FIELD RESEARCH 2012

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Kansas State University Agricultural Experiment Station and Cooperative Extension Service

Kansas State University Agronomy

FIELD RESEARCH 2012

Contents

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East Central Kansas Experiment Field

Introduction

The research program at the East Central Kansas Experiment Field is designed to keep area crop producers abreast of technological advances in agronomic agriculture. Specific objectives are to (1) identify top performing varieties and hybrids of wheat, corn, soybean, and grain sorghum; (2) establish the amount of tillage and crop residue cover needed for optimum crop production; (3) evaluate weed and disease control practices using chemical, no chemical, and combination methods; and (4) test fertilizer rates, timing, and application methods for agronomic proficiency and environmental stewardship.

Soil Description

Soils on the field's 160 acres are Woodson. The terrain is upland and level to gently rolling. The surface soil is a dark gray-brown, somewhat poorly drained silt loam to silty clay loam over slowly permeable clay subsoil. The soil is derived from old alluvium. Water intake is slow, averaging less than 0.1 in./hour when saturated. This makes the soil susceptible to water runoff and sheet erosion.

2011 Weather Information

Precipitation during 2011 totaled 26.2 in., which was 10 in. below the 35-year average (Table 1). Overall, the 2011 growing season was one of the hottest and driest in recent years. Average rainfall during the months of June, July, and August were 49% below average. During the summer of 2011, 71 days had temperatures exceeding 90.0°F, and 20 days had temperatures exceeding 100.0°F. August was extremely hot. The hottest 5-day period was August 9 through 13, when temperatures averaged 101.7°F. The overall hottest day was August 13, when the temperature reached 103.5°F. The coldest temperatures occurred in January and February, with 17 days in single digits or below. The coldest day overall was –16.5°F on February 10. The last freezing temperature in the spring was March 29 (average, April 18), and the first killing frost in the fall was October 29 (average, October 21). There were 213 frost-free days, which is more than the long-term average of 185.

Table 1. Precipitation at the East Central Kansas Experiment Field, Ottawa

Month	2011	35-year avg.	Month	2011	35-year avg.
	---------- in. ----------			---------- in. ----------	
January	0.53	1.03	July	0.88	3.37
February	2.50	1.32	August	2.42	3.59
March	2.82	2.49	September	2.43	3.83
April	2.16	3.50	October	0.34	3.43
May	5.12	5.23	November	4.52	2.32
June	2.66	5.21	December	2.50	1.45
			Annual total	26.22	36.78

Glyphosate-Resistant Waterhemp Control in Roundup Ready Soybean

D. Peterson, C. Thompson, D. Shoup, K. Janssen, and E.A. Adee

Summary

A field experiment was conducted at the East Central Kansas Experiment Field near Ottawa, KS, in the summer of 2011 to evaluate various herbicide programs for control of glyphosate-resistant waterhemp in soybean. A stand of 1- to 2-in. waterhemp was present at the time of the preemergence herbicide applications. The glyphosate-only treatment provided minimal control of emerged waterhemp, confirming the presence of a glyphosate-resistant population. All preemergence herbicide treatments evaluated provided greater than 85% waterhemp control prior to postemergence herbicide application. Fierce generally provided the highest level of preemergence waterhemp control, followed by Authority XL, Authority First, and Valor XLT. Postemergence herbicide treatments provided only minor additional waterhemp control, suggesting the waterhemp may also be PPO-resistant in addition to glyphosate-resistant. Effective preemergence herbicides will likely be needed to provide adequate control of glyphosate-resistant waterhemp in soybean.

Introduction

The introduction of Roundup Ready soybean in 1996 provided farmers with a cost-effective technology to achieve good postemergence weed control in soybean. Consequently, Roundup Ready soybeans were widely adopted, and glyphosate has been relied on extensively for weed control. Unfortunately, heavy reliance on glyphosate has resulted in the development of glyphosate-resistant weed populations, including common waterhemp. Glyphosate-resistant waterhemp is now present across much of eastern Kansas and has become a serious weed control challenge. The objective of this experiment was to evaluate various herbicide programs for control of glyphosate-resistant waterhemp in Roundup Ready soybean.

Procedures

A field experiment was established on a Woodson silt loam soil with 3.0% organic matter and a pH of 6.2 at the East Central Kansas Experiment Field near Ottawa, KS. NK S47-R3 Roundup Ready soybean were planted and preemergence (PRE) herbicide treatments applied on June 8, 2011, into a plot area with 0.5- to 2-in. waterhemp. A broadcast application of Roundup PowerMax at 22 fl oz/a plus ammonium sulfate (AMS) was applied across the plot area on June 9 to control non-glyphosate-resistant weeds. Early postemergence (EP) treatments were applied to 2 trifoliate, 5-in. soybeans, and 1- to 4-in. waterhemp on June 28 at 80°F, 50% relative humidity, and clear skies. Postemergence (P) treatments were applied to 4 trifoliate, 10-in. soybean and 8- to 12-in. waterhemp on July 5 at 86°F, 58% relative humidity, and clear skies. All treatments were applied with a CO_2 backpack sprayer delivering 15 gal/a spray volume at 30 psi through TT110015 flat fan spray tips to the center 6.3 ft of 10- by 30-ft plots. The experiment had a randomized complete block design with three replications.

Soybean injury and waterhemp control were visually evaluated at regular intervals throughout the growing season. Soybeans were harvested on October 20.

Results

None of the preemergence herbicides caused noticeable crop injury (Table 1). Postemergence treatments that included Flexstar caused typical foliar burn symptoms following application, but new growth was unaffected. The planting time broadcast treatment of Roundup PowerMax provided minimal control of waterhemp, thus confirming the presence of glyphosate resistance. Most preemergence herbicide treatments provided good control of existing waterhemp at treatment time, along with good control of new flushes of waterhemp. Fierce generally provided the highest waterhemp control from preemergence applications, followed by Authority XL, Authority First, and Valor XLT. The postemergence glyphosate-only treatment provided minimal waterhemp control, similar to the planting time treatment. Postemergence applications of Flexstar and Warrant provided some additional waterhemp control, but the majority of control resulted from the preemergence herbicide treatments. Hot, dry conditions through much of the season resulted in modest soybean yields. Soybean yields for all treatments with preemergence herbicide applications were about 40% higher than yields with glyphosate alone. Yields were similar among treatments with a preemergence herbicide application but tended to be a little higher for those with the highest waterhemp control.

Table 1. Glyphosate-resistant waterhemp control in Roundup Ready soybean

			Waterhemp control				Soybean injury		
Treatment[1]	Application[2] rate	Timing	Jun. 28	Jul. 20	Aug. 17	Sep. 6	Jul. 20	Aug. 17	Yield
	(oz/a)		------------------- (%) ------------------				------- (%) -------		(bu/a)
Valor XLT/Roundup PowerMax	4/22	PRE/EP	91	91	91	86	0	0	33
Valor XLT/RUPM+Flexstar	4/22+20	PRE/EP	89	92	86	86	3	0	34
Valor XLT/RUPM+Flexstar+Warrant	4/22+20+48	PRE/EP	91	95	89	90	2	0	32
Valor XLT/RUPM+Flexstar+Warrant	4/22+24+48	PRE/EP	90	93	91	92	4	0	33
Valor XLT/RUPM+Flexstar+Warrant/RUPM+Warrant	4/22+20+48/ 22+48	PRE/EP/P	86	96	94	95	4	0	35
Valor XLT+Prowl H2O/RUPM+Flexstar+Warrant	4+32/22+20+48	PRE/EP	94	94	90	90	1	0	36
Authority XL/RUPM+Flexstar	6.5/22+20	PRE/EP	98	97	96	96	1	0	34
Authority XL/RUPM+Flexstar+Warrant	6.5/22+20+48	PRE/EP	100	98	97	98	1	0	36
Authority XL/RUPM+Flexstar+Warrant	6.5/22+24+48	PRE/P	96	96	96	97	4	0	34
Authority First/RUPM+Flexstar	6.5/22+20	PRE/EP	90	96	94	94	0	0	33
Authority First/RUPM+Flexstar+Warrant	6.5/22+20+48	PRE/EP	93	95	91	93	2	0	35
Authority First/RUPM+Flexstar+Warrant	6.5/22+24+48	PRE/P	94	97	94	94	2	0	33
Fierce/ RUPM+Flexstar	4.5/22+20	PRE/EP	100	100	100	100	2	0	37
Fierce/ RUPM+Flexstar+Warrant	4.5/22+20+48	PRE/EP	97	97	96	96	1	0	35
Fierce/ RUPM+Flexstar+Warrant	4.5/22+24+48	PRE/P	100	99	99	99	4	0	36
Roundup PowerMax	22	P	--	16	10	15	0	0	22
LSD (5%)			7	4	5	5	2	NS	4

[1] RUPM = Roundup PowerMax always applied with 2% w/w ammonium sulfate; / = sequential application.
[2] PRE = preemergence, EP = early postemergence, P = postemergence.

Evaluation of Nitrogen Rates and Starter Fertilizer for Strip-Till Corn

K.A. Janssen

Summary

Effects of nitrogen (N) rates and starter fertilizer were evaluated for rainfed, strip-till fertilized corn at the East Central Kansas Experiment Field at Ottawa, KS, from 2006 through 2011. Because of extreme drought one year, below-average rainfall two years, above-average rainfall three years, and extreme N loss one year, 60 to 160 lb/a N were required to maximize corn grain yields. This range suggests that not knowing the amount of rainfall and potential N loss that might result prior to the growing season makes precise preplant application of N difficult. One strategy might be to apply an intermediate rate of N (between 60 and 160 lb/a). Other strategies might be to treat some or all of the N with a safener to help minimize potential N losses or to side-dress some of the N to better match the N application with crop need. Starter fertilizer placed beside and below the seed row at planting, compared with application in the strip-till zone, increased early season corn growth 5 out of 6 years, but starter at planting increased grain yield in only one year. Highest grain yields were generally produced when the starter fertilizer (nitrogen-phosphorus-potassium, NPK) was applied along with the rest of the N fertilizer in the strip-till zone. These findings suggest that for strip-till fertilized corn, application of starter fertilizer in the strip-till zone may be as or more effective at increasing yield as placement beside and below the seed row at planting.

Introduction

Corn growers in eastern Kansas are increasingly adopting strip-tillage for seedbed preparation and are preplant deep-banding NPK fertilizers in the same tillage pass. Because most N rate calibration information for corn was established years ago, and in many cases with conventional tillage and broadcast N, growers might benefit from newer, more accurate N rate recommendations. The high cost of N fertilizer and the potential for increased N losses with overapplication demand prudent use. Research is also needed to determine whether applying starter fertilizer at planting is justified when N, P, and K fertilizers are already applied under-the-row in the strip-till zone. Such research could help strip-till corn growers make better decisions about the amount of N fertilizer to apply, whether to purchase costly planter fertilizer-banding equipment, and whether to apply starter fertilizer at planting.

Procedures

This was the sixth year of this study. Six N rates and three starter fertilizer placement options were studied. Nitrogen rate treatments were 0, 60, 80, 100, 120, 140, and 160 lb/a. Starter fertilizer treatments were placement of all starter fertilizer 5 to 6 in. below the strip-till row, placement of the starter fertilizer approximately 2 in. to the side and 2 in. below the seed row at planting, and application of half of the starter fertilizer in the strip-till zone and half beside and below the seed row at planting. In all cases, 30 lb/a N was included with the P and K starter fertilizers. Research by Barney Gordon at the North Central Kansas Experiment Field at Scandia, KS, showed that at least a 1:1 ratio of N-P fertilizer mix should be used for best starter P benefit.

The experimental design was a randomized complete block with four replications. No-till soybean was grown prior to the strip-till corn studies each year. For preplant weed control, 1 qt/a atrazine 4L plus 0.66 pint/a 2,4-D LVE, plus 1 qt/a crop oil concentrate was applied. Pioneer 35P17 corn was planted April 6, 2006; May 19, 2007; May 13, 2008; May 20, 2009; May 5, 2010; and May 3, 2011. Plantings in 2007, 2008, and 2009 were delayed because of wet weather. Corn was planted at a rate of 24,500 seeds/a in 2006 and at 26,500 seeds/a all other years. Preemergence herbicides containing 0.5qt/a atrazine 4L plus 1.33 pint/a Dual II Magnum were applied the day after planting each year for in-season weed control. Effects of the N rates and starter fertilizer treatments were evaluated by measuring early season growth response (6- to 7-leaf stage) and grain yield.

Results

Seasonal moisture was extremely limited for corn in 2011, below average in 2006 and 2007, and above average in 2008, 2009, and 2010. Under these conditions and with corn following soybean, 60 lb/a N preplant maximized corn grain yield in 2011, 80 lb/a in 2006 and 2007, 100 to 140 lb/a in 2008 and 2009, and 160 lb/a N was not adequate in 2010 (Table 1). Increased demand for N in 2008 and 2009 was due to higher rainfall and increased yield potential. Extreme need for N in 2010 was because of severe N loss from 7.5 in. of rain from mid-April through mid-May. The lowest requirement for N was in 2011 because of extreme drought. Not knowing the amount of rainfall and N loss that might occur prior to growing the crop makes precise preplant application of N difficult. One strategy might be to apply an intermediary rate of N (between 60 and 160 lb/a); we suggest 120 lb/a. In some years, that rate would be too high and in other years, too low. Other strategies might be to apply a safener with some or all of the N to help minimize N losses so lower rates can be applied and still maintain yield or to apply some of the N side-dress to better match the N application with seasonal corn needs.

Application of starter fertilizer at approximately 2 in. to the side and 2 in. below the seed row at planting increased early season growth of corn five out of six years compared with the same fertilizer amount applied in the strip-till zone (Table 1). The combination starter application of applying half the starter fertilizer at planting and half in the strip-till zone produced intermediate early season plant growth (Figure 1). Neither application of the planting-time starter fertilizer statistically increased grain yield compared with placement in the strip-till zone except in 2011, when corn grain yields were extremely low and enhanced early growth was apparently beneficial (Table 1). Grain yields were generally highest when all starter fertilizer nutrients (N, P, and K) were included along with the rest of the strip-till N fertilizer in the strip-till zone (Figure 2). These data suggest that for strip-till fertilized corn, placement of NPK fertilizer under the row may be as good as or better than placement beside and below the seed row at planting. Also, there may not be a significant yield benefit to applying starter fertilizer at planting.

Table 1. Effects of nitrogen (N) rates and starter fertilizer on early season growth and grain yields of strip-till corn, East Central Kansas Experiment Field, Ottawa, 2006–2011

Fertilizer treatments		Plant V6-V7 dry weights						Grain yields					
Strip-till	Starter approx. 2 in. × 2 in.	2006	2007	2008	2009	2010	2011	2006	2007	2008	2009	2010	2011
------------ $N-P_2O_5-K_2O$, lb/a ------------		----------------------------- g/plant -----------------------------						------------------------- bu/a -------------------------					
Check 0-0-0		2.1	5.3	7.1	5.1	6.0	6.6	47	37	63	61	16	24
60-40-20	--	5.5	9.5	10.9	7.3	11.4	10.9	101	89	121	108	61	43
80-40-20	--	4.2	9.8	11.4	8.3	12.7	10.1	109	95	134	118	66	38
100-40-20	--	4.4	8.3	11.4	7.6	12.9	10.0	103	93	138	132	73	38
120-40-20	--	4.3	9.4	9.7	7.0	11.3	9.4	108	99	138	136	89	37
140-40-20	--	3.9	9.0	10.5	6.7	12.3	9.7	109	98	147	136	90	38
160-40-20	--	4.0	8.9	10.1	6.7	11.9	9.3	108	101	145	142	106	36
Evaluation starter at three N levels													
80-40-20		4.2	9.8	11.4	8.3	12.7	10.1	109	95	134	118	66	38
50-20-10+	30-20-10	6.4	9.5	12.8	9.8	13.3	11.8	101	88	124	96	62	37
50+	30-40-20	6.6	9.7	12.9	10.0	13.7	10.3	103	90	121	92	62	39
120-40-20		4.3	9.4	9.7	7.0	11.3	9.4	108	99	138	136	89	37
90-20-10+	30-20-10	6.2	9.5	11.8	9.3	12.4	10.5	105	102	140	133	83	38
90+	30-40-20	7.6	9.2	12.2	10.9	13.9	11.4	102	95	136	124	75	42
160-40-20		4.0	8.9	10.1	6.7	11.9	9.3	108	101	145	142	106	36
130-20-10+	30-20-10	5.3	9.2	12.4	8.8	12.6	10.3	106	99	150	140	103	36
130+	30-40-20	6.8	8.7	14.5	9.6	13.0	9.8	100	98	143	131	100	39
LSD (0.05)		1.0	1.4	0.9	1.3	0.8	1.0	6	9	7	11	5	3

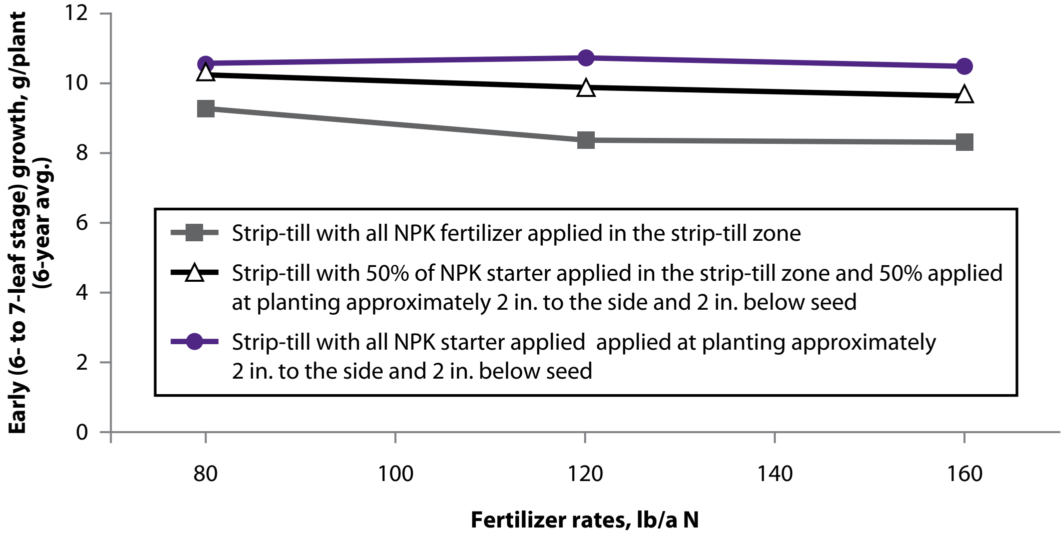

Figure 1. Nitrogen (N) rate and starter fertilizer placement effects on early growth of strip-till corn.

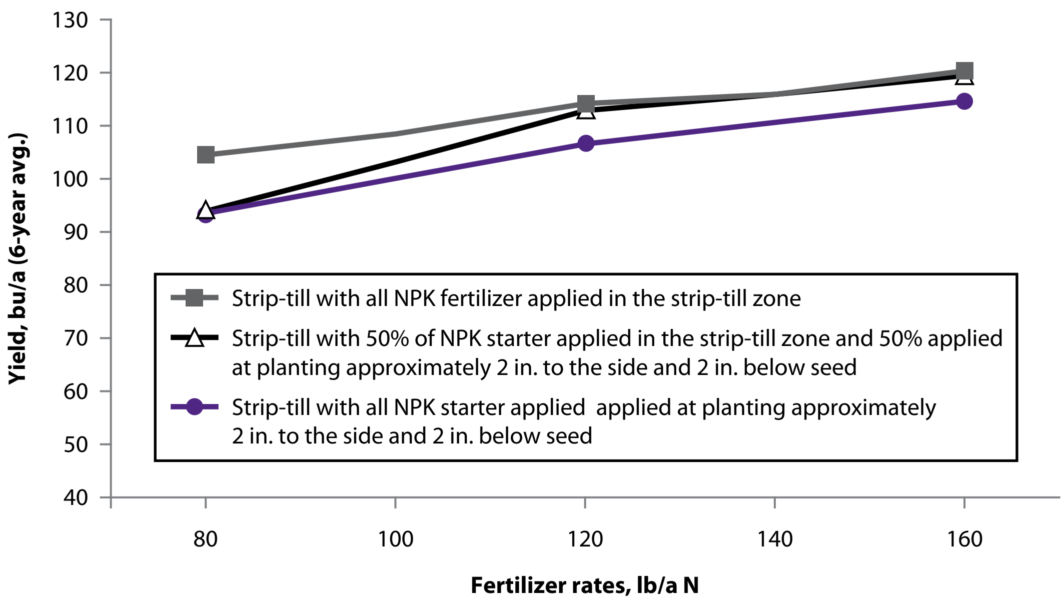

Figure 2. Nitrogen (N) rate and starter fertilizer placement effects on yield of strip-till corn.

Impact of Planting at Different Distances from the Center of Strip-Till Fertilized Rows on Plant Population, Early Growth, and Yield of Corn

K.A. Janssen

Summary
Corn growers who have automatic guidance systems technologies (GPS and auto-steer) can plant corn directly on top of previously established strip-till fertilized rows, or at specific distances from the rows. The objective of this study was to determine the effects of planting corn at different distances from strip-till fertilized rows. The locations evaluated were planting directly on top of the strip-till fertilized rows and approximately 4, 8, and 15 in. off the center of the rows. Planting corn directly on top of recently strip-till fertilized rows negatively affected plant stand, and thus yield. Planting at distances greater than 4 in. from strip-till fertilized rows sometimes reduced plant stand, nearly always reduced early season corn growth, and sometimes reduced yield. The best location for planting was within 4 in. of the strip-till fertilized rows where the soil was firm and moist for planting and where plant roots quickly contacted the fertilizer bands.

Introduction
Corn growers who have automatic guidance systems technologies, such as GPS and auto-steer, have the ability to plant corn in precise locations relative to previously established strip-till fertilized rows; however, depending on the amount of time that has elapsed between the strip-till operation and planting and the rate and forms of fertilizers applied, the best location for planting may not always be to plant directly on top of the strip-till fertilized rows. For example, freshly strip-till fertilized rows could be loose and have air pockets under the row, might be dry or cloddy, or could contain excessive levels of fertilizer salts or free ammonia. On the other hand, planting too far away from the strip-till fertilized rows might reduce benefits from warmer tilled soil, cleared residue, and rapid fertilizer-root contact. The objective of this study was to determine the effects of planting corn at various distances from the center of previously established strip-till fertilized rows on fine textured soils in eastern Kansas.

Procedures
Field experiments were conducted on an Osage silty clay loam soil near Lane, KS, in 2006 and 2008 and on a Woodson silt loam soil at the East Central Kansas Experiment Field at Ottawa, KS, in 2009, 2010, and 2011. The planting distances evaluated were directly on top of the strip-till fertilized rows and approximately 4, 8, and 15 in. off the center of the rows. The experiment was designed as a randomized complete block with three to four replications. Plot size, depending on the field location and year, ranged from 0.03 to 0.55 acres. The combination strip-till fertilizer operation was performed 1 day before planting in 2006, 2 weeks before planting in 2008, 2.5 months before planting in 2009, 22 days before planting in 2010, and 17 days before planting in 2011. Fertilizer was applied at a standard rate (120-30-10 lb/a). The fertilizer source was a mixture of dry urea, diammonium phosphate, and muriate of potash. Depth of the strip-till fertilizer application was 5 to 6 in. below the row. The planting treatments

were evaluated for effects on plant population, early season corn growth, nutrient uptake, and grain yield.

Results

In 2006 and 2008, plant populations were higher for corn planted approximately 4 in. off the center of the strip-till fertilized rows compared with planting directly on top of the rows (Figure 1). This was expected in 2006 because the strip-till fertilization operation was performed only 1 day before planting and the soil was loose and had air pockets under the row. In 2008, when 2 weeks elapsed between the strip-tillage operation and planting, plant population was still increased by planting just slightly off the strip-till fertilized rows. No differences in plant populations occurred in 2009, when the strip-till operation was performed 2.5 months before planting. In 2010, when soil was waterlogged and cold after planting, plant population was best when planting was directly on the row or 4 in. off the center of the rows. Planting 8 and 15 in. off the center of the rows significantly decreased plant population. Effects for 2011 were similar to 2010.

Early season corn growth at the 6- to 7-leaf growth stages tended to be better for corn planted directly on top of the strip-till fertilized rows (Figure 2). Planting corn 8 in. from the center of the strip-till fertilized rows reduced early season growth of corn at the 6- to 7-leaf growth stage 24% on average, and planting 15 in. away reduced early season growth 40%. Uptake of plant nutrients (i.e., nitrogen, phosphorus, and potassium) followed a pattern similar to that for plant growth (data not shown).

In 2006, yield of corn planted directly on top of the strip-till fertilized rows was 8% less than that of corn planted 4 in. off the center of the rows (Figure 3), which was a result of 1,637 fewer plants/a. In 2008, corn planted 4 in. off the center of the strip-till fertilized rows had the highest plant population and the highest numerical grain yield. In 2009, when the strip-till operation was performed 2.5 months before planting and the strip-till seedbed had plenty of time to settle and become firm, there were no differences in plant population and no differences in yield between planting directly on the strip-till fertilized rows and 4 in. off the rows. In 2010, with very wet saturated soil conditions and cold temperatures after planting, significant reductions in plant populations and early corn growth occurred with planting 8 and 15 in. from the center of the rows compared with planting directly on or 4 in. off the rows. Planting 8 in. off the center of the strip-till fertilized rows reduced plant population 2,616 plants/a, and 15 in. off reduced population 6,800 plants/a. Early growth was reduced 38 and 53%, respectively. Interestingly, these effects had only a marginal impact on yield (15% reduction), because under these conditions nitrogen fertilizer was also lost. In 2011, under extreme heat, drought, and near crop failure conditions, all treatments yielded below 30 bu/a, and planting distances from the row had no statistically significant effect on yield.

These results suggest that the best location for planting strip-till fertilized corn will vary depending on the growing season, condition of the strip-till fertilized zone, and the amount of time between planting and when the strip-till fertilizer operation was performed. The best location for planting will need to be evaluated for each year, field, and planting situation. Strip-till fertilized corn should be planted in a moist, firm seedbed to obtain best stands and within 4 in. of strip-till fertilized rows to ensure quick contact between corn roots and fertilizer.

Additional studies are needed to determine if these results might be different when planting strip-till fertilized corn on course-textured soils and when higher rates of fertilizer and other sources of nitrogen (such as anhydrous ammonia) are used.

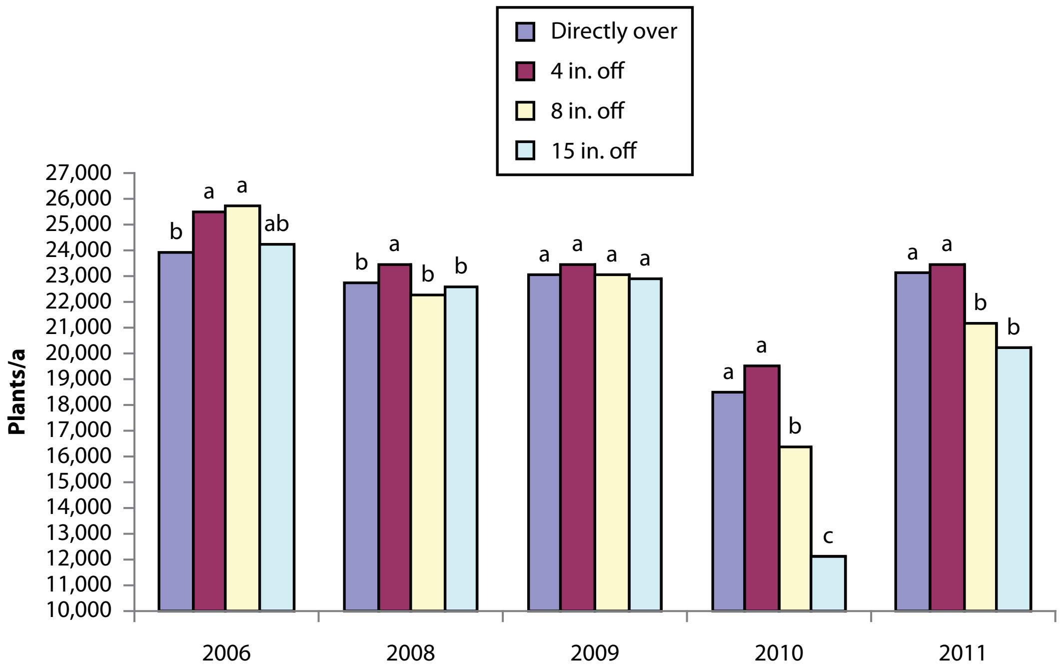

Figure 1. Effects of planting at different distances from the center of strip-till fertilized rows on corn plant population.

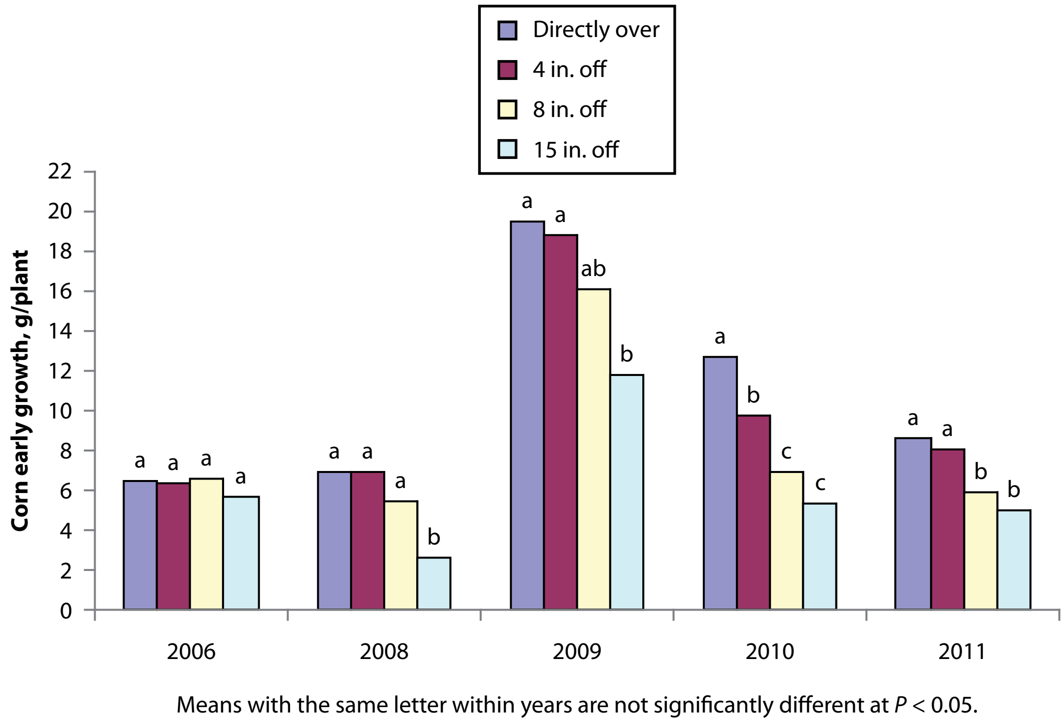

Figure 2. Effects of planting at different distances from the center of strip-till fertilized rows on corn growth at the 6- to 7-leaf stage.

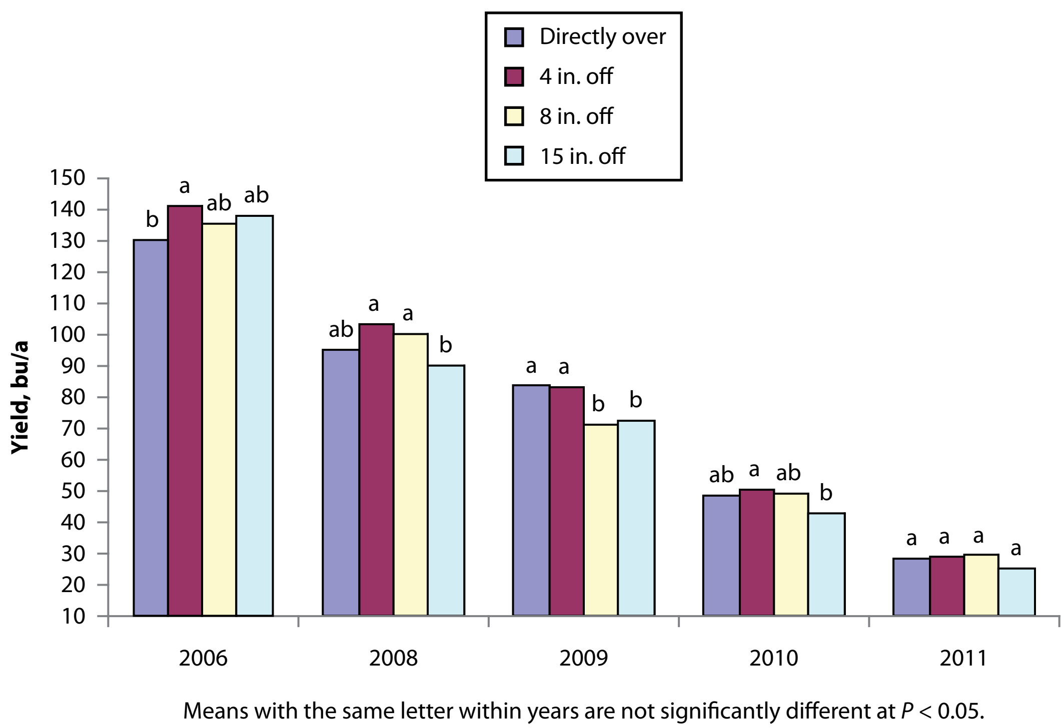

Figure 3. Effects of planting at different distances from the center of strip-till fertilized rows on corn grain yield.

Kansas River Valley Experiment Field

Introduction

The Kansas River Valley Experiment Field was established to study management and effective use of irrigation resources for crop production in the Kansas River Valley. The Paramore Unit consists of 80 acres located 3.5 miles east of Silver Lake on U.S. Highway 24, then 1 mile south of Kiro, and 1.5 miles east on 17th street. The Rossville Unit consists of 80 acres located 1 mile east of Rossville or 4 miles west of Silver Lake on U.S. Highway 24.

Soil Description

Soils on the two fields are predominately in the Eudora series. Small areas of soils in the Sarpy, Kimo, and Wabash series also occur. Except for small areas of Kimo and Wabash soils in low areas, the soils are well drained. Soil texture varies from silt loam to sandy loam, and the soils are subject to wind erosion. Most soils are deep, but texture and surface drainage vary widely.

2011 Weather Information

The frost-free season was 199 and 180 days at the Paramore and Rossville units, respectively (average = 173 days). The last spring freeze was April 5 and 4 (average = April 21), and the first fall freeze was October 20 and 1 (average = October 11) at the Paramore and Rossville units, respectively. There were 71 and 57 days above 90°F and 20 and 9 days above 100°F at the Paramore and Rossville units, respectively. Precipitation was below normal at both fields for the growing season (Table 1). Precipitation was below average from December through April, above normal in May, and irrigation was necessary in late June through August. Corn varied widely from single digits to over 200 bu/a, averaging 118 bu/a. Soybean yields were more consistent at both fields, averaging 54 bu/a.

Table 1. Precipitation at the Kansas River Valley Experiment Field

	Rossville Unit		Paramore Unit	
Month	2010–2011	30-year avg.	2010–2011	30-year avg.
	-------------- in. --------------		-------------- in. --------------	
October	0.61	0.95	0.73	0.95
November	1.66	0.89	1.32	1.04
December	0.00	2.42	0.06	2.46
January	0.56	3.18	0.53	3.08
February	0.60	4.88	2.50	4.45
March	1.60	5.46	2.82	5.54
April	2.87	3.67	2.16	3.59
May	6.45	3.44	5.12	3.89
June	1.29	4.64	2.66	3.81
July	1.83	2.97	0.88	3.06
August	3.23	1.90	2.42	1.93
September	2.15	1.24	2.43	1.43
Total	22.85	35.64	23.63	35.23

Macronutrient Fertility on Irrigated Corn in a Corn/Soybean Rotation

E.A. Adee

Summary
Effects of nitrogen (N), phosphorus (P), and potassium (K) fertilization on a corn/soybean cropping sequence were evaluated from 1983 to 2011 (corn planted in odd years). Corn yield was near optimum at 160 lb/a N. P and K fertilization alone did not consistently increase yields. When both P and K were applied with N, yields increased as much as 15 bu/a.

Introduction
A study was initiated in 1972 at the Topeka Unit of the Kansas River Valley Experiment Field to evaluate the effects of N, P, and K on furrow-irrigated soybean. In 1983, the study was changed to a corn/soybean rotation with corn planted and fertilizer treatments applied in odd years. Study objectives were to evaluate the effects of N, P, and K applications to a corn crop on grain yield of corn, yield of the following soybean crop, and soil test values.

Procedures
The initial soil test in March 1972 on this silt loam soil was 47 lb/a available P and 312 lb/a exchangeable K in the top 6 in. of the soil profile. Rates of P were 50 and 100 lb/a P_2O_5 (1972–1975) and 30 and 60 lb/a P_2O_5 (1976–2011), except in 1997 and 1998, when a starter of 120 lb/a of 10-34-0 (12 lb/a N + 41 lb/a P_2O_5) was applied to all plots of corn and soybean. Rates of K were 100 lb/a K_2O (1972–1975), 60 lb/a K_2O (1976–1995), and 150 lb/a K_2O (1997–2011). Nitrogen rates included a factorial arrangement of 0, 40, and 160 lb/a of preplant N (with single treatments of 80 and 240 lb/a N). The 40 lb/a N rate was changed to 120 lb/a N in 1997. Treatments of N, P, and K were applied every year to continuous soybean (1972–1982) and every other year (odd years) to corn (1983–1995, 1999–2011).

Corn hybrids planted were: BoJac 603 (1983), Pioneer 3377 (1985, 1987, 1989), Jacques 7820 (1991, 1993), Mycogen 7250 (1995), DeKalb DKC626 (1997, 1999), Golden Harvest H2547 (2001), Pioneer 33R77 (2003), DeKalb DKC63-81 (2005), Asgrow RX785 (2007), DeKalb DKC63-42 (2009), and DeKalb DKC63-69 (2011). Corn was planted in mid-April, herbicides were applied preplant and incorporated each year, and postemergence herbicides were applied as needed. Plots were cultivated, furrowed, and furrow-irrigated through 2001 and sprinkler-irrigated with a linear move irrigation system from 2002 through 2011. A plot combine was used for harvesting grain yields.

Results
Corn yields are shown in Table 1. Yield response of corn to N rate is shown in Figure 1. Most of the yield increase with N was with the first 120 lb, with a yield response of 3 bu/a for an additional 40 lb of N. The optimum N rate, where the last pound of N

pays for itself with increased yield, depends on grain price and cost per unit of N. These data suggest the optimum N rate falls from 120 to 160 lb/a N.

P and K did not increase yields significantly on their own, but yields increased up to 15 bu/a when both P and K were applied in combination with N. These data support the importance of a balanced fertility program on these soils.

Table 1. Effects of nitrogen, phosphorus, and potassium applications on corn yields in a corn/soybean cropping sequence, Kansas River Valley Experiment Field, Topeka Unit

Fertilizer[1]			Corn yield	
N	P_2O_5[2]	K_2O	1983–1995	1997–2011
-------------------- lb/a --------------------			---------- bu/a ----------	
0	0	0	86.3	100.3
0	0	60/150	85.4	101.2
0	30	0	92.0	118.1
0	30	60/150	84.8	98.7
0	60	0	83.3	103.9
0	60	60/150	90.7	101.2
40/120	0	0	127.5	177.6
40/120	0	60/150	124.7	174.8
40/120	30	0	121.6	174.2
40/120	30	60/150	136.7	186.1
40/120	60	0	122.2	173.8
40/120	60	60/150	131.3	188.6
160	0	0	169.9	180.0
160	0	60/150	175.5	175.3
160	30	0	166.4	168.1
160	30	60/150	179.4	189.6
160	60	0	165.8	187.2
160	60	60/150	165.5	195.5
80	30	60/150	149.6	175.2
240	30	60/150	181.1	191.1
LSD (0.05)			10.9	13.7

continued

Table 1. Effects of nitrogen, phosphorus, and potassium applications on corn yields in a corn/soybean cropping sequence, Kansas River Valley Experiment Field, Topeka Unit

Fertilizer[1]			Corn yield	
N	P_2O_5[2]	K_2O	1983–1995	1997–2011
-------------------- lb/a --------------------			---------- bu/a ----------	
Nitrogen means				
0			87.1	103.9
40/120			127.3	179.2
160			170.4	182.6
LSD (0.05)			4.6	5.8
Phosphorus means				
0			128.2	151.5
30			130.1	155.8
60			126.5	158.4
LSD (0.05)			NS	NS
Potassium means				
0			126.1	153.7
60/150			130.4	156.8
LSD (0.05)			3.8	NS

[1] Fertilizer applied to corn in odd years from 1983 through 2011 and to soybean for 11 years prior to 1983 (the first number of the two is the rate applied to corn from 1983 through 1995).

[2] Phosphorus treatments not applied in 1997. Starter fertilizer of 10 gal/a of 10-34-0 was applied to all treatments in 1997 and 1998 (corn and soybean). N and K treatments were applied to corn in 1997.

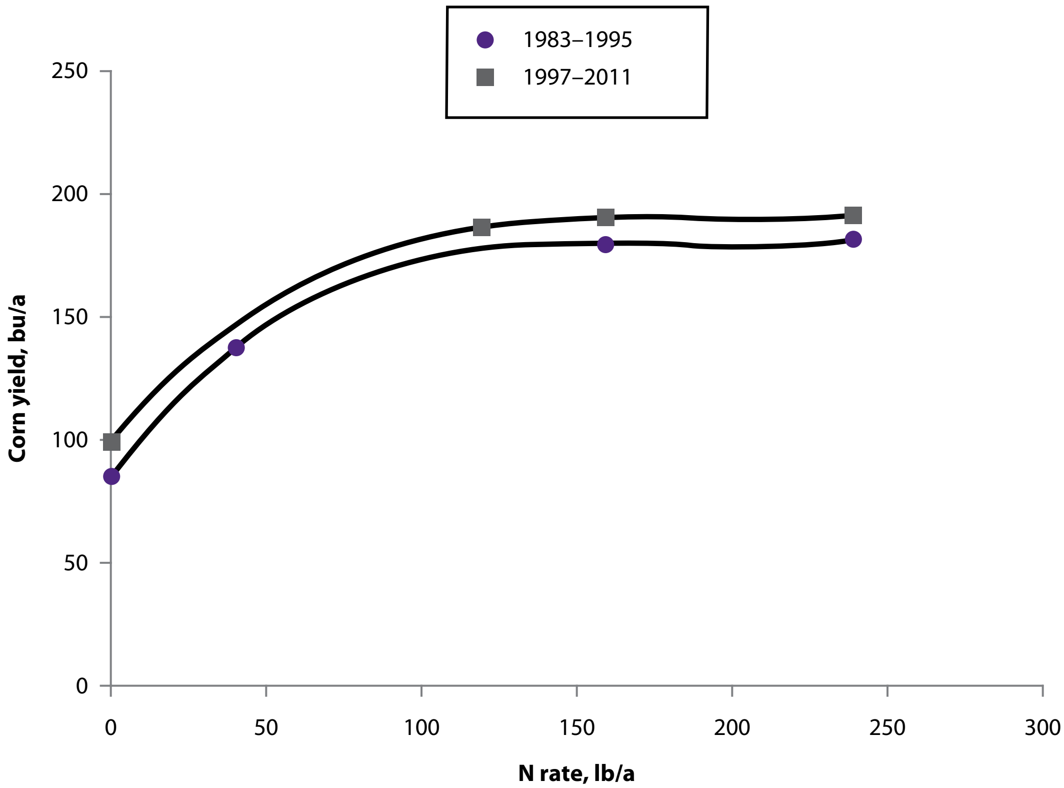

Figure 1. Corn response to nitrogen (N) rate with 30 lb phosphorus (P) and 60 lb potassium (K) in 1983–1995 and 30 lb P and 150 lb K in 1997–2011.

Corn Herbicide Performance Test

C.R. Thompson and E.A. Adee

Summary

The experiment was conducted at the Rossville Unit of the Kansas River Valley Experiment Field and compared three herbicide timings: preemergence (PRE), two-pass (PRE plus early or late-postemergence [EP or LP]), and EP. Visual weed control ratings were made August 31, 2011. Most treatments gave greater than 90% control of Palmer amaranth (PA), common sunflower (CS), and ivyleaf morninglory (IM). Touchdown Total applied alone LP provided 57% control of IM and 63% control of large crabgrass (LC). Control of LC was generally less than other weed species, with several treatments showing less than 90% control, due to heavy LC pressure. All corn receiving herbicide treatment yielded more than untreated corn. Yield differences between treatments ranged from 139 to 214 bu/a.

Introduction

Controlling weeds in corn with herbicides reduces weed competition and increases grain yields. Timing of herbicide application is a major factor in effective weed control. This study compared the effectiveness of 16 herbicide treatments including three timings of application, PRE, EP (2-in. weeds), and LP (30-in. corn). Control was evaluated for LC, PA, CS and IM.

Procedures

The test was conducted on a Eudora silt loam previously cropped to soybean at the Rossville Unit. Soil at the test site had 1.4% organic matter and pH 6.4. Corn hybrid DeKalb DKC 64-69 VT3 was planted May 16 at 28,400 seeds/a in 30-in. rows. Anhydrous ammonia at 150 lb/a nitrogen (N) was applied preplant, and 120 lb/a of 10-34-0 fertilizer was banded at planting. There were 16 treatments plus the untreated control. Herbicides were broadcast-applied with 15 gal/a spray volume with 8003XR flat fan nozzles at 17 psi. The experimental design was a randomized complete block with three replications. PRE applications were made May 16. EP applications were done June 8 to V4 corn and 0.5- to 3-in. weeds. LP treatments were applied June 23 to 30-in. corn, and PA and CS were 2 to 8 in. Weeds in plots previously treated with a PRE treatment or EP treatment had much smaller weeds. Plots were not cultivated. Visual weed control ratings were made on August 31. Over 2 in. of rain was received from May 18 through 21, and plots were irrigated with 3.14 in. of water. Corn was harvested from the middle 2 rows of each plot on September 28 with a modified John Deere 3300 plot combine, and yields were reported in bu/a at 15.5% moisture.

Results

No corn injury was observed from any PRE applied treatment. The June 15 rating indicated that some treatments injured corn quite severely (data not shown). Stunting and slight chlorosis in the whorl were typical symptoms. Cinch ATZ applied PRE followed by Realm Q and Abundit (glyphosate) EP did not cause any crop injury. When Realm Q was applied EP to corn treated with Basis or Prequel PRE, severe crop injury occurred. Subsequent rating indicated that injury declined over time; however, when corn elongation occurred, severe stunting was evident as indicated by the July ratings (data not shown). Chlorotic whorls were not present in July. Other treatments caused slight injury (10% or less), but likely would not be noticed by a corn producer and would not be a concern. No stunting or chlorosis of corn was observed with any treatment at the August rating.

Large crabgrass pressure was extremely heavy. Densities were estimated at 20 to 30 plants/ft^2. Initial PRE treatments provided acceptable control through the June 6 rating, 21 days after the PRE application. A few escapes occurred, thus rating percentile was 90+. Crabgrass ratings tended to decline until the POST herbicides were applied. June 8 ratings suggest that crabgrass was still emerging (data not shown).

Morningglory emerged through the PRE herbicide; initial ratings made on May 26 raised significant concerns because the best rating was 52% for Lexar (data not shown). The June 16 rating (data not shown) was much improved because much of the emerged IM had been controlled by the uptake of the PRE herbicide. Realm Q POST applied alone did not improve IM control. When Realm Q was applied with Atrazine or dicamba, IM control was 95% or better. PRE applied SureStart without atrazine did not control IM, and Durango POST needed to be applied EP instead of LP to adequately control IM. Cinch ATZ followed by Abundit LP gave 85% control of IM. Densities were 1 to 2 plants/ft^2.

Palmer amaranth densities were 2 to 3 plants/ft^2. PRE applied herbicides initially gave excellent control of Palmer amaranth, but control declined over time until the POST herbicide was applied. Rating with some treatments declined to 70%. The two-pass systems effectively controlled PA. Single-pass treatments of Halex GT and SureStart+Durango with and without atrazine controlled PA 100% at the July 8 rating (data not shown).

Sunflower control was acceptable with all PRE herbicides. Perhaps Cinch ATZ provided the lowest level of CS control (78%). All two-pass systems controlled this native CS population. Densities were 1 to 2 plants/yd^2.

Grain yields with herbicide treatments were all greater than the untreated control, and yields were different among treatments. The lower yields appear to be related to inadequate weed control or crop injury that was described earlier. The LP application of Realm Q to 30-in. corn was an off-label treatment. Realm Q should be applied to corn 20 in. or less, or corn having 7 collars, whichever is most restrictive. The late application of Realm Q could have contributed to the injury and yield reductions observed.

Table 1. Effect of Preemergence and postemergence herbicides on weed control and grain yield of corn, Kansas River Valley Experiment Field, Rossville, 2011

			Weed control August 31, 2011[3]				
Treatment[1]	Rate	Application time[2]	Large crabgrass	Palmer amaranth	Common sunflower	Ivyleaf morninggy	Grain yield
			---------- % ----------				bu/a
Untreated check							96
Basis	0.5 oz	PRE	97	98	100	98	171
Atrazine	1 qt	PRE					
RequireQ	4 oz	EP					
Abundit S	32 oz	EP					
Basis	0.5 oz	PRE	95	98	100	98	178
Atrazine	1 qt	PRE					
RealmQ	4 oz	EP					
Abundit S	32 oz	EP					
Basis	0.5 oz	PRE	98	99	100	97	187
Atrazine	1 qt	PRE					
ResolveQ	1.25 oz	EP					
Abundit S	32 oz	EP					
Prequel	1.66 oz	PRE	94	96	100	96	181
Atrazine	1 qt	PRE					
RequireQ	4 oz	EP					
Abundit S	32 oz	EP					
Prequel	1.66 oz	PRE	92	96	100	96	155
Atrazine	1 qt	PRE					
RealmQ	4 oz	EP					
Abundit S	32 oz	EP					
Prequel	1.66 oz	PRE	95	97	100	96	174
Atrazine	1 qt	PRE					
ResolveQ	1.25 oz	EP					
Abundit S	32 oz	EP					
Cinch ATZ	1 qt	PRE	91	96	100	93	139
RealmQ	4 oz	EP					
Abundit S	32 oz	EP					
Cinch ATZ	1 qt	PRE	75	93	100	91	183
Abundit S	32 oz	EP					
Halex GT	3.6 pt	EP	95	97	100	95	199
SureStart	1.75 pt	PRE	84	95	100	89	191
Durango	24 oz	MP					
SureStart	1.75 pt	PRE	88	95	100	92	214
Atrazine	1 qt	MP					
Durango	24 oz	MP					

continued

Table 1. Effect of Preemergence and postemergence herbicides on weed control and grain yield of corn, Kansas River Valley Experiment Field, Rossville, 2011

			Weed control August 31, 2011[3]				
Treatment[1]	Rate	Application time[2]	Large crabgrass	Palmer amaranth	Common sunflower	Ivyleaf morninggy	Grain yield
			--------------------------- %			---------------------------	bu/a
SureStart	1.75 pt	EP	89	95	100	96	205
Durango	24 oz	EP					
Durango	24 oz	EP	80	96	100	93	200
Durango	24 oz	MP					
SureStart	1.75 pt	EP	86	98	100	98	207
Atrazine	1 qt	EP					
Durango	24 oz	EP					
Lexar	3 qt	PRE	88	95	100	92	198
Touchdown Total	23 oz	MP					
Touchdown Total	23 oz	MP	63	90	100	57	163
LSD (0.05)			7.9	2.4	0.0	5.2	32.7
CV			4.7	1.4	0.0	3.1	19.6

[1] All Abundit (glyphosate) and Halex GT treatments were applied with NPAK AMS at 13 lb/100 gal; Durango and Touchdown Total treatments were applied with NPAK AMS at 17 lb/100 gal.
[2] PRE = Preemergence (May 16), 2-in. weeds (June 8), 30-in. corn (June 23).
[3] LC = large crabgrass, PA = Palmer amaranth, CS = common sunflower, IM = ivyleaf morningglory.

Soybean Herbicide Performance Test

D.E. Peterson and E.A. Adee

Summary
This study was conducted at the Rossville Unit of the Kansas River Valley Experiment Field to compare herbicide treatments for soybean. Nineteen herbicide treatments were evaluated for control of large crabgrass (LC), Palmer amaranth (PA), hophornbeam copperleaf (HC), and ivyleaf morninglory (IM) and their effects on grain yield. Several treatments provided season-long control of 90% or higher for the weed species evaluated. Large crabgrass and ivyleaf morninglory were controlled 70% or less by several herbicide treatments. The lowest yields corresponded with treatments that did not have both pre- and postemergence treatments.

Introduction
Controlling weeds in soybean can reduce weed competition and increase yield. Treatments in this study included an untreated check, preemergnce (PRE), early postemergence (EP), postemergence (P), and combinations of PRE, EP, and P applications. Four weeds were evaluated in this test: LC, PA, HC, and IM.

Procedures
This test was conducted on a Eudora silt loam soil previously cropped to corn. Soil at the test site had 1.4% organic matter and pH 6.4. Corn stubble had been disked and chiseled in the fall and field-cultivated in the spring. Soybean variety Pioneer 94Y01-N206 was planted June 8, 2011, at 139,000 seeds/a in 30-in. rows. Herbicides were broadcast with 15 gal/a spray volume with 8003XR flat fan nozzles at 15 psi.

The experimental design was a randomized complete block with three replications per treatment. Herbicide treatments were applied as follows: PRE on June 8; EP on June 28 to V2 soybeans, 1- to 2.5-in. LC, 1- to 5-in. PA, 1- to 3-in. HC, and IM; P on July 12 to V5 soybeans, 2- to 10-in. LC and HC, 2- to 24-in. PA, and 4- to 12-in. IM. Herbicides and rates applied are listed in Table 1. Populations of all four weeds were moderate to heavy. Plots were not cultivated. Rainfall of 0.02, 0.1, 0.08, and 0.22 in. was received 4, 8, 9, and 10 days after PRE application, respectively. The study was irrigated four times in July and August with a total of 4.9 in. of water. Yields were harvested from the middle 2 rows of each plot on October 6 with a modified John Deere 3300 plot combine.

Results
Most preemergence herbicide treatments caused some minor early stunting, but soybeans appeared to recover with time. Postemergence herbicide treatments with Prefix and Flexstar GT caused some foliar burn and stunting of soybean following application, but symptoms dissipated with time. Premergence treatments with Prefix, Boundary, Fierce, and Zidua gave the best early season LC control. The same treatments with a subsequent postemergence glyphosate treatment had similar results, and the sequential postemergence glyphosate treatment provided the best late-season crabgrasss control. Most preemergence herbicide treatments provided very good early season

PA and HC control. One-pass herbicide treatments generally did not provide as good control of PA or HC as two-pass herbicide programs. Postemergence glyphosate alone and Prefix or Boundary followed by postermegence herbicide treatments were less effective for IM control than the other herbicide programs evaluated. Soybean yields were variable, probably due to the extreme heat during the summer. The untreated check was not harvested due to heavy weed pressure. The EP treatment consisting of Flexstar plus FirstRate plus Fusion generally had lower LC and PA control ratings and soybean yield compared with the other herbicide treatments, but was probably applied later than it should have been to optimize performance.

Table 1. Weed control in conventional-tillage soybean, Rossville Unit, 2012

			Percentage weed control, July 22[3]				
Treatment[1]	Rate/a	Application time[2]	LC	PA	HC	IM	Yield
							bu/a
Untreated check			0	0	0	0	
Prefix Touchdown Total	2 pt 24 oz	PRE P	92	95	80	50	51.2
Boundary Flexstar GT 3.5	1.5 pt 3.5 pt	PRE P	90	97	87	53	48.2
Flexstar GT 3.5	3.5 pt	EP	93	89	72	87	56.1
Prefix Touchdown Total	2 pt 24 oz	EP EP	93	87	73	86	53.5
Prefix Authority First	2 pt 4 oz	PRE PRE	85	90	97	93	43.7
Prefix Authority First Touchdown Total	2 pt 4 oz 24 oz	PRE PRE P	92	100	100	97	57.3
Roundup PowerMax Warrant	22 oz 1.5 qt	EP EP	83	95	73	83	58.1
Roundup PowerMax	22 oz	P	50	95	50	50	50.3
Sonic Durango DMA	3 oz 24 oz	PRE P	78	96	95	87	51.1
Sonic Durango DMA	4.5 oz 24 oz	PRE P	77	98	98	93	55.7
Durango DMA First Rate Durango DMA	24 oz 0.3 oz 24 oz	PRE PRE P	95	100	96	97	57.5

continued

Table 1. Weed control in conventional-tillage soybean, Rossville Unit, 2012

			Percentage weed control, July 22[3]				
Treatment[1]	Rate/a	Application time[2]	LC	PA	HC	IM	Yield
							bu/a
Envive	4 oz	PRE	77	96	96	90	58.6
Classic	032oz	P					
Abundit	33oz	P					
Envive	4 oz	PRE	68	100	99	92	58.5
SynchronyXP	0.33oz	P					
Abundit	32 oz	P					
Enlite	4 oz	PRE	70	100	98	88	54.1
Classic	0.375oz	P					
Abundit	32 oz	P					
Enlite	2.8oz	PRE	77	100	100	88	56.8
SynchronyXP	0.32oz	P					
Abundit	33oz	P					
Fierce	3 oz	PRE	88	100	98	85	56.6
Roundup PowerMax	22 oz	P					
Zidua	2.5 oz	PRE	98	100	95	93	55.3
Optill	2 oz	PRE					
Roundup PowerMax	22 oz	P					
Authority XL	4 oz	PRE	75	99	98	92	55.9
Roundup PowerMax	22 oz	P					
Flexstar	1pt	EP	53	81	87	87	41.2
FirstRate	0.03 oz	EP					
Fusion	8 oz	EP					
LSD(0.05)			13.9	5.9	8.3	7.4	9.19
CV			11.0	3.94	5.95	5.63	10.38

[1]All Abundit, Durango DMA, Roundup PowerMax, and Touchdown Total treatments included N PAK AMS at 8.5 lb/100 gal.
[2] PRE = preemergence, June 8; EP = early postemergence, June 28; P = postemergence, July 12.
[3] LC = large crabgrass, PA = Palmer amaranth, HC = hophornbeam copperleaf, IM = ivyleaf morningglory.

Management Practices Influence Productivity of Degraded or Eroded Soils

M.M. Mikha, P. Stahlman, J.G. Benjamin, and P.W. Geier

Summary
Management practices influence the productivity of eroded or degraded soil. This study investigates the influence of beef manure amendment compared with commercial fertilizer (urea) applied at two rates (60 and 120 lb N/a) with two tillage practices (conventional tillage, CT, and no-tillage, NT). In 2006, a study site was established on eroded/degraded soil at the Kansas State University Agricultural Research Center–Hays in Hays, KS. In 2011, winter wheat yield and wheat biomass production were greatly influenced by manure addition compared with commercial fertilizer. Wheat yield and wheat biomass were not influenced by nitrogen (N) rate and tillage practices. Overall, manure addition improved the productivity of eroded soil. More analysis is being conducted to evaluate manure amendment on different aspects of soil quality in this eroded/degraded soil.

Introduction
In the central Great Plains region, soil degradation is a consequence of soil organic matter losses due to soil disturbance and plant residue decomposition. Continuous tillage promotes soil organic matter decomposition and enhances soil erosion. Although no-tillage minimizes soil disturbance and promotes soil organic matter accumulation, manure amendment can restore the productivity of degraded/eroded soils by improving the nutrient status and increasing soil organic matter levels. The objectives of this study were to (1) identify the rate of beef manure necessary to supply nitrogen to the dryland cropping system and (2) evaluate the advantages of using manure as an amendment versus managing those same eroded soils with chemical fertilizer.

Procedures
The experiment site was established in 2006 on eroded/low-productivity soil at the Kansas State University Agricultural Research Center–Hays. The management practices consisted of two tillage practices, conventional tillage (CT, chisel disk) and no-tillage (NT), and two N-sources (beef manure and commercial fertilizer) applied at two rates, low (normal N rate for crop needs) and high (twice the normal N rate). The current crop rotation is grain sorghum (2006)/forage oat (2007)/winter wheat (2008)/grain sorghum (2009)/millet (2010)/winter wheat (2011). The four replicated experiment plots (21 ft by 45 ft) were organized in a randomized complete block design. In September 2010, before planting winter wheat, solid beef manure and commercial fertilizer (urea) were applied at 60 lb N/a (low rate) and 120 lb N/a (high rate). Winter wheat (Danby) was seeded in October at 59 lb seed/a with a Sunflower 9711 drill (Sunflower Manufacturing, Beloit, KS) with 7.5-in. row spacing. Grain was harvested in July 2011 using a plot combine. Grain yields were determined at 12.5% moisture.

Results

The 2011 winter wheat grain yield and plant biomass production (Table 1) were significantly affected ($P \leq 0.05$) by N source. The addition of manure significantly ($P \leq 0.05$) increased wheat yield and wheat biomass compared with fertilizer treatment. The interaction of N source and N rate greatly influenced wheat biomass production, especially with the manure amendment. Tillage practices and N rate had no influence on grain yield and plant biomass. No differences in wheat yield and wheat biomass were observed between commercial fertilizer treatments (at both N rates) and the control. Overall, the improvement of winter wheat yield and biomass production in this eroded soil with manure amendment treatments could be related to improvements in many aspects of soil quality and soil nutrient status compared with commercial fertilizer. The influence of manure amendment on soil quality parameters is being conducted and will be reported periodically for the duration of the experiment.

Table 1: Effect of tillage, nitrogen (N) source, and nitrogen rate on wheat yield and wheat biomass production of eroded soil in Hays, KS, 2011

Tillage treatment	N source	N rate	Wheat yield	Wheat biomass
		lb/a	bu/a	lb/a
No-till	Control[1]	0	9.1	1976
	Manure	120	15.9	3637
		60	17.9	3343
	Fertilized	120	9.3	2251
		60	10.4	2302
Tillage	Control	0	7.6	1953
	Manure	120	16.8	4080
		60	15.3	3396
	Fertilized	120	8.9	2226
		60	8.9	2544
Tillage (mean)			NS[2]	NS
No-till			13.4	2883
Conventional-till			12.5	3062
Nitrogen source (mean)			0.0051*	0.023*
Fertilizer			9.4b	2331b
Manure			16.5a	3614a
Nitrogen rate (mean)			NS	NS
High[3]			12.7	3050
Low[4]			13.1	2896
N source × N rate (mean)			NS	0.045
High fertilizer			9.1	2239c
Low fertilizer			9.6	2423c
High manure			16.3	3858a
Low manure			16.6	3369b

[1] Control was not included with the statistical analysis.
[2] NS = not significant.
[3] High rate (120 lb/a N).
[4] Low rate (60 lb/a N).
* Significant at $P < 0.05$.
abc Values followed by a different letter are significantly different at $P < 0.05$.

Organic Amendment and Residue Removal Rates Influence Soil Productivity

M. M. Mikha and A. J. Schlegel

Summary

Removing crop residue could affect different soil quality parameters and plant productivity. The first objective of this study is to evaluate the influence of removing crop residue at different rates (0%, 45–55%, and 60–85%) on crop productivity. The second objective is to assess the advantages to soil productivity of using an organic amendment instead of crop residue. In 2011, an irrigated continuous corn study site was established at the Kansas State University Southwest Research-Extension Center in Tribune, KS. Incorporated beef manure was compared with no-till commercial fertilizer (urea) applied at 180 lb N/a. The preliminary data suggest that manure addition improved the productivity compared with commercial fertilizer. The influence of residue removal will be evaluated in subsequent years.

Introduction

Interest in using crop residues as a renewable feedstock for biofuel production is great, but removing crop residue could have a negative impact on soil organic C (SOC) levels, and consequently on soil quality and plant productivity. Management practices that include adding organic residue as a nitrogen (N) source could compensate for removing the residue and prevent the deterioration of soil quality and grain yield through time. The objectives of this study are to (1) identify the rate of residue removal that maintains soil productivity and (2) evaluate the advantages of using beef manure as an N source vs. commercial fertilizer as a replacement for crop residue.

Procedures

The experiment site was established in 2011 on an irrigated field at the Tribune Unit of the Kansas State University Southwest Research-Extension Center. The management practices consist of continuous corn and two N-sources (beef manure and commercial fertilizer) applied at the same rate (180 lb N/a). The plots received commercial fertilizer (urea) were manage in no-till, whereas the beef manure (13.3 ton/a) was incorporated in the plots that received manure. All plots received 50 lb/a of P_2O_5. Three rates of corn residue removal were chosen: 0%, 45–55%, and 60–85%. The experiment units (15 ft by 30 ft) were organized in a randomized complete block design with four replications. On April 18, 2011, before corn planting, solid beef manure and commercial fertilizer (urea) were applied. Corn (hybrid Pioneer 1151XR) was seeded on May 7 at 32,000 seeds/a using a John Deere 1700 planter with 30-in. row spacing. Corn biomass was evaluated at R6 growing stage. Grain was hand-harvested on September 27, 2011. Grain yields were determined at 15% moisture. The corn residue was removed at different percentages using a Carter harvester, and the residue remaining in each plot was evaluated in October after the grain harvest.

Results

The first-year corn grain yield and plant biomass production (Table 1) were significantly affected ($P \leq 0.05$) by N source. The addition of manure greatly ($P \leq 0.05$) increased corn yield compared with fertilizer treatment. The N-source had no influence on corn biomass and residue remaining. The amounts of residue remaining were significantly influenced by the amount of residue removed. Overall, the preliminary data suggest that manure addition improved corn productivity, whereas the influence of different rates of residue removal could take several growing seasons. The influence of manure addition and residue removal on soil quality parameters is being conducted and will be reported throughout the study.

Table 1. The effect of nitrogen (N) source and residue removal rate on corn yield and corn biomass production in Tribune, KS, 2011

N-source	Residue removal rate	Corn yield	Corn biomass	Residue remaining
	%	bu/a	-------------- lb/a --------------	
Fertilizer	0	250.7	10116	22858
	45-55	255.0	11002	12539
	60-85	254.5	10142	8797
Manure	0	271.6	11092	24198
	45-55	268.8	10733	12479
	60-85	269.6	10559	7378
N source (mean)		0.007*	NS[1]	NS
Fertilizer		253.4 b	10420	14672
Manure		270.0 a	10794	14685
Residue removal rate (mean)		NS	NS	<0.0001*
0%		261.2	10604	23528 a
45–55%		261.9	10867	12419 b
60–85%		262.0	10350	8087 c

[1] NS = not significant.
* Significant at $P<0.05$.
[abc] Values fallowed by a different letter are significantly different.

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Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Experiments with pesticides on nonlabeled crops or target species do not imply endorsement or recommendation of nonlabeled use of pesticides by Kansas State University. All pesticides must be used consistent with current label directions. Current information on weed control in Kansas is available in *2012 Chemical Weed Control for Field Crops, Pastures, Rangeland, and Noncropland*, Report of Progress 1063, available from the Distribution Center, Umberger Hall, Kansas State University, or at ***www.ksre.ksu.edu/library*** (type Chemical Weed Control in search box).

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