Final Report for Project #410

1. **Title of Grant**: Best management of soybean in a double crop system
2. **Period Covered (life of project for final report)**: July 2017 through July 2018
3. **Project Leader and Co-Primary Investigators**: William (Bill) Wiebold
4. **Layman’s Summary (limit to one page)**

This project added additional data to the dataset collected from a one-year USB project. It consisted of two experiments. Experiment 1 will focused on plant management issues: variety maturity group and seeding rate. We used four Pioneer brand varieties with 3.2, 3.7, 4.3, and 4.8 maturities. Seeding rates were 50,000, 100000, 150000, 200000, and 250000 seeds/acre. Experiment 2 focused on disease and insect management. The 4.3 maturity variety was planted with and without a full spectrum seed treatment. Foliar pesticides were applied at growth stage R3. The four treatments were Quadris Top (fungicide), Warrior (insecticide), Quadris Top + Warrior, and a no-spray control. Row spacing in both experiments was 15 inches. Grain yield was corrected to 15% moisture. Data from this 2017 MSMC project were combined with data from the 2016 USB project.

The MG of the two highest yielding varieties were 3.7 and 4.3. This result from the double-crop system matches our experience with full season soybean production. This confirms our recommendation that varieties chosen for double crop use should be the same varieties used for full season production.

For unknown reasons, stand densities were only about 50% of the seeding rates in both years. The 200,000 and 250,000 seeding rates resulted in stand densities of 105,000 and 130,000 plant per acre. These stands resulted in the highest yields. We have found that yield maximizes in full season soybean production at around 90,000 plants/acre in most years. Results from this experiment confirm that stand densities in double crop system should be greater than full season, although we would predicted that the 130,000 density might yield more than the 105,000 density. The late summer weather during the second year was very dry. That may have limited the yield response to stand density.

Seed treatment increased soybean yield in both years. Average increase was 7%. We’ve never found that seed treatment increased yield of full season soybean. Perhaps stand density is more important for double cropped soybean or some effect on plant health influenced yields.

In-season application of a foliar fungicide increased yields in both years. We did not scout for or identify specific diseases. With a short growing season, protecting leaf area is critical to yield.

Complete data averaged over the two years is appended to the end of this report.

1. State your objectives in question form and discuss how your results answer these objectives.
2. Please answer the following.
3. **How do your results benefit Missouri soybean growers?** Wheat is planted in a double crop system on less than 20% of Missouri’s soybean acreage. Improving the performance of soybean in a DC system will add choices, and perhaps profitability, for Missouri soybean farmers. Adding wheat to the rotation allows protects the environment.
4. **Estimate financial return for the average Missouri soybean producer**. Adding wheat into a rotation by double cropping does not decrease soybean return as much as wheat adds to the total return if performed in areas of the state where DC is appropriate. Increase in total return is 10 to 50 dollars per acre.
5. **Do your results benefit the environment?** Yes. Wheat is a valuable winter annual. Planted in the fall, it protects soil surface from water and wind caused erosion from early fall through late spring. Wheat is a recognized cover crop.
6. **What products or processes can be commercialized from this research?** Not applicable
7. **List disclosure(s) of inventions or plant varieties submitted to the MU Tech Transfer Office**. Not applicable
8. **Identify potential disclosure(s) of inventions or plant varieties. *Please note that credit must be given to MSMC for any inventions or discoveries resulting from this research***. Not applicable
9. **How would you commercialize these products or processes?** Not applicable
10. **If no specific products or processes were produced, how do you plan to make your results available to producers or industry?** Results shared with soybean growers in IPCM newsletter and at grower meetings. Results will be published in a journal read by certified crop advisers
11. **Is additional time or research required before your results can be used by producers and industry?** This winter meeting season
12. **List publications by type (popular press, thesis, journals, other) written or planned.** Planned venues: *Integrated Pest and Crop Management Newsletter*; *Crops, Forages, and Turfgrass Management*

VIII. **List cost of original project and actual expenditures**. ***The U.S. Department of Agriculture requires that we ask for budget information, including the number of hours spent on the project, the number of dollars remaining on account, as well as a breakdown of expenses. You are required to provide this information in your report.* Please also include names and titles/positions of those whose time has been charged to this project.** Approximately 95% of requested $20,276 amount were spent. The only employee was Jarrod Nichols, Senior Research Specialist.

1. **List equipment purchased with MSMC funds, identifying inventory and serial number. (It is not considered equipment unless it costs $500 or more and has a life expectancy of at least 2 years.) Indicate current and future use of this equipment in support of soybean research.** None

Stand Densities and Yield from Experiment 1, Average of 2016 and 2017.

|  |  |  |  |
| --- | --- | --- | --- |
| Maturity Group | Seeding Rate | Stand | Yield |
|  | #/acre | #/acre | bushels/acre |
| 3.4 | 50,000 | 32564 | 21.6 |
| 3.4 | 100,000 | 64782 | 33.5 |
| 3.4 | 150,000 | 79885 | 40.4 |
| 3.4 | 200,000 | 109215 | 42.0 |
| 3.4 | 250,000 | 130904 | 44.7 |
| 3.7 | 50,000 | 35366 | 26.7 |
| 3.7 | 100,000 | 62444 | 39.7 |
| 3.7 | 150,000 | 89079 | 44.2 |
| 3.7 | 200,000 | 113375 | 47.6 |
| 3.7 | 250,000 | 141983 | 47.5 |
| 4.3 | 50,000 | 31826 | 24.1 |
| 4.3 | 100,000 | 60468 | 37.5 |
| 4.3 | 150,000 | 92714 | 42.5 |
| 4.3 | 200,000 | 113570 | 48.1 |
| 4.3 | 250,000 | 123339 | 48.0 |
| 4.8 | 50,000 | 26797 | 21.5 |
| 4.8 | 100,000 | 54458 | 36.3 |
| 4.8 | 150,000 | 71520 | 41.9 |
| 4.8 | 200,000 | 87189 | 43.3 |
| 4.8 | 250,000 | 123398 | 47.5 |
| Maturity Group  Means |  |  |  |
| 3.4 |  | 83470b | 36.4 a |
| 3.7 |  | 88449b | 41.1c |
| 4.3 |  | 84383b | 40.0c |
| 4.8 |  | 72672a | 38.1b |
|  |  |  |  |
| Seeding Rate  Means |  |  |  |
|  | 50,000 | 31638a | 23.5a |
|  | 100,000 | 60538b | 36.7b |
|  | 150,000 | 83299c | 42.2c |
|  | 200,000 | 105837d | 45.3d |
|  | 250,000 | 129906e | 46.9d |

Stand Densities and Yields from Experiment 2, Average of 2016 and 2017.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Seed Treatment | Foliar App | Stand |  | Yield |
|  |  | #/acre |  | bushels/acre |
| Untreated | None | 80631 |  | 42.2 |
| Untreated | Fungicide | 86263 |  | 45.2 |
| Untreated | Insecticide | 74931 |  | 42.2 |
| Untreated | Fungicide +  Insecticide | 74489 |  | 43.2 |
| Treated | None | 88351 |  | 45.7 |
| Treated | Fungicide | 93038 |  | 47.6 |
| Treated | Insecticide | 91041 |  | 44.4 |
| Treated | Fungicide +  Insecticide | 91050 |  | 47.2 |
|  |  |  |  |  |
| Seed Treatment  Means |  |  |  |  |
| Untreated |  | 79078a |  | 43.2a |
| Treated |  | 90870b |  | 46.2b |
|  |  |  |  |  |
| Foliar App Means |  |  |  |  |
|  | None | 84491a |  | 44.0a |
|  | Fungicide | 89650a |  | 46.4b |
|  | Insecticide | 82986a |  | 43.3a |
|  | Fungicide +  Insecticide | 82769a |  | 45.2ab |