participants consumed a O3FA test beverage (5 g O3FA (2 g EPA; 2 g DHA)) and an isocaloric (320 kcal), macronutrient-matched control beverages (5 g corn oil) with a 4-week washout period. Participants arrived fasted. Energy expenditure and substrate oxidation were measured via indirect calorimetry and appetite was measured via visual analog scales over a 4 h period. Blood samples were collected at 0, 90 and 240 min postprandial. 24-hour food intake was measured using weighed food records. Data was analyzed using two-factor, crossover, repeated measures ANOVA or two-sample independent t test.

Results: NW and OW participants had decreased (*P*<0.05) hunger, desire to eat, and cravings for a snack over the 4 h period following O3FA. O3FA consumption decreased calorie intake by ~13 kcal/d in NW participants and ~43 kcal/d in OW participants. There was a time x diet interaction (*P*<0.0001) for thermic effect of feeding/post prandial energy expenditure with higher values at 120’ following O3FA consumption (0.07± 0.02 v 0.01± 0.02 kcal/min, *P*<0.01) in both NW and. Carbohydrate oxidation was higher in OW participants, with no effect of O3FA. Fat oxidation was higher (*P*<0.01) at 60’ following O3FA consumption. O3FA decreased postprandial plasma free fatty acids in both groups.

Conclusions: This study indicates O3FA consumption affects postprandial responses in NW and OW children. O3FA increase TEF and fat oxidation and reduces hunger in NW and OW when compared with an isocaloric control. NCT03139773.

**Title: Consumers’ emotional responses toward e cues vary as a function of their personality traits**

**Authors:** Shilpa S. Samant and Han-Seok Seo

Emotional responses have been used to predict consumer behavior toward flavors of food and beverage products. However, previous techniques have not considered consumer variations in personality traits influencing food-evoked emotions. The objective of this study was to determine whether and how consumers’ personality traits affect prediction models of overall liking and preference toward taste stimuli, using independent predictors of “intensity perception” and “emotional responses”. Sixty-seven participants (31 females; 41 ± 15 years) were asked to taste and rate taste intensities (TI) of water, sucrose, citric acid, salt, and caffeine solutions. Emotional responses were measured using facial expression analysis (FA), autonomic nervous system responses (heart rate, skin conductance, and skin temperature) (ANS), and self-rated emotion- questionnaire (EQ). Their liking and preference toward each solution were also evaluated along with five personality traits (extraversion, openness, neuroticism, agreeableness, and conscientiousness). A hierarchical cluster analysis categorized participants into two groups: “high neuroticism” (HNG) and “high extraversion” (HEG). Results showed that the EQ explained maximum variance in overall liking for the HNG (*R*2 = 0.42) and HEG (*R*2 = 0.48). A combination of EQ, FA, and TI measures increased the predictability of the models for the HNG (Cohen’s *f2* = 0.21 and 0.09, respectively) more than for the HEG (Cohen’s *f2* = 0.02 and 0, respectively). ANS showed limited contribution in this regard. In conclusion, personality traits, especially extraversion and neuroticism, influence emotional responses toward taste substances. Our findings can be used to further understand consumer behaviors toward commercial beverages while accounting for

individual personality differences.

**PhD Poster**

**Title: A Localized Surface Plasmon Resonance Sensor Coupled with Magnetic Nanobeads-based**

**Immunoseparation for Rapid and Sensitive Detection of *E. coli* O157:H7 (\*1st place)**

**Authors:** Wenqian Wang, Ronghui Wang, and Yanbin Li

*Escherichia coli* O157:H7 is one of the most commonly identified foodborne pathogens, which poses a great threat to human health and may cause substantial economic cost to society. The rapid and sensitive detection of foodborne pathogens is critical to ensure food safety. The objective of the present study is to develop a rapid and sensitive localized surface plasmon resonance (LSPR) sensor coupled with magnetic nanobeads-based immunoseparation (MNBs-IS) for *E. coli* O157:H7 detection in foods.

Biotinylated anti-*E. coli* O157:H7 antibodies were immobilized on streptavidin pre-coated MNBs (100 nm) surface to specifically capture and isolate target bacteria from food matrix. A functionalized LSPR sensor chip was activated with carbodiimide hydrochloride and *N*- hydroxysuccinimide to covalently bind to anti-*E. coli* O157:H7 antibody, and then used for detection. In tests, 100 μl of the separated MNBs-*E. coli* complexes were pumped into the sensor and measured with a LSPR analyzer.

The results showed that the LSPR/MNB-IS sensor could greatly shorten the detection time down to 4 min. The detection range of *E. coli* O157:H7 was 102 to 107 CFU/ml, with a detection limit as low as 82 cells in a sample of 100 μl. The MNBs used in this study were served not only in sample pretreatment, but also in amplification of the detection signal. No interference was observed with non-target bacteria. The developed LSPR/MNB-IS sensor is potentially a rapid, specific and simple approach for detection of *E. coli* O157:H7 at low concentrations in foods.

**Title: Effect of dicamba drift on soybean grain quality (\*2nd place)**

**Authors:** M.L. Zaccaro, J.K. Norsworthy, and D. Moseley

The United States is one of the largest producers and exporters of soybean, which provides protein, oil, and many other nutrients to humans and animals. The increase of area planted to dicamba-resistant soybean may generate losses on susceptible crops. Previous research detected an interaction of dicamba rate and application timing affected seed composition and seed mass in glyphosate-resistant soybean. The objective of this study was to evaluate if seed mass and concentrations of seed protein and oil changed after low rates of dicamba were applied to soybean at the at R5 growth stage. A study was established in 2017 at the Arkansas Agricultural Research and Extension Center in Fayetteville, AR where glufosinate-resistant soybean was treated with a range of dicamba rates from 3/4X to 1/256X, with the labeled rate for dicamba- resistant soybean being 560 g ae ha-1 (1X). Soybean was harvested at maturity using a small-plot combine. Weight per 100 seed along with protein and oil content were determined with a near infrared spectroscopy analyzer. Soybean seed protein and oil concentrations versus dicamba rate followed a linear response. Predicted soybean seed protein concentration increased from 38.28% at 2.2 g ae ha-1 of dicamba to 40.28% at 420 g ae ha-1. Predicted accumulation of seed oil decreased from 23.35% at the lowest rate of dicamba to 20.89% at highest. While treatments had no significant impact on seed mass, a significant change in seed composition was observed. Future efforts will focus on quantifying dicamba and its metabolites in seeds.

**Title: Plant Uptake of Major and Trace Elements from Soils Amended with a High-Calcium Dry Flue**

**Gas Desulfurization By-Product (\*3rd place)**

**Authors:** Jason R. Burgess-Conforti, David M. Miller, Kristofor R. Brye, and Erik D. Pollock

Coal combustion by-products (CCBs) are a potentially valuable source of essential plant nutrients, but CCBs also frequently contain trace elements. The objective of this greenhouse study was to evaluate the effects of soil and application rate of a high-calcium (Ca) dry flue gas desulfurization (DFGD) by-product on Bermudagrass (*Cynodon dactylon* L.) growth and plant tissue and soil composition. Surface horizons of two soils with contrasting texture were mixed with a high-Ca DFGD by-product at rates of 0, 2.5, 5, 10, and 15 Mg ha-1. Bermudagrass was allowed to grow in the soils for 119 days. Concentrations of plant nutrients and selected trace elements were determined in soil and plant tissue. Plant dry matter and tissue concentrations of Ca, Mg, B, Se, Rb, and U increased as DFGD application rate increased. Concentrations of Mehlich-3-extractable soil P, Ca, Mg, S, Na, Fe, and B and strong-acid-extractable V and Hg increased with increasing application rate. Soil pH increased with application rate and electrical conductivity was only greater than that in the control at the 15 Mg ha-1 application rate after 119 days. The DFGD by-product used in this study can be beneficially reused as a soil amendment provided soil pH and plant tissue Se concentrations are closely monitored.

\* The following abstracts in this category are in no particular order.

**Title: Leucine Improves Markers Energy Metabolism in Palmitate-treated C2C12 Myotubes**

**Authors:** Hexirui Wu and Jamie I. Baum

One contributor to the development of obesity is an increase energy intake accompanied by a decrease energy expenditure. Muscle plays an important role in energy utilization and production in human body. The objectives of this study were to determine if the branched- chain amino acid leucine lowers intracellular fatty acid uptake, and determine if mitochondria are involved in the leucine-mediated effect on fatty acid uptake. C2C12 myotubes were used as a cell model for muscle. Cells were treated with palmitate for 24 hours in order create an obesogenic muscle model. All cells were serum and leucine starved for 24 hours before receiving one of the following four treatments: control (CON), palmitate (PALM, palmitate treated for 24h), palmitate + 0.5mM leucine (PALM+0.5mM LEU,, palmitate and 0.5mM leucine co-treated for 24h), palmitate + 1.5mM leucine (PALM+1.5mM LEU,, palmitate and 1.5mM leucine co-treated for 24h). Intracellular lipid deposition was measured using oil red o staining kit and quantified using ImageJ software. Both doses of leucine showed significant effect (p<0.05) on lowering the intake of intracellular lipid uptake in PALM treated cells. Real-time PCR results showed higher (p<0.05) expression of uncoupling proteins (UCP2 and UCP3), which are involved in ATP synthesis, in both leucine treatment groups compared with PALM. There was no significant difference in gene expression of NRF1, SIRT1, Tfam, PPARγ and ANT1, all involved in mitochondria DNA transcription. In conclusion, these data suggest leucine promotes energy metabolism through regulating uncoupling protein in mitochondria in C2C12 myotubes, indicating a possible target for improving obesity.

**Title: Mapping of QTLs associated with Carbon Isotope Discrimination in Soybean (*Glycine max* L. Merr)**

**Authors:** Sumandeep Bazzer, Larry C. Purcell, Avjinder Singh Kaler, Andrew King, Jeffery D. Ray, and Sadal

Hwang

Soybean production is limited by drought stress. Water use efficiency (WUE) is considered as an important physiological trait associated with drought tolerance. The carbon isotope discrimination (Δ13C) provides an integrated measurement of WUE in C3 plants due to its substantial genetic variance, high heritability, and small genotype by environment interaction (G×E). The objective of this study was to identify quantitative trait loci (QTLs) associated with the Δ13C using a recombinant inbred line (RIL) population derived from a cross between KS4895 × Jackson. The experiment was conducted in three environments to evaluate the Δ13C under water-stressed and well-watered conditions. Analysis of variance of Δ13C showed significant effects of genotype, environment, treatment, and genotype x treatment interaction. Averaged values of Δ13C across all environments identified three QTLs on chromosomes Gm05, Gm06, and Gm20 at LOD scores of 3.2 or above using composite interval mapping (CIM) analysis, which collectively accounted for 79% of the phenotypic variation with individual R2 values ranging from 8 to 25.1%. Multiple interval mapping (MIM) analysis identified two QTLs on chromosomes Gm06 and Gm20, which explained phenotypic variation from 17.2 to 22.2%. The QTLs on Gm06 and Gm20 also showed the additive × additive epistasis interaction that contributed approx. 4.2% to total phenotypic variation. These two QTLs were also observed in all single environments and QTL on Gm20 was reported in previous genome wide association studies of carbon isotope ratio. Identified genomic regions can be important resource in soybean breeding program to improve tolerance to drought stress.