Determining Duration of Residual Control of Soil-applied Herbicides to Form Total Preemergence Herbicide Programs in Soybean**, Project 63-2021**
Annual Report

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Rationale/Justification for Research: Currently, growers in Mississippi are faced with the issue of producing soybean crops while competing against 23 individual combinations of weed species by site of action herbicide resistance. Managing populations of herbicide resistant weeds have severely cut into profit margins of producers as these weeds are more difficult to control. Palmer amaranth (*Amaranthus palmeri* L.) is among the most resilient and difficult weed species to manage, and it has been documented to have multiple resistance traits. In Mississippi, Palmer amaranth populations have been confirmed to have multiple resistance to both ALS and glyphosate herbicides. In Arkansas and Tennessee, PPO-resistant Palmer amaranth populations have become more widespread. Additionally, populations of Palmer amaranth have been discovered in Tennessee where reduced efficacy has been reported following applications of auxin herbicides. Existing populations of Palmer, or any weed, during critical weed free periods of soybean development can result in substantial reductions in yield and returns on investment. Because of overreliance on chemical control, many post-emergence (POST) herbicide chemistries have been ruled out as options for control of troublesome weed species. To overcome herbicide resistance and protect remaining chemistries from resulting in developed herbicide resistance, it is crucial to utilize as many herbicide chemistries as possible to manage weed populations. These proposed studies would investigate a wide spectrum of soil-applied herbicides for their ability to alleviate selection pressure on POST chemistries. Not only do soil-applied herbicides have the potential to slow the development of herbicide resistance, but programs built upon these chemistries could result in an entire cropping season without competition from weedy species. Data from these studies will be made available through publication in on-line journals and in Extension materials to be made available to soybean growers and contributors throughout Mississippi.

Objective 1: <u>Evaluate duration of control for labeled soil-applied herbicides in soybean production.</u>

Quarter 1:

- Study was conducted three different times at two different locations: Brooksville, MS and Starkville, MS
- Brooksville plantings included the following: April 22, 2021; May 26, 2021; and June 18, 2021.
- Starkville plantings included the following: April 21, 2021; May 25, 2021; and June 18, 2021.
- Both locations were planted with Asgrow AG47XF0 soybeans.
- Brooksville application timings included: April 23, 2021; May 26, 2021, and June 18, 2021.
- Starkville application timings included: April 23, 2021; May 26, 2021; and June 18, 2021.

- Brooksville data collection timings following initial applications included: April 29, 2021; May 6, 2021; May 13, 2021; May 20, 2021; May 26, 2021; June 3, 2021; and June 14, 2021.
- Brooksville data collection following the second applications included: June 3, 2021; June 14, 2021; June 18, 2021; and June 24, 2021.
- Brooksville data collection following the third applications includedL June 24, 2021; July 1, 2021; July 7, 2021; July 15, 2021; and July 21, 2021.
- Starkville data collection timings following initial applications included: April 29, 2021; May 6, 2021; May 13, 2021; May 20, 2021; May 26, 2021; June 3, 2021; and June 14, 2021.
- Starkville data collection timings following the second applications included: June 3, 2021; June 14, 2021; June 18, 2021; June 24, 2021; and July 1, 2021.
- Starkville data collection timings following the third applications included: June 24, 2021; July 1, 2021, July 8, 2021; July 15, 2021; and July 22, 2021.

- Treatments for this study include the herbicides below:

acetochlor (Warrant)
cloransulam-methyl (First Rate)
clomazone (Command 3ME)
dimethenamid-P (Outlook)
flumetsulam (Python)
fomesafen (Reflex)
flumioxazin (Panther SC)
imazaquin (Scepter)
metribuzin (Dimetric)
pyridazinone (Solicam)
pendimethalin (Prowl H20)
pyroxasulfone (Zidua SC)
S-metolachlor (Dual Magnum)
sulfentrazone (Shutdown)
sulfentrazone + S-metolachlor (BroadAxe XC)
S-metolachlor + metribuzin (Boundary 6.5EC)
S-metolachlor + fomesafen (Prefix)
sulfentrazone + metribuzin (Authority MTZ)
acetochlor + fomesafen (Warrant Ultra)
sulfentrazone + flumioxazin (Authority Superior)
flumioxazin + pyroxasulfone (Fierce)

Quarter 2: Fields were maintained after data collection that occurred in quarter 1.

Quarter 3: Soybeans were harvested.

Quarter 4: Data from field trials were presented at the Southern Weed Science Society annual meeting in Austin, TX.

Objective 2: <u>Determine rainfall activation requirements for labeled soil-applied herbicides in soybean production.</u>

Quarter 1: Soil Samples were collected to locate the soil textures required for this study. Two soil textures from the delta and two soil textures from the hills were collected and sent to Waypoint soil testing lab.

Quarter 2:

- Soil samples from Starkville, MS and Brooksville, MS were collected to determine soil texture and sent to Waypoint soil testing lab. The results came back as a sandy loam and a clay loam, respectively.
- Prospective silt loam soils from Starkville, MS and Verona, MS were sent to Waypoint soil testing lab to be tested for texture. Once textures are confirmed, soils will be dug, allowed to air dry, then sieved in preparation for greenhouse studies.
- Clay loam soil from Brooksville, MS was confirmed by Waypoint Analytical. Soils have been dug and are air drying. Once dry, soils will be ground and sieved in preparation for greenhouse studies.
- Sandy loam soil has been confirmed, dug, and air dried. Soils have been ground and sieved in preparation for greenhouse studies.

Quarter 3:

- We have excavated 4 large trash cans of loam soil from Starkville, MS.
- We have ground and sieved both the clay loam and loam soils and prepared them to be put into greenhouse conetainers.
- Cones, trays, herbicide, and all other supplies to carry out the greenhouse project have been purchased and received.
- Weed seed have been purchased to plant into the cones for the study.
- We have discussed the final details of how the project will be carried out with Dr. Darrin Dodds and Dr. Jason Krutz.

Quarter 4:

- 1st run of greenhouse trial successfully conducted.
  - All rainfall amounts were successfully applied following herbicide application
  - Visual evaluation of weed control were made
  - Fresh and dry weight biomass data were collected at conclusion of experiment
  - Data will be analyzed during quarter 1 of 2022.
- 2nd run of greenhouse trial initiated.

Objective 3: <u>Use results from Objectives 1 and 2 to develop and evaluate total preemergence (PRE) herbicide program for soybean production.</u>

Quarter 1: Results from Objectives 1 and 2 need to be determined before moving forward for Objective 3.

Quarter 2: Results from Objectives 1 and 2 need to be determined before moving forward for Objective 3.

Quarter 3: Results from Objectives 1 and 2 need to be determined before moving forward for Objective 3.

Quarter 4: Results from Objectives 1 and 2 need to be determined before moving forward for Objective 3. Once the second year of data has been collected, all data will be coalesced and analyzed. Following analysis, programs outlined in objective 3 will be put forth.