The Oklahoma Cooperative Extension Service

Bringing the University to You!

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

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2016 Soybean Disease Management Trials

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Field trials were completed in 2016 that focused on the management of important soybean diseases in Oklahoma. The evaluated management strategies included seed treatments for control of seedling diseases and soybean cyst nematode, resistant varieties for soybean cyst nematode and fungicide programs for control of foliar diseases. Financial support from the Oklahoma Soybean Board, BASF Ag Products, and DuPont Crop Protection Crop Protection is gratefully acknowledged. Excellent cooperation was received from the OSU Research Stations at Bixby, Stillwater and Perkins and the contributions of Station Superintendents Rocky Walker (Stillwater), Butch Havener and Rodney Farris (Bixby) and Josh Massey (Perkins) are greatly appreciated.

Results from 2016 are summarized in this report. In interpreting the results, small differences in treatment values should not be overemphasized. Statistical analysis at the 95 percent confidence level is applied to all trial data. Unless values are statistically different (followed by different letters), little confidence can be placed in the superiority of one treatment or variety over another.

Conditions were generally favorable for development of the soybean crop in 2016 as extremely hot temperatures did not develop, although rainfall was generally below normal. Additionally, a mild fall allowed maturity of full-season soybeans without issues from an early freeze. At Bixby, rainfall during the cropping period totaled 3.72 inches for May, 0.82 inches for June, 4.20 inches for July, 2.63 inches for August, 3.77 inches for September and 2.34 inches for October. Plots received sprinkler irrigation as necessary to promote crop development. Compared to the 30-year average, rainfall at Bixby was below normal each month except July. In total, rainfall during the cropping period (May to October) was 8.35 inches below normal. Average monthly temperatures were above normal each month except for May and August, which were near normal. At Stillwater, rainfall during the cropping period totaled 1.92 inches for June, 5.57 inches for July, 3.14 inches for August, 2.57 inches for September and 3.87 inches for October. Plots received 0.5 inch water by sprinkler irrigation on Aug. 5 to promote crop development. Rainfall at Stillwater was 1.4 inches below normal during the cropping period of June through October. Average monthly temperatures were above normal except for August, which was near normal. At Perkins, rainfall during the cropping period totaled 2.33 inches for May, 1.43 inches for June, 5.09 inches for July, 2.86 inches for August, 2.38 inches for September and 2.11 inches for October. Rainfall was below normal each month except July. Rainfall at Perkins for the cropping period of May through October totaled 7.29 inches below normal. Average monthly temperatures were above normal each month except for May and August, which were below normal. Plots at Perkins did not receive irrigation.

Soybean Responses to Seed Treatments at Various Planting Dates

The objective of these trials was to assess the effects of seed treatments on stand establishment and yield at various planting dates. Seed treatments were fungicides (Thiram®, Evergol Energy®, Apron Maxx®) and combinations of fungicides and insecticides (Evergol Energy® + Gaucho®, CruiserMaxx Vibrance®). The trial at the Oklahoma Vegetable Research Station in Bixby was planted using conventional tillage practices in a field of Wynona silty clay loam previously cropped to soybeans. The trial at the Cimarron Valley Research Station in Perkins was planted using no-till techniques in a field of Teller loam previously cropped to soybeans. Seed treatments were applied using a rotary drum in a total slurry volume of 8 fluid ounces per 100 pounds of seed. The experimental design was a split plot with planting date as the whole plot and seed treatment as the sub-plot. Sub-plots consisted of two, 20-foot long rows, spaced 36 inches apart and planted at a rate of approximately nine seeds per foot. Stand counts were taken about 14 days after each planting date. Plots were harvested with a small-plot combine on Nov. 1 at Bixby and on Nov. 17 at Perkins and yields were adjusted to 13 percent moisture.

Response of soybeans to seed treatments grown under conventional tillage at various planting dates at Bixby

Seed treatments generally increased plant stands compared to the non-treated check for the May 12 and June 7 planting dates, but treatment effects on stands were variable

Table 1. Plant stand and yield responses of soybeans to seed treatments at various planting dates at Bixby, 2016.

Treatment and rate/cwt seed	Planting date[1] May 12	June7	June 20	July 7	Average[2]
	Plant stand (no./ft row)				
Non-treated check	6.2 c[3]	6.2 c	3.9 ab	3.2 bc	4.9
Thiram 42S 2 fl oz	6.8 b	6.7 b	3.3 b	2.6 c	4.9
Evergol Energy® 1.47F 1 fl oz	6.8 b	6.6 bc	3.8 ab	3.3 bc	5.1
Evergol Energy® 1.47F 1 fl oz + Gaucho® 600 5F 2 fl oz	6.8 b	6.6 bc	4.1 a	4.2 a	5.4
CruiserMaxx Vibrance® 2.49F 3.2 fl oz	7.3 a	6.9 b	4.4 a	3.4 abc	5.5
ApronMaxx® + Moly RTA 0.165F 5 fl oz	7.3 a	7.4 a	4.4 a	3.7 ab	5.7
Average[3]	6.9	6.7	4.0	3.4	
	Yield (bu/A)				
Non-treated check	41.5 a	52.6 a	47.2 b	35.8 a	44.4
Thiram 42S 2 fl oz	41.9 a	49.3 a	47.1 b	35.3 a	43.5
Evergol Energy® 1.47F 1 fl oz	39.5 a	51.2 a	47.4 b	33.5 a	42.9
Evergol Energy® 1.47F 1 fl oz + Gaucho® 600 5F 2 fl oz	39.8 a	50.8 a	56.2 a	49.2 a	49.0
CruiserMaxx Vibrance® 2.49F 3.2 fl oz	43.8 a	48.9 a	57.4 a	35.9 a	46.5
Apron Maxx® + Moly RTA 0.165F 5 fl oz	43.7 a	48.2 a	53.5 ab	33.2 b	44.6
Average[4]	41.7	50.2	51.5	37.3	

[1] The variety 'AG4531' was used on the May 12 and June 7 planting dates and 'AG5632' was used on June 20 and July 7 planting dates.
[2] Averaged over planting dates.
[3] Values in a column followed by the same letter are not statistically different at P=0.05.
[4] Averaged over treatment.

on the June 20 and July 7 planting dates (Table 1). Generally, seed treatments with insecticides (Gaucho® and Cruiser®) provided the best stand response, suggesting insect involvement with stand establishment. Stand increases were generally in the range of 0.5 to 1 plant per foot. Yields were above average compared to previous trials at this site. In comparing stand counts and yields for all plots, plot yields were positively correlated (r=0.24, P=0.01) with plant stand. Yields were highest for the May and June planting dates. Yield responses to seed treatment were only statistically significant for the June 20 planting date when the treatments with insecticides increased yields compared to the non-treated check. Averaged over planting dates, only the insecticide treatments had higher yields compared to the non-treated check. There was a small stand advantage to planting treated seed, but yield effects were limited.

Response of soybeans to seed treatments grown under no-tillage at various planting dates at Perkins

Emergence was good (more than 50 percent) on the May and June planting dates and poor (less than 50 percent) for the July planting date (Table 2). Seed treatments performed similarly over the planting dates. Averaged over planting dates, all seed treatments except Thiram® increased stand establishment compared to the non-treated check. Increases in stand for effective treatments averaged about 0.5 plants per foot. Yields were lower due to below average rainfall. Yields for the July planting date were not taken because weights were not sufficient to measure on the combine scales. Yields were highest for the May 19 and June 17 planting dates compared to the May 3 planting dates. Treatment effects on yield were not statistically significant. Averaged over planting dates, all seed treatments except ApronMaxx® increased yields compared to the non-treated check, although the responses were not statistically significant and only about 1 to 2 bushels per acre. There was a small stand advantage to planting treated seed but not an associated yield advantage.

Response of Soybeans Varieties to Seed Treatments for Control of Soybean Cyst Nematode

The objective of this trial was to assess the effects of seed treatments containing nematicides on control of soybean cyst nematode (SCN) and yield of soybean varieties with variable levels of resistance to SCN. Seed treatments containing the nematicides Votivo (*Bacillus firmus*), Avicta (abamectin), and Clariva (*Pasteuria nishizawae*) were compared to the check treatment CruiserMaxx Vibrance® that does not contain a nematicide. Soybean varieties were all maturity group 4 and had variable resistance to race 3 SCN from Resistant (R - AG4232), moderately resistant (MR - AG4934), and susceptible (S - AG4531). The trial was located at the Oklahoma Vegetable Research Station in Bixby, OK in a field of Wynona silty clay loam with a history of SCN infestation. Seed treatments were applied using a rotary drum in a total slurry volume of 8 fluid ounces per 100 pounds seed. The trial was planted on June 7 using conventional tillage techniques. The experimental design was a split plot with variety as the whole plot and seed treatment as the sub-plot. Sub-plots consisted of two,

Table 2. Plant stand and yield responses of soybeans to seed treatments at various planting dates at Perkins, 2016.

Treatment and rate/cwt seed	*Planting date*[1]				
	May 3	*May 19*	*June 17*	*July 6*	*Average*[2]
	Plant stand (no./ft row)				
Non-treated check	5.7	6.2	4.5	2.8	4.8 c[3]
Thiram® 42S 2 fl oz	6.1	6.6	4.6	2.6	5.0 c
Evergol Energy® 1.47F 1 fl oz	6.4	7.0	4.4	3.5	5.3 b
Evergol Energy® 1.47F 1 fl oz + Gaucho® 2 fl oz	6.7	7.1	5.1	3.6	5.6 a
CruiserMaxx Vibrance® 2.49F 3.2 fl oz	6.1	7.4	5.0	3.0	5.4 ab
ApronMaxx® + Moly RTA 0.165F 5 fl oz	6.3	7.1	5.4	3.0	5.4 ab
Average[4]	6.2 b[3]	6.9 a	4.8 c	3.1 d	
	Yield (bu/A)				
Non-treated check	16.3	24.6	24.1		21.7 a
Thiram® 42S 2 fl oz	18.7	24.0	24.3		22.3 a
Evergol Energy® 1.47F 1 fl oz	18.7	22.8	26.8		22.8 a
Evergol Energy® 1.47F 1 fl oz + Gaucho® 2 fl oz	18.5	24.8	27.4		23.6 a
CruiserMaxx Vibrance® 2.49F 3.2 fl oz	17.9	24.6	27.4		23.3 a
ApronMaxx® + Moly RTA 0.165F 5 fl oz	17.1	23.5	24.5		21.7 a
Average[4]	17.8 b	24.1 a	25.8 a		

[1] The variety 'AG4531' was planted on the May 3 and May 19 and 'AG5632' was planted on June 17 and July 6 planting dates.
[2] Averaged over planting dates.
[3] Values in a column or row followed by the same letter are not statistically different at P=0.05.
[4] Averaged over treatment.

Table 3. Response of soybean varieties with different levels of resistance to soybean cyst nematode to nematicide seed treatments, Bixby, 2016.

Treatment and rate/cwt seed	*Variety*			
	AG4232 (R)	*AG4934 (MR)*	*AG4531 (S)*	*Average*[1]
	Soybean Cyst Nematode (no. eggs/100 cc soil)			
CruiserMaxx Vibrance® 2.49F 3.2 fl oz	51	286	875	404 a[2]
Evergol Energy® 1.47F 1 fl oz + Poncho Votivo® 2 fl oz	83	122	576	261 a
Avicta® Complete Beans 3.29F 6.2 fl oz	374	121	577	358 a
CruiserMaxx Vibrance® 2.49F 3.2 fl oz + Clariva® 2 fl oz	61	129	1,057	416 a
Average[3]	142 a[2]	165 a	771 a	
	Yield (bu/A)			
CruiserMaxx Vibrance® 2.49F 3.2 fl oz	42.3	43.5	38.9	41.5 a
Evergol Energy® 1.47F 1 fl oz + Poncho Votivo® 2 fl oz	39.4	43.5	35.1	39.3 a
Avicta® Complete Beans 3.29F 6.2 fl oz	38.6	43.7	39.8	40.7 a
CruiserMaxx Vibrance® 2.49F 3.2 fl oz + Clariva® 2 fl oz	41.7	43.3	37.8	40.9 a
Average[3]	40.5 a	43.5 a	37.9 a	

[1] Averaged over varieties.
[2] Values in a column or row followed by the same letter are not statistically different at P=0.05.
[3] Averaged over treatments.

20-foot long rows spaced 36 inches apart planted at a rate of approximately nine seeds per foot. Soil was sampled in each sub-plot near the end of the growing season in October and SCN eggs were extracted and counted to determine treatment and variety effects on nematode reproduction. Plots were harvested with a small-plot combine on Oct. 31 and yields were adjusted to 13 percent moisture.

Cyst nematode reached severe levels in some plots (up to 5,150 eggs per 100 cc soil). However, population levels were highly variable and no SCN eggs were detected in many sub-plots. The resistant and moderately resistant varieties had lower average cyst levels compared to the susceptible variety, but the effect was not statistically significant because of high variability (Table 3). Seed treatments did not affect SCN reproduction. Similar trends were observed for yield. Yields were 2.5 to 5.6 bushels per acre greater for the resistant and moderately resistant varieties although the effect was not statistically significant. Seed treatment had no effect on yield. Results suggest that varietal resistance is the best approach for management of SCN, although the results were not definitive.

Soybean Responses to Fungicides for Control of Foliar Diseases

The objective of these trials was to evaluate fungicides registered for use on soybeans for control of foliar diseases and resulting yield response. 'Asgrow 5632' soybeans were planted on June 8 at the OSU Vegetable Research Station in Bixby and on June 13 at the OSU Entomology and Plant Pathology Research Farm in Stillwater in fields previously cropped to soybeans using conventional tillage techniques. Plots consisted of four, 30-foot long rows spaced 30 inches apart. The experimental design was a randomized complete block with four replications separated by a 10-foot-wide fallow buffer. Treatments were broadcast to the middle two rows of each plot with a CO_2-pressurized wheelbarrow sprayer equipped with flat-fan nozzles (8002vk) spaced 18 inches apart. The sprayer was calibrated to deliver 25 gallons per acre at 40 pounds per square inch. The adjuvant Induce was added to each treatment at a rate of 0.25 percent of the total spray volume. Treatments were applied at the R3 (beginning pod) growth stage. Disease incidence, the percentage of leaves with foliar disease including defoliation, and defoliation alone were visually assessed in three areas per plot in early Oct. at the R7 (beginning maturity) growth stage. The middle two rows of each plot were harvested on Nov. 1 at Bixby and on Nov. 17 at Stillwater using a small-plot combine and yields were adjusted to 13 percent moisture.

Evaluation of fungicides for control of foliar diseases of soybeans at Stillwater

Brown spot *(Septoria glycines)* and Cercospora blight *(Cercospora kikuchii)* were the most prevalent foliar diseases and were present at severe levels compared to previous trials at this site. All treatments except Topguard® reduced levels of diseased leaves and defoliation compared to the non-treated check (Table 4). Stratego® reduced levels of diseased leaves but not defoliation compared to the compared to the non-treated check. Plot yields were negatively correlated (P=0.05) with incidence of diseased leaves (r=-0.31) but not defoliation. Yields were high and while all treatments had numerically greater yields than the non-treated check, the treatment effect on yield was not statistically significant.

Evaluation of fungicides for control of foliar diseases of soybeans at Bixby

Brown spot (*Septoria glycines*) and Cercospora blight (*Cercospora kikuchii*) were the most prevalent foliar diseases and were present at moderate levels compared to previous trials at this site. The high levels of defoliation were due in part to natural senescence and maturity (Table 5). All treatments reduced incidence of diseased leaves compared to the non-treated check. While there were trends for reduced defoliation with fungicide treatment, defoliation levels did not statistically differ among treatments. Yields were high and favored by warm conditions in September and October. Yields were not correlated with levels of disease and did not statistically differ among treatments.

Table 4. Disease and yield responses of soybeans to fungicides for control of foliar diseases, Stillwater, 2016.

Treatment and rate/A (timing)[1]	*Diseased leaves (%)*	*Defoliation (%)*	*Yield (bu/A)*
Untreated check	61.6 a[2]	27.5 a	61.4 a
Approach® 2.08F 6 fl oz (R3)	33.7 bcd	10.0 b	67.2 a
Approach Prima® 2.34F 6.8 fl oz (R3)	27.5 b-e	12.5 b	66.6 a
Folicur® 3.6F 4 fl oz (R3)	41.3 b	15.0 b	66.8 a
Stratego® 2.08F 10 fl oz (R3)	27.5 b-e	17.5 ab	67.7 a
Quilt Xcel® 2.2F 14 fl oz (R3)	24.6 de	8.7 b	65.4 a
Headline® 2.08E 6 fl oz (R3)	22.9 de	14.1 b	63.0 a
Priaxor® 4.17F 4 fl oz (R3)	17.9 e	5.8 b	71.9 a
Quadris® Top 2.72F 10 fl oz (R3)	27.1 cde	12.1 b	64.9 a
Topguard® 1.04F 7 fl oz (R3)	39.6 bc	17.1 ab	63.5 a
P>F[3]	<0.01	0.05	0.21

[1] Applications were made at growth stage R3 on Aug. 26.
[2] Means in a column followed by the same letter are not statistically different.
[3] Probability of a significant treatment effect.

Table 5. Disease and yield responses of soybeans to fungicides for control of foliar diseases, Bixby, 2016.

Treatment and rate/A (timing)[1]	*Diseased leaves (%)*	*Defoliation (%)*	*Yield (bu/A)*
Untreated check	75.8 a[2]	80.0 a	63.0 a
Approach® 2.08F 6 fl oz (R3)	48.3 bc	61.6 a	63.6 a
Approach Prima® 2.34F 6.8 fl oz (R3)	57.5 b	70.9 a	63.4 a
Folicur® 3.6F 4 fl oz (R3)	48.3 bc	66.6 a	60.6 a
Stratego® 2.08F 10 fl oz (R3)	45.0 bc	67.5 a	60.5 a
Quilt Xcel® 2.2F 14 fl oz (R3)	40.9 c	63.3 a	65.8 a
Headline® 2.08E 6 fl oz (R3)	55.0 bc	71.7 a	66.4 a
Priaxor® 4.17F 4 fl oz (R3)	49.9 bc	62.5 a	64.6 a
Quadris® Top 2.72F 10 fl oz (R3)	46.6 bc	67.5 a	62.3 a
Topguard® 1.04F 7 fl oz (R3)	48.3 bc	72.5 a	60.1 a
P>F[3]	0.01	0.40	0.40

[1] Applications were made at growth stage R3 on Aug. 25
[2] Means in a column followed by the same letter are not statistically different.
[3] Probability of a significant treatment effect.