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Southwest Research-Extension Center

FIELD DAY

1997

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REPORT OF PROGRESS
789

KANSAS STATE UNIVERSITY
AGRICULTURAL EXPERIMENT STATION
AND COOPERATIVE EXTENSION SERVICE

K-STATE
Kansas State University

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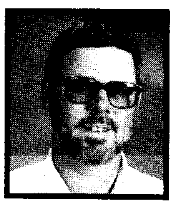
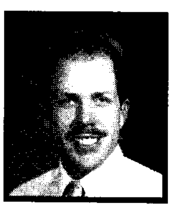


Dave Frickel - Research Associate - Tribune. Dave received his B.S. from the University of Nebraska-Lincoln in 1987. He began his work here as an Agricultural Technician. In 1991, he moved to his current position.



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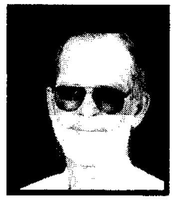
Paul Hartman - Associate Head and Area Extension Director, Paul received his B.S. and M.S. in Animal Sciences and Industry from Kansas State University. Prior to that, he served as County Extension Agricultural Agent in Stanton and Pratt counties.



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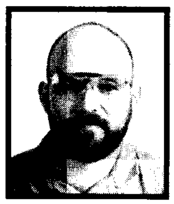

Jeff Elliott - Research Farm Manager. Jeff received his B.S. from the University of Nebraska. In 1984, Jeff began work as an Animal Caretaker III and was promoted to Research Farm Manager in 1989.

Gerald Greene - Entomologist. Gerald received his M.S. from Kansas State and his Ph.D. from Oregon State University. He was Station Head from 1976-1982. His research is on livestock entomology, with emphasis on control of stable flies by predators and parasites in feedlots of western Kansas.

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WEATHER INFORMATION FOR GARDEN CITY

by

Jeff Elliott

Total precipitation for 1996 was 19.25 inches. Although this is similar to the 30-year average of 17.91 inches, the precipitation distribution was far from normal. Moisture for the 7-month period of October ’95 - April ’96 totaled only 2.35 inches. This was the driest winter-spring since 1964. May through September proved to be the opposite extreme with precipitation totaling 16.45 inches. This is 4.12 inches above the 30-year average for this 5-month period. August was the wettest month with 4.31 inches, and December was the driest with 0.00 inches, neither of which were records. Snowfall was light, measuring 5.3 inches, or 12.4 inches below normal. Only the months of January, February, and March received measurable snowfall in 1996.

July was the warmest month, with an average temperature of 75.5º and an average high temperature of 88.7º. January was the coldest, with a mean temperature of 28.0º and a mean low temperature of 11.9º. Monthly mean temperatures for 1996 did not deviate appreciably from the 30-year average.

Daily minimum temperatures below zero were recorded on 15 occasions, with the coldest being -10º, -13º, -12º falling on three consecutive nights beginning on February 2nd. Temperatures of 100º or above occurred on 6 days, with the highest being 103º on May 19 and July 5.

Sixteen temperature records were broken or tied in 1996. Record lows occurring were: -10º on Feb. 2, -13º on Feb. 3, -12º on Feb. 4, 3º on Feb. 29, -7º on March 7 and again on March 8, and 44º on May 30. High temperature records were 89º on Apr. 3; 86º on Apr. 12; 94º on May 15 and again on May 16; 103º on May 19; and 72º, 77º, 76º, 70º on four consecutive days beginning on December 9.

The last spring freeze (31º) fell on May 1, 4 days later than average. The first fall freeze (23º) occurred on October 18. This is 5 days later than average, resulting in a frost-free period of 170 days. The normal frost-free period is 169 days.

Open pan evaporation from April 1 through October 31 totaled 69.11 inches, compared to 73.76 inches in an average year. The mean wind speed was 5.6 mph, with 5.5 mph being the average.

The 1996 weather is summarized in the table below.

Table 1. Climatic data. Southwest Research-Extension Center, Garden City, KS.

	Precipitation inches		Temperature (ºF) 96 Average		Mean		96 Extreme		Wind MPH		Evaporation inches	
Month	1996	Avg.	Max.	Min.	1996	Avg.	Max.	Min.	1996	Avg.	1996	Avg.
January	0.23	0.33	44.1	11.9	28.0	27.9	70	-8	5.2	4.8		
February	0.06	0.45	53.2	17.2	35.2	32.8	80	-13	4.8	5.5		
March	1.00	1.15	52.5	21.1	36.8	41.3	81	-7	6.9	7.0		
April	0.38	1.56	70.0	36.7	53.4	52.7	92	24	7.7	7.0	11.12	8.75
May	2.38	3.11	78.8	48.8	63.8	62.2	103	31	6.3	6.4	10.53	10.67
June	4.18	2.87	88.1	59.1	73.6	72.4	101	43	4.9	6.0	12.55	12.89
July	3.02	2.60	88.7	62.3	75.5	77.9	103	56	4.3	5.2	11.57	14.19
August	4.31	2.16	84.0	61.4	72.7	75.4	94	56	4.3	4.5	9.07	11.66
September	2.56	1.59	76.1	50.8	63.5	66.6	92	34	5.0	4.9	7.00	8.84
October	0.41	0.98	71.0	40.1	55.5	55.0	89	23	6.1	4.8	7.27	6.76
November	0.72	0.76	52.3	23.8	38.0	41.1	76	8	6.0	4.8		
December	0.00	0.35	50.0	14.6	32.3	30.7	77	-6	5.2	4.5		
Annual	**19.25**	**17.91**	**67.4**	**37.3**	**52.4**	**53.0**			**5.6**	**5.5**	**69.11**	**73.76**

Average latest freeze in spring	April 26	1996:	May 1
Average earliest freeze in fall	Oct. 12	1996	Oct. 18
Frost-free period	169 days	1996:	170 days

All averages are for the period 1961-90.

WEATHER INFORMATION FOR TRIBUNE

by

David Frickel and Dale Nolan

Precipitation for 1996 totaled 21.88 inches, which is 5.92 inches above normal. Precipitation was above normal in 6 months. The wettest months were May, June, July, August, and September with 4.05 inches, 2.82 inches, 4.43 inches, 4.67 inches, and 3.77 inches, respectively. October was the driest month with only a trace reported on the 29th. The largest single amount of precipitation was 2.33 inches on May 26, and the greatest single amount of snowfall was 3.0 inches reported on February 2 and April 14. The greatest monthly amount of snowfall, 4.0 inches, was received in January. Snowfall for the year totaled 18.2 inches, with a total of 20 days of snow cover. The longest consecutive period of snow cover, 5 days, was from February 1 to 5.

The air temperature was above normal for only 4 months of the year, with July being the warmest month with a mean temperature of 74.4^o and an average high temperature of 88.9^o. The coldest month was January, with a mean temperature of 27.0^o, an average high of 44.9^o, and an average low of 9.1^o. Nine record high temperatures were set: January 2, 3, and 14; March 21; May 15, 16, and 19; and December 10 and 31. Record low temperatures were set on February 3 and 4 and March 8 and 25. A difference of 100^o occurred within a 7-day period when a record low of -23^o was recorded on February 3 and a record high of 77^o was tied on February 10.

Deviation from the normal was greatest in March, when the mean temperature was 5.8^o below normal. There were 4 days of 100^o or above, compared to the 30-year average of 10 days, and there were 45 days of 90^o temperature and above compared to the 30-year average of 63 days. The lowest temperature for the year was -23^o on February 3 and the highest was 106^o on July 5. The last day of 32^o or less in the spring was on April 30 which is 3 days earlier than the normal date, and the first day of 32^o or less in the fall was October 3, which is the normal date. The frost-free period was 156 days, which is 3 days more than the normal of 153 days.

Open pan evaporation from April through September totaled 59.09 inches, which was 12.58 inches below normal. Wind speed for the same period averaged 4.8 mph, which is 0.9 mph less than normal.

Table 1. Climatic data. Southwest Research-Extension Center, Tribune, KS.

	Precipitation inches		Temperature (°F) 1996 Average		Normal		1996 Extreme		Wind MPH		Evaporation inches	
Month	1996	Normal	Max.	Min.	Max	Min.	Max.	Min.	1996	Avg.	1996	Avg.
January	0.16	0.36	44.9	9.1	43.3	14.2	73	-7				
February	0.24	0.40	52.8	15.5	48.7	18.7	77	-23				
March	1.08	0.99	52.4	18.1	56.6	25.4	78	-9				
April	0.28	1.13	69.6	31.3	67.5	35.1	91	23	6.2	6.6	10.85	8.82
May	4.05	2.69	76.5	46.1	76.0	45.3	103	33	5.3	6.0	9.28	10.95
June	2.82	2.71	87.1	55.7	86.9	55.3	99	40	4.4	5.7	11.65	13.71
July	4.43	2.60	88.9	59.9	92.7	61.3	106	54	4.0	5.5	11.55	15.64
August	4.67	1.98	84.9	58.0	89.9	59.2	98	52	3.9	5.2	9.54	13.01
September	3.77	1.54	75.9	49.2	81.3	49.9	91	35	4.4	5.4	6.22	9.55
October	T	0.74	70.9	34.4	70.4	37.3	90	22				
November	0.30	0.49	50.5	20.7	54.7	25.3	82	6				
December	0.08	0.33	49.0	13.5	44.9	16.6	72	-13				
Annual	**21.88**	**15.96**	**66.9**	**34.3**	**67.7**	**37.0**	**106**	**-23**	**4.8**	**5.7**	**59.09**	**71.67**
	Average latest freeze in spring[1]				May 3		1996:	April 30				
	Average earliest freeze in fall				October 3		1996:	October 3				
	Average frost-free period				153 days		1996:	156 days				

[1]Latest and earliest freezes recorded at 32°F. Average precipitation is a 30-year average (1961-1990) calculated from National Weather Service. Average temperature, latest freeze, earliest freeze, wind, and evaporation are for the same period calculated from station data.

ALTERNATIVE DRYLAND CROPS

by
Charles Norwood

SUMMARY

Dryland soybean and and sunflower were compared in the wheat-soybean-fallow and wheat-sunflower-fallow rotations. Soybean produced adequate yields but may not produce enough effective residue for conservation compliance. Sunflower yielded well and may produce enough residue with careful management. Dryland sunflower probably can be grown on a field basis, whereas dryland soybean is probably suited to special situations such the corners of sprinkler-irrigated fields. Reduced or no tillage generally improved the yield of both crops.

INTRODUCTION

Dryland soybean is seldom grown in southwest Kansas because of lack of drought tolerance. More acres of dryland sunflower are grown, but acreage is far below that of dryland grain sorghum and particularly dryland wheat. Neither crop produces as much residue as grain sorghum or wheat, and the residue decomposes faster. Reduced and no-tillage may allow these crops to be grown, but suitable herbicides are limited.

PROCEDURES

Dryland soybean and sunflower were grown in the wheat-soybean-fallow and wheat-sunflower-fallow cropping systems, respectively, from 1992 through 1996. Conventional-, reduced-, and no-till treatments were compared. Conventional tillage consisted of use of the sweep plow as necessary for weed control during fallow. Weed control in reduced tillage consisted of postemergence herbicides applied as needed between wheat harvest and winter freeze-up followed by sweep tillage in the spring prior to planting. No-tillage consisted of the use of postemergence herbicides for weed control during the entire fallow period. Postemergence herbicides were used because there are very few satisfactory labeled residual herbicides that do not require incorporation. Cargill SF100 sunflower and Olde 3431 soybean were planted in late May to early June at rates of 18000 plants/acre and 60 lbs/acre, respectively.

RESULTS AND DISCUSSION

Yields are presented in Table 1. Climatic conditions during the 1992-1996 growing seasons were much more favorable than normal, and except for 1994, resulted in soybean yields higher than can usually be expected. Well distributed, above-average rainfall in 1996 resulted in yields exceeding 40 bu/acre. At the yield levels in this study, and considering price, soybean was probably competitive with grain sorghum. However, soybean does not produce enough residue to prevent erosion, and even with the straw remaining from the previous wheat crop, may not meet conservation compliance requirements. However, dryland soybean could be used in special situations such as the corners remaining in center-pivot irrigated beans. Sunflower produced good yields, and with proper management of the stalks during fallow, can meet conservation compliance requirements in most years, particularly with reduced- or no-till.

Table 1. Yield of dryland soybean and sunflower in a wheat-row crop-fallow rotation.

Crop	1992	1993	1994	1995	1996	Avg
			- bu/acre -			
Soybean						
CT[1]	36a[2]	27a	14b	18b	43a	28
RT	29b	30a	17b	24a	43a	29
NT	38a	27a	21a	24a	46a	31
			- lb/acre -			
Sunflower						
CT	1575	3156	1812	1944	1545	2006b
RT	1697	3102	1921	2098	1686	2101b
NT	1872	3300	2503	2208	1890	2354a

[1]CT = Conventional tillage, RT = reduced tillage. NT = no tillage.
[2]Within a crop, means in a column followed by a different letter differ at the 0.10 probability level.

No-till often improved the yield of both crops. However, no-till is probably not practical for either crop, because of the absence of suitable labeled herbicides. The use of reduced-, rather than no-tillage, may make dryland soybean and sunflower practical. More research is needed.

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SAFFLOWER, AN ALTERNATIVE DRYLAND CROP FOR WESTERN KANSAS

by
Curtis Thompson, Alan Schlegel, and Neil Riveland[1]

SUMMARY

Safflower, a deep-rooted, annual, broadleaf crop, may have similar yield potential to sunflowers. Over a 3-year period, yields ranged from 550 to 2150 lbs/acre. In a poor year, yields ranged from 550 to 1010 lbs/acre, whereas in a good year yields ranged from 1640 to 2150 lbs/acre. Safflower can be planted and harvested with conventional wheat equipment. At this time, our nearest market is in Colorado. Grown for its edible oil-bearing seed and/or the birdseed market, safflower is an alternative crop that appears to be adapted to western Kansas.

INTRODUCTION

Safflower is an annual broadleaf crop that may be grown as an alternative crop in western Kansas. Safflower is grown for it seed, which is crushed for edible oil or used whole in the bird seed industry. This deep-rooted crop appears to have similar yield potential to sunflower but has better drought tolerance, is bird resistant, and has fewer problems with insects. Safflower can have significant disease problems, especially when grown in areas with high precipitation and humidity; thus, its adaptability would likely decrease in central or eastern Kansas. For these reasons, Tribune was selected as a site to evaluate safflower as a potential crop in western Kansas.

PROCEDURES

Safflower varieties were planted on March 3, 1994; March 28, 1995; and April 16, 1996. Treflan at 1.5 pints/acre was applied and incorporated prior to planting safflower in 1994 and '95. No preemergence herbicide was used in 1996. Safflower was planted with a hoe-drill in 10-inch rows approximately 1 inch deep. Poor emergence can result from planting safflower too deep. Safflower were planted at 350,000 pure live seed (PLS) in 1994, and 200,000 to 250,000 PLS in 1995 and '96. The recommended seeding rate for safflower is 15 to 25 pounds per acre, which is similar to the 1995 and '96 planting rates. All safflower experiments were planted on fallow in a wheat fallow system. Plot size was 5 by 35 or 40 feet. Safflower was harvested on August 12, 28, and 29 in 1994, '95, and '96, respectively.

RESULTS AND DISCUSSION

Twenty six to 33 lb seeding rates were used with the early March planting in 1994 (Table 1). Safflower had good tolerance to cold temperatures early; however, the early planting didn't appear to enhance safflower yield. Plant densities were too thick and little branching occurred. More normal seeding rates were used in 1995 and '96 with the late March and April seedings (Table 1).

Safflower planted in early March began flowering during the third week of June approximately 16 weeks after planting (Table 1). Safflower planted in mid April began flowering in early July approximately 11+ weeks after planting. Safflower is typically a 120-day crop; however, very early planting dates will extend the growing period.

Safflower yields during the 3-year period ranged from 550 to 2149 lb/acre (Table 2). The variety Girard had a very poor year in 1994 and was dropped from testing. Centennial, Montola, S208, and S541 have been the best yielding varieties in the trial over the 3-year period. Safflower yields were similar to yields of sunflower in the area; however, the early planted safflower in 1994 may have been lower yielding than sunflowers. This study was not designed to make an actual yield comparison with sunflowers.

[1]Research agronomist at the North Dakota State University, Williston Research Center near Williston, North Dakota.

Safflower plant height ranged from 25 to 35 inches (Table 3). Height was affected by variety and appeared to vary among years; however, planting dates varied in each of the three years. Very early planting dates may lead to shorter plants. Test weights ranged from 37.3 to 45.2 lb/bu. Good safflower seed should weigh from 42 to 45 lb/bu.

Further testing should be conducted on safflower planting dates and also to evaluate a wheat-safflower-fallow rotation or perhaps a wheat-sorghum-safflower-fallow rotation. Safflower should not be used in rotation with sunflower.

Table 1. Safflower planting rates and flowering dates for 1994 - 1996, Tribune, KS.

	Planting Rate				Flowering Date	
Variety	1994	1995	1996		1994	1996
		- lb/acre -			June	July
Centennial	26	21	18		21.5	7.8
Finch	31	22	21		22.0	4.5
Girard	30	---	---		22.8	---
Montola	30	18	16		22.0	4.0
Morlin	---	19	18		----	8.0
S-208	33	19	21		22.5	6.3
S-541	29	21	20		22.0	6.3
Pure live seed/acre (PLS)						
	350,000	250,000	200,000	LSD (0.05)	0.9	1.0

PLS accounts for germination and variation in seed size.

Table 2. Safflower seed yield during 1994 - 1996, Tribune, KS.

	Seed Yield at 8% Moisture			
Variety	1994	1995	1996	Average
		- lb/acre -		
Centennial	840	1005	2063	1303
Finch	859	786	1678	1108
Girard	552	----	----	----
Montola	1011	1196	2146	1451
Morlin	----	960	1640	----
S-208	937	1048	2149	1378
S-541	917	1195	2117	1410
LSD (0.05)	158	132	195	

Table 3. Safflower agronomic data, Tribune, KS, 1994 - 1996.

	Plant Height			Test Weight		
Variety	1994	1995	1996	1994	1995	1996
	- inches -			- lb/bu -		
Centennial	27	33	32	39.2	41.3	37.3
Finch	28	32	27	43.5	45.2	40.7
Girard	27	---	---	39.5	---	---
Montola	25	27	26	41.3	42.1	39.8
Morlin	---	30	26	---	41.6	38.0
S-208	27	32	31	40.8	42.0	37.8
S-541	28	35	30	40.7	42.3	38.3
LSD (0.05)	3	2	2	1.1	0.5	1.7

A COMPARISON OF THE WHEAT-SORGHUM-FALLOW AND WHEAT-CORN-FALLOW CROPPING SYSTEMS

by
Charles Norwood

SUMMARY

The dryland wheat-sorghum-fallow (WSF) and wheat-corn-fallow (WCF) systems were compared from 1992 through 1995. The WCF system produced more grain and profit than WSF because corn yielded more than grain sorghum. Wheat yields were not increased by a reduction in tillage, and corn responded to reduced or no-till more often than sorghum. The most profitable system was a conventional-till wheat, no-till corn system. Dryland corn produced high yields because of favorable climatic conditions. Research with WCF will continue to determine yields under more typical climatic conditions.

INTRODUCTION

The WSF cropping system is superior to wheat-fallow (WF) in terms of yield and profitability. In the northwest Kansas, southwest Nebraska, northeast Colorado region, corn often is substituted for sorghum in a WCF rotation. Dryland corn is perceived to lack sufficient drought and heat tolerance for southwest Kansas. However, interest in dryland corn is increasing, and the wheat-corn-fallow system may be feasible using modern corn hybrids and production practices. Therefore, a study was conducted to compare the yield and profitability of the WSF and WCF cropping systems.

PROCEDURES

The WSF and WCF cropping systems were compared from 1992 through 1995. Conventional - (CT), reduced- (RT), and no-till (NT) treatments were compared. The CT, RT, and NT treatments were applied to both crops in the rotation. Because wheat usually has not responded to a reduction in tillage, a conventional-till wheat, no-till corn or sorghum treatment (CNT) was included to reduce herbicide expense and increase profitability. Herbicide and tillage operations used by farmers for these cropping systems will vary depending on factors such as rainfall and weed pressure. The treatments used in this particular study are listed below.

<u>WHEAT-SORGHUM OR CORN-FALLOW (PRIOR TO WHEAT)</u>

CT and CNT - Four tillage operations.

RT - 2.4 lb/acre cyanazine in the spring followed by two tillage operations.

NT -2.4 lb/acre cyanazine in the spring followed by two applications of 0.5 lb/acre glyphosate + 1.0 lb/acre 2,4-D.

<u>WHEAT-CORN-FALLOW (PRIOR TO CORN)</u>

CT - Two tillage operations after wheat harvest followed by one preplant tillage operation and a preplant application of 1.0 lb/acre atrazine + 1.5 lb/acre metolachlor.

RT - 2.0 lbs/acre atrazine + 0.75 lb/acre glyphosate + 1.0 lb/acre 2,4-D after wheat harvest followed by one preplant tillage operation and a preplant application of 1.0 lb/acre atrazine +1.5 lb/acre metolachlor.

NT and CNT - 2.0 lbs/acre atrazine + 0.75 lb/acre glyphosate + 1.0 lb/acre 2,4-D after wheat harvest followed by 1.0 lb/acre atrazine + 1.5 lb/acre metolachlor about 14 days prior to planting.

<u>WHEAT-SORGHUM-FALLOW (PRIOR TO SORGHUM)</u>

CT - Two tillage operations after wheat harvest followed by two tillage operations before planting and a preplant application of 1.0 lb/acre atrazine + 1.5 lb/acre metolachlor.

RT- 2.0 lbs/acre atrazine + 0.75 lb/acre glyphosate + 1.0 lb/acre 2,4-D after wheat harvest followed by one preplant tillage operation and a preplant application of 0.5 lb/acre atrazine + 1.5 lb/acre metolachlor.

NT and CNT - 2.0 lbs/acre atrazine + 0.75 lb/acre glyphosate + 1.0 lb/acre 2,4-D after wheat harvest followed by 1.6 lb/acre cyanazine about 30 days prior to planting.

Thus for WSF and WCF, prior to wheat, one herbicide application in RT replaced two tillage operations, or one-half the tillage. Three herbicide applications in NT replaced all tillage. For WSF and WCF, prior to corn or sorghum, one herbicide application in RT replaced two tillage operations, or the tillage that otherwise would occur in the summer and fall following wheat harvest. Two herbicide applications in NT replaced all tillage.

Tillage was performed with a sweep plow. The wheat and row crops were fertilized with 40 and 80 lb N/acre, respectively. The N source was anhydrous ammonia for all treatments except NT which received UAN. Planting dates for corn were between May 13 and 17, whereas sorghum planting dates varied between May 20 and June 12. Wheat was planted between September 13 and September 21. Seeding rate for wheat was 60 lbs/acre, whereas the sorghum plant population was about 25,000 plants /acre. The target plant population for corn was 18,000 plants/acre, but varied from about 12,700 in 1992 to 16,700 in 1995. The reduction in emergence was due to either dry surface soil at planting or crusting after rainfall. 'Warner 744BR' grain sorghum, 'ICI 8714' (105 day maturity) corn, and 'TAM 107' winter wheat were planted each year.

An enterprise budget was developed for each cropping system following the guidelines in a Kansas State University Farm Management Guide (MF-904, 1996). The variable costs for labor, fuel, and repairs and the fixed machinery costs were based on individual machinery sets for each system. Assumptions were based on a 2,000 acre farm, all of which is owned.

RESULTS AND DISCUSSION

Yields. Wheat yields were highest in 1994 because of above-average growing-season rainfall but were reduced in 1995 because of a late-spring freeze (Table 1). Wheat yields were not affected by cropping system or tillage in any year. The lack of a wheat yield response to a reduction in tillage is not inconsistent with other studies at Garden City. In western Kansas, spring rains tend to even out soil water differences at planting, eliminating potential yield differences in wheat.

Corn usually yielded more than grain sorghum (Table 2). In 1993, CT sorghum yielded more than CT corn, but the use of reduced or no tillage resulted in corn yields equaling or exceeding sorghum yields. In 1994, CT corn yields were not statistically different from CT sorghum yields, but RT and NT corn yields were higher than the respective sorghum yields. In 1992 and 1995, corn yielded more than sorghum regardless of tillage treatment. This occurred because corn has a higher yield potential, and favorable climatic conditions during the study period allowed that yield potential to be expressed. The highest corn yields of the 4-yr period occurred in 1992, because of above-average, well-distributed rainfall and cooler than normal temperatures. Little difference occurred in corn yield during the remaining years. Sorghum yields were reduced in 1995 by an early freeze; thus, yields of both sorghum and wheat were reduced by freezes in 1995, an unusual occurrence.

Sorghum yields were not affected consistently by a reduction in tillage. Yields were increased by RT and NT only in 1994. Unlike wheat, sorghum usually responds to a reduction in tillage. This response usually is caused by additional soil water at planting. The no-till sorghum plots had additional soil water at planting only in 1994 and 1995; any potential yield response was negated by the freeze in 1995. Corn yields were increased by both reduced and no tillage in 3 of 4 years. No-tillage did not increase yields above those of reduced tillage, and no-till corn yields were not affected by the tillage system used prior to the previous wheat crop (CT or NT). Corn responded to the reduction in tillage more often than did sorghum because of additional soil water at planting and the higher water-use-efficiency of corn.

Budgets. Combined costs for wheat and sorghum or corn are presented in Table 3. These costs would be incurred over a 3-year period or more likely in one and one-half years, if the acreage is divided into thirds so that both wheat and corn or sorghum are produced each year. Total costs increased as tillage was reduced. However, a significant amount of this cost increase was negated by use of the CNT system. Compared to CT in the WSF system, NT was $32.43 more expensive, but CT wheat and NT sorghum (CNT) cost only $17.07 more than an all-CT system. For the same comparisons in WCF, the figures were $42.66 and $29.84. Thus, savings of $15.36 and $12.82 for the 2 acres were obtained for WSF and WCF, respectively, by using CNT rather than an all-NT system. These cost reductions were due mainly to lower herbicide and fertilizer costs for the CT wheat in the CNT system. Whereas variable costs were lower for the CNT system compared to the all-NT system, fixed costs were higher because machinery was retained. A close inspection of Table 3 reveals that machinery costs (depreciation, interest, and insurance) were $17.94 higher for CNT compared to the all NT system. This was because tillage equipment was needed for the CT wheat phase of the rotation.

Table 1. Yield of wheat as affected by cropping system and tillage, Garden City, KS.

	1992		1993		1994		1995		Average	
Tillage	WCF[1]	WSF	WCF	WSF	WCF	WSF	WC	WSF	WCF	WSF
CT	48	48	40	43	54	60	17	19	40	42
RT	46	48	45	41	51	53	17	21	40	41
NT	42	42	42	39	55	58	17	19	39	40
CNT	47	48	45	43	55	60	17	20	41	43
Avg	45	47	43	41	54	58	17	20	40	41

LSD (0.05) Cropping system, ns; tillage, ns; cropping sys x tillage, ns.

[1]WCF = Wheat-corn-fallow; WSF = wheat-sorghum-fallow; CT = all conventional tillage, RT = all reduced tillage, NT = all no tillage, CNT = conventional-till wheat, no-till sorghum.

Table 2. Yield of corn and sorghum as affected by tillage, Garden City, KS.

		Tillage System			
Year	Crop	CT[§]	RT	NT	CNT
		bu/acre			
1992	Corn	126a[†]	113b	119ab	128a
	Sorghum	99a	87b	101a	100a
	Difference	27*	26*	18*	26*
1993	Corn	78b	95a	93a	100a
	Sorghum	95a	91a	91a	90a
	Difference	17*	4ns	2ns	10†
1994	Corn	78b	101a	104a	107a
	Sorghum	68c	79ab	87a	74bc
	Difference	10ns	22*	17*	33*
1995	Corn	84b	102a	99a	99a
	Sorghum	49a	51a	51a	42a
	Difference	35*	51*	48*	57*
Avg	Corn	92b	103a	104a	109a
	Sorghum	78a	77a	82a	77a
	Difference	14*	26*	22*	32*

*,†indicate difference is significant at the 0.05 and 0.10 levels of probability, respectively; ns = not significant.
‡Means within a row followed by a different letter differ at the 0.05 probability level.
§CT = All conventional tillage, RT = all reduced tillage, NT = all no tillage; CNT = conventional-till wheat, no-till corn or sorghum.

However, the increase in fixed machinery costs was offset partially by lower variable costs (labor, fuel, repairs) of $8.00 in WSF and $5.64 in WCF, because the machinery was used less than it was in the all-CT system. Further comparisons indicate that WCF was $24.42, $30.65, $34.65, and $37.19 more expensive than WSF for the CT, RT, NT, and CNT treatments, respectively, because of increased seed and herbicide costs.

Returns. Because it takes 3 years to complete one cycle of WSF or WCF, the sums of the wheat and row crop returns were divided by three and expressed as $/acre/year in Table 4. Differences in return between the WCF and WSF systems were influenced mainly by the returns of corn and sorghum, because wheat yields and returns were not affected by cropping system. The WCF system returned significantly more than WSF in 12 of the 16 year x tillage comparisons because of higher yield and return from corn. More income was produced by WSF in only one year x tillage combination, that being CT in 1993. On average, the WCF system produced $7.80, $17.10, $13.55, and $19.87 more income than WSF for the CT, RT, NT, and CNT treatments, respectively. Returns in 1995 were negative from WSF and near zero from WCF, because the freeze reduced wheat and sorghum yields.

No-till returns in WCF did not differ from CT returns in 1993, 1994, and 1995, but were less than CT in 1992. Thus, the response of corn to NT usually compensated for the lack of response of wheat to NT (and the corresponding lower returns of NT wheat) and resulted in no statistical differences between CT and NT returns of WCF in 3 of 4 years. Reduced-tillage returns were never greater than CT returns and were less than CT returns in 1992. Reduced-tillage returns were higher than NT returns in 1995. The CNT treatment in WCF had statistically higher returns than NT in 1992 and 1993, RT in 1992, and CT in 1993 and 1994. The CNT treatment never had statistically lower returns than any other treatment. Thus, CNT was among the best treatments in all years and returned more than all other WCF treatments averaged over 4-yr.

Returns from the CNT system in WSF were never higher than CT and were lower than CT in 1995. The most profitable treatments in WSF were CT and CNT in 1992 and 1993 and CT and RT in 1995. Tillage had no effect on WSF returns in 1994.

Considering income for the 4 years, CNT in WCF produced $24.68, $27.48, and $42.40/acre more than CT, RT, and NT, respectively. The CNT system in WSF produced $16.44/acre more than RT and $17.12/acre more than NT, but $23.60/acre less than CT. Thus, the CNT system was more profitable in WCF than in WSF. In contrast to previous studies, the CT system produced the most income in WSF because of the lack of response of sorghum to NT during this particular period of time.

Table 3. Costs of production for the wheat-sorghum fallow and wheat-corn-fallow cropping systems, Garden City, KS.

	WSF†				WCF			
Variable Costs‡	CT	RT	NT	CNT	CT	RT	NT	CNT
	- $ -							
Labor	7.19	4.96	4.23	5.43	6.58	4.96	4.23	5.43
Seed	6.59	6.59	6.59	6.59	24.61	24.61	24.61	24.61
Herbicide	15.92	47.32	61.01	29.10	15.92	48.92	67.26	35.35
Fertilizer	16.80	16.80	32.40	27.20	16.80	16.80	32.40	27.20
Insecticide	6.71	6.71	6.71	6.71	10.10	10.10	10.10	10.10
Fuel, oil	8.21	4.16	2.14	5.06	7.31	4.16	2.14	5.06
Repairs	11.05	7.40	6.02	7.96	10.20	7.40	6.02	7.96
Custom harvest	46.40	46.10	47.18	46.43	50.83	52.59	52.78	54.58
Interest	3.63	4.69	5.96	4.41	4.58	5.84	7.34	5.79
Total variable costs	122.50	144.73	172.19	138.89	146.92	175.38	206.84	176.08
Fixed Costs‡								
Real estate taxes	7.36	7.36	7.36	7.36	7.36	7.36	7.36	7.36
Land interest	88.20	88.20	88.20	88.20	88.20	88.20	88.20	88.20
Machinery depreciation	27.82	28.72	16.50	28.28	27.82	28.72	16.50	28.28
Machinery interest	13.92	14.36	8.26	14.14	13.92	14.36	8.26	14.14
Machinery insurance	0.70	0.72	0.42	0.70	0.70	0.72	0.42	0.70
Total fixed costs	138.00	139.36	120.74	138.68	138.00	139.36	120.74	138.68
Total costs	260.50	284.09	292.93	277.57	284.92	314.74	327.58	314.76

†WSF = Wheat-sorghum-fallow, WCF = wheat-corn-fallow, CT = all conventional tillage, RT = all reduced tillage, NT, all no tillage, CNT = conventional-till wheat, no-till sorghum.
‡Costs to produce 1 acre of wheat and 1 acre of corn or sorghum.

TRANSITION FROM IRRIGATED TO DRYLAND CROPPING SYSTEMS[1]

by
Charles Norwood

SUMMARY

Corn yields from one, two, and three irrigations were 121%,129%,and 148% more, respectively, than dryland yields. Gross income averaged $315/acre when all acres were dryland. When all acres were irrigated once, gross income (less the cost of the irrigation water) was $372/acre. When one-half the acres were dryland and one-half were irrigated twice, gross income was $351/acre. When two-thirds of the acres were dryland and one-third was irrigated three times, gross income was $356/acre. Thus, during the time period of this study, irrigating all acres one time was the most profitable practice.

INTRODUCTION

Many producers are limiting irrigation because of the decline of the Ogallala aquifer and increasing energy costs. A reduction in irrigated area is expected to result in an increase in dryland cropping systems such as wheat-fallow and wheat-sorghum-fallow. Dryland crops produce only one-third to one-half the yield of irrigated crops. To slow the transition from irrigated to dryland acres, cropping systems that efficiently use both precipitation and irrigation water need to be developed. Continued irrigation, even if very limited, will allow the use of expensive irrigation systems already in place and, more importantly, will stabilize grain production in areas that otherwise would be returned to dryland. Therefore, a study was designed with the objective of determining whether it is more profitable to irrigate a large acreage fewer times or a smaller acreage more times.

PROCEDURES

Dryland corn was compared with corn irrigated one, two, or three times. Each irrigation consisted of 4 inches of water. When corn was irrigated once, the irrigation was at tassel; when irrigated twice, at tassel and grain fill; and when irrigated three times, at vegetative, tassel, and grain fill. The cropping system used for all treatments was the wheat-corn-fallow system, which has 10- to 11-month fallow periods prior to each crop. The fallow period was used to store water and made pre-irrigation unnecessary. Conventional tillage (CT) and no-tillage (NT) treatments were compared. Herbicides in the NT plots consisted of 2 lb/acre atrazine applied after wheat harvest followed by 1 lb/acre atrazine plus either 1.6 lb/acre Bladex or 2 lb/acre Dual applied as a tank mix shortly before planting. The CT plots received the same preplant herbicides, but sweep tillage was used for weed control during fallow instead of atrazine.

RESULTS AND DISCUSSION

Corn yield increased with irrigation, as expected (Table 1). However responses to the different irrigations were not linear. Average responses to one, two, and three irrigations were 12, 8, and 20 bu/acre, respectively. Response to two irrigations was less, and response to three irrigations was more than expected. Corn responded to NT in 2 of 3 years, and average yield increased 14 bu/acre.

The figures in Table 2 are gross income less the cost of irrigation water at $2.25/inch. These results should be considered preliminary, because climatic conditions during the study period were more favorable than usually can be expected. However, based on 3 years of results, the most income occurred when all acres were irrigated one time, whereas irrigating a reduced acreage more times produced less income. This particular experiment was flood irrigated; however, the results also can be applied to sprinkler irrigation. What the results do not illustrate is the importance of timeliness. A farmer with a low capacity well may not be able to flood irrigate all acres in a timely manner, i.e., when the crop is in the proper growth stage, whereas a farmer with a sprinkler can probably irrigate his acres faster. With limited water, the most important irrigation is the one at pollination; therefore, the amount of irrigated acres should be adjusted so that the corn is irrigated prior to pollination. Any additional irrigations, up to the maximum economic return, should be considered a bonus.

[1]This research is being funded by Kansas Corn Commission check-off funds.

Table 1. Effect of number of irrigations and tillage on corn yield, 1994-1996, Garden City, KS.

Number of	1994			1995			1996			Average		
Irrigations[1]	CT	NT	Avg	CT	NT	Avg	CT	NT	Avg	CT	NT	Avg
						- bu/acre -						
0	104	120	112c	78	103	90c	108	118	113b	96	113	105c
1	141	150	146b	97	122	109b	120	130	125ab	119	134	127b
2	157	166	161ab	107	120	114b	124	137	130ab	129	141	135b
3	178	170	174a	140	165	153a	128	149	138a	149	161	155a
Avg	145a[2]	152a		105b	127a		120b	133a		123b	137a	

[1]Each irrigation consisted 4 inches of water.
[2]Means in a column or row within a year followed by a different letter differ at the 0.05 probability level.

Table 2. Gross income from combinations of irrigated and dryland corn, 1994-1996, Garden City, KS.

System	1994	1995	1996	Avg.
		- $/acre[1] -		
100% dryland	336	270	339	315
100% irrigated once[2]	429	318	366	372
50% dryland, 50% irrigated twice	400	297	355	351
67% dryland, 33% irrigated three times	389	324	355	356

[1]Gross income minus irrigation water at $2.25/inch.
[2]Irrigated one, two, or three times means that 4, 8, or 12 inches of irrigation water, respectively, were applied.

Southwest Research-Extension Center

TILLAGE AND NITROGEN EFFECTS ON DRYLAND CROP PRODUCTION

by
Alan Schlegel, David Frickel, and Curtis Thompson

SUMMARY

Tillage system had no effect on wheat yields in any year from 1993-96. Grain sorghum yields in 2 of 4 years were greater with reduced- than no-till, primarily because of increased grassy weed problems in no-till. Production costs were less with reduced- than no-tillage. Grain yields were increased 64 to 90% by N fertilization. Fertilizer N requirements were greater than 50 lb N/acre for both crops. Fertilization of the previous crop increased yield of the subsequent crop up to 33%. Nitrogen applications tended to increase fallow efficiency. Available soil water at planting was not affected by N rate or tillage.

INTRODUCTION

The principal dryland crop in the central Great Plains is winter wheat grown in a wheat-fallow system. However, producers are changing to more intensive cropping systems, such as wheat-sorghum-fallow, because of the potential for increased profitability. To be feasible, reduced- or no-tillage practices must be used in these intensive cropping systems to better utilize limited precipitation and maintain crop productivity. Nitrogen fertilizer is applied routinely to dryland crops in this region to optimize grain yields. This study was conducted to 1.) quantify wheat and grain sorghum responses to N fertilization in a wheat-sorghum-fallow rotation under reduced- and no-tillage systems, 2.) determine the residual effect of N fertilization on subsequent crops, and 3.) determine the effect of tillage practices on N response.

PROCEDURE

This research was initiated in 1991 in west-central Kansas at the Southwest Research-Extension Center near Tribune, KS. The study was located on a Richfield silt loam soil with a pH of 7.5 and organic matter of 1.5%. The experimental design was a split plot with tillage as main plots and N treatments as subplots. The two tillage systems were reduced (RT) and no tillage (NT). The RT system utilized a combination of herbicides and tillage for weed control during fallow, whereas NT relied solely on herbicides. A generalized weed control program for each system is outlined in Table 1. A blade plow (sweep) was used for all tillage operations, which is typical for this region. Weed control costs were about 20% greater with no-till than reduced tillage. The N treatments were 25, 50, and 100 lb N/acre applied to either wheat or grain sorghum and 25 and 50 lb N/acre applied to both crops along with an untreated control. Nitrogen fertilizer as urea was surface broadcast in the early spring on growing wheat and near planting time of grain sorghum. Phosphorus fertilizer (100 lb P_2O_5/acre) was applied at wheat planting to maintain adequate soil P levels. Plot size was 20 by 60 ft. The center of each plot was machine harvested, and grain yields were adjusted to 12.5% moisture.

Grain yields reported are averaged across 1993-96. Soil water to a depth of 8 ft was measured at planting and harvest in three N treatments (25 and 50 lb N/acre applied to both crops and the control) in both tillage systems. Along with precipitation records, this allowed calculation of crop water use, soil water accumulation during fallow, and fallow efficiency. Precipitation during the study period was 20% greater than the normal of 16 inch/yr. Residual soil N content at the start of the study was less than 10 ppm N (nitrate plus ammonia in a 2-ft profile).

RESULTS AND DISCUSSION

Nitrogen fertilization increased wheat yields up to 90% or 26 bu/acre (Table 2). Application of 50 lb N/acre was not sufficient to maximize yields, because wheat yields were 9 bu/acre greater with 100 than with 50 lb N/acre. Nitrogen applied to the previous

Table 1. Weed control program and costs, Tribune, KS.

Item	RT-W	RT-S	NT-W	NT-S
Herbicides				
Atrazine @$3.25/lb	0	2.0	0	2.0
Landmaster @$0.133/oz.	40	80	160	120
Ally/2,4-D/Banvel @$5/acre	1	0	1	0
Dual @$17.50/qt.	0	1	0	1
Applications @ $3.15 each	2	3	5	4
Herbicide, $/planted acre	$16.62	$44.09	$42.00	$52.56
Tillage				
Sweep plow @ $4.27/acre	3	1	0	0
Tillage, $/planted acre	$12.81	$4.27	$0.00	$0.00

sorghum crop had a positive residual effect on subsequent wheat yield. For example, when sorghum received 100 lb N/acre, wheat yields were 10 bu/acre greater than those of the control. Tillage had no effect on wheat yield, and no N x tillage interaction occurred.

Grain sorghum yields were increased up to 64% or 23 bu/acre by 100 lb N/acre applied to sorghum (Table 3). Again, N requirements were greater than 50 lb N/acre because sorghum yields were 6 bu/acre greater with 100 than with 50 lb N/acre. The residual effect of fertilizer N applied to wheat increased sorghum yields up to 12 bu/acre. Averaged across the 4 years, tillage had little effect on grain yield, and no N x tillage interaction occurred. However, in 2 years the effect of tillage was significant. In 1993 and 1996, sorghum yields were greater with reduced tillage than with no-tillage. Grassy weeds (especially witchgrass and sand dropseed) caused severe problems in 1996, particularly in no-till, which greatly reduced grain yield. In general, weed control costs were greater with no-till than reduced tillage (Table 1).

Nitrogen applications tended to increase crop water use, decrease soil water at harvest, and increase fallow efficiency (Tables 4 and 5). This corresponds to increased residue production in the fertilized treatments (data not shown). Tillage had little effect on residue production and generally little effect on soil water storage or use. However, for both crops, more soil water was available deeper in the profile with no-till than with reduced tillage (data not shown).

Table 2. Wheat grain yield response to N fertilizer and tillage in a wheat-sorghum-fallow rotation, Tribune, KS 1993-96.

N Rate			Wheat Yield				
Wheat	Sorghum	Tillage	1993	1994	1995	1996	Avg.
- lb/acre -					- bu/acre -		
0	0	Red.	43	19	25	30	29
		No	44	21	24	27	29
0	25	Red.	45	22	27	29	31
		No	38	18	30	20	26
0	50	Red.	47	20	25	28	30
		No	46	18	28	32	31
0	100	Red.	51	30	34	37	38
		No	55	30	36	37	39
25	0	Red.	44	30	35	33	36
		No	45	27	32	30	33
25	25	Red.	51	31	37	32	37
		No	62	30	33	41	41
50	0	Red.	57	42	44	41	46
		No	57	41	42	44	46
50	50	Red.	59	43	46	38	47
		No	60	46	50	45	50
100	0	Red.	66	49	56	50	55
		No	66	47	54	51	55
N Rate Means							
0	0		44	20	25	28	29
0	25		42	20	29	24	29
0	50		46	19	27	30	30
0	100		53	30	35	37	39
25	0		45	28	33	32	34
25	25		56	30	35	36	39
50	0		57	41	43	43	46
50	50		60	45	48	41	48
100	0		66	48	55	51	55
LSD 0.05			11	5	5	9	4
Tillage Means							
Reduced			52	32	36	35	39
No till			53	31	37	36	39
LSD 0.05			12	5	3	5	5
ANOVA							
N			0.001	0.001	0.001	0.001	0.001
Tillage			0.794	0.617	0.923	0.627	0.876
N x Till			0.929	0.938	0.728	0.641	0.675

Table 3. Grain sorghum yield response to N fertilizer and tillage in a wheat-sorghum-fallow rotation, Tribune, KS, 1993-96.

N Rate			Grain Sorghum				
Wheat	Sorghum	Tillage	1993	1994	1995	1996	Avg.
- lb/acre -			- bu/acre -				
0	0	Red.	40	56	25	31	38
		No	35	59	22	17	33
0	25	Red.	51	78	30	43	50
		No	39	65	33	17	38
0	50	Red.	55	82	51	48	59
		No	42	82	42	24	48
0	100	Red.	65	81	49	54	62
		No	51	96	54	26	57
25	0	Red.	45	54	20	28	37
		No	38	58	25	20	36
25	25	Red.	51	78	29	40	49
		No	42	77	32	22	43
50	0	Red.	53	62	24	32	43
		No	47	56	27	21	38
50	50	Red.	69	71	35	53	57
		No	57	74	47	35	53
100	0	Red.	74	66	21	45	51
		No	58	66	26	29	45
N Rate Means							
0	0		37	57	24	24	36
0	25		45	71	32	30	44
0	50		49	82	47	36	53
0	100		58	88	51	40	59
25	0		42	56	23	24	36
25	25		46	77	31	31	46
50	0		50	59	26	27	40
50	50		63	72	41	44	55
100	0		66	66	24	37	48
LSD 0.05			6	10	8	8	4
Tillage Means							
Reduced			56	70	32	42	50
No till			46	70	34	23	43
LSD 0.05			7	13	13	7	8
ANOVA							
N			0.001	0.001	0.001	0.001	0.001
Tillage			0.021	0.932	0.572	0.004	0.081
N x Till			0.676	0.354	0.316	0.155	0.261

Table 4. Analysis of variance for selected variables, tillage and nitrogen study, Tribune, KS.

Crop and Treatment	Grain Yield	Crop Residue	Available Water at Planting	Fallow Efficiency	Crop Water Use
Wheat					
Tillage	0.876	0.548	0.157	0.297	0.073
N treatment	0.001	0.001	0.274	0.022	0.001
Till x N trt	0.675	0.694	0.237	0.967	0.110
Sorghum					
Tillage	0.459	0.416	0.493	0.719	0.477
N treatment	0.001	0.005	0.944	0.029	0.486
Till x N trt	0.253	0.068	0.599	0.460	0.435

Table 5. Main effect means, tillage and nitrogen study, Tribune, KS.

Crop and Treatment	Available Water		Fallow Efficiency	Crop Water Use
	Planting	Harvest		
	inch/8 ft profile		%	inch
WHEAT				
Tillage				
Reduced	10.0	6.3	16	20.3
No-till	11.1	5.8	23	21.7
LSD .05	1.5	1.7	14	1.6
N rate				
0 lb/acre	10.8	6.7	19	20.5
25	10.2	6.5	15	20.2
50	10.7	4.9	25	22.2
LSD .05	0.8	1.2	7	1.0
SORGHUM				
Tillage				
Reduced	10.7	5.1	34	15.3
No-till	11.2	6.1	34	14.8
LSD .05	1.5	0.9	4	1.5
N rate				
0 lb/acre	11.0	6.1	30	14.7
25	10.9	5.3	34	15.3
50	11.0	5.5	38	15.1
LSD .05	1.0	1.0	6	1.1

LONG-TERM FERTILIZATION OF IRRIGATED CORN

by
Alan Schlegel

SUMMARY

Long-term research shows that phosphorus (P) and nitrogen (N) fertilizers must be applied for optimum grain yields of irrigated corn in western Kansas. In this study, N and P fertilization increased corn yields more than 100 bu/acre. Application of 160 lb N/acre tended to be sufficient to maximize corn yields. Phosphorus increased corn yields by 75 bu/acre when applied with at least 120 lb N/acre. Application of 40 lb P_2O_5/acre was adequate and higher rates were not necessary.

INTRODUCTION

This study was initiated in 1961 to determine responses of continuous corn grown under flood irrigation to N, P, and potassium (K) fertilization. The study is conducted on a Ulysses silt loam soil with an inherently high K content. No yield benefit to K fertilization was observed in 30 years and soil K levels remained high, so the K treatment was discontinued in 1992. However, a yield increase from P fertilization has been observed since 1965, and we were concerned that the level of P fertilization might not be adequate. So, beginning in 1992, a higher P rate was added to the study and replaced the K treatment.

PROCEDURE

Initial fertilizer treatments in 1961 were N rates of 0, 40, 80, 120, 160, and 200 lb N/acre without P and K; with 40 lb P_2O_5/acre and zero K; and with 40 lb P_2O_5/acre and 40 lb K_2O/acre. In 1992, the treatments were changed with the K variable being replaced by a higher rate of P (80 lb P_2O_5/acre). All fertilizers were broadcast by hand in the spring prior to planting and incorporated. The corn hybrid was Pioneer 3379 (1992-94) and Pioneer 3225 (1995-96) planted at 32,000 seeds/acre in late April or early May. All plots were furrow irrigated to minimize water stress. The center two rows of all plots were machine harvested after physiological maturity. Grain yields were adjusted to 15.5% moisture.

RESULTS AND DISCUSSION

Nitrogen and P fertilization increased corn yields averaged across the 5-year period by over 100 bu/acre. In 1995, hail during the growing season reduced overall yields about 40%, but yields still were increased up to 80 bu/acre by N and P fertilization. The apparent N fertilizer requirement was about 160 lb/acre. Application of 40 lb P_2O_5/acre increased yields about 75 bu/acre when applied with at least 120 lb N/acre. A higher rate of P was not necessary, because no significant yield difference occurred for applications of 40 and 80 lb P_2O_5/acre.

Table 1. Effects of N and P fertilizers on irrigated corn. Tribune, KS, 1992-96.

		Grain Yield					
Nitrogen	P_2O_5	1992	1993	1994	1995	1996	Mean
- lb/acre -		- bu/acre -					
0	0	73	43	47	22	58	49
0	40	88	50	43	27	64	54
0	80	80	52	48	26	73	56
40	0	90	62	66	34	87	68
40	40	128	103	104	68	111	103
40	80	128	104	105	65	106	102
80	0	91	68	66	34	95	71
80	40	157	138	129	94	164	136
80	80	140	144	127	93	159	133
120	0	98	71	70	39	97	75
120	40	162	151	147	100	185	149
120	80	157	153	154	111	183	152
160	0	115	88	78	44	103	86
160	40	169	175	162	103	185	159
160	80	178	174	167	100	195	163
200	0	111	82	80	62	110	89
200	40	187	169	171	106	180	163
200	80	165	181	174	109	190	164
ANOVA							
Nitrogen		0.001	0.001	0.001	0.001	0.001	0.001
linear		0.001	0.001	0.001	0.001	0.001	0.001
quadratic		0.001	0.001	0.001	0.001	0.001	0.001
P2O5		0.001	0.001	0.001	0.001	0.001	0.001
linear		0.001	0.001	0.001	0.001	0.001	0.001
quadratic		0.001	0.001	0.001	0.001	0.001	0.001
N x P		0.013	0.001	0.001	0.001	0.001	0.001
Means							
Nitrogen	0 lb/acre	80	48	46	25	65	53
	40	116	90	92	56	102	91
	80	129	116	107	74	139	113
	120	139	125	124	83	155	125
	160	154	146	136	82	161	136
	200	154	144	142	92	160	138
	LSD .05	14	7	13	7	10	5
P_2O_5	0 lb/acre	96	69	68	39	92	73
	40	149	131	126	83	148	127
	80	141	135	129	84	151	128
	LSD .05	10	5	9	5	7	4

BEST MANAGEMENT PRACTICES FOR RETURNING CRP LAND TO CROP PRODUCTION

by
Alan Schlegel and Curtis Thompson

SUMMARY

The majority of the CRP acres in Kansas are in western Kansas. Most contracts under the initial CRP are about to expire. If these acres are not re-enrolled in the new CRP program, most of the land is expected to be returned to crop production. This study was initiated in 1995 to evaluate best management practices for returning CRP land to crop production. The CRP grasses (mixed species, warm-season grasses) were controlled better by tillage than herbicides, and good grass control is essential for optimum crop production. Removal of the old residue by burning may be beneficial. Soil water content is very low following destruction of the CRP grasses. Sufficient time should be allowed between destruction of the CRP grasses and planting of the first crop to allow accumulation of soil water. Residual soil inorganic N levels are extremely low in CRP land and supplemental N fertilization (possibly greater than normal amounts) will be required for optimal growth of the initial crop.

INTRODUCTION

In Kansas, 2.9 million acres were enrolled in the Conservation Reserve Program (CRP), which was the third greatest participation by any state. The majority (>50%) of the CRP acres in Kansas are in the western one-third of the state. Hamilton County had the highest CRP, enrollment of over 125,000 acres. Stanton, Morton, and Greeley counties each had over 80,000 acres. Most contracts under the initial CRP are about to expire. The new Farm Bill re-authorized the CRP, and some of the land currently enrolled in CRP will be enrolled again. However, some of the CRP land will not be eligible for re-enrollment, and some land will not be rebid. Over 90% of the CRP land in Kansas is planted to grass. Based on past experience with an earlier land retirement program, the “Soil Bank”, most acres planted to grass will return to crop production. The southwest and west-central Kansas crop reporting districts have almost 1.2 million acres enrolled in the CRP (over 40% of the Kansas total). The principal crop grown on land prior to enrollment in the CRP was winter wheat. With the expiration of CRP contracts, the opportunity exists to initiate alternative cropping systems that include crops other than winter wheat. These systems may be more productive and profitable than wheat-fallow systems and can reduce soil erosion and better sustain soil quality.

PROCEDURES

This study was initiated in the spring of 1995 in west-central Kansas near Tribune, KS. The study area was enrolled in the CRP and had an established stand of warm-season grasses. Primary species were sideoats grama, little bluestem, blue grama, buffalograss, and switchgrass, which are typical for the area. Soil type was a Richfield silt loam with less than 1% slope. The objectives of the project were to determine best management practices for returning CRP land to crop production. The variables evaluated were residue treatment (burn, mow, or leave standing); grass control method (tillage or chemical control); and initial crop selection. The site was divided into four areas for planting of grain sorghum in the springs of 1995 and 1996 and winter wheat in the falls of 1995 and 1996. The burn treatments were done on all four areas in late April 1995. The mow treatments were done in early May 1995 for the 1995 plantings and early July 1996 for the 1996 plantings. The area to be planted to wheat in fall 1996 was mowed again in late September 1995.

Treatments for 1995 grain sorghum were combinations of residue treatment (burn, mow, or leave standing) and grass control method (tillage or chemical). The tillage treatment consisted of two offset disk operations in mid-June. The chemical grass control treatment consisted of applications of glyphosate (1 qt/acre) plus ammonium sulfate and surfactant in early June and repeated in late June. Grain sorghum was planted in late June. Atrazine (0.75 lb/acre) and Dual (1 qt/acre) were applied to all treatments.

The area for 1995-96 winter wheat had identical residue treatment as described for 1995 sorghum. For the plots using tillage only for grass control, they were offset disked in mid-June, early July, and mid-August followed by a sweep plow operation in mid-September. For grass control using only herbicides (no-till), glyphosate (plus ammonium sulfate and surfactant) was applied in early June (1 qt/acre), late June (1 qt/acre), and late September (2 qt/acre). Other treatments consisted of a mixture of tillage and herbicides for grass control. Winter wheat was planted in late September.

In preparation for planting sorghum in 1996, residue was burned in late April 1995 and mowed in early July 1995. The tilled plots were offset disked in early July and mid-August 1995 followed by a sweep plow in mid-September 1995 and early-June 1996 immediately prior to sorghum planting. The no-till plots received glyphosate (2 qt/acre) in mid-July and again in late-September 1995 followed by glyphosate and 2,4-D (Landmaster BW at 40 oz/acre) in early June 1996 prior to sorghum planting. Reduced-till treatments combined one application of glyphosate (2 qt/acre) either in July or September 1995 with several tillage operations. The reduced-tillage treatment that received glyphosate in July was offset disked in August and sweep plowed in September 1995. The other reduced tillage treatment was offset disked in July 1995 and treated with glyphosate in September 1995. Both reduced-tillage treatments were tilled (sweep plow) prior to sorghum planting on June 11, 1996. Atrazine (0.75 lb/acre) was applied on June 19 to all treatments.

The no-till treatment for 1996-97 wheat received three applications of glyphosate (2 qt/acre) plus ammonium sulfate and surfactant (mid-July 1995, early July 1996, and late August 1996). The conventional-tillage treatment was offset disked twice (July and August 1995) and sweep plowed four times (September 1995, June, July, and September 1996). Reduced tillage treatments received one application of glyphosate (2 qt/acre) plus ammonium sulfate and surfactant either in July or September 1995. The reduced-tillage treatment that received glyphosate in July was offset disked in August 1995 and sweep plowed in September 1995. The other reduced-tillage treatment was offset disked in July 1995. Both reduced-tillage treatments were sweep plowed three times in 1996 (June, July, and September). Winter wheat was planted on September 13, 1996 with starter fertilizer (100 lb/acre of 11-52-0 applied with the seed). Stand establishment was adequate in all treatments. Fertilizer N was applied in December at rates of 50, 100, and 150 lb N/acre.

RESULTS AND DISCUSSION

Sorghum growth in 1995 was hampered severely by lack of soil moisture, and no crop was harvested. Chemical grass control was better following residue burning than other residue treatments but was not adequate with any no-till treatment. This area was planted to sorghum again in 1996. Grain yields were very low in all treatments (Table 1).

Table 1. Grain sorghum yields on CRP near Tribune, KS, 1996. Sorghum 1995 area was replanted to sorghum in 1996. Wheat 1996 failed and was planted to sorghum. (Cooperator Ross Kuttler.)

Treatment		Grain Sorghum Yield: 95 Sorghum Area	Failed Wheat Area	96 Sorghum
			- bu/acre -	
Mow	Till	10	31	26
Mow	Till-Chem		31	18
Mow	Chem-Till		12	14
Mow	Chem	7	5	8
Burn	Till	11	32	31
Burn	Till-Chem		29	22
Burn	Chem-Till		21	12
Burn	Chem	5	7	6
LS	Till	11	29	24
LS	Chem	8	6	5
	LSD.05	2	7	7

For 1995 sorghum, LSD calculated using only burn and mow treatments.
LS = residue was left standing.

For 1996 wheat, June 1995 applications of glyphosate were unsuccessful in controlling the warm-season grasses. The glyphosate treatment in September increased grass control to about 75% (primarily sideoats grama). Generally, all disk treatments provided acceptable control of the grasses. Soil inorganic N levels at wheat planting were very low. Soil nitrate was about 2 ppm in the surface foot and less than 1 ppm in the 2 through 6 ft depth. Initial stand establishment was much better in the tilled plots than in no-till. However, the wheat was killed by dry winter conditions and spring freezes. This area was planted to sorghum in June 1996. Sorghum yields ranged from 6 to 32 bu/acre and were greatest in the tilled treatments and least with no-till (Table 1). With reduced tillage, yields were greater when the initial operation was tillage rather than a chemical application. The residue treatment had little effect on sorghum yield.

For the 1996 grain sorghum area, yields were greatest in the conventional-tillage treatments and least in the no-till treatments (Table 1). Yields in the tilled treatments tended to be slightly greater when the residue had been burned rather than mowed or left standing. In general, grain yields were disappointingly low, possibly because of inadequate N availability. Evaluation of fertilizer N needs will be made in the 1997 wheat crop.

Grass control ratings were taken in early September 1996 prior to planting of winter wheat . The warm-season grasses were eliminated by conventional tillage and 90% controlled in no-till. With reduced tillage, grass control was 90% when the residue had been burned but only about 70% when the residue had been mowed. An evaluation in spring of 1997 will provide better information on long-term control.

Observations from this study are: 1.) the mixed species, warm-season grasses established on CRP land in western Kansas are difficult to control with herbicides alone; 2.) burning of the residue may be beneficial; 3.) crop establishment and growth will be difficult without good grass control; 4.) some tillage may be required to ensure adequate control of the CRP grasses; 5.) soil water is depleted by the CRP grasses, and a fallow period to store soil water will be necessary prior to crop planting; and 6.) residual soil inorganic N levels are extremely low, and supplemental N fertilization will be required (likely in excess of typical N rates).

WATER-USE EFFICIENCY OF FULL-SEASON AND SHORT-SEASON CORN[1]

by

Todd Trooien, Larry Buschman, Phil Sloderbeck, Kevin Dhuyvetter[2], William Spurgeon[3], and Dennis Tomsicek

SUMMARY

Short-season corn, full-season corn, and grain sorghum were grown and irrigated for 4 years to compare their water-use efficiency. Full-season corn yields (in bu/acre) were greater than short-season corn yields, which were greater than grain sorghum yields. Fully irrigated yields were greater than yields under limited irrigation (replacing 70% of crop evapotranspiration, or ET). Full-season corn used the greatest amount of water from emergence to maturity. Water-use efficiency was greatest for full-season corn for 2 of the 4 years but was greatest for short-season corn in the other 2 years. In summary, the results indicate no justification for choosing short-season corn over full-season corn based solely on water-use efficiency.

INTRODUCTION

Corn is often the most profitable crop choice for fully irrigated production in southwest Kansas. However, if well capacities decrease and energy prices increase, full irrigation can become impractical or impossible in some cases. Crop production alternatives are being sought to reduce the amount of irrigation water required.

One potential crop is short-season corn. Among other things, short-season corn matures more quickly and, as a result, uses less water. But the yield potential of short-season corn is less than that of full-season corn, so full-season corn has an advantage in high-rainfall years because of its greater yield potential. Also, we do not know if the water-use efficiency (grain yield per inch of water used by the crop) is greater or lesser for short-season corn compared to full-season corn.

The objective of this study was to compare the water-use efficiency of short-season corn to that of full-season corn.

PROCEDURES

This experiment was conducted in southwest Kansas under a modified center pivot fitted with low-pressure in-canopy nozzles operated in the spray mode. The four-factor experiment was arranged in a randomized complete block design with four replications. Treatments were (1) three crops (full-season corn, short-season corn, and medium-season grain sorghum); (2) two planting dates (early and late, presented in Table 1); and (3) two irrigation amounts (fully irrigated and limited irrigation). Maturity ratings were 118 days for the full-season corn (Pioneer 3162) and 97 days for the short-season corn (Pioneer 3751). The grain sorghum hybrid used was DK-56. Grain sorghum was not grown in 1996. The irrigation treatments were full replacement of the base irrigation requirement (1.0 BI, the calculated ET minus received rainfall) and 0.70 BI for the limited irrigation. Crop ET for irrigation scheduling was calculated with an alfalfa-based, modified Penman equation.

Weather variables were measured with the Southwest Research-Extension Center automated weather station, about a mile from the experiment site. Precipitation was measured at the experiment site. Soil water content was monitored approximately weekly with a neutron attenuation moisture meter. Total crop water use was the sum of irrigation, precipitation, and the soil water depletion during the

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[1]This research is being funded by Kansas Corn Commission check-off funds.
[2]Northeast Area Office, Kansas State University, Manhattan.
[3]Spurgeon Engineering and Consulting, Scottsbluff, NE.

Table 1. Planting dates, Garden City, KS.

	Corn		Grain sorghum	
Year	Early Planting	Late Planting	Early Planting	Late Planting
1993	7 May	21 May	21 May	15 June
1994	18 April	18 May	10 May	6 June
1995	12 April	22 May	2 June	22 June
1995	11 April	13 May	-	-

growing season. Water-use efficiency was calculated as the grain yield divided by the crop water use. Grain yield was measured by hand-harvesting a 40-ft length in each of the two interior rows of each plot.

RESULTS AND DISCUSSION

Grain yields of full-season corn were equal to or greater than grain yields of short-season corn except for the late planting in 1995 (Table 2). For corn, limited irrigation always resulted in reduced yields. Yields of short-season corn were greater than yields of grain sorghum in our experiment for both limited and full irrigation. For the grain sorghum, limited-irrigated yields were equal to or greater than fully irrigated yields in 1993 and 1995.

The water-use values (Table 3) reflect the fact that seasonal ET was less than the long-term average for all 4 years of this study. When compared within a planting date, seasonal water use by the full-season corn was greater than water use by short-season corn. Water use by grain sorghum was comparable to that of short-season corn in 1993 and 1994. In 1995, stress reduced water use and yield of grain sorghum, especially for the late planting.

The water-use efficiency of short-season corn was not consistently greater than that of full-season corn (Table 4). In 1993 and 1996, water-use efficiency of full-season corn was actually equal to or greater than that of short-season corn, except for the late-planted, fully irrigated corn in 1993. In 1994 and 1995, however, water-use efficiency of short-season corn was equal to or greater than that of full-season corn, again with one exception (early-planted, fully irrigated corn in 1995). The water-use efficiency for corn was always equal to or greater than that for grain sorghum except for early-planted, limited-irrigated grain sorghum that had high yield and low water use in 1995.

In conclusion, the water-use efficiency of short-season corn was not consistently greater than the water-use efficiency for full-season corn. Therefore, when making cropping decisions, short-season corn should not be selected over full-season corn solely on the basis of water-use efficiency.

Table 2. Corn and grain sorghum yields, bu/acre, Garden City, KS.

	Early Planting						Late Planting					
	FS Corn		SS Corn		Grain Sorghum		FS Corn		SS Corn		Grain Sorghum	
Year	Lim	Full	Lim	Full	Lim	Full	Lim	Full	Lim	Full	Lim	Full
1993	152.2	180.2	133.0	159.7	112.0	108.7	124.5	139.2	92.0	116.4	77.9	62.1
1994	139.9	171.2	135.4	150.5	113.1	135.1	151.9	171.7	144.0	172.3	105.7	130.2
1995	118.7	168.7	118.8	141.4	93.3	92.7	124.0	140.3	134.4	143.5	55.8	44.0
1996	114.6	122.8	95.9	104.6	-	-	130.3	145.6	97.1	110.3	-	-

FS Corn: Full-season corn; SS Corn: short-season corn
Lim: limited irrigation; Full: full irrigation

Table 3. Corn, and grain sorghum water use, inches, Garden City, KS.

	Early Planting						Late Planting					
	FS Corn		SS Corn		Grain Sorghum		FS Corn		SS Corn		Grain Sorghum	
Year	Lim	Full	Lim	Full	Lim	Full	Lim	Full	Lim	Full	Lim	Full
1993	18.45	22.96	17.10	20.91	18.63	23.15	21.90	26.08	16.50	21.27	16.29	18.21
1994	18.28	26.11	16.93	21.90	17.50	21.85	20.67	25.96	18.35	22.90	22.33	24.46
1995	21.23	25.68	19.31	23.22	13.89	19.63	21.63	25.78	18.60	21.79	10.40	12.68
1996	19.87	25.72	19.11	24.42	-	-	17.90	22.35	16.63	22.23	-	-

FS Corn: Full-season corn; SS Corn: short-season corn
Lim: limited irrigation; Full: full irrigation

Table 4. Corn and grain sorghum water-use efficiency, bu/acre-inch, Garden City, KS.

	Early Planting						Late Planting					
	FS Corn		SS Corn		Grain Sorghum		FS Corn		SS Corn		Grain Sorghum	
Year	Lim	Full	Lim	Full	Lim	Full	Lim	Full	Lim	Full	Lim	Full
1993	8.5	7.9	7.8	7.6	6.0	4.7	5.9	5.3	5.6	5.5	4.7	3.4
1994	7.6	6.6	8.0	6.9	6.5	6.2	7.4	6.6	7.8	7.5	4.7	5.3
1995	5.6	6.6	6.2	6.1	6.7	4.7	5.7	5.5	7.2	6.6	5.4	3.6
1996	5.7	4.8	5.0	4.3	-	-	7.5	6.9	6.6	6.4	-	-

FS Corn: Full-season corn; SS Corn: short-season corn
Lim: limited irrigation; Full: full irrigation

WELL CAPACITY AND SEEDING RATE EFFECTS ON IRRIGATED CORN[1]

by
Alan Schlegel, David Frickel, and Dale Nolan

SUMMARY

Corn is the primary grain crop for irrigators in western Kansas. However, many irrigation systems have insufficient well capacities to obtain maximum corn yields. This study evaluated the effects of limited well capacity and seeding rate on corn production. Growing-season precipitation was above normal in 1996, which greatly reduced irrigation requirements. The lowest well capacity evaluated, 0.10 inch/day, was adequate for maximizing grain yield. Maximum grain yields were obtained with 26,000 seeds/acre. Higher seeding rates were not needed, and lower seeding rates reduced yields about 20 bu/acre.

INTRODUCTION

Corn is the primary grain crop for irrigators in western Kansas. Past research has shown that each acre-inch of irrigation water has the potential to produce 7 to 15 bushels of corn. In some areas, declining water availability has resulted in a significant number of irrigation systems being operated with insufficient well capacity to obtain maximum yields. This research addresses the effect of limited well capacity on corn yield.

PROCEDURES

The study was conducted at the Tribune Unit, Southwest Research-Extension Center near Tribune, KS in 1996 on a Ulysses silt loam soil. The entire study area was irrigated in early spring to minimize soil water differences among treatments at planting. The irrigations were applied in 2.3-inch increments in level flood basins. This amount of irrigation was necessary for uniform water distribution across each plot. The first in-season irrigation was on June 25 for all treatments except the control. The frequency of irrigation was dependent upon the various simulated well capacities, and the interval ranged from about 9 days for the 0.25 inch/day capacity to about 23 days for the 0.10 inch/day capacity. Total in-season irrigations were as follows with the last irrigation on August 29:

Well capacity		In-season irrigation
inch/day	inches	(number of irrigations)
0	0	
0.101	6.9 in.	(3)
0.125	9.2 in.	(4)
0.168	11.5 in.	(5)
0.200	13.8 in.	(6)
0.250	18.4 in.	(8)

Precipitation from emergence (May 7) through August 31 was 15.61 in. Estimated evapotranspiration (ET) for the same period was 20.99 in. The lowest capacity treatment provided sufficient irrigation to meet ET in 1996.

Corn (Pioneer 3162) was planted on April 21 at three seeding rates (18, 26, and 34 thousand seeds/acre). An insecticide (Force at 8 lb/acre) was applied at planting. For weed control, Harness Plus (1 qt/acre) + atrazine (1 lb/acre) was applied preemergence on April 22. Fertilization totaled 210-100-0 applied in split applications. The center two rows of each plot were machine harvested on October 18, and yields were adjusted to 15.5% moisture.

RESULTS AND DISCUSSION

Growing-season precipitation was above normal in 1996, which greatly reduced the need for irrigation. Estimated ET was only about 6 inches greater than precipitation. The lowest well capacity (0.10 inch/day or 1.9 gpm/acre) supplied about 6.9 inches of irrigation water and was adequate to maximize grain yield (Table 1). To determine the required well capacity for field irrigation systems, the system application efficiency must be taken into account. For example, in a furrow-flood system with 60% application efficiency, the well capacity to supply 0.10 inch/day of applied water would be 500 gpm for 160 acres. For a sprinkler system with 90% efficiency, it would take a 260 gpm well to irrigate 125 acres. The highest irrigation treatment, 0.25 inch/day, would require a 1250 gpm well for the flood system and a 650 gpm well for the sprinkler.

A seeding rate of 26,000 seeds/acre was adequate to produce maximum grain yield at each well capacity. Without irrigation, the highest seeding rate reduced grain yield by about 30 bu/acre. With irrigation, increasing the seeding rate above 26,000 seeds/acre had little effect on grain yield. The lowest seeding rate (18,000 seeds/acre) reduced yield about 20 bu/acre at all irrigation levels.

[1]This research is being funded by Kansas Corn Commission check-off funds.

Table 1. Effects of well capacity and seeding rate on corn, Tribune, KS, 1996.

Well Capacity	Seeding Rate	Yield	Moisture	Test Wt	Plant Pop.
inch/day	1000/acre	bu/acre	%	lb/bu	1000/acre
0	18	147	21.0	56.5	17.8
	26	168	21.8	56.2	23.3
	34	135	21.4	55.5	26.8
0.101	18	164	21.0	55.9	17.7
	26	193	21.9	54.7	23.8
	34	189	21.9	54.8	29.4
0.125	18	178	21.9	54.8	17.6
	26	190	23.5	53.7	25.1
	34	201	22.3	54.0	31.5
0.168	18	163	21.9	55.4	17.3
	26	185	23.0	54.3	24.9
	34	199	22.1	54.6	30.9
0.200	18	167	21.4	55.5	18.1
	26	190	22.7	54.2	22.7
	34	188	21.8	54.9	28.0
0.250	18	174	21.1	55.4	18.6
	26	199	22.2	54.4	25.5
	34	197	22.8	54.1	31.3
ANOVA (P>F)					
Well capacity		0.008	0.134	0.042	0.032
Seeding rate		0.001	0.001	0.001	0.001
Well capacity X seed rate		0.005	0.164	0.394	0.120
Means					
Well capacity					
0		150	21.1	56.1	22.6
0.101 in/day		182	21.6	55.1	23.6
0.125		190	22.5	54.2	24.8
0.168		183	22.3	54.8	24.4
0.200		182	21.9	54.9	22.9
0.250		190	22.0	54.6	25.2
LSD.05		20	1.1	1.1	1.7
Seeding Rate					
18,000 seeds/acre		166	21.4	55.6	17.8
26,000		188	22.3	54.6	24.2
34,000		185	22.0	54.7	29.7
LSD .05		6	0.4	0.3	0.9

GAUCHO SEED TREATMENT TRIAL, GARDEN CITY, KANSAS — 1996

by

Phil Sloderbeck, Merle Witt, and Gerald Wilde[1]

SUMMARY

Five different sorghum hybrids treated with Gaucho were monitored to evaluate the seed treatment's impacts on greenbug populations and sorghum yield under both dryland and irrigated conditions. Gaucho was found to reduce greenbug populations by about 99% early in the season (18 days after planting) on 4- to 5-leaf sorghum and by about 70% later in the season (70 days after planting) as the sorghum was heading in the dryland plots. Similar reductions in greenbug numbers were observed in the irrigated plots. However, because greenbug populations were below economic levels, yield differences between treated and untreated hybrids were not significantly different.

PROCEDURES

Treated and untreated seed of five sorghum hybrids (NC+ 271, Cargill 607E, DeKalb DK-56, Deltapine 1552, Pioneer 8500) were obtained from Gustafson, Inc. for use in the trial. Part of each seed lot had been treated with Gaucho™480 (imidacloprid) at a rate of 8 oz per 100 lb of seed (4 oz ai/cwt). Plots were established on 3 and 4 June at the Southwest Research-Extension Center, Finney County, Kansas. Plots were two rows (5 ft) by 22 ft, arranged in a randomized split plot design, and replicated four times. Seed was planted with a cone planter using 7 g of seed/row (12.2 lb seed/acre) in the irrigated trial and 1.5 g of seed/row (2.6 lb seed/acre) in the dryland trial. Ramrod and Atrazine were used for weed control.

Greenbugs were sampled in the dryland plots on 21 June (18 days after planting) by visually examining five plants in each row in each plot. Late-season greenbug counts were made on 12 and 13 August (70 days after planting) by cutting off two plants per plot (one plant at random from each row) at ground level and visually searching them for greenbugs. Yields were taken by machine harvesting the plots and calculating yields on a bu/acre basis.

RESULTS AND DISCUSSION

Low numbers of greenbugs were noticed in the plots a few days after planting, and counts made in the dryland plots indicated that the Gaucho was very effective at controlling this early-season invasion (about 99% control). Low numbers of greenbugs also were observed in mid-August, and counts showed about a 70% reduction in greenbug numbers in both the dryland and irrigated trials. Gaucho is a seed treatment, so the cost per acre is dependent on the amount of seed used to plant each acre. In these trials, the costs on a per acre basis were estimated to be about $2.80/acre on the dryland plots and $13.30/acre on the irrigated plots. Thus the significant reduction in greenbug numbers and the low cost per acre makes this treatment fairly attractive to dryland sorghum producers. However, in this particular year, greenbug numbers were low. Although the Gaucho provided significant reductions in greenbug numbers even late in the season, yields were not significantly affected by the Gaucho treatment when averaged across hybrids. Thus, these trials indicate that Gaucho can be equally effective in reducing greenbug numbers in both dryland and irrigated plots, and even though the treatment is cheaper when using dryland seeding rates, the economics of the treatment will depend on the severity of the pest populations.

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Table 1. Gaucho seed treatment trial on dryland sorghum, Southwest Research-Extension Center, 1996.

	Avg. Greenbug Numbers per Plant 21 June 18 Days after Planting		Avg. Greenbug Numbers per Plant 12 Aug. 70 Days after Planting		Yield bu/acre	
Hybrid	Without Gaucho	With Gaucho	Without Gaucho	With Gaucho	Without Gaucho	With Gaucho
NC+271	11.2	0.02	263	51	118.8	120.5
Cargill 607E	4.2	0.02	90	34	98.4	91.6
DeKalb DK-56	1.1	0.1	66	40	118.9	115.9
Deltapine 1552	7.0	0.05	95	22	109.3	110.3
Pioneer 8500	8.7	0.05	104	56	116.9	116.3
ANOVA	P-Value		P-Value		P-Value	
Hybrid	0.1598		0.1151		0.0001	
Seed Treatment	0.0001		0.0060		0.4058	
Interaction	0.1527		0.2218		0.5736	
Main Effect Means						
Hybrid						
NC+271	5.6		157		119.7 c	
Cargill 607E	2.1		62		95.0 a	
Dekalb 56	0.6		53		117.4 c	
Deltapine 1552	3.5		59		109.8 b	
Pioneer 8500	4.4		80		116.6 c	
Seed Treatment						
Without Gaucho	6.45 b		124 b		112.4	
With Gaucho	0.05 a		41 a		110.9	

Means separated using the Duncan New Multiple Range Test.

Table 2. Gaucho seed treatment trial on irrigated sorghum, Southwest Research-Extension Center, 1996.

Hybrid	Avg. Greenbug Numbers per Plant 13 Aug. 70 Days after Planting: Without Gaucho	With Gaucho	Yield bu/acre: Without Gaucho	With Gaucho
NC+271	125	39	115.9	113.9
Cargill 607E	93	9	107.3	111.6
DeKalb DK-56	95	60	124.5	121.7
Deltapine 1552	236	45	94.1	93.3
Pioneer 8500	216	51	112.0	114.5
ANOVA	P-Value		P-Value	
Hybrid	0.0600		0.0014	
Seed Treatment	0.0001		0.9383	
Interaction	0.1451		0.9610	
Main Effect Means				
Hybrid				
NC+271	82 ab		114.9 bc	
Cargill 607E	51 a		109.5 b	
Dekalb 56	78 ab		123.1 c	
Deltapine 1552	141 b		93.7 a	
Pioneer 8500	134 b		113.3 bc	
Seed Treatment				
Without Gaucho	153 b		110.8	
With Gaucho	41 a		111.0	

Means separated using the Duncan New Multiple Range Test.

EVALUATION OF FORTRESS INSECTICIDE AND THE SMARTBOX™ APPLICATION SYSTEM FOR CORN ROOTWORM CONTROL, 1996

by
Larry Buschman and Phil Sloderbeck

SUMMARY

The T-band applications of Fortress failed to give significant reductions of rootworm damage in this trial, probably because of the extremely dry conditions immediately after planting. However, the in-furrow applications did significantly reduce rootworm damage. No difference was observed between the conventional and the SmartBox™ applications of Fortress.

INTRODUCTION

This experiment was designed to test Fortress applied at planting with conventional or SmartBox™ application technology for the control of corn rootworm larvae.

PROCEDURES

Plots were planted at 30,600 seeds per acre on 9 May in a furrow-irrigated field at the Southwest Research-Extension Center, in Finney County, Kansas. The field was prewatered on 9 April, but the seed-bed dried out and the field was watered again 24 May to complete emergence. The soil type was a Richfield silt loam with a pH of 7.5 and an organic matter content of 1.5%. Plots were two rows (5 ft) by 50 ft long, arranged in a randomized complete block design, and replicated four times. Plots were separated by 10 ft alleyways at the end of each plot and four rows of border corn between each plot. Planting time treatments were applied as a 7-inch band over the open seed-furrow (T-band) or into the open seed-furrow (in-furrow) with either a standard John Deere™ planter-mounted insecticide applicator or with a SmartBox applicator. Spring incorporators were used after the press wheels. Rootworm damage was evaluated on four plants from each plot on 9 July using the 6-point Iowa scale. The weather was very dry after planting, averaging 0.4 inches of pan evaporation for the first 17 days. Then 1.8 inches of rain fell on 26 May, and 6.5 inches of rain was recorded between planting and evaluation of the roots. Yields were taken by mechanically harvesting each plot and measuring rows to correct for gaps created by the destructive sampling.

RESULTS AND DISCUSSION

Rootworm damage was severe, causing noticeable stunting, lodging, and stand loss. The in-furrow treatments of Fortress (both standard and SmartBox) gave significant control of rootworm damage, whereas the T-band applications did not. The T-band applications of Counter and Force also gave significant control of rootworm damage. Under the harsh conditions in this test, too much early volatilization of Fortress must have occurred to allow the banded treatments to be as effective as the standard treatments in reducing rootworm damage. The percent of plants with ratings greater than 3 were surprisingly high for all but the Counter treatment. All treatments except one (Fortress 5G, SmartBox, in-furrow) had significantly higher yields than the untreated check.

Table 1. Evaluation of Fortress insecticide and the SmartBox™ application system for corn rootworm control, 1996, Garden City, KS.

Treatment/ Formulation	Rate lb(AI)/acre	Placement	Application	CRW Root Damage	% of Plants > 3	Yield bu/acre
Check	—	——	——	5.3 a	94 a	84.
Fortress 5G	0.15	In-furrow	SmartBox	3.7 cde	75 a	99.9 bc
Fortress 5G	0.15	T-Band	SmartBox	4.4 abcd	94 a	111.9 ab
Fortress 5G	0.15	In-furrow	Standard	3.7 cde	81 a	108.8 ab
Fortress 5G	0.15	T-Band	Standard	4.3 abcd	94 a	108.6 ab
Fortress 5G	0.112	In-furrow	SmartBox	4.1 bcd	81 a	108.2 ab
Fortress 2.5G	0.112	T-Band	Standard	4.7 abc	81 a	106.9 ab
Fortress 2.5G	0.15	T-Band	Standard	4.9 ab	94 a	109.7 ab
Counter 20CR	1.30	T-Band	Standard	2.9 e	13 b	119.2 a
Force 1.5G	0.16	T-Band	Standard	3.6 de	81 a	105.5 ab
LSD				1.07	1.04	18.6
F-test Prob.				0.0035	0.0001	0.08

Means followed by same letter do not differ significantly (P=0.05, LSD).

CORN BORER RESISTANCE AND GRAIN YIELD FOR BT AND NON-BT CORN HYBRIDS, 1996

by
Larry Buschman, Phil Sloderbeck, Randy Higgins[1], and Victor Martin[2]

SUMMARY

Six pairs of Bt- and non-Bt-corn hybrids were evaluated for corn borer resistance and grain yield performance. First generation ECB damage to whorl stage corn was reduced effectively by all six Bt corn hybrids. Second generation corn borer damage to posttassel corn was variable depending on the Bt event. Averaging over both locations ECB control averaged 96.3%, 97.5% and 26%; SWCB control averaged 100%, 85%, and 44%; and corn borer tunneling control averaged 99.7%, 91%, and 49%, for the three Bt events, Bt-11, MON810, and Bt 176, respectively. Total grain yields in the unsprayed blocks at St. John averaged 144.6 and 164.6 bu/acre in the non-Bt and Bt corn, respectively, for an advantage of 20 bu/acre for Bt corn. In non-Bt corn, the grain yield from fallen plants in the unsprayed blocks averaged 42.9 bu/acre. In Bt corn, the grain yield from fallen plants averaged 0, 4.9 and 27.5 bu/acre for the three Bt events, Bt-11, MON810, and Bt-176, respectively.

INTRODUCTION

The new corn borer-resistant Bt corn hybrids have shown outstanding resistance to the European corn borer (ECB), Ostrinia nubilalis (Hübner), and the Southwestern corn borer (SWCB), Diatraea grandiosella Dyar. Bt corn has been genetically engineered to express the delta endotoxins originally isolated from the bacterium, Bacillus thuringiensis. This is the same protein that is found in some Bt insecticide sprays. This protein is toxic to certain lepidopterous larvae, including the two corn borers, which are among the most important pests of corn in North America. Each insertion of genetic material into a new hose is referred to as an event. Once the event is created it can be transferred to different hybrids using standard breeding procedures. These trials were conducted to evaluate the corn borer resistance of different Bt corn hybrids and to evaluate grain yield performance under insecticide-protected and unprotected conditions.

PROCEDURES

At the Southwest Research-Extension Center near Garden City, KS, corn hybrid plots were machine planted on 16 May at 28,000 plants/acre. At the Sandyland Experiment Field near St. John, KS, corn hybrid plots were machine planted on 17 May at 26,000 plants/acre. The plots were four rows wide (10 ft.) and 30 ft long at Garden City and 22 ft long at St. John. Two additional rows of Bt corn were planted as border rows between the plots to reduce the impact of larval migration from untreated plots. The alley-ways were 3 feet wide. The experimental design was a split-plot with four replications; however, at Garden City, two replications were abandoned for late-season observations and yield measurements because of uneven emergence and stand problems. The main plots were insecticide-protected versus insecticide unprotected, and the sub-plots were the 12 corn hybrids. The protected blocks were sprayed on 24 July at St. John and on 6 Aug. at Garden City with bifenthrin at 0.08 lb. AI/acre. The 12 hybrid entries included six pairs of corn hybrids (Table 1). Each pair included a Bt hybrid and a matched non-Bt hybrid. Four of the pairs we understand to be fairly closely related sister hybrids (Ciba #1, Ciba #2, Monsanto and Northurp King pairs). The Mycogen hybrids are not sister hybrids, but they have similar genetic backgrounds. The NK/Pioneer pair are unrelated hybrids included as standards. First

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[2]Sandyland Experiment Field, Kansas State University, St. John.

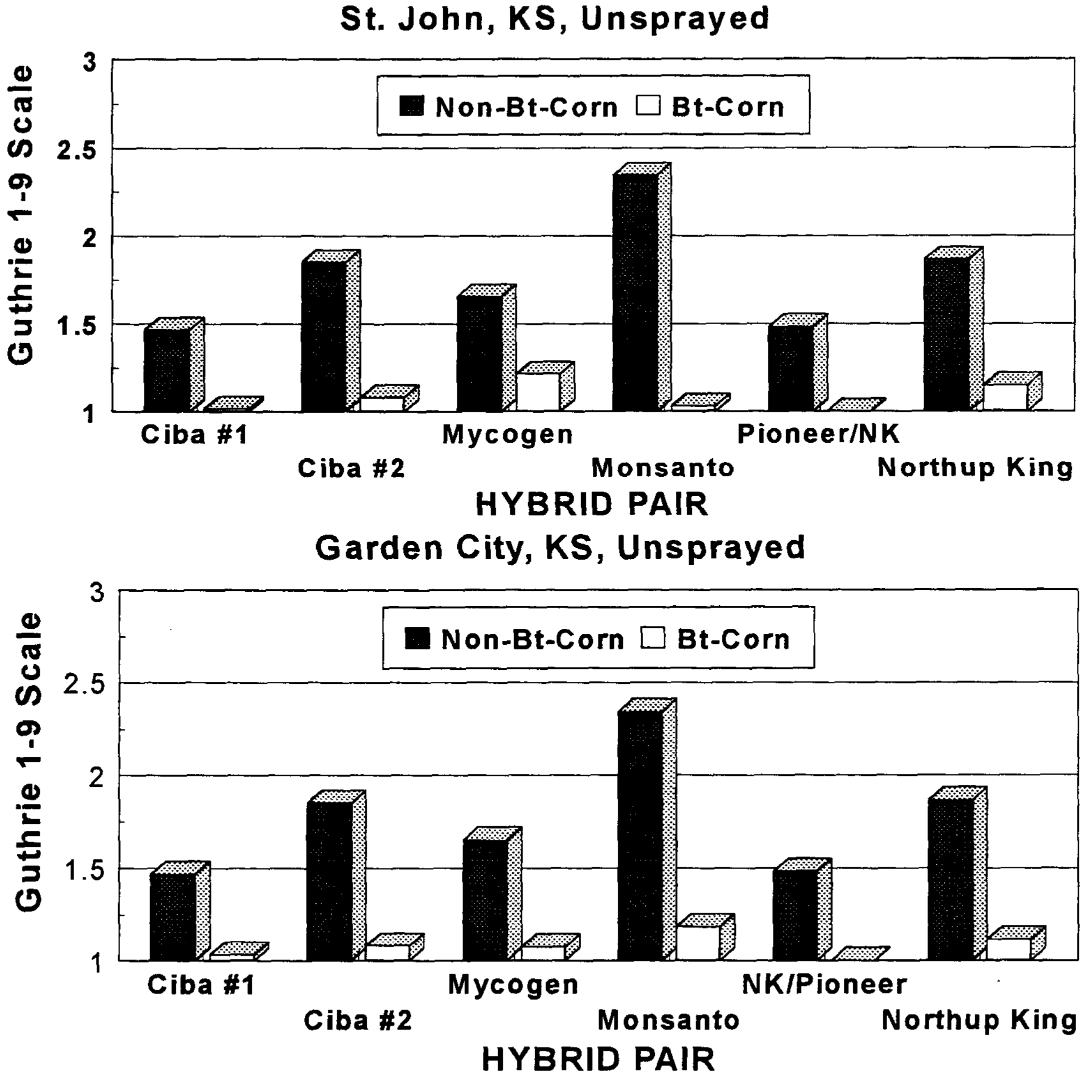
Table 1. Six pairs of hybrids tested in the 1996 trials.

Hybrid Pairs/ Company	Non-Bt Hybrid	Bt Hybrid	Bt Event
1. Ciba #1	4394	Max21	KnockOut ™ Bt-176
2. Ciba #2	4494	Max454	KnockOut ™ Bt-176
3. Mycogen	2815	NG7959	Natureguard ™ Bt-176
4. Monsanto	B73/MO17	B73/MO17Bt	YieldGuard ™ Bt-MON810
5. Pioneer/Northrup King	3162	N7639Bt	YieldGuard ™ Bt-11
6. Northrup King	N7590	N7590Bt	YieldGuard ™ Bt-11

generation ECB infestation was augmented manually by adding 40 to 50 ECB neonate larvae to the first 15 plants of one of the two center rows. Manual infestations were made on 8 and 9 July at Garden City when the plants were at the 14-leaf stage. At St. John, manual infestations were made on 12 and 13 July when the plants were at the 18-leaf stage. About 14 days after infestation, the plots were rated for first generation shot-hole damage, using the Guthrie 1 to 9 scale. Natural ECB and SWCB infestations accounted for the second generation infestation. Five consecutive plants in each of the two center rows from each plot were dissected to measure corn borer tunneling and record the numbers of each species of corn borer. Kernel damage (mostly corn earworm (CEW), Helicoverpa zea,(Boddie)) was recorded as percent of kernels damaged on each ear. Stalk rot rating was recorded as the number of internodes at the base affected by stalk rot. Yield was determined by hand harvesting the two middle rows of each plot in late Oct. Ears from standing plants and those from fallen plants (primarily from SWCB) were harvested separately. Yields per acre were calculated for fallen and total grain at 15.5% moisture.

RESULTS AND DISCUSSION

Fig. 1. First generation ECB feeding damage in 12 corn hybrids including six pairs of Bt and non-Bt-corn hybrids planted at St. John and Garden City, 1996.

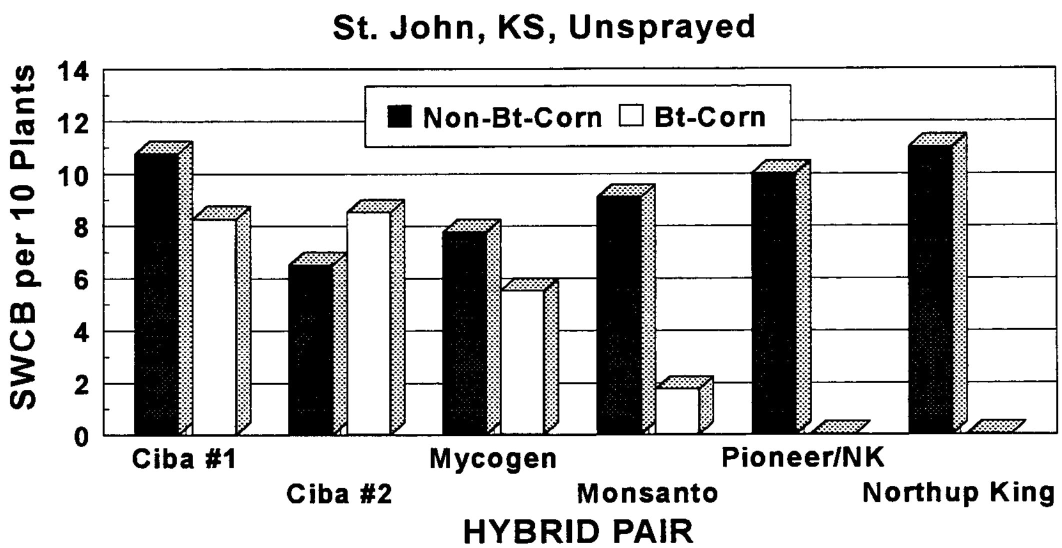


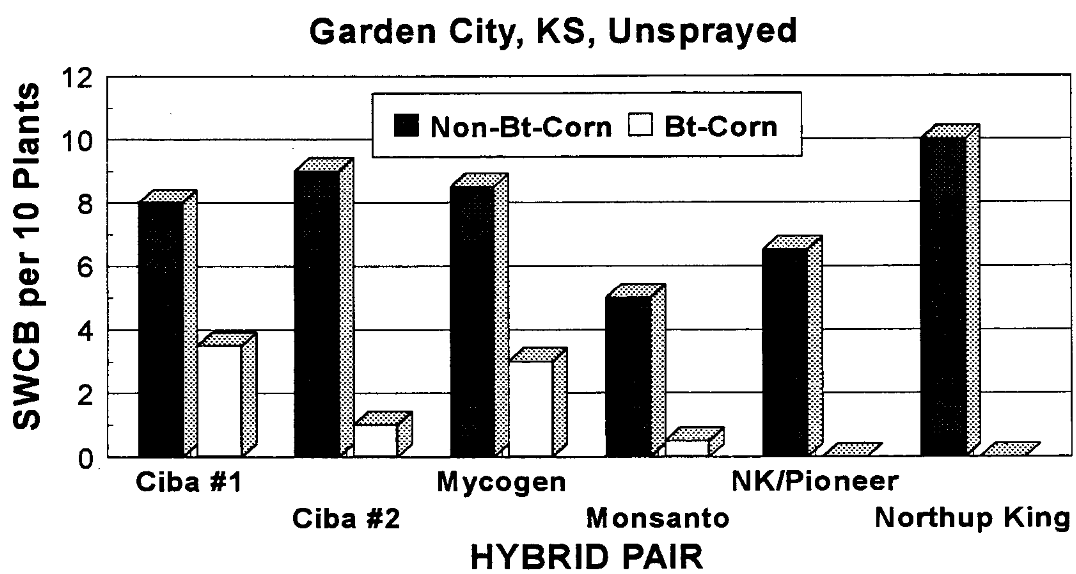
Natural first-generation infestation was absent.

Feeding damage from the manually infested ECB was also light, up to 2.3 at St. John and up to 3.0 at Garden City on the 1 to 9 Guthrie scale.

Al1 six Bt-corn hybrids had ratings for first generation ECB feeding damage that were significantly lower than those of the non-Bt counterparts.

Fig. 2. Number of second generation SWCB larvae in 12 corn hybrids including six pairs of Bt and non-Bt-corn hybrids planted at St. John and Garden City, 1996.





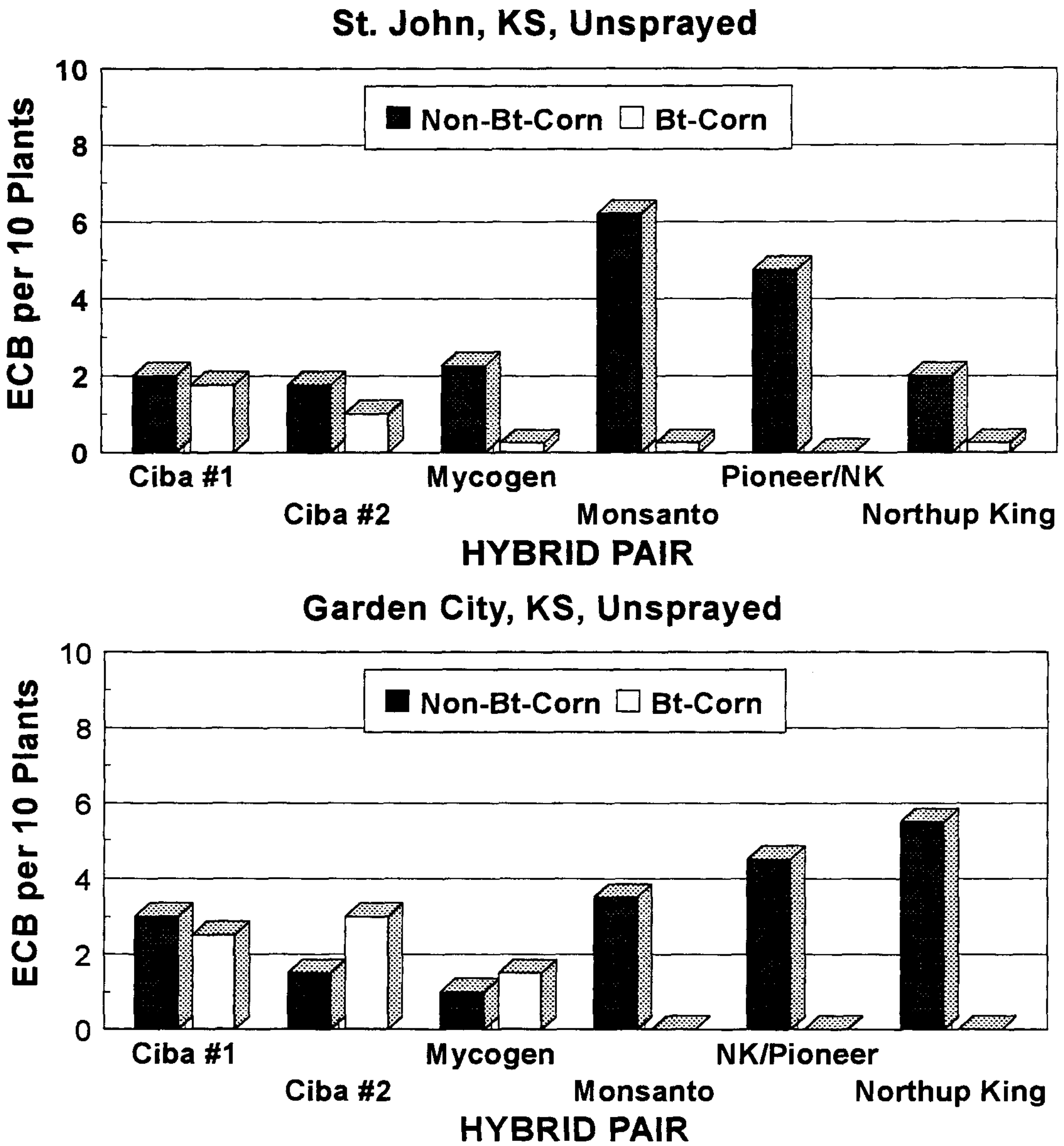
Second generation SWCB pressure was heavy at both locations and averaged up to 10.75 larvae in 10 plants.

SWCB control averaged 100%, 85%, and 44% for the three Bt events, Bt-11, MON810, and Bt-176, respectively.

Control in the three "YieldGard" Bt hybrids (Bt-11 and MON810) averaged 95%, whereas control in the three Bt-176 hybrids averaged 44%.

The insecticide treatment gave 95% control of SWCB at St. John and 72% control of SWCB at Garden City (data not shown).

Fig. 3. Number of second generation ECB larvae in 12 corn hybrids including six pairs of Bt and non-Bt-corn hybrids planted at St. John and Garden City, 1996.



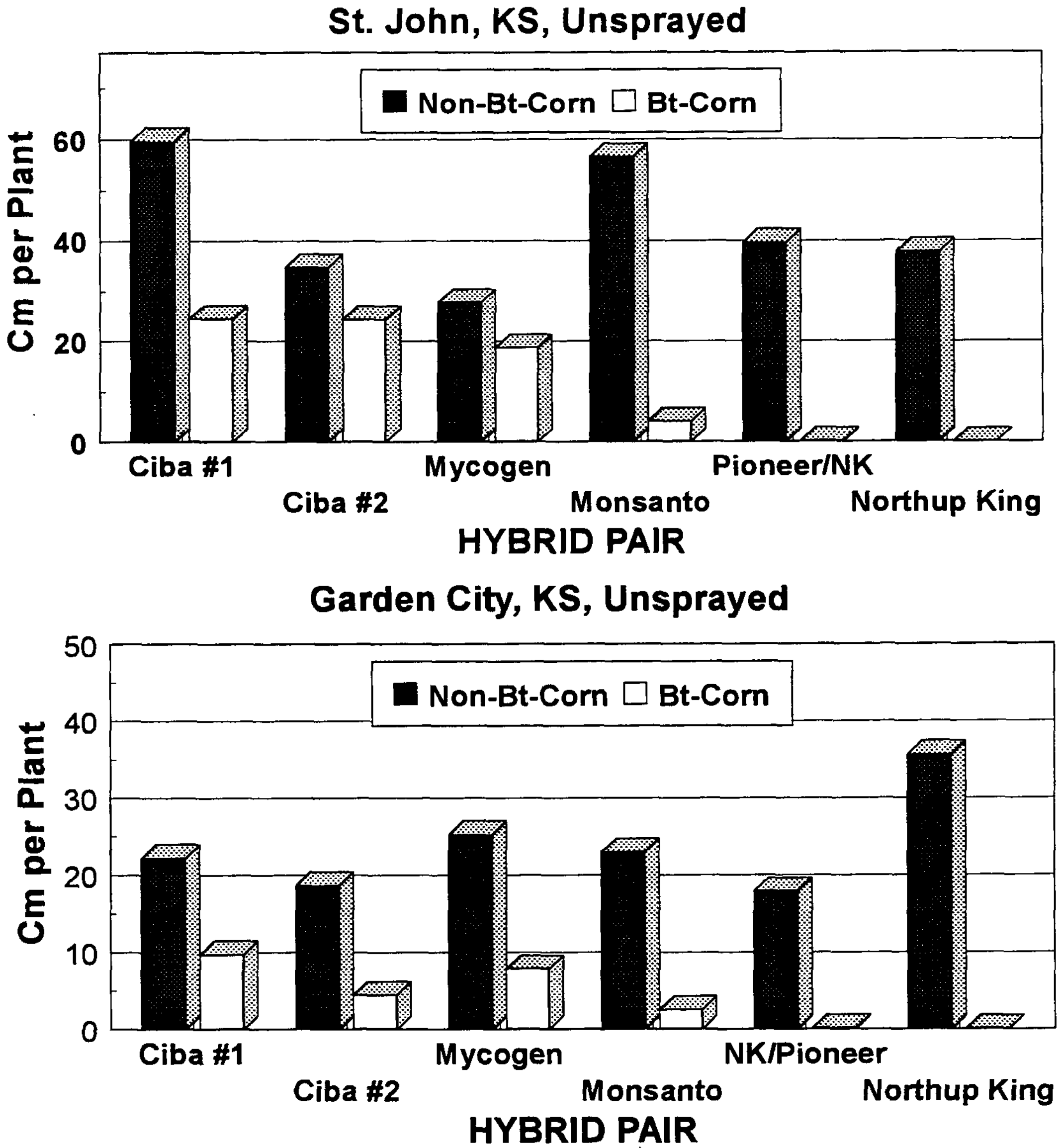
Second generation ECB pressure was somewhat lower then the SWCB pressure and may have been suppressed somewhat through cannibalism by SWCB. The ECB pressure averaged up to 6.25 and 5.5 larvae per 10 plants at St. John and Garden City, respectively.

ECB control averaged 96.3%, 97.5% and 26% for the three Bt events, Bt-11, MON810, and Bt-176, respectively.

Control in the three “YieldGard” Bt hybrids (Bt-11 and MON810) averaged 96.6%, whereas control in the three Bt-176 hybrids averaged 26%.

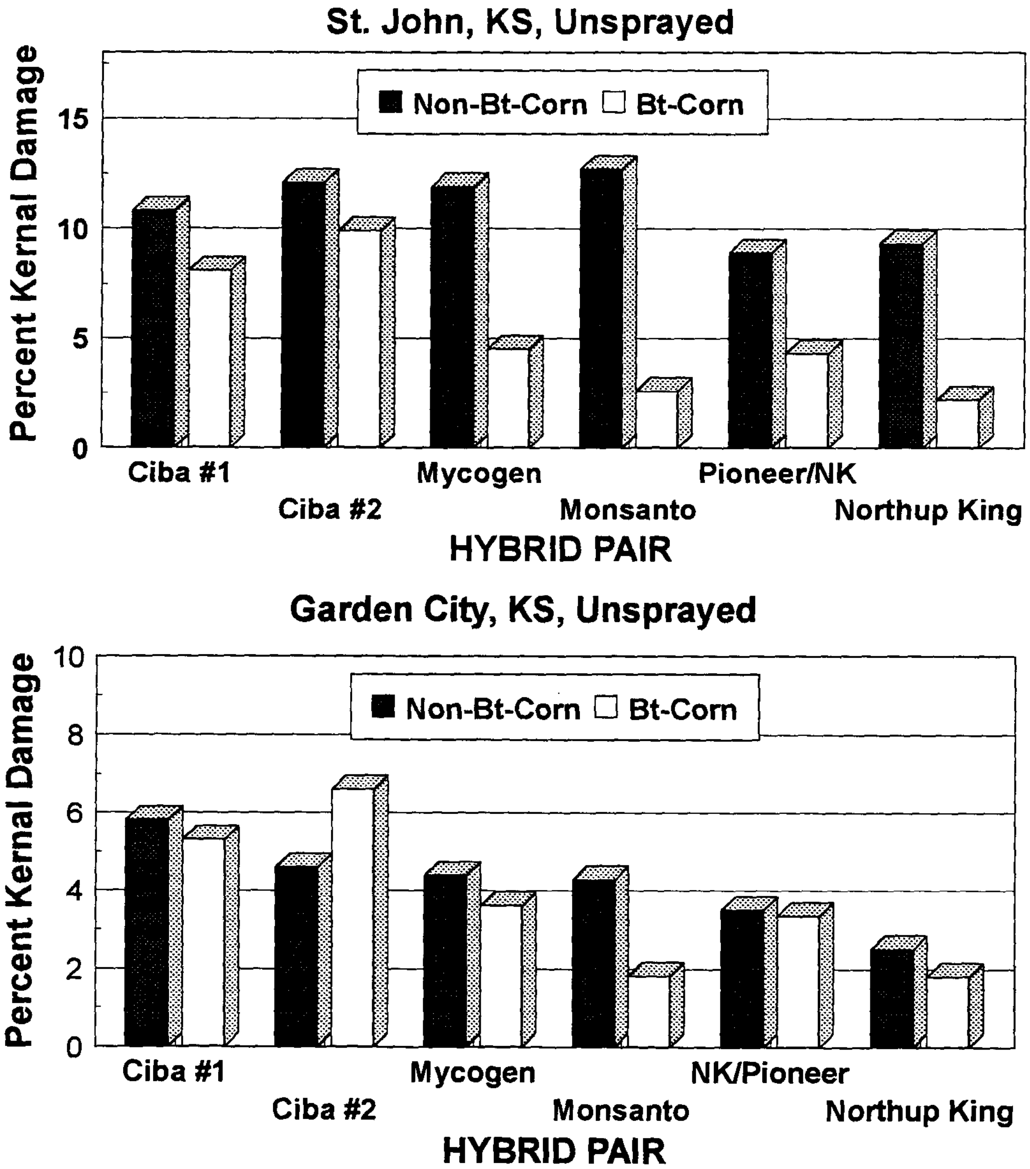
The insecticide treatment gave 78% control of ECB at St. John and 38% control of ECB at Garden City (data not shown).

Fig. 4. Second generation corn borer tunneling in 12 corn hybrids including six pairs of Bt and non-Bt-corn hybrids planted at St. John and Garden City, 1996.



- Second generation corn borer tunneling damage to posttassel corn averaged up to 59.4 cm at St. John and up to 35.6 cm at Garden City.
- Corn borer tunneling was reduced by averages of 99.7%, 91%, and 49%, for the three Bt events, Bt-11, MON810, and Bt-176, respectively.
- Reduction in tunneling for the three “YieldGard” Bt hybrids (Bt-11 and MON810) averaged 96.8%, whereas reduction in tunneling for the three Bt-176 hybrids averaged 49%.
- The insecticide treatment reduced tunneling by 96% at St. John and 68% at Garden City (data not shown).

Fig. 5. Percent kernels damaged in 12 corn hybrids including six pairs of Bt and non-Bt-corn hybrids planted at St. John and Garden City, 1996.

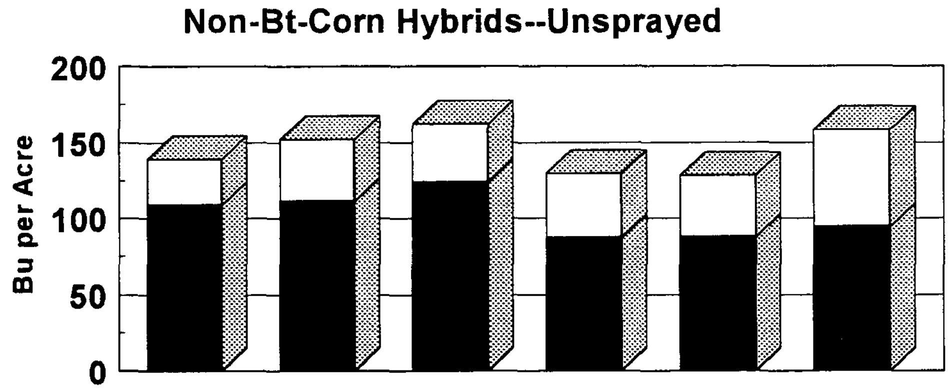


Kernel damage was caused primarily by corn earworm, but some corn borer activity occurred as well.

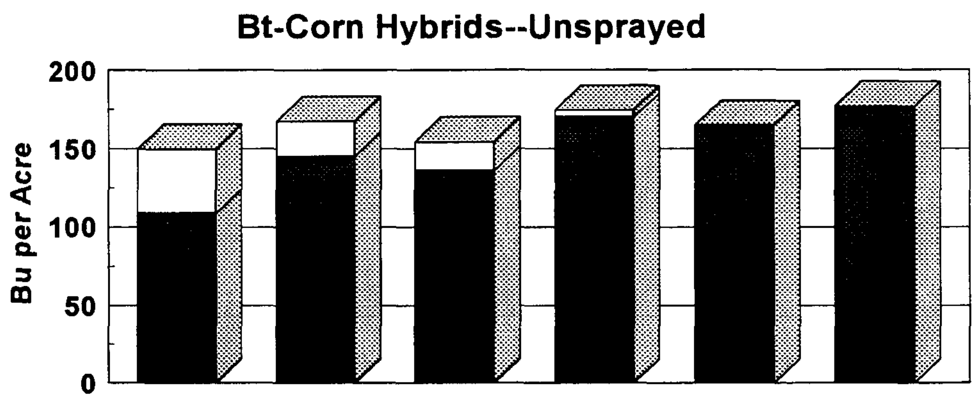
Reductions in kernel damage averaged 39.7%, 69.8%, and 22.0% for the three Bt events, Bt-11, MON810, and Bt-176, respectively.

The insecticide treatment reduced kernal damage by 40% and 18% in the non-Bt hybrids and 12% and 29% in the Bt hybrids at St. John and Garden City, respectively (data not shown).

Fig. 6. Harvestable grain yield and fallen grain yield for 12 corn hybrids including six pairs of Bt and non-Bt-corn hybrids planted at St. John, 1996.

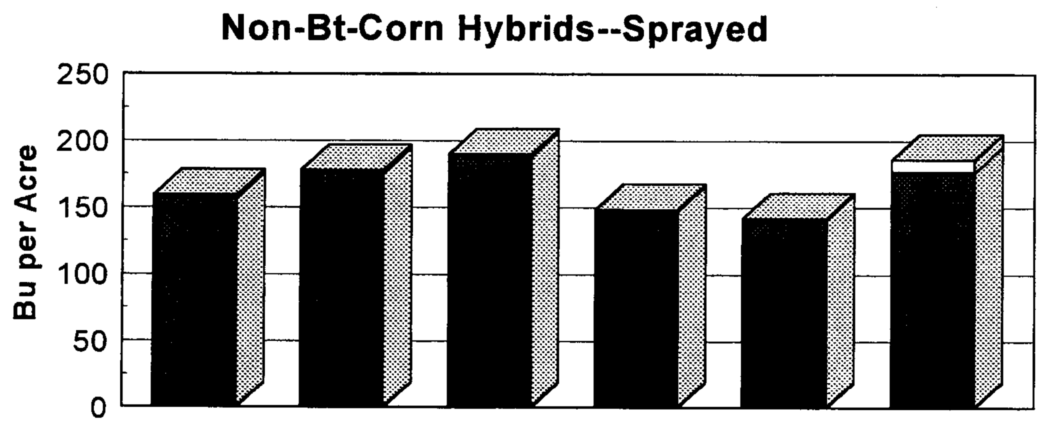


	4394	4494	2815	B73/MO17	3162	N7590
Standing ■	108.8	111.2	123.8	87.0	87.2	94.0
Fallen □	30.4	40.9	38.3	42.5	41.1	64.1

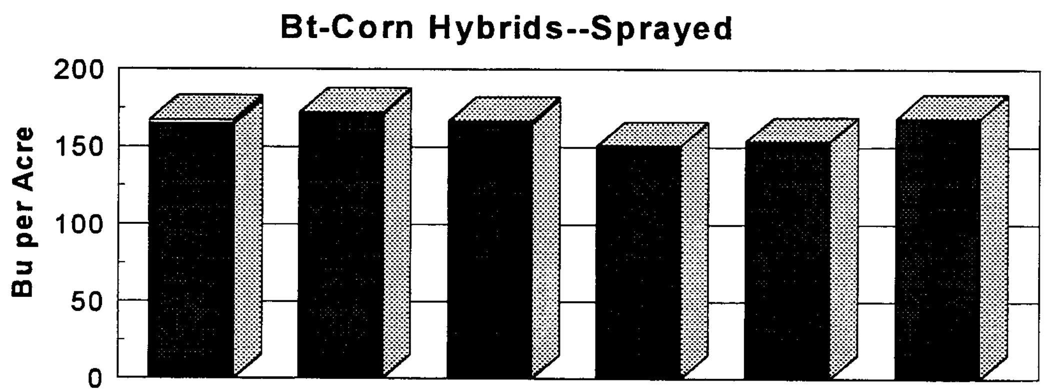


	MAX21	MAX454	NG7959	B73/MO17Bt	N7639Bt	N7590Bt
Standing ■	108.3	144.8	135.8	169.5	164.7	176.8
Fallen □	41.4	22.6	18.5	4.9	0.0	0.0

Fig. 6, continued. Harvestable grain yield and fallen grain yield for 12 corn hybrids including six pairs of Bt and non-Bt-corn hybrids planted at St. John, 1996.



	4394	4494	2815	B73/MO17	3162	N7590
Standing	157.0	175.5	188.3	147.4	141.3	176.9
Fallen	2.6	2.6	1.7	1.4	0.8	9.3



	MAX21	MAX454	NG7959	B73/MO17Bt	N7639Bt	N7590Bt
Standing	164.9	171.5	165.1	150.8	153.6	168.4
Fallen	2.5	0.6	1.9	0.0	0.0	0.0

Total grain yields in the unsprayed blocks at St. John averaged 144.6 and 164.6 bu/acre in the non-Bt and Bt corn, respectively, giving an advantage of 20 bu/acre for Bt corn.

In the sprayed blocks, total grain yields averaged 167.5 and 163.2 bu/acre in the non-Bt and Bt corn, respectively, giving an advantage of 4.3 bu/acre for the non-Bt corn.

In non-Bt corn, the grain yield from fallen plants in the unsprayed blocks averaged 42.9 bu/acre.

In Bt corn, the grain yield from fallen plants averaged 0, 4.9, and 27.5 bu/acre for the three Bt events, Bt-11, MON810, and Bt-176, respectively.

The standard hybrid, Pioneer 3162, yielded only 142.0 bu/acre, apparently because of gray leaf spot disease.

Total harvested ears averaged 66 per plot or 25,000 per acre. Only the B73/Mo17 line had significantly fewer ears then the rest of the hybrids.

EVALUATION OF REGENT INSECTICIDE FOR EARLY-SEASON INSECT CONTROL IN CORN, 1996

by
Larry Buschman and Phil Sloderbeck

SUMMARY

Regent was shown to reduce rootworm damage when applied in-furrow at planting and to reduce corn borer numbers and tunneling when applied at planting, banded on 8-inch corn, or broadcasted on whorl-stage corn. However, surprisingly, Regent also appeared to reduce second generation corn borer numbers and tunneling.

INTRODUCTION

This experiment was designed to test Regent applied at planting and at the whorl stage for the control of corn rootworm larvae and corn borer larvae. Regent is a new soil insecticide that is not yet registered for use in corn.

PROCEDURES

Plots were planted at 30,600 seeds per acre on 9 May in a furrow-irrigated field at the Southwest Research-Extension Center, in Finney County, Kansas. The field was prewatered on 9 April, but the seed-bed dried out, and the field was watered again on 24 May to complete emergence. The soil type was a Richfield silt loam with a pH of 7.5 and an organic matter content of 1.5%. Plots were 2 rows (5 ft) by 50 ft long, arranged in a randomized complete block design, and replicated four times. Plots were separated by 10 ft alleyways at the end of each plot and with four rows of border corn between plots. Planting-time granular treatments were applied as a 7-inch band over the open seed-furrow (T-band) or into the open seed-furrow (in-furrow) with planter-mounted John Deere™ granular applicators. The liquid applications at planting were made with a CO_2 backpack sprayer mounted on the planter with nozzles directed into each furrow delivering 1.5 gal/acre. Rootworm damage was evaluated on four plants from each plot on 9 July using the 6-point Iowa scale. Plant stunting also was rated visually as percent reduction in biomass relative to the best corn rootworm treatment (Counter). The banded treatment on 8-inch corn was made on 13 June with a hand sprayer. Whorl-stage applications were made on 11 July using a high clearance sprayer with three nozzles directed at each row and calibrated to deliver 20 gal/acre at 2 mph and 40 psi. A total of 6.5 inches of rain was recorded between planting and taking the root ratings and another 1.3 inches of rain was recorded between 9 July and 19 July when the corn borer ratings were taken. To assure first generation corn borer pressure, five European corn borer egg masses were pinned to every third plant in a 15-plant marked section in each plot on 25 June. These plants were evaluated for corn borer injury on 19 July using the Guthry scale and by dissecting plants to determine the number of corn borers and the amount of tunneling. Second generation damage was evaluated on 30 September by dissecting 15 plants in each plot. Yields were taken by mechanically harvesting each plot and measuring rows to correct for gaps created by the destructive sampling.

RESULTS AND DISCUSSION

Rootworm damage was severe, causing noticeable stunting, lodging, and stand loss. The in-furrow applications of Counter, Regent, and EXP 61216A applied at planting all significantly reduced the rootworm feeding injury. The banded application of Regent on 8-inch corn was applied too late to be very effective at reducing the rootworm damage. The planting-time applications of Regent and EXP 61216A reduced the amount of leaf injury from the manually applied first generation corn borer. The banded application of Regent on 8-inch corn significantly reduced damage by first generation corn borer. However, all of the Regent treatments reduced the amount of tunneling and the number of larvae from the first generation corn borers . Surprisingly, the in-furrow planting-time application of Regent also significantly reduced numbers of second generation European corn borer and corn borer tunneling. Yield loss appeared to be associated with rootworm injury rather than corn borer injury.

Table 1. Evaluation of Regent insecticide for control of first generation corn borer, 1996, Garden City, KS.

			First Generation ECB - Manual Infestation			
Treatment/ Formulation	Rate lb(AI)/acre	Application Method	Leaf Damage 1-9 scale	% Plants with Leaf Damage	Tunnel Length in cm /15 Plants	Larvae /15 Plants
Check	—	——	2.1 ab	46.6 ab	7.4 a	3.5 a
EXP 61216A 3G*	0.13	in-furrow at planting	1.4 bcd	21.8 bc	1.3 cd	0.3 b
Counter 20CR	1.3	in-furrow at planting	2.2 a	53.6 a	4.4 ab	4.4 a
Regent 80WG*	0.13	in-furrow at planting	1.4 cd	17.5 bc	0.4 cd	0.6 b
Regent 80WG*	0.13	banded at 8-inch stage	1.1 d	8.3 c	0.0 d	0.0 b
Pounce 1.5 G	0.15	bdcst at whorl	1.7 abcd	42.1 ab	3.3 bc	0.7 b
EXP 61216A 3G*	0.15	bdcst at whorl	1.9 abc	59.9 a	0.9 cd	0.3 b
Regent 80WG*	0.13	bdcst at whorl	1.8 abc	42.9 ab	0.0 d	0.0 b
Regent 80WG*	0.06	bdcst at whorl	1.5 bcd	34.6 abc	0.7 cd	0.6 b
Regent 80WG*	0.03	bdcst at whorl	2.2 a	53.8 a	1.7 bcd	0.3 b
LSD			0.63	30.3	3.0	1.3
F-test Prob.			0.02	0.02	0.05	>0.00%

Means followed by same letter do not significantly differ (P=0.05, LSD)

***These treatments not yet registered for use on corn.**

Table 2. Evaluation of Regent insecticide for control of corn rootworm damage and second generation corn borer, 1996, Garden City, KS.

			Corn Rootworm			Second Generation Corn Borer/15 Plants				
Treatment/ Formulation	Rate lb(AI) acre	Application Method	Root Rating	% Plants > 3	Biomass % max.	# Plants Infested	SWCB Larvae	ECB Larvae	Tunnel Length in cm	Yield bu/acre
Check	—	——	5.1 a	94 a	66 d	6.5 ab	2.3	5.8 ab	10.0 a	113.1 bc
EXP 61216A 3G*	0.13	In-furrow at Planting	3.1 b	31 b	86 b	—	—	—	—	130.1 ab
Counter 20CR	1.3	In-furrow at Planting	2.6 b	6 b	99 a	7.5 a	1.3	9.3 a	10.3 a	138.3 a
Regent 80WG*	0.13	In-furrow at Planting	3.0 b	13 b	92 ab	4.0 c	0.7	1.5 b	3.9 c	115.8 abc
Regent 80WG*	0.13	Banded at 8 Inch Stage	4.6 a	69 a	76 c	—	—	—	—	103.1 cd
Pounce 1.5 G	0.15	Bdcst at Whorl	—	—	—	7.3 a	1.5	5.0 ab	8.5 ab	95.9 cd
EXP 61216A 3G*	0.15	Bdcst at Whorl	—	—	—	—	—	—	—	80.8 d
Regent 80WG*	0.13	Bdcst at Whorl	—	—	—	4.5 bc	1.0	2.5 b	5.1 bc	98.7 cd
Regent 80WG*	0.06	Bdcst /Whorl	—	—	—	—	—	—	—	88.2 d
Regent 80WG*	0.03	Bdcst /Whorl	—	—	—	—	—	—	—	98.7 cd
LSD			0.65	35	8.25	2.4	2.4	4.4	3.7	23.2
F-test Prob.			0.0001	0.005	0.0001	0.022	0.71	0.019	0.007	0.0005

Means followed by same letter do not significantly differ (P=0.05, LSD)

***These treatments not yet registered for use on corn.**

WEED CONTROL IN NO-TILL DRYLAND GRAIN SORGHUM IN WESTERN KANSAS

by
Curtis Thompson and Alan Schlegel

SUMMARY

Sorghum yields were highest when broadleaf and grass weeds were controlled with preemergence treatments. Atrazine was an essential component of all treatments that provided good broadleaf and grass control and the highest sorghum yields. The exception was Milopro, which is propazine and in the same chemical family as atrazine; it provided excellent weed control similar to atrazine. Lasso, Dual II, and Frontier alone did not provide adequate control of pigweed, kochia, or Russian thistle. Peak, Permit, Banvel, Buctril, or 2,4-D did not provide any grass control. Sorghum yields were low when either grass or broadleaf weeds were not controlled.

INTRODUCTION

The greatest factor limiting production of dryland sorghum in western Kansas is moisture. No-till increases the efficiency of moisture storage, which in return has increased grain production. Control of broadleaf and grass weeds is essential so that the benefits of this no-till system can be translated into increased grain production. Grass problems tend to increase in the no-till wheat-sorghum-fallow system. The following study evaluated pre- and postemergence herbicides for broadleaf and grass weed control in grain sorghum planted no-till into wheat stubble.

PROCEDURES

Pioneer 8771 Concep-treated seed was planted no-till into wheat stubble at 30,000 seeds/acre in 30-inch rows, and preemergence treatments were applied on May 17 with a hand-boom CO_2 pressurized plot sprayer delivering 20 gpa. Landmaster at 40 oz/acre was broadcast over the entire experiment to control all emerged weeds on May 17. Postemergence treatments were applied as previously described to 2- to 6-inch broadleaf weeds, 4- to 5-leaf volunteer wheat, 1- to 3-inch witchgrass, and 5-collar sorghum approximately 6 to 7 inches tall on June 20. Climatic conditions, soil characteristics, and weed densities are presented in Table 1. Crop injury and weed control were evaluated visually on July 2, and heads were counted and weed control evaluated again on October 25 prior to grain harvest. Plots were 10 by 30 feet. Grain was harvested from two rows 27 feet long with a plot combine on October 28.

RESULTS AND DISCUSSION

Sorghum yields ranged from 30 to 111 bu/acre and were strongly correlated to the level of grass and broadleaf weed control (Table 2). All treatments containing atrazine provided grass suppression or control and broadleaf weed control, which lead to higher grain yields. Test weights tended to increase as yields increased, indicating that kernel fill was better when weed competition was less. The number of heads/acre correlated well with yields and weed control ratings.

Sorghum was injured by atrazine, and atrazine-containing compounds, Guardsman, Bicep Lite II, and Bullet applied preemergence (Table 2). Frontier alone caused more injury to sorghum than Dual II or Lasso applied alone. Injury from preemergence treatments did not correlate well with grain yield, indicating that sorghum recovered from the injury and that weed control was a more critical factor affecting yield. Postemergence treatments that caused sorghum injury were 2,4-D and Shotgun (2,4-D + atrazine). Apparently, sorghum did not recover from the 0.5 lb rate of 2,4-D and yield was reduced compared to yields from sorghum treated with 0.375 lb of 2,4-D.

All treatments without atrazine failed to control either broadleaf or grass weeds (Table 3), resulting in poor sorghum yields. Atrazine was the essential

Table 1. Climatic conditions, soil information, and weed densities, Tribune, KS, 1996.

		Preemergence surface	Postemergence
Application timing		Preemergence surface	Postemergence
Application date		5/17/96	6/20/96
Time of day		8:00 pm	1:00 pm
Air temperature (F)		80 F	85 F
Wind speed mph (direction)		3 (N)	3 (N)
Relative humidity		28%	60%
Soil surface moisture		Dry	Dry
Weed densities / yd^2:			
	Vol. wheat	11	
	Witchgrass	9	
	Pigweed species	25	
	Kochia	5	
	Russian thistle	0.5	
Soil	pH	7.3	
	OM (%)	1.9	
	Classification	Richfield silt loam	

component that provided broadleaf control with grass herbicides and grass control or grass suppression with broadleaf herbicides. Atrazine was the essential component and the only herbicide that provided adequate control of volunteer wheat.

Preemergence treatments provided the most consistent weed control (Table 3) and highest sorghum yields. The exceptions were Frontier, Dual II, and Lasso applied alone. Volunteer wheat and broadleaf weeds escaped these treatments. Control of pigweed species with these herbicides ranged from 50 to 60% at the early evaluation, which was a bit disappointing. Insufficient moisture likely caused this poor control.

Peak generally provided excellent control of pigweed species and acceptable control of kochia and Russian thistle. However, tankmixing with other compounds having broadleaf weed activity increased the control ratings for kochia and Russian thistle above 95% (Table 3). Permit did not control broadleaf weeds as well as Peak. Banvel, Buctril, Peak, Permit, or 2,4-D did not provide any grass control; thus, sorghum yields were suppressed by witchgrass and volunteer wheat competition.

Milopro and atrazine applied preemergence gave the best overall weed control for single herbicide treatments (Table 3). Preemergence atrazine becomes a very economical treatment for dryland sorghum. Under severe grass pressure, atrazine may not provide sufficient control.

Table 2. Sorghum response to pre- and postemergence herbicides, Tribune, KS, 1996.

Treatment	Rate	Application Time	Crop Injury	Yield	Moisture	Test Weight	Heads/ Acre
	lb ai/a		%	bu/a	%	lb/bu	x1000
Untreated	----	----	--	33	12.5	57.0	26.5
Peak	0.018	Post	0	48	12.5	58.5	37.4
COC	2.0 pt	Post					
Peak	0.027	Post	0	36	12.5	58.4	31.9
COC	2.0 pt	Post					
Peak	0.036	Post	0	46	12.3	57.9	34.8
COC	2.0 pt	Post					
Peak	0.018	Post	0	88	12.6	58.8	51.0
Atrazine	0.75	Post					
COC	2.0 pt	Post					
Peak	0.018	Post	3	55	12.8	59.2	36.6
Banvel	0.25	Post					
NIS	0.25% v/v	Post					
Peak	0.018	Post	0	51	12.6	59.3	32.6
Buctril	0.25	Post					
NIS	0.25% v/v	Post					
Permit	0.031	Post	1	35	12.7	58.5	32.3
NIS	0.25% v/v	Post					
Banvel	0.25	Post	1	55	13.0	58.3	34.4
Marksman	1.0	Post	4	78	12.7	59.0	46.5
Buctril&Atrazine	0.75	Post	0	90	12.5	59.1	51.1
Buctril	0.25	Post	0	57	12.5	58.4	37.1
Atrazine	1.0	Post	0	89	12.6	59.4	58.7
COC	2.0 pt	Post					
2,4-D LVE	0.375	Post	9	41	12.4	58.7	30.8
2,4-D LVE	0.5	Post	14	30	12.6	58.3	24.8
Shotgun	0.81	Post	9	82	12.8	59.1	49.5
Atrazine	1.0	Pre	15	103	12.8	59.3	61.1
Frontier	1.2	Pre	14	47	12.3	56.9	27.9
Guardsman	2.15	Pre	18	107	12.6	59.0	62.0
MiloPro	1.2	Pre	6	111	12.6	59.1	64.4
Dual II	1.8	Pre	6	39	12.5	57.8	30.0
Bicep Lite II	2.5	Pre	9	102	12.8	58.8	60.5
Lasso	2.2	Pre	5	52	12.5	58.1	31.0
Bullet	2.4	Pre	15	93	12.8	59.5	60.3
Untreated	----	----	--	34	12.8	57.8	23.1
LSD (0.05)			7	21	0.3	1.2	9.1

Table 3. Weed control with pre- and postemergence herbicides in grain sorghum, Tribune, KS, 1996.

Treatment	Rate	Application Time	Pigweed Species[1] 7/2	Pigweed Species[1] 10/25	Vol. Wheat 7/2	Witchgrass 7/2	Witchgrass 10/25	Kochia 7/2	Kochia 10/25	Russian Thistle 7/2
	(lb ai/A)		(% Control)							
Peak	0.018	Post	100	100	0	0	3	89	88	97
COC	2.0 pt	Post								
Peak	0.027	Post	100	100	0	0	0	90	95	97
COC	2.0 pt	Post								
Peak	0.036	Post	100	99	3	0	0	89	91	98
COC	2.0 pt	Post								
Peak	0.018	Post	99	100	89	18	72	97	99	100
Atrazine	0.75	Post								
COC	2.0 pt	Post								
Peak	0.018	Post	99	100	8	0	0	98	100	99
Banvel	0.25	Post								
NIS	0.25% v/v	Post								
Peak	0.018	Post	100	100	1	0	3	100	96	100
Buctril	0.25	Post								
NIS	0.25% v/v	Post								
Permit	0.031	Post	74	89	0	0	9	68	71	84
NIS	0.25% v/v	Post								
Banvel	0.25	Post	76	99	9	0	0	79	100	79
Marksman	1.0	Post	95	99	80	1	56	85	94	95
Buctril&Atrazine	0.75	Post	100	99	81	5	66	100	99	100
Buctril	0.25	Post	89	92	0	0	0	98	94	99
Atrazine	1.0	Post	100	99	93	23	81	78	95	100
COC	2.0 pt	Post								
2,4-D LVE	0.375	Post	80	95	1	0	0	64	59	83
2,4-D LVE	0.5	Post	90	97	0	4	0	75	64	87
Shotgun	0.81	Post	98	99	80	9	58	93	91	98
Atrazine	1.0	Pre	100	100	100	--	99	96	96	100
Frontier	1.2	Pre	53	35	28	--	86	23	24	20
Guardsman	2.15	Pre	100	100	100	--	99	99	97	100
MiloPro	1.2	Pre	100	100	100	--	99	100	100	100
Dual II	1.8	Pre	61	29	68	--	95	18	15	18
Bicep Lite II	2.5	Pre	100	100	100	--	100	100	100	100
Lasso	2.2	Pre	63	53	34	--	89	29	20	29
Bullet	2.4	Pre	100	100	100	--	97	100	100	100
LSD (0.05)			9	9	7	10	15	16	16	16

[1]Tumble, redroot, and Palmer amaranth.

KSTATE
Southwest Research-Extension Center

COMPARISONS OF 58 HERBICIDE TANK MIXES FOR WEED CONTROL IN IRRIGATED, POAST-RESISTANT CORN

by
Randall Currie

SUMMARY

Corn emerged before weeds, which greatly enhanced control of many treatments. Under these conditions, herbicides in the chloroacetamide class produced much higher levels of broadleaf weed control than are normal. Therefore, the broadleaf control data here should be used with caution. Under these much more competitive conditions, even the untreated plots produced yields ranging from 59 to 70 bu/acre. Excellent weed control more than doubled yield compared to the untreated control.

INTRODUCTION

This study was designed to compare 58 tank mixes of herbicides applied at different times for control of weeds in Poast-resistant corn.

PROCEDURES

Weeds were planted as described in Table 1, and Poast-resistanct corn was planted as described in Table 2. All weed not mentioned in Table 1 were natural infestations. Herbicides were applied as described in Table 3. Weed number per square foot was counted every 1 to 2 weeks. Ratings on 6/27 and 8/5 are presented as representative of mid-season and late-season weed pressure. Yield was determined by combine harvest and adjusted to 15.5% moisture.

Table 1. Weed seeding information.

Weeds	Velvetleaf, pigweed, crabgrass
Planting Date	4-18-96
Planting Method	Great Plains drill
Carrier	Rolled corn
Rate, Unit	Velvetleaf—1.66/ft^2; Pigweed—3.2/ft^2; Crabgrass—50/ft^2
Depth, Unit	Broadcast on surface
Row Spacing, Unit	10 in.

Table 2. Crop information.

Variety	Cargill 7800SR
Planting Date	5-7-96
Planting Method	JD Max Emerge II
Rate, Unit	30,600 kernels/acre
Depth, Unit	1.5 in.
Row Spacing, Unit	30 in. rows on 60 in. beds
Soil Temp., Unit	60 F at 5 in.
Soil Moisture	Dry surface, moist 2 in. below
Emergence Date	5-15-96

RESULTS AND DISCUSSION

At the mid-season rating, most treatments that provided complete control were those that had shown good results in the past (Table 4). However, the outstanding control seen in treatments 40, 42, 46, and 55 was very atypical for this area. This is attributed to good emergence of the corn and little rainfall for the first several weeks after planting.

At mid-season, kochia data were highly variable primarily because of generally low densities. One should not use these data to select a herbicide to control kochia. They were included for the reader's use if they confirm results seen in other replicated research or to draw inferences about the total mix of weed species present and their impact on yield. This is also true of grassy sandbur data. Even though the data presented here are variable, they might be useful as a guide to further investigations because so few data are available on control of grassy sandbur.

Later in the season, most treatments provided much higher levels of control than is typical because of good corn canopy. Treatments 3, 7, 8, 9, 16, 18, 34, 43, 45, 47, 49, 50, 51 and 56 provided season-long control of pigweed. As described earlier, rating date treatments 40, 42, and 46 also provided excellent albeit atypical season-long control.

Seed bed preparation is the foundation of any good weed control program. If moisture is available at the depth where corn is planted and unavailable in the top 1 to 2 inches, this dry soil acts as a de facto mulch allowing the crop to shade the ground before weeds emerge. This certainly was the case in this study.

Because of these conditions, many of the tank mixes that normally produce good grass control and modest to poor broadleaf weed control provided excellent broadleaf weed control. Therefore, the broadleaf control provided by chloroacetamide herbicides in this study should be used with caution unless similar conditions can be predicted.

Table 3. Application information, herbicide study on Poast-resistant corn, Garden City, KS, 1996.

Application Date	4-23-96	5-6-96	5-7-96	6-5-96	6/13/96	7/1/96
Time of Day	9:00 am - 10:00 am	3:00 pm - 3:40 pm	2:36 pm	2:30 pm	9:30 am - 11:30 am	11:00 am - 11:30 am
Application Method	Broadcast	Broadcast	Broadcast	Broadcast	Broadcast	Broadcast
ApplicationTiming	10-15 days early preplant	PPI	PRE	Early post	Post emerge	Late Post
Air Temp., Unit	60° F	74.6° F	78° F	99° F	94° F	99° F
% Relative Humidity	< 20%	54%	61%	20%	25%	46%
Wind Velocity, Unit	5-15 mph S	8-10 mph NNE Gusts 20mph	8 mph	0 mph	0 mph	0-2 mph SSE
Dew Presence (Y/N)	N	N	N	N	N	N
Soil Temp., Unit	51° F at 5"	64° F at 5"	61° F at 5"	82° F at 5"	79° F at 5"	77° F at 5"
Soil Moisture	Dry surface, moist below surface	Dry surface, moist 2" below surface	Dry surface, moist 2" below surface	Dry surface, moist 2" below surface	Dry surface moist 2" below surface	Dry surface, moist 2" below surface
% Cloud Cover	0%	60%	100%	20%	20%	20%
APPLICATION EQUIPMENT						
Appl. Equipment	Windshield sprayer	Windshield sprayer	Windshield sprayer	Windshield sprayer	Windshield sprayer	Windshield sprayer
Pressure, Unit	35 psi	31 psi	32 psi	35 psi	38 psi	38 psi
Nozzle Type	Teejet XR	Teejet XR	Teejet XR	Teejet XR	Teejet XR	Teejet XR
Nozzle Size	8004 VS	8004 VS	8004 VS	8004 VS	8004 VS	8004 VS
Nozzle Spacing, Unit	20"	20"	20"	20"	20"	20"
Boom Length, Unit	10'	10'	10'	10'	10'	10'
Boom Height Unit	18"	18"	18"	18"	18"	18"
Groung Speed, Unit	3.3 mph	3.3 mph	3.3 mph	3.3 mph	3.3 mph	3.3 mph
Incorp. Equipment	None	Lilleston	None	None	None	None
Time to Incorp., Unit	NA	18 hours after spraying and @0.02" of rain	NA	NA	NA	NA
Incorp. Depth, Unit	NA	1 1/2"	NA	NA	NA	NA
Carrier	Water	Water	Water	Water	Water	Water
Spray Volume, Unit	20 GPA	20 GPA	20 GPA	20 GPA	20 GPA	20 GPA
Propellant	Carbon Dioxide	Carbon Dioxide	Carbon Dioxide	Carbon Dioxide	Carbon Dioxide	Carbon Dioxide

Table 4. Weeds per square foot in Poast-resistant corn on 6/27/96, Garden CIty, KS.

	Treatment	Rate lbs AI/acre	Application Time	Crabgrass 6/27/96	Pigweed 6/27/96	Foxtail 6/27/96	Kochia 6/27/96	Sandbur 6/27/96
1	(Frontier) + Banvel + 28% UAN	(1.265)+0.50+ 1.00 % v/v	(PreEM)+Early Post	28.5	0.0	0.3	1.3	0.3
2	(Frontier) + SAN821 H 600SL +28% UAN	(1.265)+0.47+ 1.00 % v/v	(PreEM)+Early Post	8.0	2.0	0.3	0.0	0.0
3	(Frontier) + Marksman + 28% UAN	(1.265)+1.40+ 1.00% v/v	(PreEM)+Early Post	7.3	0.0	0.0	0.0	0.0
4	(Frontier) +SAN1269 H 70WG + 28% UAN + NIS	(1.265) +0.263 + 1.00% v/v + 0.25 v/v	(PreEM)+Early Post	5.0	0.3	0.0	0.0	0.0
5	(Frontier) +SAN1269 H 70WG + 28% UAN + NIS	(1.265) +0.263 + 1.00% v/v + 0.25 v/v	(PreEM)+ Post	42.8	0.5	0.0	0.0	0.0
6	Guardsman	2.81	Pre Em	7.0	0.3	0.0	0.3	0.0
7	(Guardsman) +Banvel	(2.81)+0.375	(PreEm)+ Early post	0.8	0.0	0.0	0.0	0.0
8	(Frontier) + Banvel + Exceed + NIS	(1.265)+0.25+ 0.031+0.25% v/v	(PreEm)+ Early post	15.0	0.0	0.0	0.0	1.0
9	(Frontier) + SAN319 H 600 EC + Atrazine + COC	(1.265)+0.70+ 1.00 + 0.25 gal	(PreEm)+ Early post	3.8	0.0	0.5	0.0	0.3
10	EXP 31130 A	0.071	Pre Em	3.5	0.3	10.0	0.0	0.0
11	EXP 31130 A	0.094	Pre Em	26.5	1.0	4.3	0.0	0.0
12	EXP 31130 A	0.118	Pre Em	16.3	0.5	0.3	0.0	0.0
13	EXP 31130 A + Surpass 6.4	0.094 + 1.00	Pre Em	14.8	0.8	1.0	0.5	0.3
14	EXP 31130 A + Dual II	0.094 + 1.25	Pre Em	12.8	0.0	0.0	0.0	0.0
15	EXP 31130 A + Atrazine	0.094 + 1.00	Pre Em	16.8	0.3	0.0	0.0	0.0
16	EXP 31130 A + Dual II + Atrazine	0.094 + 1.00 + 1.00	Pre Em	5.0	0.0	0.0	0.0	0.0
17	EXP 31130 A + Dual II + Atrazine	0.094 + 1.00 + 1.50	Pre Em	10.8	0.3	0.3	0.0	0.0
18	EXP 31130 A + Atrazine	0.094 + 1.50	Pre Em	17.3	0.0	0.0	0.0	0.0
19	EXP 31130 A + Dual II	0.094 + 1.50	Pre Em	3.8	0.0	0.0	0.0	0.0
20	EXP 31130 A + Surpass 6.4	0.094 + 1.20	Pre Em	29.3	0.5	0.0	0.0	0.0
21	Bicep II	2.00	Pre Em	2.3	1.3	0.0	0.3	0.0
22	Buctril + Accent + Atrazine + NIS	0.25 +0.03 + 1.00 + 0.25 % v/v	Pre Em	10.0	0.5	2.8	0.0	2.5
23	Scorpion III + NIS + 28% UAN	0.21 + 0.25% v/v + 2.5% v/v	Post < 8"	43.0	0.5	29.8	0.5	0.0
24	Broadstrike Plus + NIS + 28% UAN	0.086 + 0.25% v/v + 2.5% v/v	Post < 8"	38.5	1.5	6.5	0.8	0.0

Continued

Table 4. Weeds per square foot in Poast-resistant corn on 6/27/96, Garden City, KS continued.

	Treatment	Rate lbs AI/acre	Application Time	Crabgrass 6/27/96	Pigweed 6/27/96	Foxtail 6/27/96	Kochia 6/27/96	Sandbur 6/27/96
25	Broadstrike Plus + NIS + 28% UAN	0.17+0.25%v/v + 2.5% v/v	Post < 8"	23.0	0.5	2.0	1.3	13.0
26	Broadstrike Plus + NIS + 28% UAN	0.086 + 0.25% v/v + 2.5% v/v	Post < 8"	22.0	0.8	22.8	1.0	1.0
27	Broadstrike Plus + NIS + 28% UAN	0.17 + 0.25% v/v+ 2.5% v/v	Post < 8"	17.0	0.8	16.8	0.8	0.3
28	Broadstrike SF + Dual	1.93	PPI	10.5	2.8	0.0	0.5	0.8
29	Broadstrike SF + Dual	1.93	Pre Em	14.0	0.5	0.0	0.3	9.8
30	Broadstrike Plus + Dual	0.21 + 2.00	PPI	33.5	0.0	0.0	0.0	0.5
31	Broadstrike Plus + Dual	0.21 + 2.00	Pre Em	4.5	0.0	0.0	0.0	0.3
32	Doubleplay	4.38	PPI	91.5	0.3	0.0	0.3	0.0
33	ICIA5676/Atrazine	3.00	Pre Em	7.8	0.0	0.0	0.0	1.5
34	ICIA5676/Atrazine	3.30	Pre Em	5.8	0.0	0.0	0.0	0.8
35	(Topnotch) + Buctril/Atrazine	(1.60) + 0.75	(10-15 EPP)+ Post	51.5	6.3	0.0	0.0	0.8
36	(Topnotch) + Buctril/Atrazine	(2.00) + 0.75	(10-15 EPP) + Post	10.5	0.0	6.0	0.0	0.0
37	(Touchdown) + 2,4-D + NIS +AmmSulfate) + Topnotch	0.50+0.50+0.5%+ 17#/100g +1.50+2.00	(10-15 EPP) + Pre Em	11.5	0.5	0.0	0.0	0.3
38	Dual II	2.00	Pre em	8.3	0.3	0.3	1.0	1.0
39	Duall II	4.00	Pre em	6.3	1.0	0.3	0.5	4.0
40	CGA77102 +Benoxacor	1.25	Pre em	1.5	0.0	0.5	1.0	0.5
41	CGA77102 +Benoxacor	2.50	Pre em	1.5	0.5	0.0	0.5	0.0
42	Surpass 6.4	1.20	Pre em	23.5	0.0	2.8	1.0	2.0
43	Surpass 6.4	2.40	Pre em	7.0	0.0	0.3	0.0	0.0
44	Harness	1.53	Pre em	7.8	0.8	0.0	0.0	0.0
45	Harness	3.06	Pre em	13.0	0.0	0.0	0.0	0.0
46	Frontier	1.05	Pre em	10.8	0.0	1.3	1.0	0.0
47	Frontier	2.10	Pre em	10.0	0.0	0.0	0.3	0.5
48	Axiom	0.72	Pre em	5.3	0.3	0.0	0.0	0.0
49	Axiom	1.44	Pre em	0.5	0.0	0.0	0.0	0.0
50	(Dual II) + Exceed + COC	(2.00)+0.036+ 0.25 gal	(PreEm)+ Post	8.8	0.0	1.8	0.8	0.0
51	(Dual II) + Exceed + NIS + Banvel	(2.00)+0.036+ 0.25 % v/v + 0.125	(PreEm)+ Post	5.3	0.0	0.0	0.3	0.0

Continued

	Treatment	Rate lbs AI/acre	Application Time	Crabgrass 6/27/96	Pigweed 6/27/96	Foxtail 6/27/96	Kochia 6/27/96	Sandbur 6/27/96
52	(Dual II) + Exceed + NIS + Buctril	(2.00)+0.036+ 0.25 % v/v + 0.125	(PreEm)+ Post	23.8	0.5	1.8	0.8	2.0
53	(Dual II) + Exceed + COC + Action	(2.00)+0.036+ 0.25 % v/v + 0.125	(PreEm)+ Post	2.8	0.8	0.0	0.5	0.0
54	Atrazine + Poast + COC	2.00 + 1.00 + 0.25 gal	Post	48.3	1.8	0.0	0.0	0.3
55	Axiom	0.77	Pre Em	2.0	0.0	0.0	0.3	0.0
56	Axiom + Atrazine	0.68 + 1.40	Pre Em	6.8	0.0	0.0	0.3	0.0
57	Sencor DF + Banvel	0.094 + 0.250	Early Post	32.0	0.0	2.5	0.0	19.0
58	Sencor DF + Tough 3.75	0.094 + 0.700	Post	38.5	0.8	1.3	0.0	0.0
59	Check			27.8	1.7	3.0	0.3	0.8
60	Check			16.0	1.8	43.3	1.8	9.3
	LSD 0.05 =			34.9	2.4	15.0	1.0	8.6

Table 4. Weeds per square foot in Poast-resistant corn on 6/27/96, Garden City, KS continued.

BROADLEAF WEED CONTROL IN WINTER WHEAT WITH PEAK COMBINATIONS

by

Curtis Thompson, DeWayne Craghead[1], and Randall Currie

SUMMARY

Peak, a new herbicide for wheat, gave excellent control of wild sunflower, Russian thistle, and buffalobur. Control of kochia, common lambsquarters, and mustard species was enhanced when Peak was applied with Banvel, Buctril, Bronate, or 2,4-D. The addition of 2,4-D to Peak or Ally did not provide adequate control of kochia. Probably, ALS-resistant kochia was present at the Hodgeman County site.

INTRODUCTION

Peak is a new herbicide registered for broadleaf weed control in wheat. Wheat produced in a wheat fallow or a wheat-summer crop-fallow rotation frequently has problems from winter annual and spring-emerging broadleaf weeds. Winter annual grass problems generally are eliminated in a wheat-summer crop-fallow rotation. In years when wheat stands are thin, broadleaf weeds can create severe harvesting problems in addition to utilizing moisture and reducing wheat yields and possibly reducing moisture and yields of the subsequent crop in the rotation. Two studies were established in Hodgeman County to evaluate broadleaf weed control in thin wheat stands.

PROCEDURES

Two experiments with 'Ike' wheat were established north and northeast of Jetmore in Hodgeman County. Plots were 10 by 30 feet. All treatments were applied with a hand-boom CO_2-pressurized plot sprayer delivering 20 gpa on April 26. Treatments were applied to 0.5- to 2-inch kochia and Russian thistle, cotyledon to 2-inch common lambsquarters and wild sunflower, cotyledon to 1-inch buffalobur, 1- to 5-inch treacle mustard and flixweed, and jointing (2-node) wheat. Climatic conditions, soil characteristics, and weed densities are presented in Table 1. Crop injury and weed control were evaluated visually on May 10 and again on June 7. Wheat was not harvested because of low yield potential.

RESULTS AND DISCUSSION

Banvel and Banvel tank mixed with Peak were the only treatments to cause injury to wheat (Table 2). Banvel should not be applied to wheat after the jointing stage begins because of increased risk of crop injury. The extremely dry winter had delayed the emergence of winter annual and spring annual broadleaf weeds; thus, treatments were applied later than normal to the wheat crop. No herbicide injury was observed at the DeWayne Craghead site (data not shown).

Peak alone or tank mixed with other broadleaf herbicides gave excellent control of wild sunflower, buffalobur, and Russian thistle (Table 2). Peak tank mixed with Banvel, Buctril, or Bronate gave better control of kochia and mustard species than Peak applied alone (Table 3). Peak tank mixed with 2,4-D and Ally tank mixed with 2,4-D gave excellent control of the mustard species, but did not give adequate control of kochia by the June 7 rating. Apparently, ALS-herbicide-resistant kochia was present in the study area, which allowed significant recovery of kochia (Table 3). Peak alone or 2,4-D alone gave less than 60% kochia control 6 weeks after treatment.

[1]Hodgeman County, Agricultural Agent, Jetmore.

Table 1. Climatic conditions, soils information, weed densities, Hodgeman County, KS, 1996.

Cooperator/Site	Darrell Craghead	DeWayne Craghead
Application date	4/26/96	4/26/96
Time of day	7:00 am	8:30 am
Air temperature (F)	34 F	52 F
Wind speed mph (direction)	0	4 (W)
Relative humidity	62%	45%
Soil surface moisture	Dry	Dry
Weed densities / yd^2:		
Kochia		25
Mustard species (treacle and flixweed)		1
Common lambsquarters		1
Sunflower	20	
Russian thistle	1	
Buffalobur	40	
Soil pH		6.7
OM (%)		1.5
Classification	Harney Silt Loam	Harney Silt Loam

Table 2. Broadleaf weed control in wheat, Hodgeman County, Darrell Craghead cooperator, 1996.

		Wild Sunflower		Russian Thistle		Buffalobur		Wheat Injury
Treatment	Rate	5-10	6-7	5-10	6-7	5-10	6-7	6-7
	oz prod/acre			- % control -				%
Peak	0.5	96	100	96	99	96	100	0
Surfactant	0.25% v/v							
Peak	0.375	94	99	95	99	97	99	11
Banvel	4.0							
Surfactant	0.25% v/v							
Peak	0.375	98	100	98	100	98	100	0
Bronate	12.0							
Surfactant	0.25% v/v							
Peak	0.375	97	100	98	100	97	100	0
Buctril	12.0							
Surfactant	0.25% v/v							
Peak	0.375	96	99	96	95	96	100	0
2,4-D ester	8.0							
Surfactant	0.25% v/v							
Ally	0.1	89	97	91	98	93	99	0
2,4-D ester	8.0							
Surfactant	0.25% v/v							
Banvel	4.0	53	86	47	88	60	85	12
Bronate	16.0	98	95	98	93	98	89	0
2,4-D ester	16.0	90	84	92	90	93	91	0
LSD (0.05)		5	7	4	5	10	10	4

Table 3. Broadleaf weed control in wheat, Hodgeman County, DeWayne Craghead cooperator.

Treatment	Rate	Kochia 5-10	Kochia 6-7	Common Lambsquarters 5-10	Mustard Species 5-10
	oz prod/acre	- % control -			
Peak	0.5	88	50	88	90
Surfactant	0.25% v/v				
Peak	0.375	94	96	95	95
Banvel	4.0				
Surfactant	0.25% v/v				
Peak	0.375	98	89	98	98
Bronate	12.0				
Surfactant	0.25% v/v				
Peak	0.375	97	86	96	96
Buctril	12.0				
Surfactant	0.25% v/v				
Peak	0.375	93	68	97	96
2,4-D ester	8.0				
Surfactant	0.25% v/v				
Ally	0.1	89	73	96	97
2,4-D ester	8.0				
Surfactant	0.25% v/v				
Banvel	4.0	60	77	43	27
Bronate	16.0	92	75	97	98
2,4-D ester	16.0	80	57	91	96
LSD (0.05)		11	23	17	5

GREEN FOXTAIL CONTROL IN DRYLAND GRAIN SORGHUM

by
Randall Currie

SUMMARY

Uncontrolled foxtail reduced yield from 36 to 49 bushels compared to treatments providing control. Although atrazine alone seldom improved grass control over that in the untreated plots, it did raise yield approximately 26 bu compared to the untreated control. Treatments providing good foxtail control raised yield 23 bu compared to atrazine alone.

INTRODUCTION

As the cheaper control compounds for broadleaf weeds have gained widespread use, a niche has opened for grassy weeds that are more expensive to control to gain supremacy. Atrazine, Banvel, Buctril, and 2,4-D have long been used for broadleaf control in southwest Kansas. They provide poor or inconsistent grass control; therefore, as expected, they have removed competition of the broadleaf weeds and allowed green foxtail to predominate in many fields. Therefore, the objectives of this test were to show yield losses caused by use of herbicide tank mixes designed to control only broadleaf weeds and to demonstrate the yield advantages associated with good green foxtail control.

PROCEDURES

Sorghum was planted as described in Table 1. Herbicide treatments were applied as described in Table 2 and 3.

Although low levels of broadleaf weeds were measured, they had no significant impact on yield. Therefore, only foxtail numbers per square foot and percent control calculated from these counts are presented. Grain was harvested with a plot combine, and all yields were adjusted to 15.5% moisture.

Table 1. Green foxtail control in dryland grain sorghum, crop information.

Variety	CIBA 1486
Planting Date	5-31-96
Planting Method	JD Max Emerge II
Rate, Unit	29,400 seed/A
Row Spacing,	Unit 30 in.
Soil Moisture	Dry surface, moist below

RESULTS AND DISCUSSION

Only one treatment reduced height at 8 days after post-emergence treatment, Peak following Dual II treatment (Table 4). As was seen in 1995 (See pages 46-50, 1996 Field Day Report), Peak injury was inconsistent. For example, height reduction seen with Dual and Peak treatment was not seen with treatments containing Peak alone or with Fe.

By 30 or 40 days after the first postemergence treatment, most herbicide treatments had reduced weed competition, so sorghum height increased (Table 5.) By July 16 and August 1, any treatment reducing foxtail numbers below 2.3 per square foot should be considered statistically equal. In mid August, any treatment reducing foxtail numbers below 2.7 per foot square should be considered statistically equal. Table 6 is provided to allow the reader to compare these data on the basis of a percent reduction in foxtail number calculated from the untreated control.

All treatments yielding below 23.7 bu were no better than the untreated plots (Table 7). Most of these treatments, with the exception of treatments 9 and 10, are not labeled for grass control. The atrazine treatment that is not labeled for grass control provided poor grass control. However, it did provide elevated yield. It may have stunted foxtail enough to provide a yield increase. All treatments providing grass control elevated yield over that with atrazine alone. Any treatment yielding greater than 42.3 bushels should be considered statistically equal. All treatments providing grass control would have easily paid for themselves compared to atrazine alone.

Table 2. Application information, green foxtail control in grain sorghum, Garden City, KS.

Application Date	5-31-96	7-1-96	7-25-96
Application Method	Broadcast	Broadcast	Broadcast
Application Timing	Pre em	Early post	Late post
Air Temp., Unit	81.2 F	102 F	74 F
% Relative Humidity	63%	35%	65%
Wind Velocity, Unit	6 mph	5 mph S	Calm
Dew Presence (Y/N):	N	N	Y
Soil Temp., Unit	60 F	87 F	74 F
Soil Moisture	Dry surface, moist below	Dry surface, moist 1 1/2 in. below	Good
% Cloud Cover	50 %	20 %	10 %

Table 3. Application equipment information, green foxtail control in grain sorghum, Garden City, KS.

Application Equipment	Windshield sprayer
Pressure, Unit	35 psi
Nozzle Type	Teejet XR
Nozzle Size	8004 VS
Nozzle Spacing, Unit	20 in.
Boom Length, Unit	10 ft.
Boom Height, Unit	18 in.
Ground Speed, Unit	3.3
Incorporation Equipment	NA
Time To Incorp., Unit	NA
Incorp. Depth, Unit	NA
Carrier	Water
Spray Volume, Unit	20 GPA
Propellant	Carbon dioxide

Table 4. Percent reduction* of sorghum height with herbicides applied to control green foxtail, Garden City, KS, 1996.

	Treatment	Rate	Appl.Stage	7-9-96	7-16-96	8-1-96	8-15-96
		lbs AI/acre			- % -		
1	Check			0.2	4.9	2.9	7.7
2	Guardsman	2.18	Pre Em	7.0	1.3	-5.8	-11.5
3	Bicep II	3.55	Pre Em	4.0	2.5	-6.8	-15.5
4	(Frontier) + Marksman	(1.58) + 0.80	(PreEm)+ Early Post	5.4	-2.4	-6.9	-10.5
5	Atrazine	1.25	Pre Em	-0.7	6.0	-8.0	-8.0
6	(Frontier) + Banvel	(1.58) + 0.25	(PreEm)+ Early Post	6.3	2.0	-8.4	-13.1
7	(Frontier) + Banvel + Peak + NIS	(1.58)+0.25+0.02+0.25% v/v	(PreEm)+ Early Post	4.0	-0.3	-9.34	-8.7
8	(Dual II) + Peak + NIS	(1.95)+0.04+0.25% v/v	(PreEm)+ Early Post	16.7	0.9	-7.4	-9.7
9	Prowl + Atrazine	0.83 + 1.20	Early Post	8.4	-0.2	0.2	-1.6
10	Prowl + Marksman	0.83 + 0.80	Early Post	3.9	0.5	-4.2	-4.4
11	Peak	0.02	Post	1.7	-2.9	-2.1	-2.0
12	Peak	0.03	Post	6.8	-3.1	0.3	-0.3
13	Peak	0.04	Post	-0.6	2.1	4.1	-0.4
14	(Peak) + Sequestrene 330FG	(0.04) + 0.09	(Post) + Late Post	-2.7	-0.4	2.5	-4.8
15	Milo-Pro	1.20	Pre Em	-2.8	-2.2	-5.2	-9.9
16	Milo-Pro	2.40	Pre Em	1.2	0.1	-4.3	-5.9
17	Milo-Pro + Dual	1.20 + 2.00	Pre Em	0.8	-2.1	-17.5	-13.8
18	Milo-Pro + Dual	2.40 + 2.00	Pre Em	-1.0	-4.8	-14.8	-18.2
19	Atrazine	1.00	Pre Em	-4.9	-7.7	-5.6	-5.7
20	Check			0.0	-4.5	-2.4	-7.7
	LSD (0.05)			12.1	18.7	8.4	11.3

* Negative reduction is defined as an increase compared to untreated control.

Table 5. Average number of green foxtail per square foot in sorghum, Garden City, KS, 1996.

	Treatment	Rate	Appl. Stage	7-9-96	7-16-96	8-1-96	8-15-96
		lbs AI/acre					
1	Check			26.5	5.3	5.0	4.8
2	Guardsman	2.18	Pre Em	4.7	0.8	1.0	0.9
3	Bicep II	3.55	Pre Em	1.5	0.3	0.5	0.8
4	(Frontier) + Marksman	(1.58) + 0.80	(PreEm)+ Early Post	7.3	2.0	2.3	2.8
5	Atrazine	1.25	Pre Em	14.0	2.5	2.5	2.5
6	(Frontier) + Banvel	(1.58) + 0.25	(PreEm)+ Early Post	12.0	3.3	2.5	3.0
7	(Frontier) + Banvel + Peak + NIS	(1.58)+0.25+0.02+0.25% v/v	(PreEm)+ Early Post	6.5	2.8	2.0	3.5
8	(Dual II) + Peak + NIS	(1.95)+0.04+0.25% v/v	(PreEm)+ Early Post	8.5	1.3	2.5	2.0
9	Prowl + Atrazine	0.83 + 1.20	Early Post	22.5	5.5	3.8	5.0
10	Prowl + Marksman	0.83 + 0.80	Early Post	19.8	5.0	3.3	5.0
11	Peak	0.02	Post	17.3	4.8	3.8	3.3
12	Peak	0.03	Post	28.0	6.0	4.3	3.5
13	Peak	0.04	Post	22.8	5.3	3.5	4.3
14	(Peak) + Sequestrene 330FG	(0.04) + 0.09	(Post) + Late Post	17.3	4.8	3.3	3.0
15	Milo-Pro	1.20	Pre Em	15.0	5.0	3.8	4.5
16	Milo-Pro	2.40	Pre Em	12.8	4.5	3.0	2.5
17	Milo-Pro + Dual	1.20 + 2.00	Pre Em	2.5	1.3	1.0	2.0
18	Milo-Pro + Dual	2.40 + 2.00	Pre Em	2.0	0.8	1.3	1.3
19	Atrazine	1.00	Pre Em	13.3	3.3	2.3	2.3
20	Check			18.8	4.3	3.5	4.0
	LSD (0.05)			15.9	1.9	1.8	1.9

Table 6. Percent reduction* of green foxtail in sorghum, Garden City, KS, 1996.

	Treatment	Rate	Appl. Stage	7-9-96	7-16-96	8-1-96	8-15-96
		lbs AI/acre					
1	Check			-13.9	-11.5	-17.1	-1.9
2	Guardsman	2.18	Pre Em	77.7	82.1	71.0	81.4
3	Bicep II	3.55	Pre Em	92.3	96.9	86.7	83.5
4	(Frontier) + Marksman	(1.58) + 0.80	(PreEm)+ Early Post	66.3	59.8	43.8	41.5
5	Atrazine	1.25	Pre Em	40.2	40.0	37.5	37.9
6	(Frontier) + Banvel	(1.58) + 0.25	(PreEm)+ Early Post	42.4	37.1	42.9	34.0
7	(Frontier) + Banvel + Peak + NIS	(1.58)+0.25+0.02+0.25% v/v	(PreEm)+ Early Post	69.1	47.3	52.1	21.7
8	(Dual II) + Peak + NIS	(1.95)+0.04+0.25% v/v	(PreEm)+ Early Post	60.6	77.5	41.7	57.7
9	Prowl + Atrazine	0.83 + 1.20	Early Post	-1.9	-12.1	8.8	-10.8
10	Prowl + Marksman	0.83 + 0.80	Early Post	10.1	-4.0	24.6	-0.2
11	Peak	0.02	Post	18.0	-16.5	2.1	32.7
12	Peak	0.03	Post	-21.4	-36.9	-3.3	23.8
13	Peak	0.04	Post	-1.6	-14.2	18.3	16.3
14	(Peak) + Sequestrene 330FG	(0.04) + 0.09	(Post) + Late Post	15.4	-6.5	12.5	42.1
15	Milo-Pro	1.20	Pre Em	27.6	-3.5	7.5	13.1
16	Milo-Pro	2.40	Pre Em	45.4	7.5	30.4	50.4
17	Milo-Pro + Dual	1.20 + 2.00	Pre Em	87.8	72.3	74.2	61.7
18	Milo-Pro + Dual	2.40 + 2.00	Pre Em	90.9	80.4	67.1	69.0
19	Atrazine	1.00	Pre Em	42.4	34.6	47.9	53.5
20	Check			15.4	19.6	17.1	20.6
	LSD (0.05)			72.9	43.1	44.7	35.0

* Negative reduction is defined as an increase compared to untreated control.

Table 7. Harvest data for soghum treated with herbicides to control green foxtail, Garden City, KS, 1996.				
	Treatment	Rate	Appl. Stage	Yield
		lbs AI/acre		(bu/acre)
1	Check			12.7
2	Guardsman	2.18	Pre Em	58.0
3	Bicep II	3.55	Pre Em	60.1
4	(Frontier) + Marksman	(1.58) + 0.80	(PreEm)+ Early Post	56.0
5	Atrazine	1.25	Pre Em	43.5
6	(Frontier) + Banvel	(1.58) + 0.25	(PreEm)+ Early Post	56.6
7	(Frontier) + Banvel + Peak + NIS	(1.58)+0.25+0.02+0.25% v/v	(PreEm)+ Early Post	53.7
8	(Dual II) + Peak + NIS	(1.95)+0.04+0.25% v/v	(PreEm)+ Early Post	53.3
9	Prowl + Atrazine	0.83 + 1.20	Early Post	22.0
10	Prowl + Marksman	0.83 + 0.80	Early Post	19.7
11	Peak	0.02	Post	19.6
12	Peak	0.03	Post	18.1
13	Peak	0.04	Post	16.8
14	(Peak) + Sequestrene 330FG	(0.04) + 0.09	(Post) + Late Post	26.0
15	Milo-Pro	1.20	Pre Em	42.2
16	Milo-Pro	2.40	Pre Em	33.6
17	Milo-Pro + Dual	1.20 + 2.00	Pre Em	66.0
18	Milo-Pro + Dual	2.40 + 2.00	Pre Em	65.5
19	Atrazine	1.00	Pre Em	37.6
20	Check			21.0
	LSD (0.05)			23.7

IMPACT OF PALMER PIGWEED DENSITY ON CORN FORAGE QUALITY

by
Randall Currie, Kelly Kreikemeier, and Rafael Massinga[1]

SUMMARY

Dry matter yield per acre decreased greatly as Palmer pigweed infestation in corn increased. Crude protein content in forage tended to increase and neutral detergent fiber value tended to decrease as pigweed infestation increased. However, the in-vitro digestibility decreased when pigweed was present. The overall effects of Palmer pigweed on total forage production and quality were negative.

INTRODUCTION

Feeding weeds to livestock is not a recommended practice, but it occurs occasionally because of unforeseen circumstances. Kochia works well when fed to nonlactating, gestating beef cows. It contains up to 16% crude protein, but because it has high levels of prussic acid, it must be managed appropriately. On occasion, infestation of cheat in wheat results in putting it up for hay. With corn, an early summer hail storm can destroy the crop and allow a pigweed infestation to occur. Whole-crop forage (corn + pigweed) occasionally is harvested. Therefore, in conjunction with an original study of the effect of Palmer pigweed on grain yield, we initiated an auxiliary study of its effect on forage yield and quality.

PROCEDURES

The corn hybrid Cargill 3700 was planted at 33,000 kernels/acre on May17, 1997 and Palmer pigweed seed was planted in clumps with a standard household salt shaker at 15, 30, 60, 120, and 240 clumps/10 ft. in a randomized complete block with 4 replications. Plot area was furrow irrigated with more than 12 inches of water within 24 hours after planting. Care was taken to maintain the level of water in the furrow below the position on the bed where pigweed seed was planted. Within 3 days, more than 1 inch of gentle rain fell. Pigweed emerged in 3 to 5days and was thinned to one plant per clump at the 3- to 5-leaf stage. These populations were maintained and all other weeds were removed throughout the season by twice weekly hand weeding. At late dent, a sample of 3.3 feet of row was harvested, and weed and crop masses were combined and analyzed for crude protein (CP), neutral detergent fiber (NDF), and in-vitro dry matter digestibility (IVDMD). From these samples, forage yields per acre also were calculated.

RESULTS AND DISCUSSION

A large reduction in dry matter (DM) yield per acre occurred as the level of pigweed infestation increased ($P<.01$) (Table 1). At 15 pigweed/10 ft of row, a 14% reduction occurred in DM yield, and with greater infestation, yield declined by 30 to 57%. This reduction in yield was greater than expected, given the visual evaluation of the amount of total plant material present.

The P-values of overall treatment effects for CP and NDF only tended to approach significance ($P=.16$). Numerically, values increased from 9.6% CP for samples with no pigweed infestation to averages of 10.6 to 12.3% CP if pigweed was present. Overall, the NDF value declined with increased pigweed infestation, but this trend was not significant ($P=.16$).

With an increased CP and decreased NDF (with greater pigweed infestation), one would have expected in-vitro digestibility to increase as well. However, the opposite occurred. In-vitro digestibility decreased numerically ($P=.47$) from 50% with no pigweed infestation to approximately 47% if pigweeds were

[1]Graduate Student, Kansas State University, Manhattan.

Table 1. Impact of Palmer pigweed density in corn on forage quality and yield, Garden City, KS, 1996.

Pigweed/ 10 ft of Row	Yield[1] Loss (%)	CP[2] (%)	NDF[3]	IVDMD[4]
0	0.0 a	9.6 a	62.7 a	49.8
15	14.6 a	11.9 b	59.0 ab	47.3
30	40.9 b	11.3 ab	59.7 ab	47.2
60	30.2 b	11.2 ab	58.3 ab	47.0
120	37.8 bc	12.3 b	59.8 ab	47.2
240	57.1 c	10.6 ab	55.9 b	46.9

[1] Numbers within a column followed by the same letter are not statistically different (P<= 0.05).
[2] Crude protein.
[3] Neutral detergent fiber.
[4] In-vitro dry matter digestibility.

present. Because the increased CP content and decreased fiber content were offset by lower digestibility, feed value was not increased with greater pigweed infestation. Also, with a 30 to 60% DM yield reduction, increased pigweed infestation apparently is detrimental not only to grain production but to total forage production as well.

NARROW-ROW CORN RESPONSE TO HAIL DEFOLIATION

by
Merle Witt

Corn was evaluated for grain yield loss caused by simulated hail defoliation at two stages (8-leaf and 12-leaf). This was done in combination with two crop row spacings (15 in. and 30 in.). Additionally, two hybrids were used; 'Asgrow RX707,' a 109 day maturity hybrid, and 'Pioneer 3162,' a 114 day maturity hybrid.

Corn was planted on 4/25/96 with a White Air Seeder at 33,000 seeds/acre. Resulting stands at 30,000 plants per acre were kept weed free with Prowl/Bladex herbicide. Defoliation at 50% of the leaf area on selected plots was accomplished on 6/4/96 for the 8-leaf (8L) stage treatments and on 6/18/96 for 12-leaf (12L) stage treatments.

The two center rows of four row plots including four replications were hand harvested on 10/14/96. Resulting grain yields as bushels per acre are shown in Table 1.

Data indicate about a 4% reduction in grain yield at the 8L stage from 50% defoliation when averaged over both hybrids and both row spacings. An approximate 10% grain yield reduction was indicated for the 12L stage with 50% defoliation when averaged over both hybrids and both row spacings. Yields were about 4% more with the 15-in. row spacing compared to the 30-in. row spacing, when averaged over both hybrids and all treatments.

The results suggest that narrow rows for corn did not affect the amount of loss caused by early-season defoliation. However, the narrow row spacing was beneficial to corn yields, regardless of whether or not defoliation occurred.

Table 1. Grain yields of defoliated corn using two hybrids at two row-spacings, Garden City, KS, 1996.

Treatment	Asgrow RX707	Pioneer 3162
30 in. rows - check	217	269
30 in. rows - 50% defoliated at 8L	204	256
30 in. rows - 50% defoliated at 12L	189	244
15 in. rows - check	226	277
15 in. rows - 50% defoliated at 8L	213	272
15 in. rows - 50% defoliated at 12L	202	249
LSD (5%) Row Spacing	8.5	15.0
LSD (5%) Defoliations	8.3	9.7
LSD (5%) Row Spacing X Defoliation	11.7	13.7

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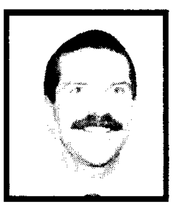

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