UNIVERSITY OF MISSOURI EXTENSION

Corn and Soybean Omission Trials

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Abstract

Corn and soybean omission trials were established at the University of Missouri Graves Chapple Research Center located at Fairfax, Missouri. The trial objective was to show the impact of changing crop inputs within a management system and measure their impact on corn and soybean yield. Each omission trial had sixteen treatments with each having a high yield system compared to a standard system in an experimental complete randomized complete block design. Treatment one was the high yield system and treatment nine was the standard system in each trial. The other treatment factor design consists of replacing the high yield level of a factor by its standard system factor and replacing the standard system of a given factor by its high yield factor. The results of the high yield corn system averaged over a 16-bushel yield increase across the three years compared to the standard system. The high yield system had reduced yields when the standard system factors of corn population, nitrogen rate and defensive hybrid were inserted into the high yield system. The standard system had a yield increase of 15-bushels with the increase in population from the high yield system. The high yield factor of early planting resulted in a 15-bushel yield loss in the standard system. The results of the high yield soybean system averaged over 10-bushels per acre greater than the standard system across three years. The high yield system had reduced yields when the standard system factors of omitting the seed treatment and the use of 30-inch row spacing. The standard system resulted in increased yields by adding the high yield factor factors of ILevo seed treatment package, narrow row spacing and fungicide application.

INTRODUCTION

Each year growers select a production system with different components that seeks to be profitable and obtain high yields. The objective of this demonstration is to determine the probability and magnitude of yield response of various practices in corn and soybean production systems. The trial was conducted by changing crop inputs within a management system and measure their impact on corn and soybean yield. A three-year summary of normalized data yield results is presented.

MATERIALS AND METHODS

The trial is comprised of two systems identified as “High Yield System” and “Standard System.” The high yield practices are those set of management practices which strives for highest yields. The standard practice system is comprised of practices which are more typical of growers. The plots were 35 X 10 foot and replicated 5 times. Center two row harvested for yield. The corn system inputs are shown below.

	Standard System (Yield goal – 200 bushel)	High Yield System (Yield goal – 300 bushel)
Hybrid	Defensive (P1244)	Offensive (P1359)
Target Planting Date	Late April	Early April
Seeding Rate	32,400	36,500
Nitrogen Rate	Pre-120 - Post 80	Pre-200 - Post 100
Fertility	Soil test indicates no P and K needed	Crop Removal of P and K applied based on yield goal (135 P_2O5, 90 K_2O)
S and Zn	None	10 lb. S - 1 lb. Zn
Fungicide	None	Quilt Xcel

The high yield system (HYS) and standard system (SS) had one practice substituted in each so the impact of that practice could be measured. One practice as a treatment from the standard system was placed into the high yield system likewise one practice from the high yield system was placed into the standard system to create treatments.

The substitution of practices are show for corn below in the chart. The color coding shows how one practice is inserted into the systems. The top half of the chart shows in the high yield system a high yield practice is removed and replaced with a standard practice.. In the bottom half of the chart, a high yield practice was added, and standard practice removed.

	Treatment Number	1	2	3	4	5	6	7	8
1	High Yielding System	HYS							
2	Two Planting Dates	10-Apr	20-Apr	10-Apr	10-Apr	10-Apr	10-Apr	10-Apr	10-Apr
3	Two Seeding Rates	36,500	36,500	32,400	36,500	36,500	36,500	36,500	36,500
4	Two N Rates	200/100	200/100	200/100	120/80	200/100	200/100	200/100	200/100
5	With and without P and K	Removal	Removal	Removal	Removal	Soil test	Removal	Removal	Removal
6	Sulfur + Zinc	S + Zn	S + Zn	S + Zn	S + Zn	S + Zn	None	S + Zn	S + Zn
7	Fungicide	Yes	Yes	Yes	Yes	Yes	Yes	None	Yes
8	Two Hybrids	Offensive	Offensive	Offensive	Offensive	Offensive	Offensive	Offensive	Defensive
	Treatment Number	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
9	Standard System	SS							
10	Two Planting Dates	20-Apr	10-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr
11	Two Seeding Rates	32,000	32,000	36,500	32,400	32,400	32,400	32,400	32,400
12	Two N Rates	120/80	120/80	120/80	200/100	120/80	120/80	120/80	120/80
13	With and without P and K	Soil test	Soil test	Soil test	Soil test	Removal	Soil test	Soil test	Soil test
14	Sulfur + Zinc	None	None	None	None	None	S + Zn	None	None
15	Fungicide	None	None	None	None	None	None	Yes	None
16	Two Hybrids	Defensive	Defensive	Defensive	Defensive	Defensive	Defensive	Defensive	Offensive

Soybean system inputs are shown below.

	Standard System (Yield goal – 60 bushel)	High Yield System (Yield goal – 80 bushel)
Variety	Defensive (P39A58X)	Offensive (P33A53X)
Planting Date	Target May 10	Target April 20
Seeding Rate	150,000	135,000
Seed Treatment	None	Ilevo and other components
Row Spacing	30-inch	15-inch
Fungicide	None	Quilt Xcel
Fertility	Soil Test (no P and K applied based on soil test levels)	Crop Removal per Yield Goal (68 lb. P_2O_5 and 115 lb. K_2O)

The substitution of practices are show for soybean below. The color coding shows how one practice is inserted into the systems. The top half of the chart shows in the high yield system a high yield practice is removed and replaced with a standard practice.. In the bottom half of the chart, a high yield practice was added.

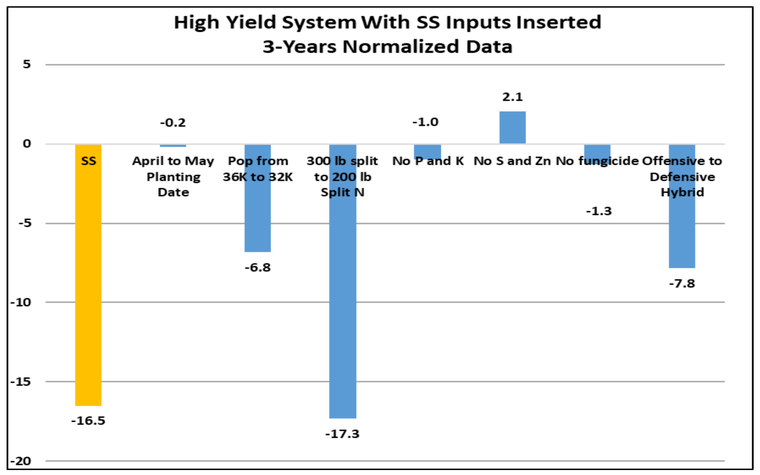
Treatment Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
High Yield System	HYS	HYS	HYS	HYS	HYS	HYS	HYS	HYS
Two Planting Dates	20-Apr	10-May	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr
Two Seeding Rates	135,000	135,000	150,000	135,000	135,000	135,000	135,000	135,000
With/Without Ilevo	Yes	Yes	Yes	None	Yes	Yes	Yes	Yes
15 vs 30-inch Row Spacing	15-inch	15-inch	15-inch	15-inch	30-inch	15-inch	15-inch	15-inch
Fungicide	Yes	Yes	Yes	Yes	Yes	None	Yes	Yes
None per Soil Test/Removal	Removal	Removal	Removal	Removal	Removal	Removal	Soil test	Removal
Offensive/Defensive Variety	Offensive	Offensive	Offensive	Offensive	Offensive	Offensive	Offensive	Defensive
Treatment Number	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Standard System	SS	SS	SS	SS	SS	SS	SS	SS
Two Planting Dates	7-May	20-Apr	10-May	10-May	10-May	10-May	7-May	7-May
Two Seeding Rates	150,000	150,000	135,000	150,000	150,000	150,000	150,000	150,000
With/Without Ilevo	None	None	None	Yes	None	None	None	None
15 vs 30-inch Row Spacing	30-inch	30-inch	30-inch	30-inch	15-inch	30-inch	30-inch	30-inch
Fungicide	None	None	None	None	None	Yes	None	None
None per Soil Test/Removal	Soil test	Soil test	Soil test	Soil test	Soil test	Soil test	Removal	Soil test
Offensive/Defensive Variety	Defensive	Defensive	Defensive	Defensive	Defensive	Defensive	Defensive	Offensive

RESULTS

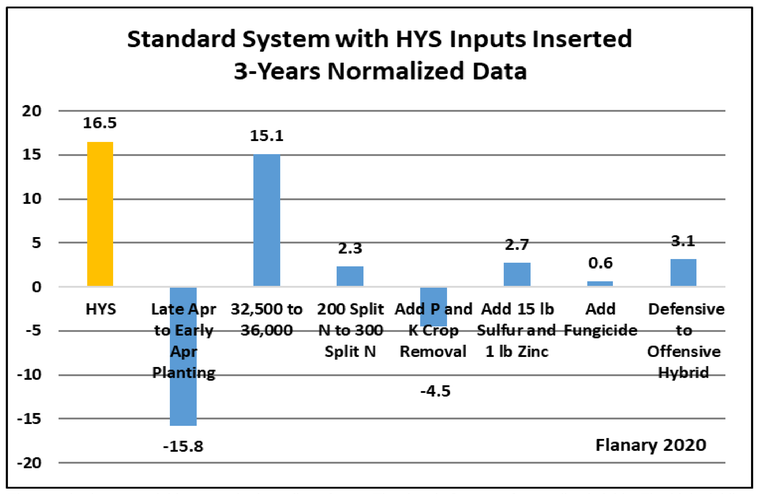
The yellow bar indicates the 3-year average yield loss of 16.5 bushels of corn compared to the high yield system which is the “0” line. The other practices are 3-years of data that are normalized. Planting date, no application of P and K, no application of sulfur and zinc and no fungicide did not impact yield. Phosphorus and potassium levels are high and so response was not expected. Sulfur and zinc has not been responsive at Graves Chapple as organic matter has increased by no-till from 2% to 3% since started in 1988.

The reducing of corn population, nitrogen rates and changing to defensive hybrid selection showed yield reduction when changed to a standard system inputs. The most important input is adequate amounts of nitrogen for high yielding corn. Population is also needed to maximize high yielding corn. Hybrid selection is also critical in high yields.

Three-year analysis of high yield corn production system with standard system inputs.



Three-year analysis of standard system of corn production system with high yield system inputs.



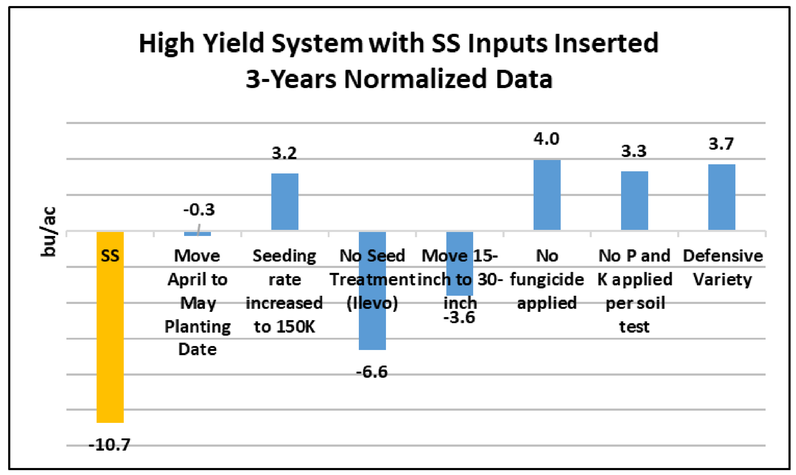
The standard system yields are at the base line of zero. The data is 3-years of normalized yields. The high yielding system averaged 16.5 bushels of corn greater than the standard system as shown in the yellow bar. Early planting had negative yield effect on standard system reducing yields by 15.8 bushels and seems to be some yield loss due to lack of phosphorus and potassium fertilizer application.

Inputs used in the high yield system such as increased population showed a large yield increase in a standard system with a 3-year average of 15 bushels per acre. Increased nitrogen rates, sulfur and zinc, fungicide and offensive hybrids showed slight yield increases.

The defensive hybrid may have disease resistance that contributed to lack of response from fungicide application.

The offensive hybrid had more yield potential than the defensive hybrid with a 3 bushel increase over three years.

High Yield System showing the Standard System inputs inserted. This is three years of data which is normalized to determine the impact of different inputs on soybean yield.



The seeding rate increased to 150K showed a 3-bushel yield increase. The author cannot explain why the lack of the fungicide application increased yield over three years. The author feels this may be plot variability or the impact of SDS soybean disease.

The lack of phosphorus and potassium yield response may be due to high levels of potash fertilizers showing yield reduction in some northern states.

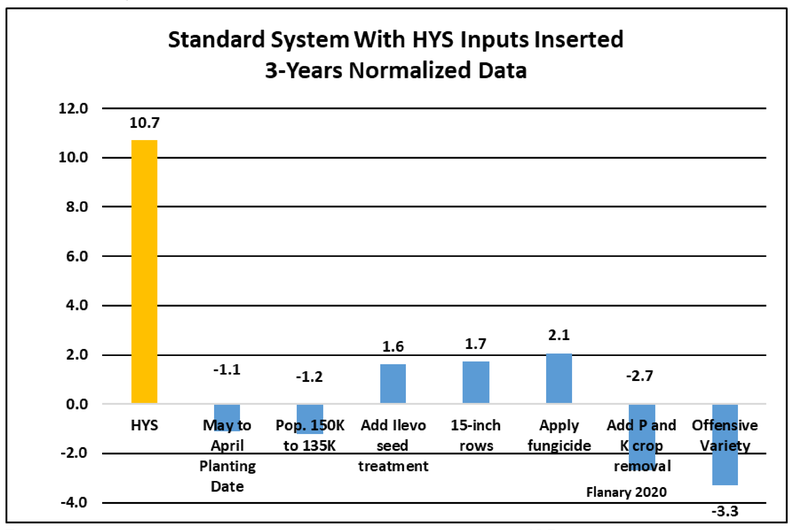
The defensive variety of soybean may have better resistance to soybean cyst nematode and SDS compared to the offensive variety.

The value of seed treatments is shown as there was an average of over 6 bushels of yield loss of three years when not applied. The field has a history of SDS.

The change from 15-inch to wide 30-inch rows showed almost a 4-bushel yield loss over three years. Narrow row spacing demonstrations at Graves Chapple have averaged a 11-12 percent yield in long-term studies.

The standard system had 10.7 bushel decrease over 3 years compared to the high yield system. Planting date did not impact crop yield.

The following chart shows the Standard System with High Yield Inputs inserted into the various treatments. The data is three years and data is normalized.



The yellow bar indicates the three-year average of the high yield system yielded 10.7 bushels greater than the standard system.

When the planting date moved from May to April, in the standard system, soybean yields were reduced by a bushel. As population was decreased from 150K to 135K, also yields were slightly decreased.

The use of Ilevo soybean seed treatment added 1.6 bushels along with 1.7 bushels with narrow row spacing. The application of a fungicide gave a yield increase in the standard system.

When P and K were applied, there was an almost 3-bushel yield decrease. Research from northern states has shown a negative impact on yield when high rates of potash applied.

The offensive variety yielded 3 bushels less in the standard system.

SUMMARY

Growers should carefully consider the price of inputs and consider the probability and magnitude of the yield increase when making crop production decisions. Growers should consider crop production limiting factors and address those of the highest priority.