Graves-Chapple Research Center
Final Report for April 1, 2016 – March 31, 2018
MSMC Project No. 16-389-18

I. Enhancing Soybean Production Efficiency in Northwest Missouri

II. Period Covered – April 1, 2016 – March 31, 2018

III. Project Leader and Co-Primary Investigators

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IV. Summary

The goal of this project is to look at several production practices to help growers increase their profitability by decreasing their input costs while maintaining good environmental stewardship. These production practices were evaluated over a two-year period regarding their input costs vs increase or decreases in yield and thus on overall profitability. The goal was to provide information that would allow producers to make a more informed decision regarding some of their input costs.

The five practices examined were:
Planting population
Comparison of 30-inch vs 15-inch vs 20-inch rows
Application of foliar fertilizers
Application of foliar fungicides
Comparing Roundup Ready® vs Liberty Link® varieties for yield

The two-year results showed no yield advantage for the application of foliar fertilizers, foliar fungicides or between RR® and LL® soybeans. This lack of any yield advantage for the foliar applied treatments is probably a result of good soil fertility and no diseases being present as was the case for most of NW Missouri.. In poorer soils or under the right environmental conditions these practices could be a benefit. However if the issue is not preset, there does not appear to be a benefit to the application of these products..

The row spacing trial showed an increase in yield for the 15-inch rows over the conventional 30-inch rows during the second year of the trial and no statistical differences the first year. We hypothesize the differences in the weather patterns between the two years accounts for the differences.

The yields for the six different planting populations followed a curve with the yield flattening out between 120,000 and 140,000 planting population and decreasing above that level. An increase in seed costs for the higher populations did not translate into higher crop yields thus reducing overall profitability.

V. State your objectives in question form and discuss how your results answer these objectives.

A) What is the optimum planting population range to maximize profitability? This trial was a comparison of six different planting populations and their yields. The two year data indicates maximum profitability was obtained when a planting population of 121,000 – 138,000 seeds per acre is used. At levels above and below this range profitability declined. Yield was reduced below these populations that the additional seed costs for the higher populations were covered by increased yield. Above these seeding levels, the yield decreased which made input costs higher with lower revenue.

An additional observation is that above 138,500 seeds per acre the plants tended to grow much taller and vined much more. This resulted in a tendency to blow over and mat to the ground if high winds occurred after they dropped their leaves and before harvest. While no loss or rotting was observed by this occurring, they were harvested within 2 days of being knocked done by storms which may not always be possible with larger fields.

Hailstorms, wind or insects can reduce a stand of soybeans. Since there was good weather both years and no stand loss was experienced, the higher value of 138,500 seeds per acre is probably a safer recommendation.

B) Is there a profitability benefit for narrow row soybeans? A comparison of 30-inch vs 15 in vs 20 inch planted soybeans during the 2 years was inconclusive. In year one, there was no significant differences between the row spacing but the 30 inch rows showed a trend for lower yields. During year two, there was a significant difference between all three spacing with the 15 inch having the highest yield and the 30 in rows the lowest yield. We speculate this is attributable to the weather since the narrow row soybeans were able to canopy faster and preserve moisture during the hot and dry summer months.

The narrow rows also showed slightly better, but statistically non-significant, weed control, which should also be considered when planting decisions are made. Soybeans were planted into clean fields with proper pre-emergent herbicides applied and then post sprayed when weeds were approximately four inches tall. However, the increased yield may not be sufficient to cover the increased cost for the split-row planter needed to plant the crop.

C) Since herbicide resistant weeds are becoming more of an issue and we are looking at different chemistries, do Roundup Ready® soybeans have a higher yield potential than Liberty Link® Soybeans? For this two-year trial, 37 varieties of Liberty Link® soybeans were compared to 37 varieties of Roundup Ready® soybeans to compare yield and weed control differences. There was only a 0.1 bu/acre difference between the two types of soybeans with no measurable difference in weed control.

The lack of a yield difference makes the LL® system less profitable due to the increased price for Liberty® herbicide compared to glyphosate. However, in both year the soybeans were planted into a clean field with maximum label rates of pre-emergent herbicides applied. Both treatments were sprayed with their respective post-emergent herbicide when weeds were approximately four inches tall as per label instructions. This resulted in very good weed control for both treatments.

D) Does the application of foliar fertilizers provide an increase in yield? An application comparing four foliar fertilizers was conducted to evaluate any yield advantages. During the two year trial there was no significant increase in yield for the soybeans that received a foliar fertilizer application. This was expected, as the soil fertility in the area is quite good. Since the plants

were not stressed from a nutrient deficiency, the application of additional nutrients provided no yield or financial benefit.

E) Do foliar applied fungicides provide a yield boost for soybeans? The application of a foliar fungicide to increase plant health and overall yield failed to show a significant increase over the two-year period. Any increase in yield was not sufficient to cover the increased costs for the fungicide. No plant fungus was found in the plots so the application of a fungicide provided no benefit to overall yield and reduced profitability.

VI. Please answer the following.

A. How do your results benefit Missouri soybean growers?
With constant market fluctuations and increasing production costs, managing inputs is vital to keep farms profitable. Proper management practices such as seeding rates, application of foliar products, equipment purchases and herbicide decisions all need to be evaluated to minimize their costs without hurting yield. These results provide Missouri growers with information they can use when making these decisions.

B. Estimate financial return for the average Missouri soybean producer.

Depending on their current practices, soil fertility and the weather a producer could reduce their input costs by up to $60 per acre. This number was estimated using a savings of $30 per acre for a reduction in seeding rates, a savings of $15 per acre by not applying foliar fertilizers and a savings of $15 per acre by not applying fungicides. However, there are cases of poor soil fertility of a fungus infestation that could make these applications profitable since an increase of 2 bushels per acre would cover these costs.

Since the row spacing and selection of a herbicide tolerant variety depends on other factors, no estimate for their effect on profitability was included. However, with resistant weeds the change in herbicide resistance seed could show a benefit as the price differential on the chemicals is only about $11 per acre or less than 1.5 bushels per acre. The effect of row spacing will depend on equipment availability and the number of acres it is used.

C. Do your results benefit the environment?

Absolutely. Reduced use of chemicals, whether a herbicide, fungicide or fertilizer results in less chance for their entry into our waters of the state. Switching to a different herbicide resistant seed could result in better weed control and reduce the needed application of chemicals. By not applying fungicides and fertilizers that are not a benefit to the crops reduces their change of leaving the field. Narrow row soybeans may have an increased ability to smother weeds due to their earlier canopy thus reducing herbicide application.

D. What products or processes can be commercialized from this research?
As these trials were focused on management decisions of current technologies, there is no new products developed.

1. List disclosure(s) of inventions or plant varieties submitted to the MU Tech Transfer Office.

2. 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*.

E. How would you commercialize these products or processes?
These are recommendations to improve current practices.

F. If no specific products or processes were produced, how do you plan to make your results available to producers or industry?
The results of these trials have been shared with over 500 producers and industry at 28 winter meetings the past 2 years as well as through numerous one-on-one consultations. Results were included in the Graves-Chapple Research Center annual report in both 2016 and 2017 with over 800 hard copies distributed each year as well as being available online.

G. Is additional time or research required before your results can be used by producers and industry?
Producers can utilize this information to make decisions regarding their operations now.

VII. List publications by type (popular press, thesis, journals, other) written or planned.
Graves-Chapple Research Center Annual Report – 2016
Graves-Chapple Research Center Annual Report – 2017
Local newspaper articles

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.

All expenditures for these projects to date have been invoiced. There was cost savings over the initial requested amount as some chemicals purchased on year one of the grant in 2016 remained and were applied in 2017. The center technician resigned in June 2016 to pursue another position and the position remains unfilled so there was a large cost savings due to the co-investigators conducting much of the work, which is a non-reimbursable expense.

Item	Budget	Actual
Seed 16 @$59.50	$1,200.00	$952.00
LL Seed 5 @ 60.00		$300.00
Fertilizer	$500.00	$495.00
Burn down and preplant chemical	$600.00	$369.92
Post emerge chemicals & additiv	$300.00	$215.29
Fungicides	$750.00	$350.00
Foliar Fertilizer	$50.00	$68.00
Part time Field Technician	$5,000.00	$2,500.00
Equipment use	$500.00	$202.30
TOTAL	**$8,900.00**	**$5,452.51**
Remaining	$3,447.49	

The two-year estimated total hours of labor spent on these projects on behalf of the grant by Co-PI's Jim Crawford and Wayne Flanary and technician Richard Breedlove is 150 hours.

IX. 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