Integrated Plant and Soil Sciences Program

Professor Bill Witt
Graduate Student Symposium

December 7, 2018

Cameron Williams Lecture Hall
Plant Science Building
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Professor of Plant and Soil Science Emeritus Bill Witt Biography

Bill Witt received his PhD in weed science from North Carolina State University. He was a faculty member in the Department of Plant and Soil Sciences for 38 years, retiring in 2012. During those years, he dedicated much of his time to graduate student advising. He advised 40+ MS and PhD graduate students, as well as serving on many other graduate student committees. He received the College's George Mitchell Award for Service to Graduate Education in 2002 and the Outstanding Teaching Award, the Distinguished Achievement Award in Education, and the Distinguished Service Award - Academia from the Weed Science Society of America, the North Central Weed Science Society, and the Southern Weed Science Society, respectively.

Funding and acknowledgements

This graduate student symposium is made possible by funding from Professor Bill Witt, The Department of Plant and Soil Sciences, and the University of Kentucky Graduate School through the Block Grant program. The organizing committee would like to acknowledge the assistance of Abbie Cain, Susan Leopold, Prof. Rebecca McCulley, and Dr. Luke Moe. The organizing committee would also like to thank the faculty judges: Prof. Sharyn Perry, Dr. Luke Moe, Dr. Hanna Poffenbarger, Prof. Art Hunt, Dr. Carlos Rodriguez, Dr. Chris Matocha, Prof. Todd Pfeiffer, Prof. Mark Coyne, and Dr. Olga Tsyusko.
## Session I

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<tr>
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<th>Advisor</th>
<th>Type</th>
<th>Moderator</th>
<th>Judges</th>
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</thead>
<tbody>
<tr>
<td>9:00-9:15</td>
<td>Xi Zhang</td>
<td>Wendroth</td>
<td>Results</td>
<td>Madison Kramer</td>
<td>Perry</td>
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<tr>
<td>9:15-9:30</td>
<td>Kelly Mercier</td>
<td>Teutsch</td>
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<td>Moe</td>
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<td>9:30-9:45</td>
<td>Zach Perry</td>
<td>Legleiter</td>
<td>Results</td>
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<td>Poffenbarger</td>
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<td>9:45-10:00</td>
<td>Timothy Shull</td>
<td>Smalle</td>
<td>Results</td>
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<td>10:00-10:15</td>
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<td>Bailey</td>
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10:30-1:40  Break - Upload talks for session II

## Session II

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<td>10:40-10:55</td>
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<td>Results</td>
<td>Katherine Rod</td>
<td>Hunt</td>
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<td>10:55-11:10</td>
<td>Elisane Tessmann</td>
<td>Van Sanford</td>
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<td>Rodriguez</td>
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<td>11:10-11:25</td>
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<td>Kawashima</td>
<td>Proposal</td>
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<td>Matocha</td>
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<td>11:25-11:40</td>
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<td>11:40-11:55</td>
<td>Mohammad Alsabri</td>
<td>DeBolt</td>
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12:00-1:15  1st Annual IPSS Chili Cook-off - PSB lobby
1:00-1:15   Break - Upload talks for session III

## Session III

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<td>1:15-1:30</td>
<td>Mohammad Foteh Ali</td>
<td>Kawashima</td>
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<td>Layne Harris</td>
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<td>1:45-2:00</td>
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<td>2:00-2:15</td>
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<td>Knott</td>
<td>Results</td>
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<td>2:15-2:30</td>
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<td>Snyder</td>
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2:35-2:50  Judges' deliberations
2:50-3:00  Awards Ceremony
SESSION I
Title: Spatial variability of saturated hydraulic conductivity at the field scale

Presenter: Xi Zhang, 3rd year PhD Student

Advisor(s): Prof. Ole Wendroth

Abstract

Saturated hydraulic conductivity ($K_s$) is a crucial hydraulic property for assessing soil water dynamics. Understanding the spatial variability of $K_s$ in a field is important for site-specific resources management. However, direct measurement of hydraulic conductivity ($K$) is time consuming and arduous. Alternatively, pedo-transfer functions (PTFs) have been developed to estimate $K_s$ indirectly through more easily measurable soil properties. Although PTFs have been used for decades, their validity for estimating the field-scale spatial variability of $K_s$ remains unclear. The objectives of this study were to characterize the spatial pattern of $K$ at and near saturation in an agricultural field by coregionalization technique, and in comparison, evaluate the performance of ROSETTA PTF in characterizing the spatial variability of $K$ at the field scale based on soil property input. $K$ was measured at 48 locations in a 71-m by 71-m grid within a no-till farmland. Apparent electrical conductivity was densely measured using a contact sensor Veris 3150 and used as ancillary variable in coregionalization approach. Experimental semivariograms and cross semivariograms were derived and applied in cokriging to generate $K$ maps. Geostatistical analysis presented similarities in maps of measured $K$ with ROSETTA-predicted $K$ data for a matric potential of -10 cm. However, the strong spatial heterogeneity of measured $K_s$, which was caused by macro-pores, observed in the field was not captured by ROSETTA estimates. The results indicated that texture-dominated PTFs like Rosetta, in which soil structure is not considered, might be useful in characterizing the spatial pattern of unsaturated $K$ rather than $K_s$. Field scale $K_s$ maps based on PTFs estimates should be evaluated carefully and handled with caution.

Presentation type: Research Results
Title: Opportunities (and challenges) of grazing diverse summer annual pastures

Presenter: Kelly Mercier, 2nd year PhD student

Advisor(s): Dr. Chris Teutsch

Abstract

Retaining calves on summer pasture provides an opportunity to add extra gain before selling at a more opportune late summer market. The dominant perennial cool-season forages in the Mid-South often have insufficient quality and yield to support desired summer gains. In contrast, summer annual forages have both improved production and nutritive value during the summer months. In 2017 and 2018, a study was conducted near Princeton, KY, where calves (725 lb in 2017 and 806 lb in 2018) grazed one of three summer annual forage treatments: 1) sorghum-sudangrass monoculture, 2) simple mixture (three species), and 3) complex mixture (12 species). Due to differences in grazing management, results varied by year (P < 0.04). In 2017, calves grazing the simple mixture and the monoculture gained 1.74 lb/day, while calves grazing the complex mixture gained 1.46 lb/day (P < 0.03). In 2018, no differences in average daily gain were detected among treatments, however, calves only gained 0.02 lb/day. The low average daily gains in 2018 were likely due to higher nutritional demand of heavier calves and the lower nutritive value of more mature forages. Keeping summer annual forages in a vegetative state is paramount to maintaining adequate gains during the summer months.

Presentation type: Research Results
Title: Evaluation of the influence of dicamba exposure on canopy closure of Glufosinate-Resistant Soybean

Presenter: Zach Perry, 2nd year MS student

Advisor(s): Dr. Travis Legleiter

Abstract

Dicamba-resistant soybean along with lower volatility dicamba formulations have been introduced to control herbicide resistant weeds such as *Amaranthus palmeri*. This introduction has increased the amount of dicamba being applied later in the growing season and increased dicamba off-target movement. The objectives of this experiment were to evaluate the influence of timing and dosage of dicamba exposure on soybean canopy development and evaluate if canopy closure delays influence late season *Amaranthus palmeri* emergence. Dicamba damage was mimicked by applying low rates of dicamba directly on soybeans at rates of 0.5 g ae ha⁻¹, 1 g ae ha⁻¹ and 5 g ae ha⁻¹ dicamba. Trial design was a randomized complete block design with four replications at three locations. The UKREC site in Caldwell County was maintained and remained weed free. Trigg County had a population of Palmer amaranth. Webster County had a population of Waterhemp, although the density was too low to evaluate. Crop injury and trifoliate damage was evaluated at all three sites. Canopy development was assessed using Canopeo photos at the UKREC site in Caldwell County. Palmer amaranth counts were taken at the Trigg County location in a pre-determined 3.5m² area within the plot. Soybean exposed to dicamba early in the month of June express the greatest damage at 21 DAE, while late June and early July exposures expressed greatest injury at 28 DAE. Reduction in canopy development as compared to a non-exposed treatment was greater in exposures in July than in June. Palmer counts showed that a greater amount of additional palmer emergence as compare to an untreated plot occurred when exposure to dicamba occurred in mid-June.

Presentation type: Research Results
Title: Nanoharvesting and Autophagy

Presenter: Timothy Shull, 3rd year PhD student

Advisor(s): Dr. Jan Smalle

Abstract:

This presentation outlines a project which combines a few seemingly unrelated topics, including flavonoids, plant/nanoparticle interactions, autophagy and oxidative stress. These topics are all satellite to a recently discovered nanotechnology termed “nanoharvesting”, which uses titanium dioxide nanoparticles (nTiO2) to isolate flavonoids from intact plant tissue. Here we show that nTiO2 exposure induces autophagy in Arabidopsis thaliana and that autophagy is a key mechanism for mitigating nTiO2-associated stress. This new understanding of nTiO2 stress in higher plants is the first step in understanding how to attenuate plant cell stress during nanoharvesting.

Presentation type: Research Results
Title: Yield, Quality and TSNA Levels in Response to Potassium Source and Rate in Dark Air-Cured, Dark Fire-Cured and Burley Tobacco

Presenter: Andrea Keeney, 3rd year MS student

Advisor(s): Prof. Andy Bailey, Prof. Bob Pearce, and Dr. Edwin Ritchey

Abstract

In 2016, dark air-cured (DAC) and dark fire-cured (DFC) tobacco trials were conducted at the University of Kentucky Research and Education Center (UKREC), using KTD14 LC in both trials. Trials were repeated in 2017 and 2018 at UKREC and in Murray, KY using KTD14 LC and NL Madole HC. There was also a burley trial added in Lexington, KY using TN90 LC and TN90 HC. Potassium sulfate (K$_2$SO$_4$) and potassium chloride (KCl) were the potassium sources used. Treatments were arranged in a randomized complete block design with four replications, including an untreated check that received no potassium. Potassium sources were broadcast applied prior to transplanting at 112, 224, 336, kg K$_2$O ha$^{-1}$, respectively. In 2016, KCl-treated tobacco yielded higher than tobacco that received K$_2$SO$_4$, although KCl-treated tobacco had a higher moisture content and higher chloride levels than tobacco from K$_2$SO$_4$ treatments. Tobacco that received the K$_2$SO$_4$ treatments had higher total TSNA levels than tobacco receiving the KCl treatments. In the 2017 dark trials, there were no differences in yield related to source. In the 2017 burley trial, tobacco receiving the lowest rate of KCl had lower yield than tobacco from any other potassium treatment, and all tobacco that received potassium yielded higher than the untreated check. In seven of the ten trials, tobacco from K$_2$SO$_4$ treatments had higher total TSNA levels than tobacco from KCl treatments.

Presentation Type: Research Results
Title: Rhizosphere Attributes and Survival Strategies: The Role of the Rhizosphere in Ni Hyperaccumulation Vs Non-Hyperaccumulation in Serpentine Adapted Flora.

Presenter: Wes Morris, 4th year PhD student

Advisor(s): Dr. David H. McNear Jr.

Abstract

Serpentine soils are those derived from the weathering of serpentinized peridotite, an ultramafic rock comprised of 70% or greater ferromagnesian minerals. The weathering of serpentinite results in a plethora of edaphic factors that tend to impose strong selection pressures on plant life. Such properties may include: high magnesium (Mg) to calcium (Ca) ratio; low cation exchange capacity (CEC), reduced water retention, ready leaching of nutrient cations; low levels of fundamental macronutrients such as nitrogen (N), phosphorus (P), and potassium (K), and high levels of geologically derived metals such as cobalt (Co), chromium (Cr), and nickel (Ni). Appropriately, plant life on serpentine soils is often specialized, sparse, and endemic. Studying the rhizosphere of serpentine adapted plants may lead to a better understanding of how plants have evolved to cope with the varied abiotic stresses posed by, but not exclusive to, serpentine soils. Such an understanding could lead to a wider portfolio of options for altering important plant species in the face of challenges posed by climate change and soil pollution. The proposed research seeks to interrogate the rhizosphere of Ni hyperaccumulating and non-hyperaccumulating plants using a multidisciplinary approach including x-ray absorption spectroscopy for Ni speciation, ratiometric fluorescent imaging for spatially resolved O$_2$ concentrations and pH, bacterial community structure via 16S and phospholipid fatty acid analysis, and bacterial community function via computational methods. The resulting data set will provide insights into how rhizosphere attributes may be involved in the development of divergent mechanisms by closely related plants for inhabiting the same niche.

Presentation type: Research Results
Title: Uptake and bioactivity of chitosan/double-stranded RNA polyplex nanoparticles in *Caenorhabditis elegans*

Presenter: Stuart Siegfried Lichtenberg, 4th year PhD student

Advisor(s): Dr. Jason Unrine

Abstract: RNA interference-based crop protection agents are potentially the most specific pesticides ever produced, while still offering useful potency. Combining dsRNA and cationic polymers generates structures known as polyplex nanoparticles. Polyplex nanoparticles have been shown to improve dsRNA uptake in cells and protect transcripts from nuclease degradation. In this study, we investigated chitosan/dsRNA polyplex nanoparticles as RNAi agents in the nematode *Caenorhabditis elegans*. By measurement of an easily observed phenotype, and uptake of fluorescently labeled dsRNA, we demonstrate that chitosan/dsRNA polyplex nanoparticles are considerably more effective at gene knockdown on a whole body concentration basis than naked dsRNA. Further, we show that chitosan/dsRNA polyplex nanoparticles introduce dsRNA into cells via a different mechanism than the canonical *sid-1* and *sid-2* pathway. Clathrin-mediated endocytosis is likely the main uptake mechanism. Finally, although largely reported as non-toxic, we have found that chitosan is capable of downregulating expression of myosin, a critical component for growth and development in eukaryotes. Given the increased potency, non-canonical uptake, and off-target effects we have identified, these findings highlight the need for rigorous safety assessment of nano-RNAi products prior to deployment. Specifically, potential adverse effects of the nanocarrier and components thereof need to be considered.

Presentation type: Research Results
Title: GWAS for Fusarium Head Blight Related Traits in Winter Wheat (*Triticum aestivum* L.) in an Artificially Warmed Treatment

Presenter: Elisane Tessmann, 5th year PhD Student

Advisor(s): Prof. David A. Van Sanford

Abstract

Global temperature increases will affect Fusarium head blight (FHB) levels in wheat (*Triticum aestivum* L.). A pressing question is whether current sources of resistance will be effective in a warmer environment. We evaluated phenotypic response to disease in 238 soft winter wheat breeding lines and cultivars grown in 2015-16 and 2016-17 under control and warmed (+ 3°C) conditions. Warming was achieved with heating cables buried 3 cm in the rhizosphere. We measured heading date, plant height, yield, FHB rating, Fusarium damaged kernels (FDK), deoxynivalenol (DON), leaf blotch rating, powdery mildew rating, and leaf rust rating. There were significant (*p* < 0.01) differences among genotypes for all traits measured. Genome-wide association study (GWAS) identified 19 and 10 significant SNPs in the control and warmed treatments, respectively. FDK and DON levels were often significantly (*p* < 0.05) higher in warmed than in control when we contrasted alleles at important quantitative trait loci (QTL) such as *Fhb1*, *Rht-B1* and *D1*, and all vernalization and photoperiod loci. Increased rhizosphere temperature resulted in a significantly (*p* < 0.01) earlier heading date (~3.5 days) both years of the study. Rank correlation between warmed and control treatments was moderate (r=0.56). Though encouraging, it indicates that selection for performance under warming should be carried out in a warmed environment.

Presentation type: Research Results
Title: Molecular and Cellular Dynamics in the *Arabidopsis* Female Gamete for Fertilization

Presenter: Umma Fatema, 1st year PhD student

Advisor(s): Dr. Tomokazu Kawashima

Abstract

Fertilization is the process of fusion of haploid male and female gametes to develop into a new individual. In most animals, microtubules drive the migration of the female pronucleus towards the male pronucleus for fertilization. By contrast, the fertilization process in flowering plants is dependent on actin filament (F-actin) dynamics; F-actin, rather than microtubules, is responsible for sperm nuclear migration (Kawashima et al. 2014). How F-actin movement is controlled in the gamete cell is largely unknown except for the involvement of a small GTPase of the Rac/Rop family in signaling for cytoskeleton organization. To identify other factors involved in F-actin dynamics of the female gametophyte, we carried out pharmacological screening. Consistently with our previous work (Kawashima et al. 2014), ROP signaling inhibitors arrested F-actin movement in the central cell. We also found the involvement of myosin in female gamete F-actin dynamics. Seventeen *MYOSIN* isoforms exist in the *Arabidopsis* genome, and transcriptional profiling analyses suggest that several of these myosin genes are expressed relatively high in the central cell. Therefore, in my project, I would like to investigate the mechanism of how this myosin controls the gamete cell F-actin dynamics and identify new factors involved in gamete nuclear migration in *Arabidopsis*. Knowledge from this project will not only provide the molecular and cellular mechanisms of how flowering plants utilize F-actin dynamics for gamete nuclear migration, but will also shed light on the role that functionally uncharacterized class myosins play in contributing to the unique double-fertilization process in flowering plants.

Presentation type: Research Proposal
Title: Understanding Irrigation Water Applied, Consumptive Water Use and Water Footprint in Nursery and Greenhouse Production

Presenter: Joshua Knight, 4th year MS student

Advisor(s): Prof. Dewayne Ingram, Dr. Krista Jacobsen, and Prof. Mark Coyne

Abstract

The calculation and comparison of Water Footprint (WF) among specialty crop growers is confounded by geography, species and process. This research draws upon models of representative plant production systems—using published Life Cycle Inventory data—including container production using recycled water in the eastern U.S. and the Pacific Northwest as well as greenhouse production in the northeastern and southeastern U.S. implementing rainfall capture, overhead and ebb/flood irrigation strategies. Consumptive water use is compared across systems considering the changing process of “weighting” these volumes by different methods (Consumption-to-availability, Available-water-remaining) to calculate Water Footprint for each production system.

Presentation type: Research Results
Title: MS79 is a microbially derived selective cellulose biosynthesis inhibitor

Presenter: Mohammad R. Alsabri, 5th year PhD student

Advisor(s): Profs. Seth DeBolt and Mark Williams

Abstract

Herbicides are used to control weeds in agricultural systems and to beneficially shift the competition between crops and weeds. Despite their importance, few new mechanisms of action have been elucidated in recent decades. Here, we describe the identification of a bio-derived herbicidal mixture from an endophytic bacterium named MS79. The MS79 strain was isolated from switchgrass tissue. A preparation of concentrated cellular material disturbs the biosynthesis cellulose in plants exposed to the mixture. Accordingly, isolation with XAD16 resin to purify metabolites results in a herbicidal mixture with similar activity against cellulose biosynthesis. The application of the MS79 to a range of plant genera suggests that it caused substantial reduction in cellulose content *Sorghum bicolor* L and other monocotylenous plants. However, Solanaceous broad leaf crops, for instance *Nicotiana tabacum* and *Solanum lycopersicum*, are less sensitive. The genome of MS79 was sequenced, revealing the presence of plant-microbe association genes and several genes encoding proteins capable of binding to or degrading plant cell wall carbohydrates. Thus, we propose that MS79 is a Class L herbicide, with specificity towards grass control in Solanaceous crops.

Presentation type: Research Results
Title: Role of F-actin and its Regulators in Coenocytic Endosperm to Determine the Seed Size Potential in *Arabidopsis thaliana*.

Presenter: Mohammad Foteh Ali, 2nd year PhD student

Advisor(s): Dr. Tomokazu Kawashima

Abstract

In most angiosperms including Arabidopsis, early endosperm development (coenocytic endosperm) is the phase when endosperm enlarges rapidly and endosperm nuclei keep on dividing without cytokinesis. After rounds of nuclear divisions, the one large coenocytic endosperm cell then undergoes cytokinesis (cellularization). In Arabidopsis, the transition period from coenocytic endosperm to cellularization is tightly linked to the seed growth and the size, as precocious or delayed endosperm cellularization produces smaller or larger seeds respectively. Recently, our lab has successfully visualized the entire coenocytic phase of endosperm development in real-time in Arabidopsis. We found that the filamentous actin (F-actin) generates unique aster-shaped structures around each endosperm nucleus and controls nuclear movement. Furthermore, we identified that * FORMIN12 (FH12) * gene, known to be one of the vital F-actin regulators, is expressed specifically in the coenocytic endosperm. In order to investigate the potential function of that gene, I obtained a knockout mutant line and integrated fluorescently labeled F-actin (lifeact), and nuclei (histone 2B) marker lines into the mutant. Next, I will carry out confocal microscopy time-lapse live-cell imaging to investigate the organization of F-actin and the movement of nuclei during the coenocytic endosperm development in the *fh12* mutant. I am also investigating the embryo and endosperm development as well as the final seed size of *fh12* mutant to understand the effect of F-actin regulators on the seed growth and development.

Presentation type: Research Results
Title: Influence of Spray Nozzle Design and Weed Density on Herbicide Coverage and Deposition

Presenter: Madison Kramer, 1st year MS student

Advisor(s): Dr. Travis Legleiter

Abstract

A series of restrictions have been created for dicamba applications. One restriction is the use of low drift nozzles. These nozzles minimize the production of driftable fines. An experiment was conducted in 2018 at the University of Kentucky Research and Education Center in Princeton, Kentucky to evaluate herbicide coverage and deposition on *Eleusine indica*. Dicamba plus glyphosate was applied to 5 to 10 cm tall weeds with Turbo TeeJet (TT11005) nozzle and two drift reduction nozzles: Turbo TeeJet Induction (TT111005) and HyproUltra Low Drift (ULD12005). Fluorescent dye (PTSA) and pink foam marker dye were added to the spray solution to evaluate deposition on target leaf surfaces within the soybean canopy and evaluate coverage on Kromekote spray cards, respectively. Applications were made with an ATV traveling at 16 kph with an output of 140 L per ha. A 0.25m² quadrant was established in each plot prior to the post-emergence application with *Eleusine indica* weed densities ranging from an average of 6 to 25 plants per quadrant. The percentage of coverage and depositions per cm² was reduced using the drift reduction nozzles as compared to the Turbo TeeJet. Deposition of spray solution on to *Eleusine indica* were not different despite differences observed on the Kromekote cards. *Eleusine indica* density did not have an influence on spray solution deposition. The data collected has shown that drift reduction nozzles and weed density may not reduce herbicide efficacy onto *Eleusine indica* due to spray solution deposition being equivalent across nozzle types used in this study.

Presentation type: Research Results
Title: Cytokinin signaling promotes protein synthesis in the model plant, *Arabidopsis thaliana*.

Presenter: Sumudu Karunadasa, 4th year PhD student

Advisor(s): Dr. Jan Smalle

Abstract

Cytokinin is an important plant hormone which regulates plant growth and development. This regulation occurs through a signaling cascade which consists of four major components: the histidine kinase (CHKs) receptors, histidine phosphotransfer proteins (HPTs), and two types of response regulators (RRs) that control gene expression. Arabidopsis response regulator 1 (ARR-1) is one of the major type B response regulators that up regulates cytokinin responsive genes upon activation. In this study, ARR1 mutant and transgenic lines were analyzed in the presence of aminoglycoside antibiotics and interestingly we found that the kanamycin resistance phenotype showed by arr1-1 mutant (which has NPTII gene as a selection marker) is suppressed by expression of the ARR1 protein. Moreover, ARR1 gain-of-function lines showed sensitivity to antibiotics that promote mistranslation of proteins (eg- kanamycin) while they showed tolerance to antibiotics that cause complete protein translation inhibition (eg- Spectinomycin, chloramphenicol).

In the analysis of protein synthesis rates, ARR1 gain-of-function lines showed higher protein synthesis rates while loss-of-function lines showed much lower protein synthesis rates compared to the Col-0 wild type. Also, the exogenous cytokinin treatments showed an increase in protein synthesis rates in a dose dependent manner in wild type plants but not in the ARR double mutants. This increased global protein synthesis rates in ARR1 gain-of-function lines caused higher mistranslation in the presence of antibiotics like kanamycin resulting in hypersensitivity to such antibiotics. This suggests that the cytokinin signaling pathway plays a crucial role in the regulation of global protein synthesis in plants.

Presentation type: Research Results
Title: Intensive Double Crop Soybean Management

Presenter: Katherine Rod, 3rd year PhD student

Advisor(s): Dr. Carrie Knott

Abstract

Double crop soybeans are grown directly following winter wheat in Kentucky’s crop rotation and usually yield lower than full season soybeans. There is interest in identifying intensive management practices to increase double crop yields. The goal of this research is to determine whether intensive management practices can increase yield of double crop soybean in Kentucky. Field trials were in 2017 and 2018 at the University of Kentucky Research and Education Center in Princeton, KY following a complementary winter wheat study. Trials were arranged as a split plot randomized complete block design in which the main plots are planting timing and the sub plots are management treatments. The objectives are to determine the effect of 1) planting timing, where early planting occurs immediately after wheat harvested at 20-22% grain moisture and late planting timing occurs after wheat harvested at 13-15% grain moisture; 2) seeding rate of 370,500 or 555,750 seeds ha⁻¹; 3) the use of seed treatment; and 4) prophylactic application of foliar fungicide (Quadris Top) and insecticide (Warrior II with Zeon Technology) at the R3 growth stage versus pesticide applications based on scouted economic thresholds. Preliminary data from the first two years of the study indicate that the early planting timing had significantly higher yields (4304 kg ha⁻¹) than the late planting timing (3497 kg ha⁻¹). The high seeding rate had a significantly higher yield (4102 kg ha⁻¹) than the normal seeding rate (3697 kg ha⁻¹). The use of seed treatment significantly increased soybean yields (4035 kg ha⁻¹) compared to no seed treatment (3766 kg ha⁻¹). Prophylactic R3 foliar pesticide applications had significantly higher yield (3699 kg ha⁻¹) than treatments that received pesticide applications based upon field scouting (3228 kg ha⁻¹). Field trials will be established in the summer of 2019 to collect the third year of data.

Presentation Type: Research Results
Title: Spider Mite Repellency of 7-Epi-Zingiberene, 9-Hydroxy-Zingiberene, and 9-Hydroxy, 10,11-Epoxy-Zingiberene Isolated from Wild Tomato

Presenter: Mohammad H.S.A. Dawood, 4th year PhD student

Advisor(s): Dr. John C. Snyder

Abstract

Tomato, *Solanum lycopersicum*, is one of the most economically important world-wide grown vegetables. Nevertheless, tomato is a host for numerous pests that reduce productivity. Tomato breeders have focused more on increasing fruit quantity and quality and less on enhancing crop resistance to herbivores. Many accessions of the wild tomato relative, *Solanum habrochaites* possess high levels of resistance to arthropods. The monocyclic sesquiterpene hydrocarbon known as zingiberene is a major component found in trichome secretions of certain accessions of *Solanum habrochaites*. To investigate if other allelochemicals are also responsible for *S. habrochaites* resistance to arthropods. Seeds of *S. habrochaites* LA2329 were germinated and grown under greenhouse conditions and then major allelochemicals were isolated by silica gel column chromatography and tested against the two spotted-spider mite *Tetranychus urticae*. Isolation and identification of allelochemicals were aided by use of gas chromatography/mass spectroscopy. The results revealed the presence of three predominate chromatographic peaks: 7-epi-zingiberene (7-epi-ZG), 9-hydroxy-zingiberene (ZG9OH) and 9-hydroxy, 10,11-epoxy-zingiberene (ZG9OH10Epoxy). Results of testing these isolated compounds for repellency to *T. urticae* using bridge bioassays revealed that the activities of ZG9OH and ZG9OH10Epoxy against *T. urticae* were both significantly higher than that for 7-epi-ZG. These results support the idea that the degree of repellency may differ among plant allelochemicals and also emphasized the potential value of introgression ZG9OH and ZG9OH10Epoxy into cultivated tomato to improve its arthropod resistance.

Presentation type: Research Results
ORGANIZING COMMITTEE

Chair: Dr. Jason Unrine

Moderators: Katherine Rod, Layne Harris, and Madison Kramer