Southwest Research-Extension Center

FIELD DAY

1996

■

REPORT OF PROGRESS
768

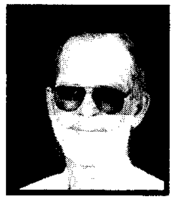
AGRICULTURAL EXPERIMENT STATION
MARC A. JOHNSON, DIRECTOR

KANSAS STATE UNIVERSITY

Pat Coyne - Center Head. B.S. degree, Kansas State University, 1966; Ph.D. degree, Utah State University, 1969. He joined the KSU faculty in 1985 as Head of the Agricultural Research Center--Hays. He was appointed head of the three western Kansas ag research centers at Hays, Garden City, and Colby in 1994. Research interests have focused on plant physiological ecology and plant response to environmental stress.

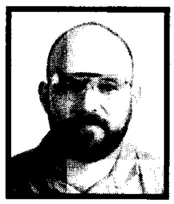
Paul Hartman - Associate Head and Area Extension Director, Paul received his B.S. and M.S. in Animal Sciences and Industry from Kansas State University. Prior to that, he served as County Extension Agricultural Agent in Stanton and Pratt counties.

Mahbub Alam - Extension Specialist, Irrigation and Water Management. Mahbub received his M.S. from American University of Beirut, Lebanon, and Ph.D. from Colorado State University. He joined the staff in 1996. Mahbub previously worked for Colorado State University as an Extension Irrigation Specialist. His extension responsibilities are in the area of irrigation and water management.

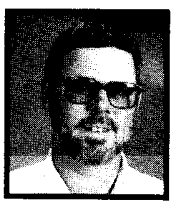


Larry Buschman - Entomologist. Larry received his M.S. at Emporia State University and his Ph.D. at the University of Florida. He joined the staff in 1981. His research includes studies of the biology, ecology, and management of insect pests, with emphasis on pests of corn - including spider mites.

Randall Currie - Weed Scientist. Randall began his agriculture studies at Kansas State University, where he received his B.S. degree. He then went on to receive his M.S. from Oklahoma State University and his Ph.D. from Texas A&M University. His research emphasizes weed control in corn.

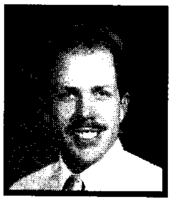


Jeff Elliott - Research Farm Manager. Jeff received his B.S. from the University of Nebraska. In 1984, Jeff began work as an Animal Caretaker III and was promoted to Research Farm Manager in 1989.



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.

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.



Scott Hughbanks - Research Assistant - Corn Entomology. Scott received his B.S. from Kansas State University in 1990 in Agriculture - Horticulture. He began as Lane County Agriculture Extension Agent in 1993 before moving to the Research Center in 1995. He is working with insects in the corn pest management project.

Kelly Kreikemeier - Ruminant Nutritionist. Kelly received his B.S. and M.S. from University of Nebraska-Lincoln, and his Ph.D. from Kansas State University. He began his research here in 1994 with emphasis on nutrition and management of feedlot cattle.

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1996 RESEARCH-EXTENSION CENTER STAFF

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Larry Buschman	Corn Entomologist
Randall Currie	Weed Scientist
Les DePew	Professor Emeritus
Jeff Elliott	Research Farm Manager
Andy Erhart	Professor Emeritus
David Frickel	Research Associate, Tribune
Gerald Greene	Feedlot Entomologist
George Herron	Professor Emeritus
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Carol Young	Extension Home Economist

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Southwest Research-Extension Center

WEATHER INFORMATION FOR GARDEN CITY

by

Dennis Tomsicek

Total precipitation for 1995 was 22.26 inches or 4.35 inches above average. May was the wettest month with a record-breaking total of 7.74 inches, and October was the driest with 0.02 inch. Snowfall for the year was 25 inches or 7.29 inches above average. February and March had the highest monthly totals with 10 and 9 inches, respectively. The first snowfall of the season was 1 inch on September 21, which was the earliest on record and the most ever received in September.

The warmest month of the year was August with a mean temperature of 80.0° and an average high of 94.5°. January was the coldest with a mean temperature of 32.1° and an average low of 17.5°. Temperature deviation was greatest in February, when the mean temperature was 6.7° above average.

Temperatures were above 100° on 13 days, with the highest being 105° on July 12. The temperature was below zero on 3 days during the year, with the lowest being -2° on January 4 and December 9. Four record high temperatures were recorded during the year: 68° on January 16, 80° on November 27, and 74° on December 2 and 3. There were also four record low temperatures for the year: 41° on June 11, 28° on September 22, 30° on September 23, and 20° on October 24.

The last spring freeze (32°) was on May 18, 22 days later than average and the first fall freeze (31°) was on September 21, which was 21 days earlier than average. This gave a frost-free period of 126 days, 43 days shorter than average and the shortest on record.

Open pan evaporation from April through October totaled 67.28 inches, which was 6.48 inches below the average of 73.76 inches Average wind speed for the year was 5.2 mph compared to the average of 5.5 mph.

A summary of the weather is presented in the table below.

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

	Precipitation inches		Temperature (°F) 95 Average		Mean		95 Extreme		Wind MPH		Evaporation inches	
Month	1995	Avg.	Max.	Min.	1995	Avg.	Max.	Min.	1995	Avg.	1995	Avg.
January	0.27	0.33	46.7	17.5	32.1	27.9	68	-2	4.3	4.8		
February	0.64	0.45	56.3	22.8	39.5	32.8	77	11	5.3	5.5		
March	1.05	1.15	54.2	28.9	41.5	41.3	85	6	6.6	7.0		
April	1.93	1.56	63.0	34.5	48.7	52.7	90	18	6.0	7.0	6.62	8.75
May	7.74	3.11	66.6	44.5	55.6	62.2	85	32	6.1	6.4	7.15	10.67
June	4.03	2.87	82.7	55.3	69.0	72.4	102	41	5.4	6.0	10.46	12.89
July	2.44	2.60	91.7	61.8	76.8	77.9	105	53	4.4	5.2	12.55	14.19
August	2.04	2.16	94.5	65.4	80.0	75.4	102	56	5.3	4.5	13.76	11.66
September	1.44	1.59	79.8	51.2	65.5	66.6	101	28	4.8	4.9	8.61	8.84
October	0.08	0.98	71.8	36.1	54.0	55.0	90	20	5.6	4.8	8.13	6.76
November	0.02	0.76	60.1	25.3	42.7	41.1	80	7	4.5	4.8		
December	0.58	0.35	47.3	17.3	32.3	30.7	76	-2	4.3	4.5		
Annual	**22.26**	**17.91**	**67.9**	**38.4**	**53.1**	**53.0**			**5.2**	**5.5**	**67.28**	**73.76**

Average latest freeze in spring	April 26	1995:	May 18
Average earliest freeze in fall	Oct. 12	1995	Sept. 21
Frost-free period	169 days	1995:	126 days

All averages are for the period 1961-90.

WEATHER INFORMATION FOR TRIBUNE

by
David Frickel and Dale Nolan

Precipitation for 1995 totaled 18.64 inches or 2.68 inches above normal. Precipitation was above normal in 6 months. The wettest months were April, May, June, and July with 2.40 inches, 5.10 inches, 3.07 inches, and 3.24 inches, respectively. The largest single amount of precipitation was 1.62 inches on May 18, and the greatest single amount of snowfall of 4.0 inches was reported on February 12. The greatest monthly amount of snowfall, 11 inches, was received in March. Snowfall for the year totaled 27.5 inches with a total of 32 days of snow cover. The longest consecutive period of snow cover was 8 days beginning February 11 and ending February 18.

The fall of 1995, beginning September 23, was the driest on record. Measurable precipitation was recorded on September 30, October 23, and November 13-14, but the greatest amount was only 0.04 inch. No measurable precipitation occurred in December.

The air temperature was above normal for 6 months of the year. August was the warmest month with a mean temperature of 77.9° and an average high temperature of 94.2°. The coldest month was January with a mean temperature of 31.2°, an average high of 46.5°, and an average low of 15.8°. Only two record low temperatures were set on June 11 and September 22. Seven record high temperatures were set on January 16, March 22, August 19, October 13, November 27, December 3, and December 14.

Deviation from the normal was greatest in May when the mean temperature was 6.4° below normal. Temperatures were 100° or above on 12 days, compared to the 30-year average of 10 days, and 90° and above on 57 days, compared to the 30-year average of 63 days. The lowest temperature for the year was 6° on December 9, and the highest was 102° on July 12 and August 8. The last day of 32° or less in the spring was April 28, which is 5 days earlier than the normal date, and the first day of 32° or less in the fall was September 21, which is 12 days earlier than the normal date. The frost-free period was 146 days, which is 7 days less than the normal of 153 days.

Open pan evaporation from April through September totaled 65.94 inches, which was 5.73 inches below normal. Wind speed for the same period averaged 4.9 mph, which is 0.8 mph less than normal.

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

	Precipitation inches		Temperature (°F) 1995 Average		Normal		1995 Extreme		Wind MPH		Evaporation inches	
Month	1995	Normal	Max.	Min.	Max	Min.	Max.	Min.	1995	Avg.	1995	Avg.
January	0.46	0.36	46.5	15.8	43.3	14.2	70	-1				
February	0.78	0.40	52.8	22.5	48.7	18.7	76	9				
March	0.91	0.99	52.9	26.7	56.6	25.4	84	2				
April	2.40	1.13	59.2	31.5	67.5	35.1	84	16	5.3	6.6	4.90	8.82
May	5.10	2.69	63.5	42.2	76.0	45.3	85	33	5.6	6.0	5.96	10.95
June	3.07	2.71	80.3	52.9	86.9	55.3	94	40	4.7	5.7	12.04	13.71
July	3.24	2.60	89.7	58.8	92.7	61.3	102	53	4.3	5.5	19.91	15.64
August	1.68	1.98	97.2	61.6	89.9	59.2	102	54	5.6	5.2	15.07	13.01
September	0.91	1.54	80.2	47.4	81.3	49.9	101	28	4.0	5.4	8.06	9.55
October	0.04	0.74	71.1	31.1	70.4	37.3	93	16				
November	0.05	0.49	59.8	24.4	54.7	25.3	79	6				
December	T	0.33	48.8	15.2	44.9	16.6	73	-6				
Annual	**18.64**	**15.96**	**66.6**	**35.8**	**67.7**	**37.0**			**4.9**	**5.7**	**65.94**	**71.67**

Average latest freeze in spring[1]	May 3	1995:	April 28
Average earliest freeze in fall	October 3	1995:	September 21
Average frost-free period	153 days	1995:	146 days

[1]Latest and earliest freezes recoreded at 32°F. Average precipitation and temperature are 30-year averages (1961-1990) calculated from National Weather Service. Average 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 sunflower were compared in 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 probably is suited to special situations such as the corners of sprinkler-irrigated fields. Reduced or no tillage generally improved the yield of both crops.

INTRODUCTION

Dryland soybean seldom is 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, if suitable herbicides can be found.

PROCEDURES

Dryland soybean and sunflower were grown in the wheat-soybean-fallow and wheat-sunflower-fallow cropping systems, respectively, from 1992 through 1995. 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 very few satisfactory, labeled, residual herbicides are available 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. Favorable climatic conditions in all years resulted in good yields of both crops. Soybean yields, in particular, except in 1994, were higher than expected. 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 of fields with center-pivot irrigated beans. Sunflower produced good yields, and with proper management of the stalks during fallow, could meet conservation compliance requirements in most years, particularly with reduced or no-till.

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

Table 1. Yield of dryland soybean and sunflower in a wheat-row crop-fallow rotation, 1992-1995, SWREC.

Tillage[1]	1992	1993	1994	1995	Average
Soybean			bu/acre		
CT	36a[2]	27a	14b	18b	24
RT	29b	30a	17b	24a	25
NT	38a	27a	21a	24a	28
Sunflower			lb/acre		
CT	1575b	3156a	1812b	1944b	2122
RT	1697ab	3102a	1921b	2098ab	2205
NT	1872a	3300a	2503a	2208a	2471

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

KSU Southwest Research-Extension Center

COMPARISON OF DRYLAND CORN AND GRAIN SORGHUM

by
Charles Norwood

SUMMARY

No-till (NT) dryland corn yielded an average of 22 bu/acre (28%) more than NT dryland sorghum, whereas conventional till (CT) corn averaged only 8 bu/acre (11%) more than CT sorghum. No-till corn yields exceeded sorghum yields in 3 of 5 years and were less than sorghum yields in only 1 yr, whereas CT corn yields exceeded those of sorghum in 2 of 5 years and were less than sorghum yields in 2 years. No tillage increased corn yields in 4 of 5 years and increased sorghum yields in 2 of 5 years. Dryland NT corn can be grown successfully in southwest Kansas, if low yields can be accepted in dry years in exchange for yields substantially higher than those of grain sorghum in favorable years.

INTRODUCTION

Dryland corn is not grown commonly in southwest Kansas, because it lacks drought tolerance. However, with adequate rainfall, corn will yield more than sorghum. No research has directly compared dryland corn and grain sorghum. Therefore, a study was begun in 1991 to compare these crops. Data are presented for the years 1991-1995.

PROCEDURES

Dryland corn and grain sorghum were compared in a wheat-row crop-fallow rotation from 1991 through 1995. Conventional- and no-till treatments were included. Warner 744BR grain sorghum was planted in late May or early June of each year, whereas ICI 8714 (105 day maturity) corn was planted on approximately May 1 of each year. Populations of sorghum and corn were 25000 and 18000 plants/acre, respectively.

RESULTS AND DISCUSSION

Soil water at planting. The amounts of available soil water at corn and sorghum planting varied greatly from year to year (Table 1). Soil water at planting was the lowest of the 5-yr period in 1991, and highest in 1993. The amounts of soil water were related to both planting date and tillage. Because the planting date for sorghum was 3 to 6 weeks later than for corn and because significant rainfall occurred during May, water often was more abundant than at sorghum planting than at corn planting. No tillage resulted in significantly more soil water at planting in 3 of 5 years for both corn and sorghum. Soil water at planting was higher with NT for both corn and sorghum in 1994 and 1995, for sorghum in 1991, and for corn in 1993. Increases in soil water from NT were highest in 1994 and 1995, exceeding 2 inches for both crops and reaching 4 inches for corn in 1995. The only year in which NT did not result in more soil water at planting for either crop was 1992. Differences among years in the amount of water stored depended on the amount of crop residue and the amount, distribution, and intensity of precipitation.

Yield. Yields of corn and sorghum were lowest in 1991 and highest in 1992 (Table 1). Growing-season precipitation was only 0.75 inch more in 1992, yet corn and sorghum yields averaged 119 bu/acre and 48 bu/acre more, respectively, than in 1991. Yields were lower in 1991 because of less soil water at planting and poorly distributed rainfall. In contrast, soil water at planting was higher, temperatures were cooler, and growing-season rainfall was well distributed in 1992, allowing corn and sorghum to express their yield potentials.

No-till corn yielded more than NT grain sorghum in 1992, 1994, and 1995, and CT corn yielded more than CT sorghum in 1992 and 1995. Both CT and

Table 1. Water use and yield of dryland corn and grain sorghum, Garden City, KS, 1991-1995.

	Soil Water at Planting (6 ft)			Yield			Water Use Efficiency		
Crop	CT	NT	Diff	CT	NT	Diff	CT	NT	Diff
	inches			bu/acre			bu/inch		
1991									
Corn	3.7	3.2	0.5	19	34	15*	1.3	2.1	0.9*
Sorghum	5.3	7.0	1.7*	45	63	18*	3.2	4.1	0.9*
Difference	1.6*	3.8*		26*	29*		1.9*	2.0*	
1992									
Corn	9.3	9.0	0.3	143	148	4	6.7	7.2	0.4
Sorghum	9.3	9.5	0.1	101	103	3	5.6	5.9	0.3
Difference	0.0	0.5		42*	45*		1.1*	1.3*	
1993									
Corn	10.9	12.3	1.4*	85	98	13*	4.4	5.3	0.9*
Sorghum	12.4	12.6	0.2	97	93	4	4.7	4.5	0.2
Difference	1.5*	0.3		12*	5		0.3	0.8*	
1994									
Corn	8.8	10.8	2.0*	74	118	44*	3.5	5.2	1.7*
Sorghum	9.7	12.1	2.4*	69	88	19*	3.4	4.0	0.6
Difference	0.9	1.3*		5	30*		0.1	1.2*	
1995									
Corn	6.7	10.8	4.1*	77	110	33*	3.9	4.7	0.8*
Sorghum	8.9	11.3	2.4*	50	52	2	3.1	2.9	0.2
Difference	2.2*	0.5		27*	58*		0.8*	1.8*	
Average									
Corn	7.9	9.2	1.3*	80	102	22*	4.0	4.9	0.9*
Sorghum	9.1	10.5	1.4*	72	80	8*	4.0	4.3	0.3*
Difference	1.2*	1.3*		8*	22*		0.0	0.6*	

*Indicates significant difference

NT sorghum yielded more than corn in the dry year of 1991, whereas in 1993, CT sorghum yielded more than CT corn, but the yields of the NT crops did not differ. These data confirm the traditional belief that sorghum will yield more than corn in a dry year, but that the opposite is true in a wet year. What is surprising is the amount by which corn yields exceeded sorghum yields. In the wettest year (1992), the difference in corn and sorghum yields exceeded 40 bu/acre. In 1994 NT corn yielded 30 bu/acre more than NT sorghum. The largest difference of 58 bu/acre occurred in 1995 for NT corn, but part of that difference was due to an early freeze on 22 Sept. reducing sorghum yield. However, freeze damage to sorghum is not uncommon, and corn does have an advantage of earlier maturity.

Yield responses to no tillage were greater for corn than for sorghum. Corn yields were increased by an average of 22 bu/acre (28%) with NT, and sorghum yields were increased by 8 bu/acre (11%). In 1991, the year sorghum yielded more than corn, the increase in the quantity of grain with NT was slightly more for sorghum than corn (18 vs. 15 bu/acre), but corn yielded 79% more with NT vs. 40% more for sorghum. In 1993, sorghum yields were not increased by NT, but corn yields increased by 13 bu/acre or 15%. As mentioned above, yields of CT corn were significantly lower than CT sorghum in 1993, but NT corn yielded as much as NT sorghum. In 1994, a year in which CT corn and sorghum yields did not differ, sorghum yields increased by an impressive 19 bu/acre (28%) with NT, but corn yields increased by 44 bu/acre (59%). No-till did not increase sorghum yields in 1995, possibly because of the freeze, but NT corn yields were 33 bu/acre or 43% higher than CT corn yields. The wet year, 1992, was the only year in which NT did not result in increased yields of either crop. Increased yield of both crops was due to an increase in the amount of soil water at planting. Yield increases occurred in all years when more soil water was present at planting following NT. Except for corn in 1991, yield increases did not occur in the absence of more soil water in NT. The increased yield of NT corn in 1991 occurred because rain between corn and sorghum planting accumulated in the NT plots.

Water use efficiency. Water use efficiency (WUE) is defined as: bu/acre divided by the amount of water used by the crop (soil water at planting - soil water at harvest + rainfall). Water use efficiencies were higher for both CT and NT sorghum than for corn in 1991, but were higher for CT and NT corn in 1992 and 1995 and for NT corn in 1993 and 1994. Water use efficiencies were higher for sorghum in 1991 because it was able to convert more of the low amount of soil water at planting and poorly distributed growing-season rainfall into grain production, whereas corn used more of the water to produce the vegetative portion of the plant. In contrast, WUEs were higher for corn in 1992 because above-average, well-distributed rainfall and cooler temperatures allowed corn to express its high yield potential. Water use efficiencies of corn in 1995 were higher at least partially because the early freeze stopped the growth of sorghum before maturity. Water use efficiencies of NT corn were higher than those of NT sorghum in 1993 because corn produced about the same amount of grain as sorghum but used less water. In 1994, the higher WUE of NT corn resulted in 30 bu/acre more grain than NT sorghum. The WUEs of NT corn were higher than those of CT corn in all years except 1992, whereas the WUE of NT sorghum was higher than that of CT sorghum only in 1991. No-till WUES were higher because wheat straw between the rows in the growing crop reduced evaporation from the soil surface and increased water for the plant.

TRANSITION FROM IRRIGATED TO DRYLAND CORN[1]

by
Charles Norwood

SUMMARY

Corn irrigated 1, 2, and 3 times yielded 27%, 36%, and 63% more, respectively, than dryland corn. Gross income was $303/acre when all acres were dryland. When all acres were irrigated once, gross income (less the cost of the irrigation water) was $375/acre. When one-half the acres were dryland and one-half were irrigated twice, gross income was $347/acre. When two-thirds of the acres were dryland and one-third were irrigated three times, gross income was $356/acre.

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 aid 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 important, will stabilize grain production in areas that would otherwise be returned to dryland. Therefore, a study was designed to compare dryland corn with corn irrigated one, two, or three times, 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; 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 avoid pre-irrigation. 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, the yield increase with two vs. one irrigations in 1995 was smaller than expected, and may have been caused by rainfall near the time of irrigation. The response to NT, particularly in 1995, emphasizes the importance of crop residue in conserving water. No-till was expected to be beneficial for dryland and perhaps one irrigation; however, in 1995 a large response occurred at all irrigation levels. The response was due to both additional water storage during fallow and a reduction in evaporation in the growing crop.

The economic results (Table 2) must be considered preliminary. However, based on 2 years' results, the most income occurred when all acres were irrigated once, 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 irrigate 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 can be 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, Garden City, KS, 1994 and 1995.

Number of Irrigations[1]	1994 CT	1994 NT	1994 Avg	1995 CT	1995 NT	1995 Avg	Average CT	Average NT	Average Avg
	bu/acre								
0	104	120	112	78	103	90	91	111	101
1	141	150	146	97	122	109	119	136	128
2	157	166	161	107	122	114	132	143	137
3	178	170	174	140	165	153	159	168	163
Average	145	152	149	105	127	116	125	139	132

LSD (0.10)		
	Irrigation (averaged over tillage and years)	12
	Tillage (within year, averaged over irrigations)	10

[1]Four inches of water per irrigation.

Table 2. Yield and gross income from combinations of irrigated and dryland corn, Garden City, KS, (1994-1995 average).

System[1]	Yield	Gross Income
	bu/acre	$/acre[2]
100% dryland	101	$303
100% irrigated once	128	375
50% dryland, 50% irrigated twice	119	347
67% dryland, 33% irrigated three times	122	356

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

NITROGEN FERTILIZATION OF DRYLAND WINTER WHEAT

by

Alan Schlegel and John Havlin[1]

SUMMARY

Research was initiated in 1993 to determine the nitrogen (N) fertilizer requirement for dryland winter wheat grown under reduced tillage systems in western Kansas. Application of N fertilizer increased grain yields in 1995 by over 20 bu/acre at sites when residual soil N was less than 10 ppm. At N-responsive sites, wheat yields were increased by N rates up to 100 lb N/acre, with the best time and method of application being spring and spoke injected.

INTRODUCTION

The N fertilizer recommendations for winter wheat in western Kansas were developed under clean tillage systems. In these systems, most of the residue is incorporated into the soil, leaving a seedbed with minimal residue cover. Current reduced-tillage systems emphasize conserving surface residue to reduce erosion potential and enhance soil water storage. However, crop residue on the soil surface can impact the efficiency of N fertilizer utilization by plants. This research was initiated to determine whether adoption of reduced-tillage systems has changed the N fertilizer requirements for dryland winter wheat in western Kansas.

PROCEDURES

Six sites in western Kansas were selected, in conjunction with farmer cooperators, that varied in residual soil N. All sites were on silt loam soil that contained adequate amounts of other nutrients. Fluid N (urea-ammonium nitrate solution) was spoke injected in the fall and spring and broadcast during the winter and spring at five rates (20, 40, 60, 80, and 100 lb N/acre) along with a zero N control. Three of the sites were lost to hail in 1995, but the remaining sites were machine harvested, and grain yields were adjusted to 12.5% moisture.

RESULTS AND DISCUSSION

Application of N fertilizer increased grain yields by over 20 bu/acre at two sites with lower residual N (Table 1). At the highest residual N site (>10 ppm), fertilizer N had little effect on grain yield. At the responsive sites, wheat yields were increased by N rates up to 100 lb N/acre, which is greater than currently recommended. The best time and method of N application were spring and spoke injected. Grain yields were similar for broadcast applications (spring or winter) and fall injected treatments. The research will be continued in 1996.

[1]Department of Agronomy, Kansas State University, Manhattan.

Table 1. Effect of time and method of N application and N rate on grain yield of dryland winter wheat at three locations in western Kansas, 1995.

Time/Method of Application	N Rate	Grain Yield Site 1	Site 2	Site 3
	lb/acre		bu/acre	
Fall Injected	20	21	30	31
	40	28	34	34
	60	36	37	35
	80	40	43	38
	100	46	45	35
Winter Broadcast	20	23	29	33
	40	29	33	32
	60	33	37	30
	80	35	43	30
	100	42	46	33
Spring Injected	20	28	35	34
	40	36	41	33
	60	42	47	32
	80	45	50	34
	100	44	53	30
Spring Broadcast	20	25	32	32
	40	29	36	26
	60	33	42	31
	80	39	44	33
	100	41	51	31
Control	0	20	26	30
Soil NH_4+NO_3 (ppm in 0-2 ft)		2.6	6.4	12.7
MAIN EFFECT MEANS				
Time/Method of app.				
Fall injected		31	36	34
Winter broadcast		31	36	31
Spring injected		36	42	32
Spring broadcast		31	38	31
$LSD_{.05}$		2	1	3
N rate				
0 lb/acre		20	26	30
20		24	32	32
40		30	36	31
60		36	41	32
80		40	45	34
100		43	49	32
$LSD_{.05}$		2	2	4

EFFECTS OF TILLAGE AND NITROGEN IN A WHEAT-SORGHUM-FALLOW ROTATION

by

Alan Schlegel and David Frickel

SUMMARY

Grain yields of wheat and grain sorghum are increased by application of N fertilizer. Averaged over the past 3 years, N fertilizer increased wheat and grain sorghum yields by 27 bu/acre. Nitrogen requirements are greater than 50 lb N/acre for both crops. Application of 100 lb N/acre to either crop increased grain yield of the subsequent crop by at least 10 bu/acre. Tillage had little effect on grain yield of wheat or grain sorghum.

INTRODUCTION

Fertilizer N often is applied to dryland crops in west-central Kansas. This study was initiated to 1.) quantify wheat and grain sorghum responses to N fertilization, 2.) determine the residual effect of N fertilization on subsequent crops, and 3.) determine the effect of tillage practices on N response.

PROCEDURES

The experimental design was a split plot with tillage systems as the main plots and N treatments as subplots. Plot size was 20 by 60 ft. The two tillage systems were reduced and zero tillage. Nitrogen fertilizer as urea was broadcast in the spring on wheat and near time of planting on grain sorghum. The N rates were 25, 50, and 100 lb N/acre to either wheat or grain sorghum, or 25 and 50 lb N/acre to both crops along with an untreated control. The center of each plot was machine harvested, and grain yields were adjusted to 12.5% moisture. The residual soil N content was in the medium category (less than 10 ppm N as nitrate plus ammonia in a 2-foot profile) at the start of the study.

RESULTS AND DISCUSSIONS

Nitrogen fertilization increased wheat yields by an average of 27 bu/acre (Table 1). 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 sorghum 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.

Grain sorghum yields were increased by 27 bu/acre by 100 lb N/acre applied to sorghum (Table 1). Again, N requirements were greater than 50 lb N/acre, because sorghum yields were 7 bu/acre greater with 100 than with 50 lb N/acre. The residual effect of fertilizer N applied to wheat increased sorghum yields by up to 13 bu/acre. Tillage had little effect on grain yield, and no N x tillage interaction occurred.

Table 1. Grain yield response to N fertilizer and tillage in a wheat-sorghum-fallow rotation, Tribune, KS 1993-95.

Treatment		Wheat				Grain Sorghum			
		1993	1994	1995	Avg.	1993	1994	1995	Avg.
N rate		bu/acre							
Wheat	Sorghum								
- lb/acre -									
0	0	44	20	25	29	37	57	24	39
0	25	42	20	29	30	45	71	32	49
0	50	46	19	27	31	49	82	47	59
0	100	53	30	35	39	58	88	51	66
25	0	45	28	33	35	42	56	23	40
25	25	56	30	35	40	46	77	31	51
50	0	57	41	43	47	50	59	26	45
50	50	60	45	48	51	63	72	41	59
100	0	66	48	55	56	66	66	24	52
	$LSD_{.05}$	11	5	5	4	6	10	8	4
Tillage									
Reduced		52	32	36	40	56	69	54	52
No till		53	31	37	40	46	70	52	50
	$LSD_{.05}$	12	5	3	5	7	13	2	9

EFFECTS OF TILLAGE AND CROPPING INTENSITY ON DRYLAND CROP PRODUCTION

by

Alan Schlegel, Kevin Dhuyvetter[1], and Curtis Thompson

SUMMARY

Wheat yields from 1991 to 1995 were similar in wheat-fallow and wheat-sorghum-fallow systems and about 20 bu/acre greater than those in continuous wheat. Grain sorghum yields were higher with no-till than reduced tillage, but tillage had little effect on wheat yields. Production costs were greater with no-till than reduced tillage because of increased weed-control costs. Profitability was about the same for wheat-sorghum-fallow and wheat-fallow (reduced tillage). Wheat-fallow (no-till) and continuous wheat were less profitable. The 1990 government program provisions increased profitability of all systems, but did not significantly favor wheat-fallow over wheat-sorghum-fallow.

INTRODUCTION

In semi-arid regions, fallow is used to store soil water and enhance crop growth in subsequent years. The prevalent crop rotation in this region is wheat-fallow (50% cropping intensity). However, more intensive cropping systems, such as wheat-sorghum-fallow (67% cropping intensity), have been shown to be feasible when used in conjunction with reduced tillage practices. Consequently, adoption of no-till practices could further favor more intensive cropping systems.

The objectives of this study were to: 1.determine the impact of increased cropping intensity on wheat grain yield; 2. determine the effect of increased cropping intensity on economic returns compared to a wheat-fallow system in west-central Kansas; and 3. determine whether no-tillage increases grain yield and net returns in wheat-fallow and wheat-sorghum-fallow cropping systems compared to reduced tillage.

PROCEDURES

This research was initiated in 1989 in west-central Kansas at the Southwest Research-Extension Center near Tribune, KS. The study site was located on a Richfield silt loam soil (average precipitation of 16 in/yr). The cropping systems evaluated were wheat-fallow [WF], wheat-sorghum-fallow [WSF], and continuous wheat [WW]. All crop rotations were grown using no-tillage (NT), and the two rotations with fallow also were grown under reduced tillage (RT).

The RT systems utilized combinations 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.

The number of tillage operations and chemical applications varied from year to year, depending upon weed pressure, with representative values used in the economic analysis. The cost of tillage and herbicide applications were based on average custom rates for western Kansas. All other production expenses (seed, fertilizer, planting, harvesting, etc.) were estimates of costs typical for the region. Grain prices were the average prices at harvest from 1991 to 1995. For participation in government programs under the 1990 Farm Bill, a 50% wheat base was assumed with 0% feedgrain base. The deficiency payment for wheat averaged $0.89/bu.

RESULTS AND DISCUSSION

Wheat yields in RT-WF ranged from 32 to 70 bu/acre (Fig. 1) and averaged 48 bu/acre (Table 2). Increasing cropping intensity to 67% (WSF) had little effect on wheat yields. However, increasing cropping

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

Item	Wheat-Fallow		Wheat-Sorghum-Fallow				W-W
	RT	NT	RT-W	RT-S	NT-W	NT-S	NT
Herbicides							
Atrazine @ $3.25/lb.	0.6	0.6		2.0		2.0	
Landmaster @ $.133/oz.	80	240	40	80	160	120	80
Ally/2,4-D/Banvel @ $5/a	1	1	1		1		1
Dual @ $15.88/qt.				1		1	
Applications @ $3.15/qt.	3	7	2	3	5	4	3
Herbicide,$/planted acre	$27.03	$60.88	$16.61	$42.45	$42.00	$50.92	$25.08
Tillage							
Sweep @ $4.27/a	4	0	3	1	0	0	0
Tillage, $/planted acre	$17.08	$0.00	$12.81	$4.27	$0.00	$0.00	$0.00

intensity to 100% (WW) reduced yields by 20 bu/acre.

Tillage had little effect on wheat yields. However, grain sorghum yields tended to be greater with NT than RT in each year (Fig. 2). Averaged over 5 years, NT sorghum yielded 11 bu/acre more than RT.

Production costs were greater with NT than RT (Table 2), primarily because of higher weed control costs (Fig. 3). The cost of weed control prior to wheat was about $15/acre greater with NT than RT in both WF and WSF. Weed control costs for sorghum were similar for RT and NT. Weed control costs will be highly sensitive to weed pressure and herbicide selection.

An economic analysis, excluding government program payments, showed that WSF is a feasible cropping alternative to WF. The net returns from WSF were similar to those of RT-WF and greater than those of NT-WF and WW (Table 2). A combination of RT prior to wheat and NT prior to sorghum would be the most profitable tillage system in the WSF rotation.

Under provisions of the 1990 Farm Bill, most producers participate in government programs, so including the impact of these programs in an analysis is important. In this area, producers often do not have a government program base for crops other than wheat. A concern is that changing cropping systems from WF to more intensive systems involving other crops will negatively impact their participation in government programs, hence reduce payments. Although participation in government programs in-

Figure 1. Wheat grain yield, Tribune, KS.

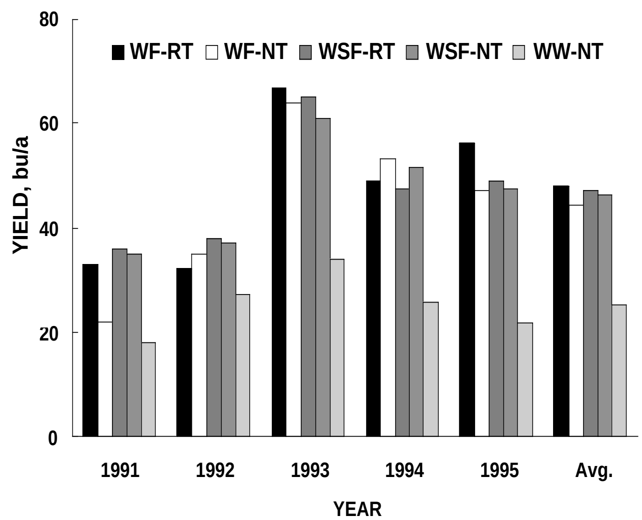


Figure 2. Sorghum grain yield, Tribune, KS.

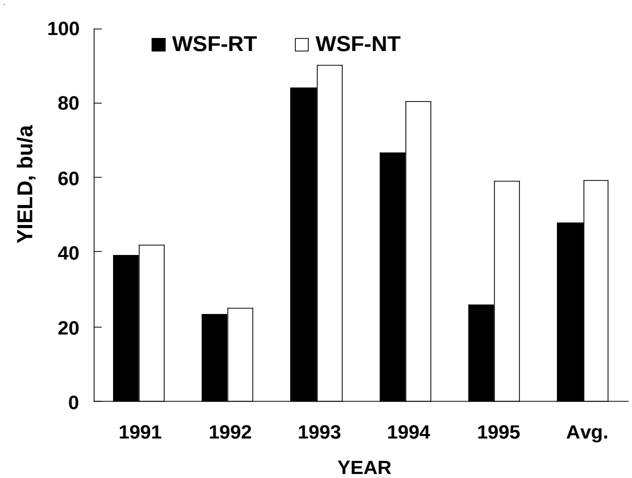


Table 2. Economic comparison of cropping systems, Tribune, KS.

Item	Wheat-Fallow RT	Wheat-Fallow NT	Wheat-Sorghum-Fallow RT-W	Wheat-Sorghum-Fallow RT-S	Wheat-Sorghum-Fallow NT-W	Wheat-Sorghum-Fallow NT-S	W-W NT
Yield, bu/a	48.0	44.3	47.0	47.7	46.4	59.3	25.3
Price, $/bu	$3.08	$3.08	$3.08	$2.13	$3.08	$2.13	$3.08
Gross return, $/a	$148	$136	$145	$101	$143	$126	$78
Costs, $/planted acre:							
Herbicides	27.03	60.88	16.61	42.25	42.00	50.92	25.08
Tillage	17.08	0.00	12.81	4.27	0.00	0.00	0.00
Other production costs	46.23	49.83	45.25	45.64	49.40	52.60	37.66
Total costs	$90.34	$110.71	$74.67	$92.16	$91.40	$103.52	$62.74
Net return/planted acre	$57.69	$25.74	$70.21	$9.10	$51.63	$22.68	$15.10
Net return/tillable acre	$28.84	$12.87	$23.40	$3.03	$17.21	$15.10	

Figure 3. Weed control costs, Tribune, KS.

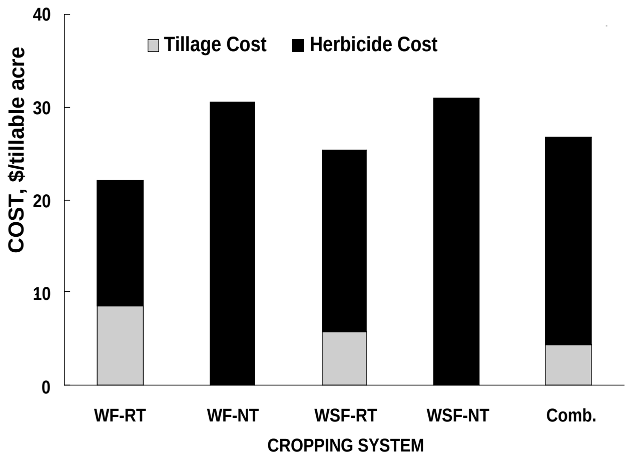
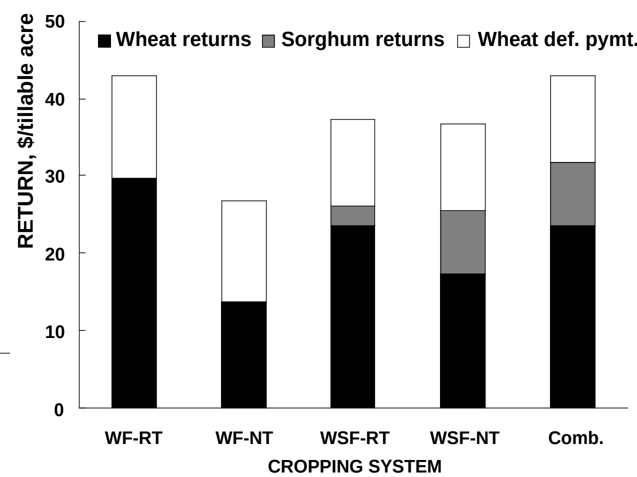


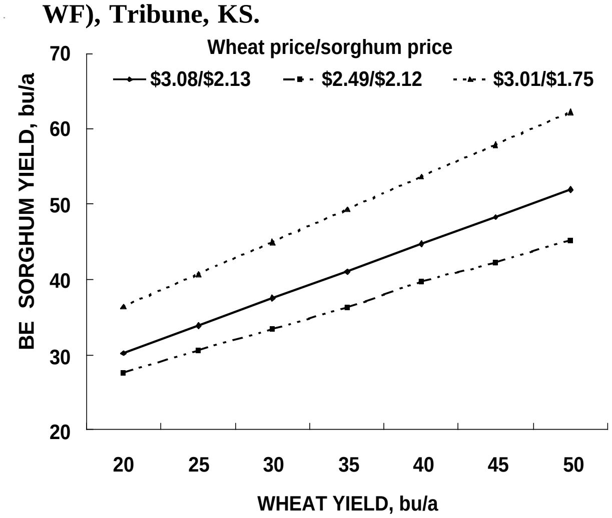
Figure 4. Economic returns including deficiency payment, Tribune, KS.



creased profitability of WF slightly more than WSF (Fig. 4), it did not significantly alter the difference between the systems. Therefore, producers could adopt a WSF system whether they participate in government programs or not. With the passing of the 1995 Farm Bill (Freedom to Farm), producers will have the flexibility to switch to alternate crop rotations with no impact on their payments.

The choice of the most profitable cropping system is sensitive to the yield and price relationships between grain sorghum and wheat. Figure 5 shows the grain sorghum yield required so that economic returns are equal for WF and WSF. If expected sorghum yields are greater than this amount, then changing from WF to WSF would increase economic returns.

Figure 5. Breakeven sorghum yield (returns of WSF-WF), Tribune, KS.



EVALUATION OF THE CORN BORER RESISTANCE IN BT CORN IN WESTERN KANSAS, 1994

by

Larry Buschman, Randall Higgins[1], Robert Bowling[1], Phil Sloderbeck, and Victor Martin[2]

SUMMARY

A Bt corn line, MON802, and a closely related control corn were evaluated for resistance to corn borers at two locations in southwest Kansas. The corn lines were exposed to native and manual infestations of corn borers. This Bt corn line gave very impressive reductions in European and Southwestern corn borer damage. MON802 is not commercially available, but hybrids incorporating this “YieldGard™”[3] Bt technology are expected to be available later in 1996 or 1997.

INTRODUCTION

The European corn borer (ECB), *Ostrinia nubilalis* (Hübner), and the Southwestern corn borer (SWCB), *Diatraea grandiosella* Dyar, are two of the most important pests of corn in North America. The new corn borer-resistant corn lines that include the Bt gene are expected to be effective in reducing damage by both species. Bt corn has been genetically engineered to contain a modified gene, orginally isolated from the bacterium *Bacillus thuringiensis,* which allows the corn plant to produce a protein that is toxic to certain lepidopterous larvae. This is the same protein that is found in Bt sprays. These trials were conducted to evaluate the effectiveness of this new source of resistance to corn borers in Kansas.

PROCEDURES

Corn plots were established at the Sandyland Experiment Field near St. John, KS and at the Southwest Research-Extension Center near Garden City, KS on May 17 and 18, 1994, respectively. The 12 different treatments replicated six times in a randomized complete block design. Plots were four rows wide and 30 feet long. Each plot was bordered by at least one row of resistant corn on each side to reduce the effects of larval migration from control plots. The plots were hand thinned to 45 plants per row.

Corn borer infestation was either natural or augmented manually. The manual infestations involved adding about 100 ECB neonate larvae to plants at the 10-leaf stage (to simulate 1st generation infestation) and/or to plants at silking stage (to simulate 2nd generation infestation). In mid-July the plots were rated for lst generation shot-hole damage using the Guthrie 1 to 9 scale. Selected plots were sprayed with pesticides. One set of treatments was sprayed with Dipel (Bt spray) or permethrin (pyrethroid spray) 14 days after each infestation. Other treatments were sprayed weekly during 1st generation and/or during 2nd generation with permethrin to eliminate corn borer pressure in these plots and/or to evaluate the relative importance of 1st and 2nd generation infestations. The 12 treatments were: 1) control corn with native corn borer infestation and no insecticide, 2) MON802 with native corn borer infestation and no insecticide, 3) control corn with native corn borer infestation and sprayed weekly with permethrin at 0.2 lb/acre, 4) MON802 with native corn borer infestation sprayed weekly with permethrin at 0.2 lb/acre, 5) control corn inoculated with laboratory-reared ECB during late June and sprayed weekly with permethrin at 0.15 lb/acre during late July and early August, 6) Bt corn inoculated with laboratory-reared ECB during late June and sprayed weekly with permethrin at 0.15 lb/acre during late July and early August, 7) control corn sprayed weekly with permethrin at 0.15 lb/A during late June and early July and inoculated with laboratory-reared ECB during

[1]Department of Entomology, Kansas State University, Manhattan.
[2]Department of Agronomy, Kansas State University, St. John.
[3]"YieldGard" is a registered trademark of Monsanto Ag. Co.

late July, 8) Bt corn sprayed weekly with permethrin at 0.15 lb/A during late June and early July and inoculated with laboratory-reared ECB in late July, 9) control corn inoculated with laboratory- reared corn borer during late June and July and not sprayed, 10) control corn inoculated with laboratory-reared corn borer during late June and July and sprayed with Dipel at 2 pt/acre 2 weeks after the inoculation, 11) control corn inoculated with laboratory-reared corn borer during late June and July and sprayed with permethrin at 0.15 lb/acre 2 weeks after inoculation, 12) Bt corn inoculated with laboratory-reared corn borer during late June and July, but not sprayed.

Spider mites and beneficial insects were recorded by visually searching selected plants in selected treatments. In late July and again in early August, the plots were sprayed with Comite to reduce spider mite populations. In mid-September, 15 plants per plot were dissected to evaluate corn borer injury. The rest of the plants were hand-harvested in early October to calculate plot yields.

RESULTS AND DISCUSSION

Native 1st generation corn borer feeding damage in untreated control corn was non existent to low at both locations, and damage ratings averaged 1.0 and 1.1 at Garden City and St. John (Tables 1 & 2) (a rating of 1 indicated no damage was visible). Untreated control corn manually infested with ECB had at least pin-hole feeding in most plants (a rating of 2) and averaged 1.7 and 2.7 at the two locations. First generation damage ratings were very low in all MON802 plots, averaging 1.0 to 1.1 in native or manually infested treatments at the two locations (Fig 1). The single sprays of Dipel or permethrin were not nearly as effective at reducing 1st generation damage as was Bt corn.

Spider mite populations were present at both locations and were higher in plots that received permethrin treatments, particularly in plots receiving weekly treatments (Tables 1 and 2). Spider mite populations did not appear to be affected by the Bt corn. In practice, Bt corn would not be sprayed for corn borers and thus would be more likely to escape spider mite outbreaks. Assorted predators of mites and other beneficials did not appear to be affected by the Bt corn (data not shown).

Native 2nd generation corn borer activity included moderate ECB pressure at both sites, and light or heavy SWCB pressure at Garden City and St. John, respectively. Native 2nd generation corn borer tunneling in untreated control corn averaged 3.7 inches at Garden City and 20.7 inches at St. John (Tables 1 & 2). Tunneling in untreated control corn manually infested with ECB averaged 5.0 and 21.3 inches at the two locations. Tunneling was very low in all the Bt corn plots and averaged 0.00-0.04 inches at Garden City and 0.00-0.9 inches at St. John in native or manually infested treatments (Fig 2). Single Bt- or permethrin-sprays applied during the 2nd generation reduced tunneling from 5.0 to 2.0-3.2 inches at Garden City or from 21.3 to 3.3-16.8 inches at St. John. However, weekly permethrin sprays reduced tunneling to levels similar to those recorded in the Bt corn. Thus, the single sprays of Dipel and permethrin were not nearly as effective at reducing tunneling as was Bt corn.

Kernel damage from native corn earworm and corn borer averaged 28.8 and 41.2 kernels per ear at Garden City and St. John, respectively (Tables 1 and 2). Manually infested corn borer treatments

Fig 1. First generation leaf feeding by corn borers - native and manual infestations, 1994.

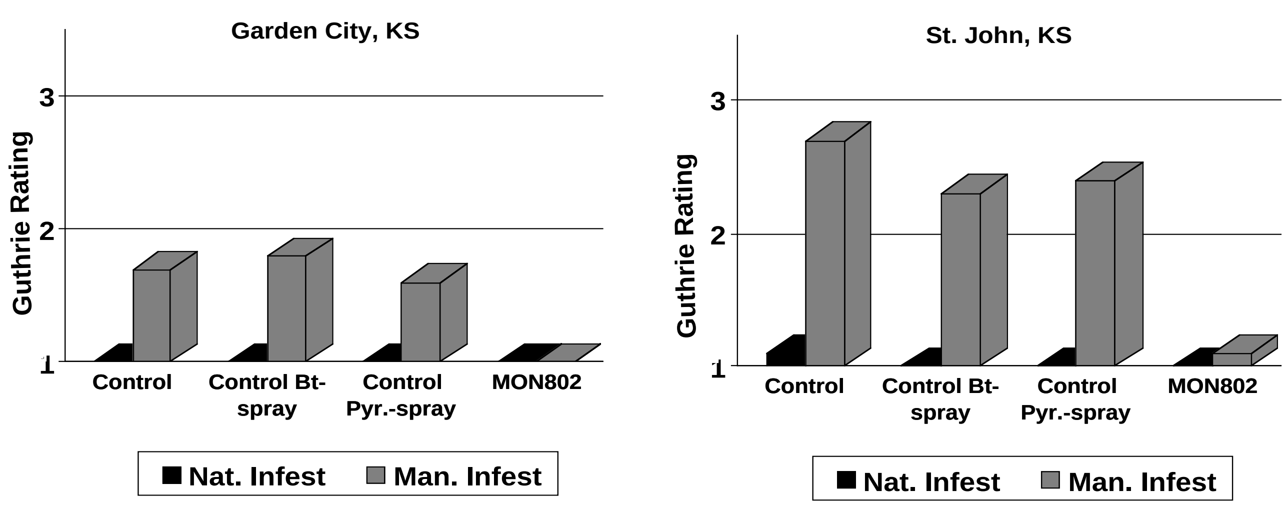


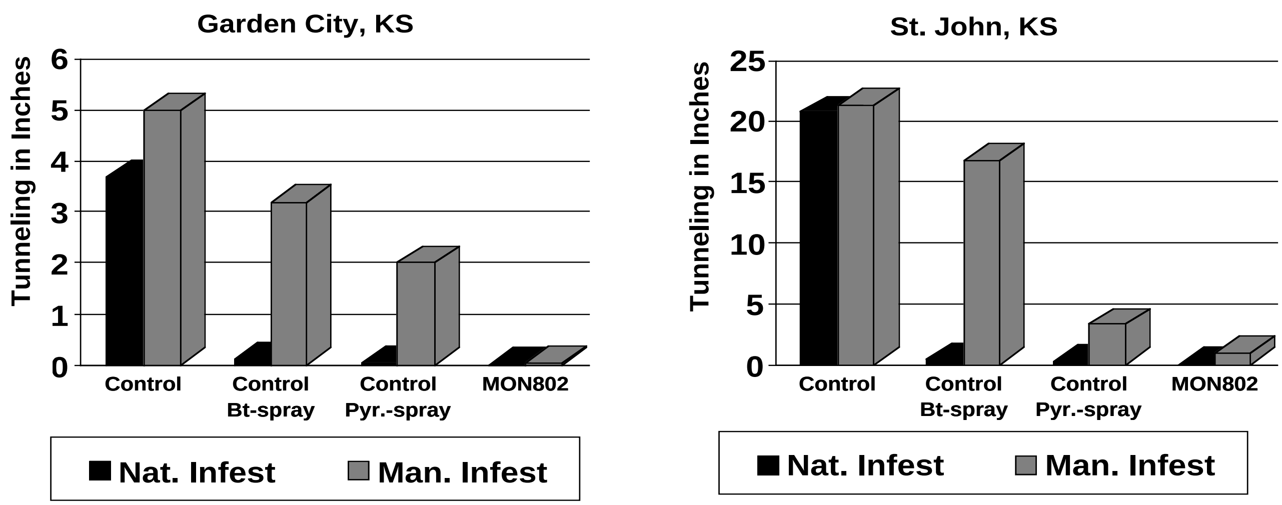
Table 1. Evaluation of corn borer resistance of Bt corn at Garden City, KS, 1994.

Corn Borer Infestation Type of Corn	Insecticide	1st Generation Corn Borer Injury Rating	Mites per Plant	Tunneling in Inches	Damaged Kernels/Ear	Yield
Native						
Control	None	1.0 c	294 bc	3.7bc	28.8 ab	112.2 b
MON802	None	1.0 c	210 c	0.12 e	17.8 cd	124.5 ab
Control	Permethrin weekly	1.0 c	715 a	0.04 e	13.4 cd	129.0 ab
MON802	Permethrin weekly	1.0 c	674 a	0.00 e	7.2 d	126.6 ab
Native + Manual 1st Generation						
Control	Permethrin weekly during 2nd gen.	1.8 a	-	0.3 e	13.5 cd	144.6 a
MON802	Permethrin weekly during 2nd gen.	1.1 c	-	0.02 e	11.9 cd	120.9 ab
Native + Manual 2nd Generation						
Control	Permethrin weekly during 1st gen.	1.0 c	-	6.6 a	38.9 a	122.0 ab
MON802	Permethrin weekly during 1st gen.	1.0 c	-	0.12 e	15.5 cd	133.0 ab
Native + Manual 1st & 2nd Generation						
Control	None	1.7 ab	-	5.0 b	32.8 ab	109.9 b
Control	Dipel 4 days after infestation	1.8 a	618 ab	3.2 cd	35.6 a	129.2 ab
Control	Permethrin 4 days after infestation	1.6 b	530 abc	2.0 d	23.2 bc	124.2 ab
MON802	None	1.0 c	323 bc	0.04 e	17.4 cd	142.5 a

Table 2. Evaluation of corn borer resistance of Bt corn at St. John, KS, 1994.

Corn Borer Infestation Type of Corn	Insecticide	1st Generation Corn Borer Injury Rating	Mites per Plant	Tunneling in Inches	Damaged Kernels/Ear	Yield bu/acre
Native						
Control	None	1.1 c	-	20.7 a	41.2 ab	111.4 cd
MON802	None	1.0 c	65 b	0.4 c	22.1cd	131.1 abc
Control	Permethrin weekly	1.0 c	2774 a	0.2 c	20.5 cd	111.7 cd
MON802	Permethrin weekly	1.0 c	893 b	0.0 c	15.9 cd	122.8 bcd
Native + Manual 1st Generation						
Control	Permethrin weekly during 2nd gen.	2.5 b	-	0.4 c	28.0 bc	141.9 ab
MON802	Permethrin weekly during 2nd gen.	1.0 c	-	0.0 c	12.3 d	148.2.a
Native + Manual 2nd Generation						
Control	Permethrin weekly during 1st gen.	1.0 c	-	18.1 b	38.9 a	122.0 ab
MON802	Permethrin weekly during 1st gen.	1.0 c	-	0.2 c	14.9 cd	129.6 abc
Native + Manual 1st & 2nd Generation						
Control	None	2.7 a	495 b	21.3 a	43.2 a	116.1 cd
Control	Dipel 4 days after infestation	2.3 b	58 b	16.8 b	52.6 a	104.9 d
Control	Permethrin 4 days after infestation	2.4 b	246 b	3.3 c	40.2 ab	131.3 abc
MON802	None	1.1 c	445 b	0.9 c	20.1 cd	126.6 abc

Fig 2. Second generation corn borer tunneling - native and manual infestations, 1994.

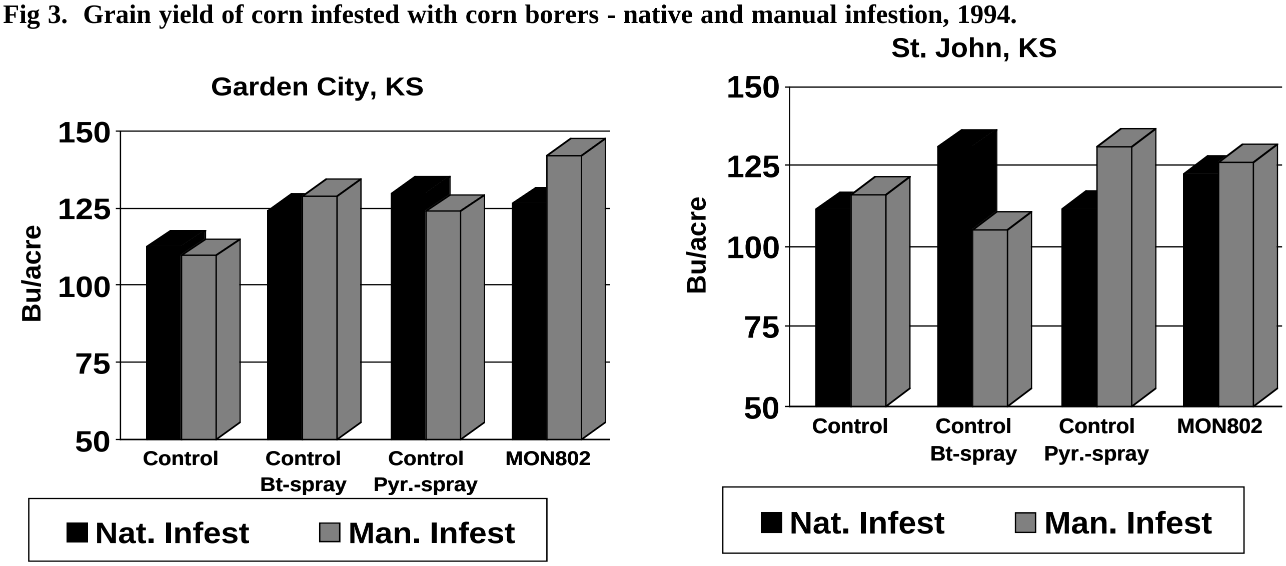


experienced only slightly more damage. The Bt corn had significantly lower kernel damage and averaged 17.8 and 22.1 kernels affected per ear at the two locations. Weekly permethrin applications during the 2nd corn borer generation reduced kernel damage significantly. Single treatments of permethrin tended to reduce kernel damage a little, but not as much as either the Bt corn or the weekly spray treatment. Bt sprays had no significant effect in reducing kernel damage.

Grain yields in Bt corn averaged 133.5 and 128.9 bu/acre, and yields for unprotected control corn averaged 111.1 and 113.8 bu/acre at Garden City and St. John, respectively (Tables 1 and 2). The apparent yield losses to corn borer damage were 22.4 and 15.1 bu/acre at the two locations. Weekly and single insecticide treatments on control corn during the 2nd generation also resulted in somewhat improved yields (Fig 3).

Bt corn effectively eliminated 1st and 2nd generation ECB and SWCB damage in corn. Bt corn also reduced kernel damage caused by corn earworm and corn borers. Under significant corn borer pressure, grain yield was improved by Bt corn and by insecticide treatments.

Fig 3. Grain yield of corn infested with corn borers - native and manual infestion, 1994.



EVALUATION OF THE CORN BORER RESISTANCE IN BT CORN IN WESTERN KANSAS, 1995

by
Randall Higgins, Larry Buschman, Robert Bowling, Phil Sloderbeck, and Victor Martin

SUMMARY

Two Bt corn lines, MON802 and MON810, and a closely related control corn were evaluated for corn borer resistance at two locations in western Kansas. The corn lines were exposed to native and manual infestations of European and Southwestern corn borers. The Bt corn lines were found to provide exceptional control of both European and Southwestern corn borer. MON802 and MON810 are not commercially available, but hybrids incorporating this "YieldGard™" Bt technology may be available in 1996 or 1997.

INTRODUCTION

The European corn borer (ECB), *Ostrinia nubilalis* (Hübner), and the Southwestern corn borer (SWCB), *Diatraea grandiosella* Dyar, are two of the most important pests of corn in North America. The new corn borer-resistant corn lines that include the Bt technology are expected to be effective against both species. These trials were conducted to evaluate this new source of resistance under Kansas conditions.

PROCEDURES

Corn plots were established at the Sandyland Experiment Field near St. John, KS and at the Southwest Research-Extension Center near Garden City, KS on 11 May, 1995. The eight different treatments were replicated six times in a randomized complete block design. Plots were two rows wide and 30 feet long. Each plot was bordered on each side with two rows of Bt corn to reduce the impact of larval migration from untreated plots. Plots were hand thinned to 45 plants per row.

Eight treatments were used in the test with three main factors. Three corn lines were used: MON802, MON810, and a closely related control. Corn borer infestation was either natural or augmented manually. The manual infestations were done with first instar laboratory- reared ECB larvae during both the 1st and 2nd generation flight periods. Pesticide treatments were Dipel (Bt) at 2 pt/acre or permethrin at 0.15 lb/acre to simulate standard insecticide managemant practices in comparison to the untreated check.

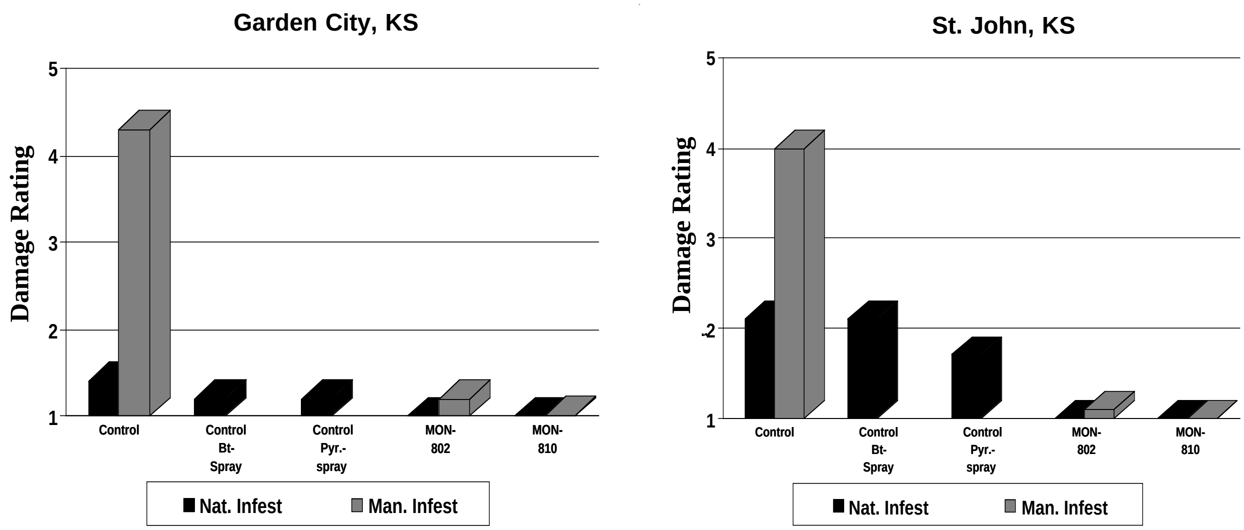
In mid-July, the plots were rated for lst generation corn borer shot-hole feeding injury using the Guthrie 1 to 9 scale. In mid-September, 15 plants per plot were split to evaluate corn borer injury. Corn ears also were rated for kernel damage. The rest of the plot was hand harvested in early October to calculate plot yields.

RESULTS AND DISCUSSION

Native 1st generation corn borer feeding damage in untreated control corn was low at both locations, averaging 1.4 and 2.1 at Garden City and St. John (Tables 1 & 2) (a rating of 1 was no damage). Untreated control corn manually infested with ECB averaged 4.3 and 4.0 at the two locations (Fig. 1). First generation damage ratings were very low in all Bt corn plots and averaged 1.0 to 1.2 in native and manually infested treatments at the two locations. Single Bt- or permethrin-sprays did not reduce damage much.

Native 2nd generation corn borer activity included moderate ECB pressure at both sites and light or heavy SWCB pressure at Garden City and St. John, respectively. Native 2nd generation corn borer tunneling in untreated control corn averaged 3.5 inches at Garden City and 32.3 inches at St. John (Tables 1 & 2). Tunneling in untreated control corn manually infested with ECB averaged 19.8 and 27.2 inches at the two locations. Tunneling was very low in all Bt corn plots and averaged 0.0-0.3 inches at Garden City and 0.0-2.8 inches at St. John in native and manually infested treatments (Fig 2). Single Bt- or permethrin-

Fig. 1. First generation corn borer damage rating - native and manual infestation, 1995.



sprays applied during the 2nd generation reduced tunneling from 3.5 to 2.8 - 3.8 inches at Garden City or from 32.3 to 16.5-26.8 inches at St. John. The single sprays of Dipel or permethrin were not nearly as effective at reducing tunneling as was Bt corn (Fig 2).

Native 2nd generation SWCB were present and caused averages of 13.7 and 21 girdled plants per plot in untreated control corn at Garden City and St. John, respectively (Table 1 and 2). In Bt corn, girdling was much reduced and averaged 0.0 and 0.2-3.0 plants per plot for MON810 and MON802, respectively (Fig 3).

Numbers of kernels damaged by native corn earworm and corn borer averaged 4.1 and 15 kernels destroyed per ear or 18.1 and 66 kernels surface damaged per ear at Garden City and St. John, respectively (Tables 1 and 2). Manually infested corn borer treatments had somewhat more damage. The Bt corn had lower numbers of kernels damaged, 2.0-3.9 and 10-16 kernels per ear at the two locations. Single treatments of Bt- or permethrin-spray had little impact on kernel damage (Fig 4).

Grain yields at Garden City were somewhat erratic. At St. John grain yields in Bt corn averaged 174.7-188.3 bu/acre, and yields for unprotected control corn averaged 123.5-155.3 bu/acre (Table 1 and 2). The apparent yield loss to corn borer damage was 19.4 and 33.3 bu/acre.

Bt corn effectively eliminated 1st and 2nd generation ECB and SWCB damage in corn. Bt corn also reduced kernel damage caused by corn earworm and corn borers. Under corn borer pressure, grain yield was improved by Bt corn.

Fig. 2. Second generation corn borer tunneling - native and manual infestation, 1995.

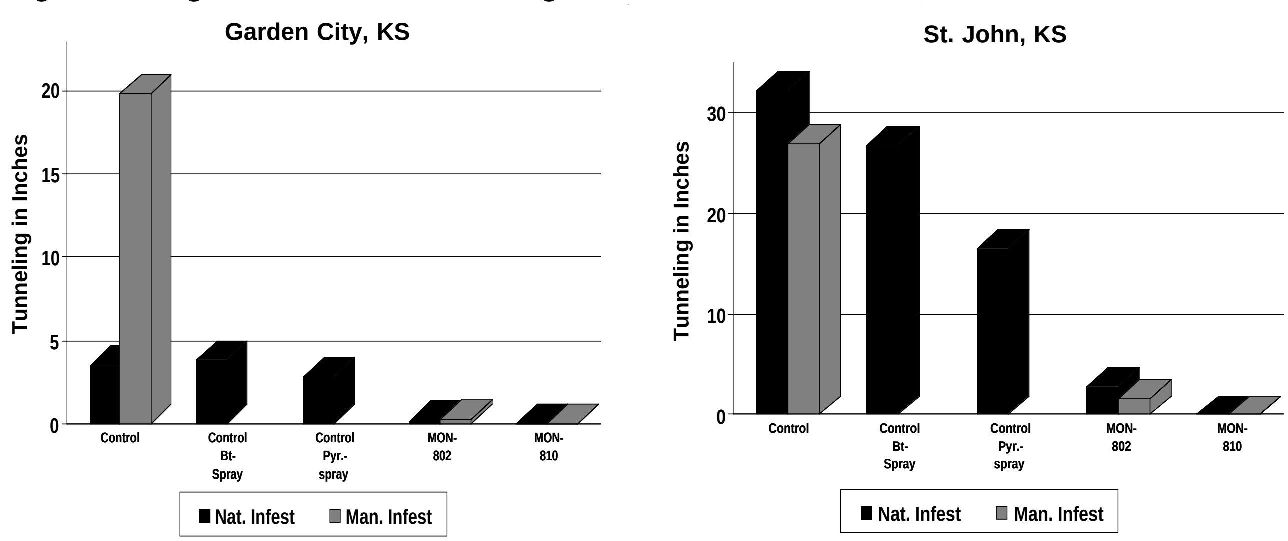


Table 1. Evaluation of corn borer resistance of two Bt corn lines at Garden City, KS, 1995.

Treatment Corn Borer Infestation	1st Generation Damage Rating	2nd Generation Tunneling in Inches	Plants Girdled	Destroyed Kernels per Ear	Surface Damage per Ear	Yield bu/acre
Native						
Control	1.4 b	3.5 b	13.7 a	4.1 b	18.1 b	100.5 ab
Control + Dipel	1.2 bc	3.8 b	10.2 a	3.6 b	9.3 bc	96.5 ab
Control + permethrin	1.2 bc	2.8 b	9.8 a	3.3 b	12.4 bc	96.5 ab
MON802	1.0 c	0.2 c	0.3 c	2.0 b	7.6 c	102.8 ab
MON810	1.0 c	0.0 c	0.0 c	2.1 b	11.4 bc	112.2 a
Native + Manual						
Control	4.3 a	19.8 a	5.5 b	9.6 a	31.5 a	68.1 c
MON802	1.2 bc	0.3 c	0.2 c	3.9 b	12.6 bc	106.6 a
MON810	1.01 c	0.04 c	0.0 c	1.0 b	6.0 c	88.06 c

Table 2. Evaluation of corn borer resistance of two Bt corn lines at St. John, KS, 1995.

Treatment Corn Borer Infestation	1st Generation Damage Rating	2nd Generation Tunneling in Inches	Plants Girdled	Destroyed Kernels Per Ear	Surface Damage Per Ear	Yield In Bu Per Acre
Native						
Control	2.1 b	32.3 b	21 a	15 bc	66 b	155.3 b
Control + Dipel	2.1 bc	26.8 b	23 a	26 a	70 b	152.5 b
Control + permethrin	1.7 b	16.5 b	21 a	17 abc	57 b	168.6 ab
MON802	1.0 c	2.8 d	3 c	16 bc	34 c	177.6 ab
MON810	1.0 c	0.0 d	0 c	13 bc	29 c	184.5 ab
Native + Manual						
Control	4.0 a	27.2 b	13 b	23 ab	102 a	123.5 c
MON802	1.1 c	1.6 d	1 c	14 bc	33 c	174.7 ab
MON810	1.0 c	0.0 d	0 c	10 c	31 c	188.3 a

Fig. 3. Girdled plants caused by Southwestern corn borer - native and manual infestation, 1995.

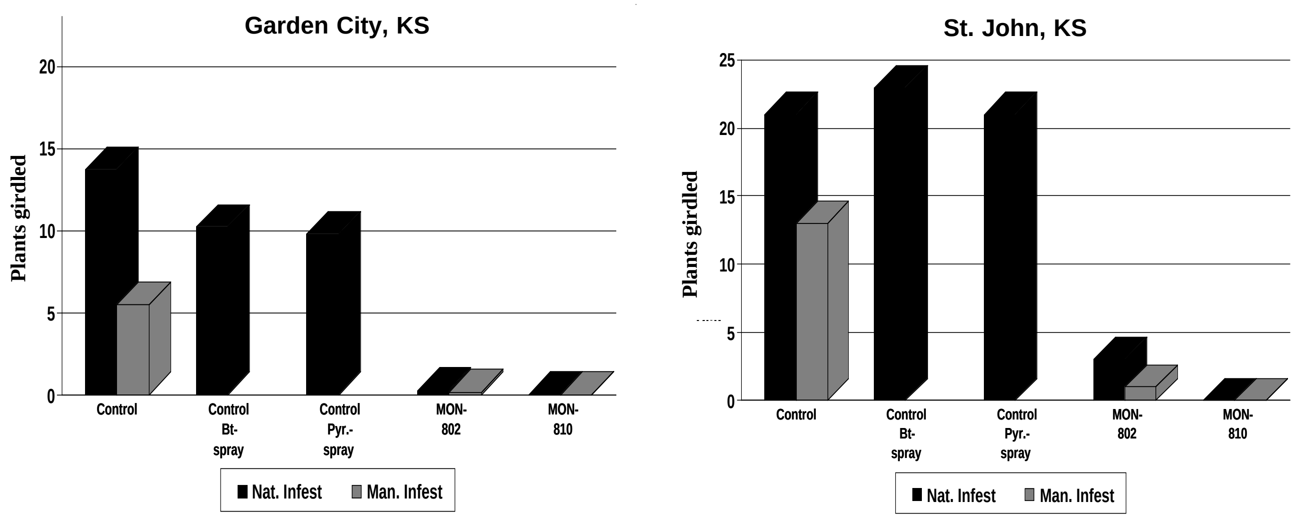
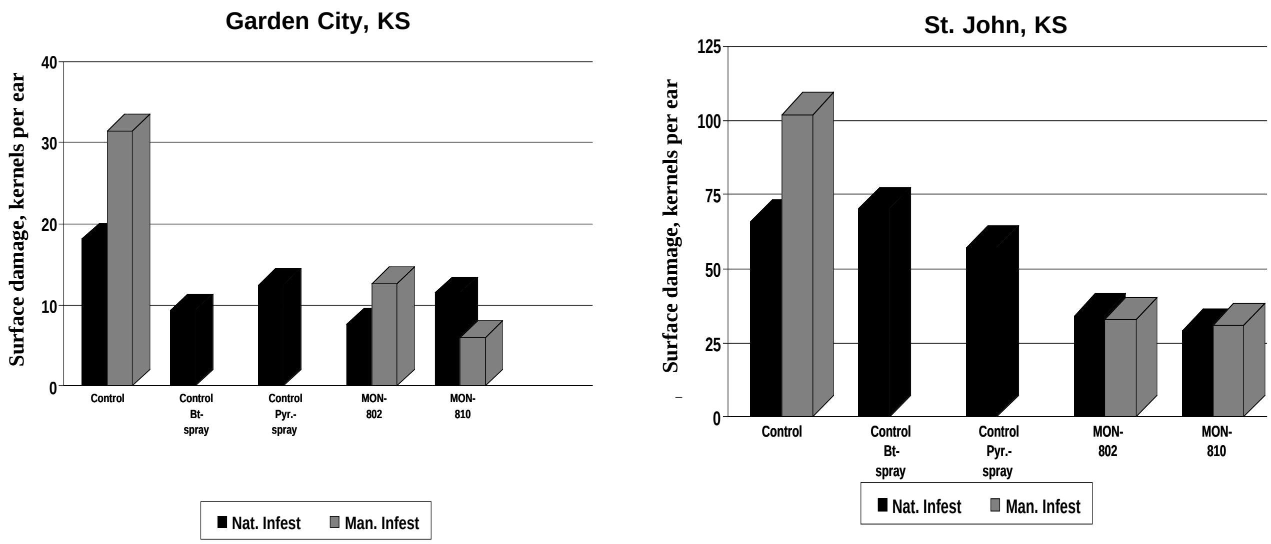


Fig 4. Corn borer and corn ear worm damage to kernels - native and manual infestation, 1995.



Acknowledgment:
The spider mite and corn borer data presented in this report are based on field counts by the following summer assistants: Alan Penrod, Heather Matticks, Terra Mehrer, and Bruce Gerber. Their continuous efforts are gratefully acknowledged.

KSU
Southwest Research-Extension Center

GAUCHO SEED TREATMENT FOR SORGHUM

by

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

SUMMARY

Five different sorghum hybrids treated with Gaucho were monitored to evaluate the seed treatment's impacts on greenbug populations and sorghum yield. Gaucho was found to reduce greenbug populations by about 40% and to reduce yield losses by about 4 bushels per acre. Greenbug reductions and yield increases tended to be higher on susceptible sorghum hybrids.

PROCEDURES

Treated and untreated seed of five sorghum hybrids (NC+ 271, DeKalb DK-56, Cargill 607E, Deltapine 1552, Pioneer 8500) were obtained from Gustafson, Inc. for use in the trial. Each treated 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 9 June in field 5B at the Southwest Research-Extension Center, Finney County, KS. Plots were 2 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 per row. Ramrod and Atrazine were used for weed control.

Greenbugs were sampled four times by cutting off two plants per plot 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

Greenbug populations reached moderate levels by mid to late August (70 to 82 days after planting). The greenbugs in the plots were identified as a mixture of biotypes E and I. The effect of Gaucho was found to be significant when analyzed across sampling dates, but the effect of sampling date was also found to be significant. The 18 and 22 August sampling dates had significantly lower greenbug numbers than the 26 and 30 August sampling dates. Thus, the data for the two pairs of sampling dates were analyzed separately. The analysis showed that Gaucho significantly reduced greenbug numbers during both sampling periods. Averaged across dates and hybrids, Gaucho reduced greenbug numbers by about 40%. Gaucho also significantly reduced yield losses by just over 4 bu/acre. Although the interaction terms for hybrid and seed treatment were not significant, trends appear when visually comparing the percent reduction in greenbug numbers from the Gaucho treatment among hybrids. Cargill 607E had very low greenbug numbers in the control plots (this hybrid is resistant to both biotype E and I greenbugs) and showed only about a 2% reduction in greenbug numbers and a yield difference of only about 1.2 bu/acre between the treated and untreated plots. DK-56 (which is resistant to biotype E greenbugs but not biotype I greenbugs) had a low to intermediate number of greenbugs on the untreated plots and only a 4.1 bu yield difference from Gaucho treatments. Pioneer 8500 (which is susceptible to both biotype E and I greenbugs) showed about a 70% reduction in greenbug numbers and had a 11.8 bu/acre yield difference in response to the Gaucho treatment. One surprising observation was the low response of NC+ 271 to the Gaucho seed treatment. In previous studies, Gaucho was shown to significantly reduce greenbug numbers and yield losses in this hybrid. The reason for this lack of response is unclear but may be related to the lateness of the greenbug infestation. These data seem to indicate that Gaucho can be effective in reducing late-season greenbug populations and associated yield losses, but

[1]Department of Entomology, Kansas State University, Manhattan.

that the amount of reduction may vary with hybrid and its type and amount of greenbug resistance. These data also indicate that greenbugs should still be monitored in Gaucho-treated plots and that other treatment measures sometimes could be justified.

Table 1. Effects of Gaucho seed treatment on sorghum, Southwest Research-Extension Center, 1995.

	Avg. Greenbug Numbers per Plant 18 & 22 Aug.		Avg. Greenbug Numbers per Plant 26 & 30 Aug.		Yield bu/acre	
Hybrid	Without Gaucho	With Gaucho	Without Gaucho	With Gaucho	Without Gaucho	With Gaucho
NC+271	137	72	725	683	80.7	80.1
DeKalb DK-56	56	4	191	45	73.9	78.0
Cargill 607E	33	49	68	49	76.4	77.6
Deltapine 1552	134	100	539	246	83.4	88.2
Pioneer 8500	295	94	270	94	92.4	104.2
Anova Table	P-Value		P-Value		P-Value	
Hybrid	0.1752		0.0090		0.0018	
Seed Treatment	0.0339		0.0452		0.0153	
Interaction	0.2838		0.6915		0.1695	
Main Effect Means						
Hybrid						
NC+271	105 ab		704 b		80.4 a	
Dekalb 56	30 a		118 a		75.9 a	
Cargill 607E	41 ab		58 a		80.4 a	
Deltapine 1552	117 ab		393 ab		85.8 a	
Pioneer 8500	194 b		182 a		98.3 b	
Seed Treatment						
Without Gaucho	131 b		359 b		81.4 a	
With Gaucho	64 a		223 a		85.6 b	

Means separated using the Duncan's New Multiple Range Test.

EFFICACY OF COMITE II "BANDED" WITH ACCENT OR BEACON EARLY IN THE SEASON, 1995

by
Larry Buschman

SUMMARY

Comite II was applied alone or with Accent or Beacon as a "banded" treatment to whorl-stage corn to control spider mites. The test was conducted as small replicated plots, which included untreated plots and plots treated with the old Comite formulation. Although the banded treatments appeared to give some reduction in mite numbers, the results were not statistically signficant.

PROCEDURES

The small plot test was conducted at the Southwest Research-Extension Center, Finnup #11. The plots were 12 rows wide, 100 ft long, and replicated four times. The plots were inoculated twice using mite-infested leaves from the laboratory colony of Banks grass mites. Five treatments used were: 1. Untreated, 2. Comite II at 1.5 pt/acre, 3. Comite II at 1.5 pt/acre plus Accent at 2/3 oz/acre, 4. Comite II at 1.5 + Beacon at 3/4 oz/acre, and 5. Comite at 1 pt/acre. Cotton seed oil was included with the pesticide applications at 1.5 pt/acre. Treatments were applied with a ground rig with nozzles directed at the bottom half of the 36-inch-high plants on 15 July. Spider mites were counted on six plants in each plot. Counts were made pretreatment and at 1, 2, and 4 weeks posttreatment. Season-long mite pressure was calculated by totaling the mites counted on the five sample dates.

RESULTS AND DISCUSSION

Spider mite numbers were low, and only the counts from the 10 August sample date and the season total are presented (Table 1). Both Comite and Comite II appeared to be suppressing mite populations, but the mite numbers were low, and the variability prevented differences among means from being statistically significant.

No leaf spotting was observed. Predator mite numbers appear to be related to total number of spider mites. *Orius* species and thrips were not affected by the treatments.

Table 1. Spider mites and mite predators in small Comite II banding test (spray directed to lower half of plant on 15 July 1995) using ground application equipment, Garden City, KS.

	Means per Nine Plants			
Treatment	Spider Mites	Predator Mites	*Orius*	Thrips
10 Aug. - 4th week				
1. Untreated	89.0			
2. Comite II	6.3			
3. Comite II + Accent	6.3			
4. Comite II + Beacon	28.8			
5. Comite	15.6			
F-test	0.17			
LSD	77			
Season Total				
1. Untreated	289.7	5.5	1.0	6.2
2. Comite II	47.0	1.4	1.4	8.3
3. Comite II + Accent	54.1	1.0	1.9	7.2
4. Comite II + Beacon	225.4	6.2	1.8	7.4
5. Comite	73.6	2.5	1.1	7.2
F-test	0.19			
LSD	255			

CORN ROOTWORM INSECTICIDE EFFICACY TEST GARDEN CITY, KANSAS — 1995

by
Larry Buschman and Phil Sloderbeck

SUMMARY

Rootworm damage to corn was compared in plots treated with planting time applications of Counter, Lorsban, Fortress, and Force to evaluate efficacy of the insecticides and to test the usefulness and efficacy of the Smartbox® application system. The Smartbox system worked well and was particularly useful in calibration of different insecticide formulations. Unfortunately, rootworm damage was low in the plots, and differences among treatments were not significant.

PROCEDURES

Field corn, Delta Pine 4581, was planted on 15 May 1995 at a rate of 32,000 seeds/acre in a furrow-irrigated field (Finnup #11) at the Southwest Research-Extension Center, Finney County, KS. The field was treated with 0.5 lb AI/acre of 2,4-D + 1.5 lb AI/acre of Atrazine preplant on 1 April, 0.5 lb AI/acre of Atrazine + 1.2 lb AI of Frontier at planting, plus 0.5 lb AI/acre of Banvel and 0.036 lb AI/acre of Beacon postemergence on 15 June. Plots were two rows (5 ft) by 100 ft, arranged in a randomized complete block design, and replicated four times. Treatments were applied with John Deere® planter-mounted granular applicators or with the Smartbox® system either as a 7-inch band over the open seed furrow (T-band) or as an in-furrow application.

Rootworm damage was rated on four plants/plot on 13 July 1995 using the 6-point Iowa scale. Considering the low amount of rootworm pressure, no yield data were collected.

RESULTS AND DISCUSSION

Rootworm injury in the untreated plots was low, averaging only 2.6 in the untreated plots (Table 1). Although a few treatments can be separated statistically, these differences are minor, and none of the insecticide treatments separated from the untreated check.

The Smartbox system worked well and was particularly helpful in calibrating for different insecticide formulations. One limitation for our purposes was an inability to store calibration information for different insecticides which could eliminate the need to stop and calibrate during planting.

Table 1. Corn rootworm test, 1995, Garden City, KS.

Treatment	Application	Placement	Rate oz product*	Average Root Rating**
Force 3G	SmartBox	in-furrow	4	2.16 a
Counter 20	Coventional	t-band	6	2.37 a b
Force 3G	Coventional	t-band	4	2.37 a b
Fortress 5G	SmartBox	t-band	3	2.41 a b
Force 3G	SmartBox	t-band	4	2.47 a b
Force 3G	SmartBox	t-band	3	2.53 a b c
Fortress 5G	Coventional	in-furrow	3	2.59 a b c
Force 3G	SmartBox	in-furrow	3	2.59 a b c
Untreated				2.59 a b c
Fortress 5G	Coventional	t-band	3	2.63 b c
Fortress 5G	SmartBox	in-furrow	3	2.78 b c
Lorsban 15	Coventional	t-band	8	2.94 c

*oz product per 1000 ft. of row.
**Duncan's New Multiple Range Test.

EFFICACY OF SELECTED INSECTICIDES AGAINST SECOND-GENERATION EUROPEAN CORN BORER, 1995

by
Larry Buschman and Phil Sloderbeck

SUMMARY

European and Southwestern corn borer pressures were very light. Corn borer tunneling averaged only 0.6 inch per plant in the untreated check. No statistically significant differences occurred in corn borer numbers or tunneling among treatments.

PROCEDURES

Field corn, Deltapine 4581, was planted on 15 April 1995 at a rate of 32,000 seeds/acre in a furrow-irrigated field (Finnup #11) at the Southwest Research-Extension Center, Finney County, KS. The field was treated with 0.5 lb AI/acre of 2,4-D + 1.5 lb AI/acre of Atrazine preplant on 1 April, 0.5 lb AI/acre of Atrazine + 1.2 lb AI of Frontier at planting, plus 0.5 lb AI/acre of Banvel and 0.036 lb AI/acre of Beacon postemergence on 15 June. Treatments were arranged in a randomized complete block design with four replications. Plots were four rows (10 ft.) wide and 50 ft. long, with a four-row border of untreated corn on each side and a 10-ft alley at each end. The single corn borer treatments were made on 4 August or 19 August with a high clearance sprayer using a 10-ft boom with three nozzles directed at each row (one on each side of the row on 16-inch drop hoses directed at the ear zone and a third nozzle directed at the top of the plant). The sprayer was calibrated to deliver 20 gal/acre at 2 mph and 40 psi. Treatment timing was based on the Kansas State University European Corn Borer model, which predicted 25-50 % oviposition to occur on 13-16 August. Corn borer moth flight also was monitored using a black light and pheromone traps.

Corn borer control was evaluated by dissecting 15 plants per plot between 9 - 21 November to determine the number of corn borer larvae and length of tunneling per plant. Grain yield was not taken because of the low pest pressure and the lack of significant differences in pest numbers and damage among treatments.

Before treatments were applied, two plants were flagged in each of the two center rows of each plot. Sections of corn leaves infested with Banks grass mites from a laboratory colony were placed in leaf axils of the flagged plants. Data on spider mites and mite predators were collected on 31 June and 10 August by visually searching each leaf of the four flagged plants in each plot and on 28 August by visually searching every other leaf on four flagged plants in each plot.

RESULTS AND DISCUSSION

European corn borer (ECB) and Southwestern corn borer (SWCB) pressures were very light. Only 23 ECB larvae and five SWCB larvae were recovered in the 600 plants dissected in this test, and tunneling averaging only 0.6 inch per plant in the untreated plots. This low level of corn borer pressure was surprising, because significant numbers of moths were captured in pheromone traps along the field border (peak of 376 ECB and 57 SWCB per night in two pheromone traps). The peak flight of ECB moths occurred on 15 August, and the peak for SWCB moths occurred on 17 August. Differences in corn borer numbers and tunneling among treatments were not statistically significant, but the early treatment of Capture was unique in that it had no corn borers or tunneling. This suggests that most of the treatments may have been applied too late to be effective. The spider mites were found to be primarily Banks grass mites with 0.7% two spotted spider mites on 16 August and 4% on 6 September. No significant differences were found in spider mite or predator numbers among treatments.

Table 1: Efficacy of selected insecticides on second generation corn borer, Garden City, KS, 1995.

Treatment	Rate per Acre	ECB per 15 Plants	SWCB per 15 Plants	% of Plants Infested[3]	Tunneling per 15 Plants in inches
Check Plots					
Untreated	—	0.0	0.0	22	8.3
Standard Applications[1]					
Capture 2EC — Early[2]	0.08	0.0	0.0	0	0
Capture 2EC	0.08	0.0	0.25	17	8.3
Capture + Furadan	0.06 +0.5	0.5	0.25	13	5.9
Warrior	0.02	0.5	0.0	13	5.1
Warrior	0.025	1.5	0.0	36	23.2
Pounce	0.15	1.5	0.5	26	24.4
Pounce	0.2	0.75	0.0	17	5.9
Warrior + Comite	0.025 + 1.69	0.5	0.0	17	5.1
Warrior + Comite	0.025 + 1.125	0.5	0.25	23	9.8
F-Test Prob.		0.12	0.72	0.44	0.73
C.V.		145%	343%	103%	313%

[1] Rate expressed as lb AI/acre and applied on 19 August (except where noted).
[2] Applied on 4 August.
[3] Percent of plants showing any signs of corn borer tunneling.

Table 2: Effects of selected insecticides on spider mites and predator mites, Garden City, KS, 1995.

Treatment	Rate per Acre	Spider Mites per Plant			Predator Mites per Plant		
		6/31	8/10	8/28	6/31	8/10	8/28
Check Plots							
Untreated	—	5	30	267	0.06	0.68	7.2
Standard Applications[1]							
Capture 2EC - Early[2]	0.08	22	12	209	0.06	0.25	1.8
Capture 2EC	0.08	1	45	218	0.06	1.50	5.2
Capture + Furadan	0.06 +0.5	5	15	120	0.13	0.18	1.0
Warrior	0.02	12	26	192	0.06	0.88	1.5
Warrior	0.025	2	48	289	0.19	1.33	3.3
Pounce	0.15	8	54	549	0.19	1.93	6.8
Pounce	0.2	8	18	138	0.00	0.75	3.4
Warrior + Comite	0.025 + 1.69	6	43	329	0.00	0.33	1.0
Warrior + Comite	0.025 + 1.125	4	33	220	0.13	1.25	2.4
F-Test Prob.		0.70	0.71	0.46	0.66	0.55	0.35
C.V.		194%	110%	96%	177%	137%	127%

[1] Rate expressed as lb AI/acre and applied on 19 August (except where noted).
[2] Applied on 4 August.

EFFICACY OF MITICIDES AGAINST BANKS GRASS MITES AND TWOSPOTTED SPIDER MITES IN CORN, 1995

by
Larry Buschman and Phil Sloderbeck

SUMMARY

Two tests were conducted to evaluate the efficacy of several miticides against the Banks grass mite (BGM), *Oligonychus pratensis* (Banks), and the twospotted spider mite (TSM), *Tetranychus urticae* Koch. In the BGM test, there were100 to170 mites per plant prior to treatment. No statistically significant differences occurred in spider mite or predator mite populations at 10 to 12 days after treatment. In the TSM test, there were 855 to 1560 mites per plant prior to treatment. No statistically significant differences occurred in spider mite or predator mite populations at 8 to 10 days after treatment. Mite populations were 16% and 99% TSM at pretreatment and 51% and 98% TSM at 12 days after treatment in the respective tests.

PROCEDURES

Field corn, Deltapine 4581, was planted on 15 April, 1995 at a rate of 32,000 seeds/acre in a furrow-irrigated field (Finnup #11) at the Southwest Research-Extension Center, Finney County, KS. The field was treated with 0.5 lb AI/acre of 2,4-D + 1.5 lb AI/acre of Atrazine preplant on 1 April, 0.5 lb AI/acre of Atrazine + 1.2 lb AI of Frontier at planting, plus 0.5 lb AI/acre of Banvel and 0.036 lb AI/acre of Beacon postemergence on 15 June. Two tests (one for BGM and one for TSM) were established, and in each test, treatments were arranged in a randomized complete block design with four replications. Plots were four rows (10 ft) wide and 50 ft long with a 4-row (10 ft) border of untreated corn on each side and a 10-ft alley at each end. Treatments were applied on 19 and 21 August with a high clearance sprayer using a 10-ft boom with three nozzles directed at each row (one on each side of the row on 16-in drop hoses directed at the ear zone and a third nozzle directed at the top of the plant). The sprayer was calibrated to deliver 20 gal/acre at 2 mph and 40 psi.

Before the treatments were applied, two plants were flagged in each of the two center rows of each plot in both tests. Sections of corn leaves infested with mites from the respective laboratory colonies were placed in leaf axils of the flagged plants. Spider mite counts were made by visually searching one-quarter of the leaves of the flagged plants for large (adult female) spider mites on 11 August in the TSM trial and by visually searching all of the leaves on the marked plants on 15 August in the BGM trials. Posttreatment counts were made by visually searching every other leaf of the flagged plants for large (adult female) spider mites on 29 and 31 August in the TSM and BGM trials, respectively. All spider mite counts were converted to mites per plant for presentation. Samples of mites were collected both pretreatment and post-treatment from the four flagged plants in each plot using a vacuum sampler to determine the mite species ratio. These samples were mounted on glass slides for microscopic examination and determination of species. Grain yield was not taken because no significant differences occurred among the mite populations across treatments.

RESULTS AND DISCUSSION

Spider mite populations were slow developing in 1995. In the BGM test, mite numbers reached 100 to 179 mites per plant by 15 August. Ten to 12 days after treatment, only the mite populations in the Kelthane MF-B treated plots were somewhat suppressed, but the differences were not statistically significant. At pretreatment, the mites were 16% TSM, and at 10 days posttreatment, they were 51% TSM.

Spider mite populations in the TSM test were much higher, 855 to 1560 per plant on 11 August. Eight to 10 days after treatment, only the mite populations in the Kelthane-treated plots were somewhat suppressed, but the differences were not statistically significant. In this trial, the mites were 99% TSM at pretreatment and 98% TSM at 10 days posttreatment.

Predator mite populations were somewhat lower in some Capture and Kelthane treatments and somewhat higher in plots with higher spider mite populations, but these differences were not statistically significant.

Table 1. Efficacy of selected miticides against Banks grass mites, Southwest Research-Extension Center, 1995.

		15 Aug Pretreatment Counts per Plant		31 Aug 10 - 12 days after Treatment Counts per Plant			
Treatment[1]	Rate lb AI/acre	Spider Mites	Predator Mites	Spider Mites	% Control[2]	Predator Mites	% Control[2]
Check		167	1.5	312	-	8.6	-
Capture 2E	0.08	120	2.8	386	-72	7.4	54
Capture 2E	0.06	165	1.3	235	24	7.9	-6
+Cygon 4E	0.5						
Capture 2E	0.06	170	1.3	373	-17	8.4	-13
+ Thiodan 3E	0.5						
Kelthane MF-B	1.0	167	3.3	121	61	8.8	54
+ Latron CS-7	0.125%						
Kelthane 50WP	1.0	146	4.3	153	40	15.4	38
+ Latron CS-7	0.125%						
Penncap M 2FM	0.75	112	1.3	238	-13	7.9	-6
TD-2374 2FM	0.75	100	1.3	286	-53	16.4	-120
TD-2348 2FM	0.75	170	4.0	196	38	9.3	60
TD-2344 0.4E	0.04	124	1.3	606	-162	14.9	-100
F-Test Prob.		0.893	0.373	0.304	-	0.303	-
C.V.		55%	108%	85%	-	60%	-

[1] Capture treatments applied on 19 Aug and the rest of the treatments on 21 August.
[2] Percent control was calculated using the Henderson and Tilton formula.
[3] F-Test probability based on two-way analysis of variance.
[4] F-Test probability based on covariance analysis of variance with pretreatment counts as the covariate.

Table 2. Efficacy of selected miticides against twospotted spider mites, Southwest Research-Extension Center - 1995.

		11 Aug Pretreatment Counts per Plant		29 Aug 8-10 days after Treatment Counts per Plant			
Treatment[1]	Rate lb AI/acre	Spider Mites	Predator Mites	Spider Mites	% Control[2]	Predator Mites	% Control[2]
Check		1165	21	539	-	13	-
Capture 2E	0.08	855	13	434	-10	10	-24
Capture 2E +Cygon 4E	0.06 0.5	1205	39	604	-8	11	50
Capture 2E + Thiodan 3E	0.06 0.5	1311	19	745	-23	14	-19
Kelthane MF-B + Latron CS-7	1.0 0.125%	1230	17	403	29	13	-24
Kelthane 50WP + Latron CS-7	1.0 0.125%	1473	18	342	50	11	1
Penncap M 2FM	0.75	986	13	853	-87	17	-111
TD-2374 2FM	0.75	1019	18	578	-23	13	-17
TD-2348 2FM	0.75	1560	8	835	-16	16	-223
TD-2344 0.4E	0.04	993	17	642	-40	14	-33
F-Test Prob.		0.383	0.123	0.144	-	0.993	-
C.V.		36%	45%	45%	-	72%	-

[1] Capture treatments applied 19 Aug and the rest of the treatments were applied on 21 August.
[2] Percent control was calculated using the Henderson and Tilton formula.
[3] F-Test probability based on two-way analysis of variance.
[4] F-Test probability based on covariance analysis of variance with pretreatment counts as the covariate.

CONTROLLING LATE-SEASON CORN PESTS BY MANAGING CULTURAL VARIABLES: RESULTS AFTER THREE YEARS OF STUDY[1]

by
Larry Buschman, Dennis Tomsicek, Phil Sloderbeck, and Kevin Dhuyvetter

SUMMARY

Spider mite pressure was reduced by using short-season corn, but corn borer pressure was not. Apparently, hybrid corn borer susceptibility is more important than the cultural variables tested. Water use for short-season hybrids was reduced, but the cost savings did not make up for the reduced yield potential. The economic returns were higher for full-season corn than for short-season corn. Short-season corn gave better returns than sorghum under full irrigation, but under limited irrigation, sorghum sometimes gave better returns than corn (1 of 2 years).

INTRODUCTION

Corn borers and spider mites are serious pests of corn in southwest Kansas and pesticides often are used to control them. Because both of these pests occur late in the season, it might be possible to plant short-season (95-105 day) corn hybrids early enough to avoid these pests. The following study was conducted to evaluate the feasibility of planting early and planting short-season hybrids to avoid pest infestations.

PROCEDURES

This experiment was conducted in SW Kansas under a modified LEPA center pivot in 1993, 1994 and 1995. The four-factor experiment was arranged in a randomized complete block design, with the pesticide treatment as a subplot of the 12 main plots. The main plots were 12 rows by 70 ft and were replicated four times. The main factors were: 1. three crops; full-season corn (FS corn), short-season corn (SS corn), medium-season sorghum; 2. two planting dates; early and late; 3. two water regimes; minimum and full water; 4. four pesticide treatments; a) untreated, b) miticide, c) corn borer insecticide, and d) miticide and corn borer insecticide. The corn hybrids were selected to differ in maturity by about 20 days (118 and 97 days), but matched in 2nd generation corn borer susceptibility. The full-season corn (FS corn) was P3162, the short-season corn (SS corn) was P3751, and the medium-season sorghum was DK-56. The two planting dates were 7 and 21 May for corn and 21 May and 15 June for sorghum in 1993; 18 April and 18 May for corn and 10 May and 6 June for sorghum in 1994; and 12 April and 22 May for corn and 2 and 22 June for sorghum in 1995. The plots were irrigated using LEPA nozzles in the flat spray mode to meet 100% or 70% of total crop water requirement based on calculated evapotranspiration (ET) measurements (100% ET or 70% ET). The miticide Comite was applied at 3 pt/acre and the corn borer insecticide Lorsban was applied at 2 pt/acre in 1993 and Ambush was applied at 12.8 oz/acre in 1994 and 1995.

Arthropod populations were evaluated weekly on four plants in each plot (or subplot after pesticides were applied). The weekly mite counts were used to calculate mite-days as a measure of the season-long spider mite pressure. Damage by 2nd generation corn borer and corn earworm was determined by dissecting 15 consecutive plants in each subplot. Forty row-ft were hand harvested in each subplot to calculate yield.

Economic returns were calculated above operating and machinery ownership cost, assuming 100% of income and 100% of costs. Seed, insecticide, and irrigation pumping expenses were based on actual inputs. Income was based on actual yield multiplied by the relevant price during the week of harvest. All other operating costs were based on KSU Farm Management Guides.

The data were analyzed as a four-factor test with insecticide treatment split on the three agronomic factors. Means were separated using LSD (p = 0.05).

RESULTS AND DISCUSSION

Spider mite populations were low in 1993 and moderate in 1994 and 1995, reaching 210, 450, and ca 500 per plant in the respective years. Spider mite pressure expressed as mite-days was significantly higher in the limited irrigation treatments in all three years, but the interaction with planting date was different in each year (Figs. 1-3). When hot weather occurred late in the season as in 1994 and 1995, mite pressure was higher in the second planting. Water stress is known to favor development of spider mite populations. Mite pressure was higher in full-season than in short-season corn in 2 of the 3 years (Fig. 4). Mite pressure in sorghum was lower than in corn in 2 of 3 years, but sorghum in 1995 was late maturing and accumulated many mite-days after corn had reached maturity. Mite pressure differed for the two planting dates, but this response was different for each year (Fig. 5). Mite pressure was higher in the second planting in the years with late-season hot weather, 1994 & 1995. Mite pressure was highest in the subplots treated for corn borer (Fig. 6).

European corn borers (ECB) were present in moderate numbers (up to 4.88 larvae per plant) in 1993 and 1994, but in low numbers (up to 0.4 larvae per plant) in 1995 (Figs. 7-9). Corn borer tunneling measured in centimeters (cm). (largely from ECB) was used as an index of corn borer activity. Contrary to expectations, corn borer tunneling was significantly higher in the short-season corn than in the full-season corn. We had expected that short-season corn would finish silking before the moth flight and, therefore, would be at a less favorable growth stage. This did occur in 2 of the the 3 years. The higher tunneling in short- season corn may have been due to this hybrid being more susceptible (in spite of the seed company ratings that show the two hybrids being equal in resistance to second generation corn borer). Southwestern corn borers (SWCB) were present in low numbers.

Corn earworm damage to the grain in the ear was significantly higher in the late plantings of corn (2 of the 3 years) (Fig. 10). Up to 5.21 % of the grain was lost to corn earworms in the late planting of corn.

Total water use (rainfall + applied irrigation +soil water change) in 1994 was nearly the same in first and second plantings. Total water use of full- season corn averaged 2.78 and 2.69 inches more than that of

Fig. 1. Planting date and watering effects on mite-days, Southwest Research-Extension Center, 1993.

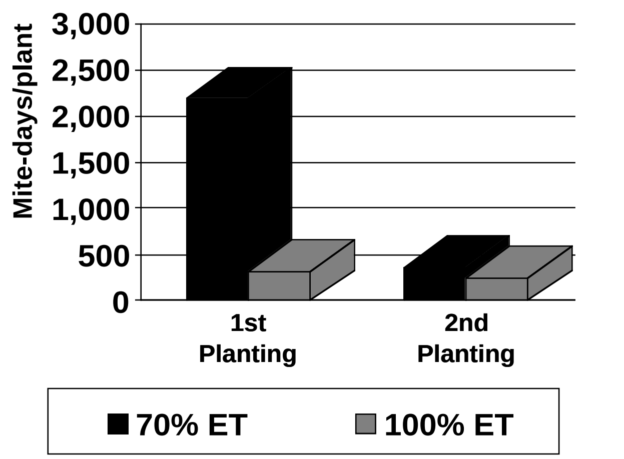


Fig. 2. Planting date and watering effects on mite-days, Southwest Research-Extension Center, 1994.

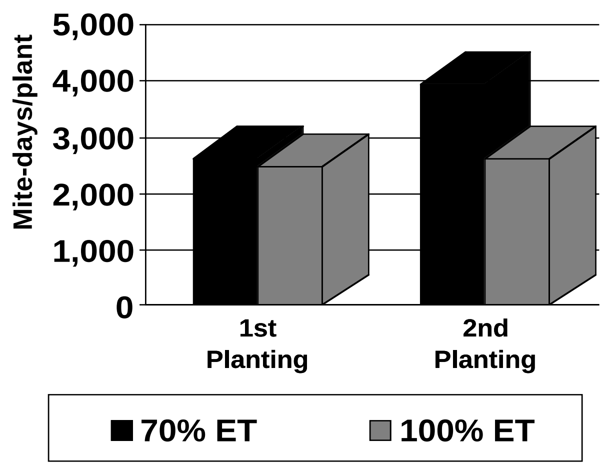


Fig. 3. Planting date and watering effects on mite-days, Southwest Research-Extension Center, 1995.

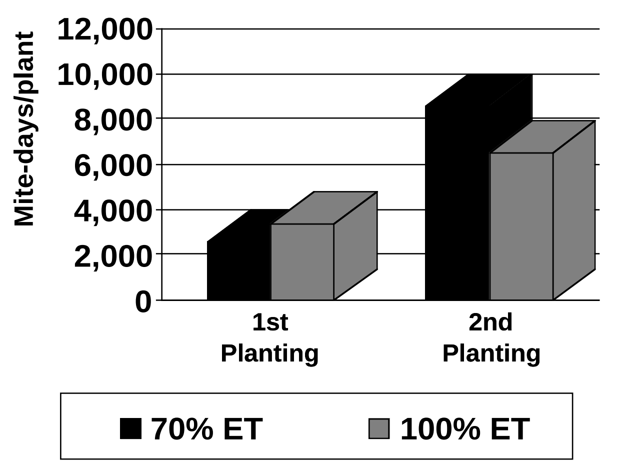


Fig. 4. Effects of three crops on mite-days, Southwest Research-Extension Center.

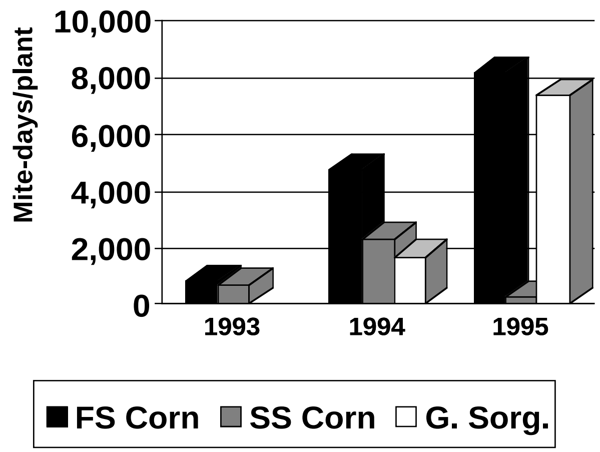


Fig. 5. Planting date effects on mite-days, Southwest Research-Extension Center.

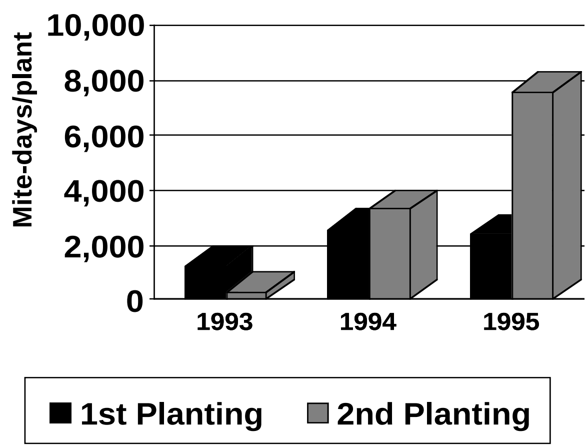


Fig. 6. Effects of two pesticides on mite-days, Southwest Research-Extension Center, 1994.

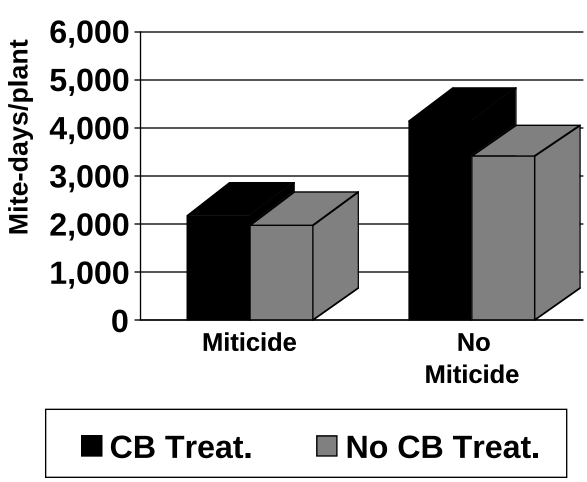


Fig. 7. Planting date and crop effects on corn borer tunneling, Southwest Research-Extension Center, 1993.

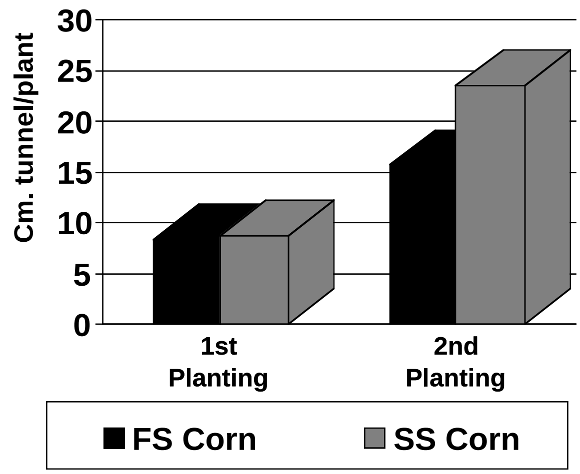


Fig. 8. Planting date and crop effects on corn borer tunneling, Southwest Research-Extension Center, 1994.

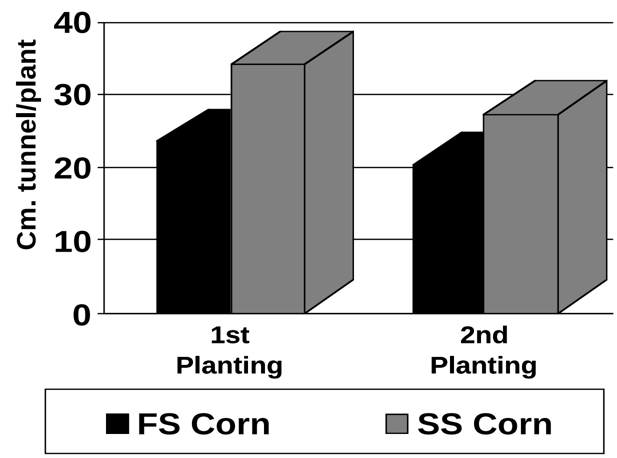
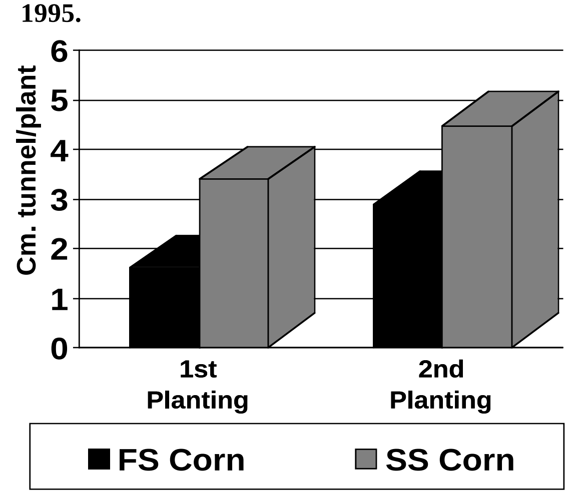
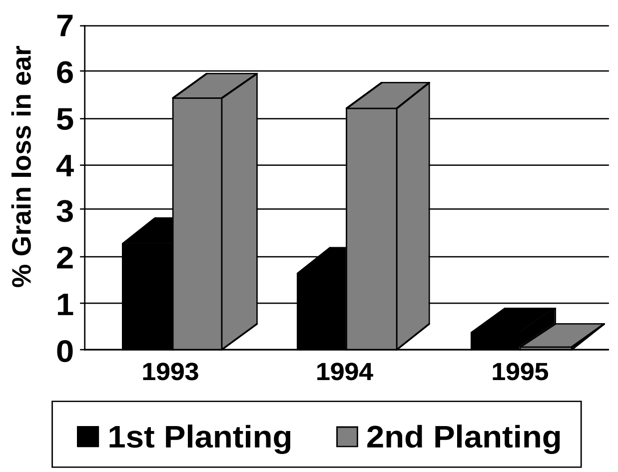


Fig. 9. Planting date and crop effects on corn borer tunneling, Southwest Research-Extension Center, 1995.



short-season corn for first and second plantings. The fully irrigated corn used an average 6.4 and 4.92 inches more total water than the limited irrigation corn for first and second plantings, respectively. The fully irrigated sorghum used an average of 4.35 inches more total water over limited irrigation sorghum. Total water use efficiency ranged from 5.96 bu/acre-inch for early planted sorghum to 8.04 bu/acre-inch for early planted short-season corn.

Fig. 10. Effects of planting date on corn earworm ear damage, Southwest Research-Extension Center.



Grain yield in the best plots averaged 163, 169, and 128 bu/acre for the 3 respective years (Fig. 11). Full-season corn yielded more than short-season corn and sorghum, and crops that received full irrigation yielded more than crops that received limited irrigation.

The best economic returns were for full-season corn receiving full irrigation: $167, 145, and 180 per acre for the respective years (Fig. 12). The best economic returns for short-season corn occurred with full irrigation; $144, 159, and 131 per acre for the respective years. In sorghum, the best economic returns were under limited irrigation in 2 of 3 years ($96 and 43 per acre), but in the good year, it was under full irrigation ($123 per acre).

Fig. 11. Effects of crop and watering on grain yield, Southwest Research-Extension Center.

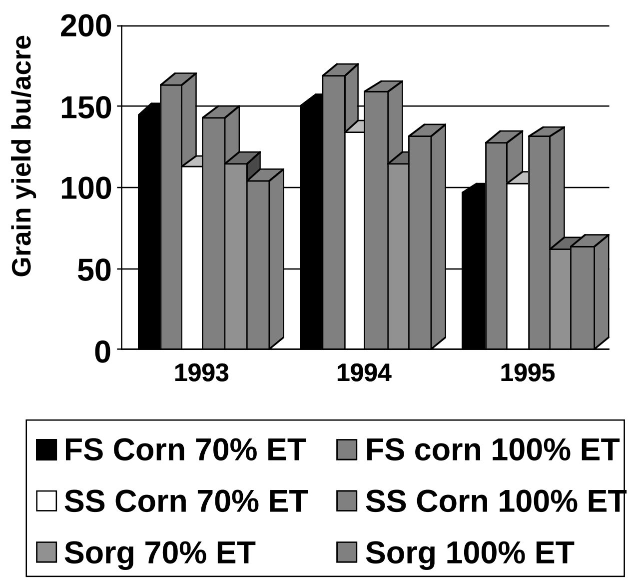
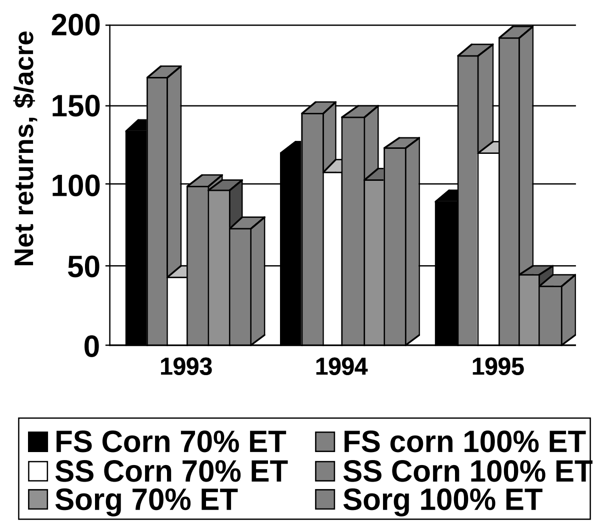


Fig. 12. Effects of crop and watering on economic returns, Southwest Research-Extension Center.



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

EFFECTS OF 38 HERBICIDE TANK MIXES FOR CONTROL OF PIGWEED, KOCHIA, JOHNSON GRASS, AND YELLOW FOXTAIL

by
Randall Currie

SUMMARY

None of the herbicide tank mixes provided excellent control of all the weed species present. Although many controlled two to three of the four prominent species, the yield penalty for failure in one or more species was severe. High rainfall followed by cool temperatures and poor corn growth after planting favored weed growth and reduced efficacy of many of the herbicides that under "normal conditions" would have provided adequate weed control.

INTRODUCTION

No one herbicide does it all at present. Many difficult-to-control weeds often occur together in the same field. This necessitates the tank mixing of two or more compounds to provide adequate control. Also, with the advent of Pursuit-resistant pigweed species, it is necessary to tank mix herbicides of differing modes of action to remedy or forestall additional herbicide resistance problems. Therefore, several Pursuit tank mixes and emerging experimental herbicides were compared.

PROCEDURES

Corn was planted as described in Table 1. Preplant incorporated, preemergence, early postemergence, and postemergence treatments were applied as described in Table 2. Treatment arranagement was a randomized complete block with four replications. Weed ratings were based on weed number per unit area. Both weeds and corn were slow to emerge. The average mean soil temperature from time of planting until sufficient weed and crop growth (30 days) was 61°. Within 5 days of application of preemergence and preplant-incorporation treatments, 2.2 inches of rain fell. During the 30-day period necessary for corn to achieve sufficient size for early postemergence treatments, 7.6 total inches of rain fell.

Table 1. Cropping information, Garden City, KS, 1995.

Crop Name	Corn
Variety	Pioneer 3162 IR
Planting Date	5-4-95
Planting Method	JD Max Emerge II
Rate, Unit	30,000/acre
Depth, Unit	2 in.
Row Spacing, Unit	30 in.
Soil Temp., Unit	58° F at 5 in.
Soil Moisture	Good
Emergence Date	About 2 in. tall on 5-17-95

RESULTS AND DISCUSSION

The combination of cool temperatures and high rainfall taxed all herbicide treatments to the breaking point in this test. Rainfall after planting incorporated at-planting treatments very well. This may have brought the herbicide into contact with a somewhat larger volume of soil organisms. Soil microbes degrade herbicide at temperatures much cooler than necessary for optimal corn growth. For the next 30 days, sustained rainfall diluted the herbicide in a much larger volume of soil than is normally experienced in this area. All these factors lead to poor herbicide performance.

No one tank mix provided excellent control of all weed species. Failure to "do it all" produced severe yield penalties. A herbicide trial often will produce an interaction of two weed species. For example, treatments that do not control kochia but do control Johnson grass are fairly easy to interpret, i.e., what was good for one was bad for the other. In this trial, four weed species appeared to interact, and many tank mixes failed on two or more species. Detailed analysis is very difficult under these conditions.

Overall trends, however, were fairly clear. Although treatments that produced yields between 50 and 70 bu/acre would have been total failures, they produced a yield increase far in excess of their cost compared to poorer treatments. Had an untreated control or a poor treatment for comparison not been present, even the best treatment would have looked poor. Therefore, as is true of most agronomic decisions, selection of a herbicide treatment should be based on a composite of herbicide trials over many years and locations coupled with the intimate knowledge of a specific field's past history.

Table 2. Application and equipment information, herbicide test for pigweed, kochia, Johnson grass, and yellow foxtail, Garden City, KS 1995.

Appl. Equipment	Windshield sprayer		
Pressure, Unit	35 lb. PSI		
Nozzle Type	Teejet		
Nozzle Size	8004 VS		
Nozzle Spacing, Unit	20 in.		
Boom Length, Unit	10 ft		
Boom Height, Unit	18 in.		
Ground Speed, Unit	3.3 mph		
Carrier	H_2O		
Spray Volume, Unit	20 GPA		
Propellant	CO_2		
	Pre/PPI	Early Post	Post
Application Date	5/4	6/2	6/9
Application Method	Windshield sprayer	Windshield sprayer	Windshield sprayer
Application Timing	Preemergence	Early postemergence	Postemergence
Air Temp., Unit	62°F	68°F	75°F
Wind velocity, Unit	N, 5-10 mph	10 mph	S, 5-10 mph
Soil Temp.	52°, 5 in. deep	58°, 5 in. deep	66°, 5 in. deep
Soil Moisture	Good	Good	Dry surface, moderate below
% Cloud Cover	30%	80%	30%

Table 3. Effects of 39 herbicide tank mixes for control of pigweed, kochia, Johnson grass, and yellow foxtail in corn, Garden City, KS, 1995.

	Treatment	Rate lbs AI/acre	Appl Time	Pigweed	Kochia	Johnson Grass	6/25 Yellow Foxtail	7/5 Yellow Foxtail	7/20 Yellow Foxtail	Yield bu/acre
1	Axiom	.72	Pre Em	-	-	S	72	75	60	50
2	Axiom	.77	Pre Em	+	+	-	72	68	59	39
3	Axiom + Atrazine	.72 + 1.40	Pre Em	+	+	-	66	78	55	40
4	Broadstrike Plus	.21	PPI	+	-	-	11	0	10	34
5	Broadstrike Plus	.21	Pre Em	-	+	-	5	48	20	35
6	Broadstrike Post + X-90 + 28% N	.21 + .25% + 2.5%	Post Em 1-2”	+	-	-	8	4	0	29
7	Broadstrike Post + X-90 + 28% N	.21 + .25% + 2.5%	Post Em 3-4"	+	+	-	24	47	30	17
8	GX411 (Cyanazine 4L)	2.75	Pre Em	-	+	-	41	46	42	22
9	GX412 (Cyanazine 90DF)	2.75	Pre Em	-	+	-	57	52	30	22
10	GX413 (Cyanazine + Atrazine)	2.75 + .94	Pre Em	+	+	-	41	61	65	22
11	GX414 (Cyanazine + Atrazine)	2.75 + .87	Pre Em	+	+	-	59	64	53	19
12	Frontier	.75	Pre Em		-	-	60	57	38	34
13	[Frontier] + [Resolve + X-90 + 28% N]	[.75] + .031 + .25% + .25 gal	[Pre Em] + [Early Post]	+	+	-	79	83	62	56
14	[Frontier] + Contour + X-90 + 28% N	[.75] + .048 + .25% + .25 gal	[Pre Em] + [Early Post]	+	+	-	78	77	71	57
15	[Extrazine II] + Resolve + X-90 + 28% N	[1.80] + .031 + .25% + .25 gal	[Pre Em] + Early Post	+	+	S	39	51	40	48
16	[Extrazine II] + Contour + X-90 + 28% N	[1.80] + .549 + .25% + .25 gal	[Pre Em] + Early Post	+	+	S	55	78	73	72
17	[Surpass] + Resolve + X-90 + 28% N	[1.256] + .031 + .25% + .25 gal	[Pre Em] + Early Post	+	+	S	60	72	57	54
18	[Surpass] + Contour + X-90 + 28% N	[1.256] + .549 + .25% + .25 gal	[Pre Em] +Early Post	+	+	S	45	91	67	58
19	[Prowl] + Resolve + X-90 + 28% N	[.825] + .031 + .25% + .25 gal	[Pre Em] +Early Post	+	+	S	76	67	58	58
20	[Prowl] + Contour + X-90 + 28% N	[.825] + .549 + .25% + .25 gal	[Pre Em] +Early Post	+	+	S	45	91	67	58
21	[Dual] + Marksman	[2.000] + 1.400	[Pre Em] +Early Post	+	+	-	87	63	79	44
22	[Prowl] + Marksman	[.825] + 1.400	[Pre Em] +Early Post	+	+	-	54	66	62	37
23	[Prowl] + Bladex	[.825] + 1.400	[Pre Em] + Early Post	-	-	-	56	1	77	28
24	Check				-	-	2	44	7	15
25	Resource + Atrazine + COC	.027 + .50 + .125 gal	Early Post	+	+	-	37	12	23	27
26	Resource + Banvel	.027+.250	Early Post	+	+	-	33	8	0	29
27	Resource + Atrazine + COC	.027 + .500+ .125 gal	Post	+	+	+	18	0	0	22
28	Resource + Banvel	.027 + .250	Post	+	+	-	25	65	0	26
29	Scepter	.123	Pre Em	+	-	-	57	59	26	57
30	Frontier	.750	Pre Em	+	-	-	62	84	50	15
31	Stature	.813	Pre Em	+	+	S+	77	85	85	86

Continued

Table 3. Effects of 39 herbicide tank mixes for control of pigweed, kochia, Johnson grass, and yellow foxtail, GardenCity, KS, 1995, continued.

	Treatment	Rate lbs AI/acre	Appl Time	Pigweed	Kochia	Johnson Grass	6/25 Yellow Foxtail	7/5 Yellow Foxtail	7/20 Yellow Foxtail	Yield bu/acre
32	Detail	1.025	Pre Em	+	+	S	94	90	83	60
33	Pursuit Plus	.906	Pre Em	+	+	S	99	92	98	58
34	Pursuit Plus + Scepter	.906 + .061	Pre Em	+	+	C	68	93	86	65
35	Broadstrike + Dual	2.158	Pre Em	+	-	-	77	79	61	40
36	Bicep II	3.600	Pre Em	+	+	-	84	91	84	36
37	Extrazine II	3.600	Pre Em	-	+	-	42	7	50	17
38	Contour + Prowl	.549 + .99	Pre Em	+	+	S+	73	88	91	61
39	Prowl + Scepter	.99 + .061	Pre Em	+	-	S	75	77	63	64
40	Check		Pre Em		-	-	0	0	0	12
	LSD.05=						10	36	38	20

Personal judgement was used to form a composite of 5 ratings throughout the season based on statiscially analyzed data. These ratings are defined as: 1. - = Poor control; 2. + = Biological activity; 3. S = Supression; 4. S+ = Very good supression; and 5. C = Good control.

EFFECTS OF TIME OF APPLICATION OF EIGHT HERBICIDE COMBINATIONS FOR WOOLYLEAF BURSAGE (BUR RAGWEED) CONTROL

by
Randall Currie

SUMMARY

With some exception, most herbicides provided better bur ragweed control when applied at flowering than if applied 30 days later. Picloram provided good control regardless of tank mix partner or time of application in all years; however, best control occurred with treatments at flowering. All other tank mixes provided poor or inconsistent control.

INTRODUCTION

Woolyleaf bursage, also known as bur ragweed, is a noxious perennial weed infesting in excess of 80,000 acres in southwest Kansas. It is found most frequently in low-lying areas of fields but also in the higher areas of fields because of movement of rootstocks and seeds by tillage equipment. Once established, this weed is very difficult to control. The objective of this study was to compare several herbicides applied at flowering and 30 days after flowering for control of woolyleaf bursage.

PROCEDURES

The study was established in August, 1990, and replicated in the 1994-1995 growing season. The experimental design was a two-factorial randomized complete block with two levels of application timing, nine levels of herbicide treatment, and three replications (Tables 1 and 2). Herbicides were applied with a CO_2-pressurized, hand-held sprayer equipped with a six-nozzle boom. Application volume was 20 gal/acre. Herbicides were applied on August 15, 1990 at flowering and on September 15, 1990.

In mid April of the next year, a tank mix of Surflan, Bladex and atrazine at 2, 4, and 2 lb AI/acre was applied to the entire plot area to control all weed species but bur ragweed (Table 3). The treatments were evaluated for bur ragweed control 9 and 11 months after treatments. The percent weed control was calculated by dividing the number of stems per unit area in the treated plots by the number in the corresponding control plot, subtracting this from 1, and multiplying the difference by 100.

RESULTS AND DISCUSSION

No rate of clopyralid provided adequate control of bur ragweed. Fluroxypr tank mixed with Dicamba or 2,4-D provided some control of bur ragweed 9 months after treatment when applied at flower. (Table 4). However, 11 months after treatment, control was inadequate with any tank mix of fluroxypr. In 1991, tank mixes of fluroxypr performed much better when applied at flowering. In 1995, this was true only of the tank mixes with 2, 4-D. However, 11 months after treatment, no tank mix of fluroxypr consistently provided adequate control. Regardless of tank mix partner, time of application, or year, Picloram provided 11 months of good control. Although a tank mix of fluroxypr and 2,4-D provided good control when applied at flowering in 1991, its control in all other tank mixes, times of application, and years was poor.

Table 1. Information for late flowering application of herbicides, Garden City, KS, 1991 and 1994.

Application Date	8-15-94	8-15-90
Application Method	Windshield sprayer	Hand-held boom
Application Equipment:		
Pressure, Unit	35 lb psi	45 lb psi
Nozzle Type	XR	FF
Nozzle Size	8004	11002
Nozzle Spacing, Unit	20 in.	20 in.
Boom Length, Unit	10 ft	10 ft
Boom Height, Unit	19 in.	19 in.
Ground Speed, Unit	3.3 mph	3.3 mph
Carrier	H_20	H_20
Spray Volume, Unit	20 GPA	20 GPA
Propellant	CO_2	CO_{2-}

Table 2. Information for application of herbicides for 30 days after flowering, Garden City, KS, 1990 and 1994.

Application Date	9-15-94	10/12/90
Application Method	Windshield sprayer	Hand-held boom
Application Equipment:		
Pressure, Unit	33 lb psi	45 lb psi
Nozzle Type	XR	FF
Nozzle Size	8004	11002
Nozzle Spacing, Unit	20 in.	20 in.
Boom Length, Unit	10 ft	10 ft
Boom Height, Unit	19 in.	19 in.
Ground Speed, Unit	3.3 mph	3.3 mph
Carrier	H_20	H_20
Spray Volume, Unit	20 GPA	20 GPA
Propellant	CO_2	CO_{2-}

Table 3. Information for spring application of herbicides, Garden City, KS, 1991 and 1994.

Application Date	3-23-95	4-25-91
Application Method	Windshield sprayer	Hand-held boom
Application Equipment:		
Pressure, Unit	35 lb psi	45 lb psi
Nozzle Type	XR	FF
Nozzle Size	8004	11002
Nozzle Spacing, Unit	20 in.	20 in.
Boom Length, Unit	10 ft	10 ft
Boom Height, Unit	17 in.	19 in.
Ground Speed, Unit	3.3 mph	3.3 mph
Carrier	H_20	H_20
Spray Volume, Unit	20 GPA	20 GPA
Propellant	CO_2	CO_{2-}

Table 4. Woolyleaf bursage control with nine herbicide tank mixes applied at flowering (Aug 15) and 30 days later, Garden City, KS.

		Nine Months after Treatment							Eleven Months after Treatment						
		1991		1995		AVG			1991		1995		AVG		
Treatment	Lbs/acre	Flwr	30 DAF	Flwr	30 DAF	Flwr	30 DAF	AVG	Flwr	30 DAF	Flwr	30 DAF	Flwr	30 DAF	AVG
		- % control-							- % control -						
1. Untreated	0	0.7	0.7	22.4	20.0	11.5	10.3	10.9	0.0	0.0	13.6	6.8	6.8	3.4	5.1
2. Clopyralid	0.12	1.8	13.8	39.4	7.1	20.6	10.4	15.5	7.3	4.2	15.7	25.5	11.5	14.9	13.2
3. Clopyralid	0.25	26.0	70.0	66.2	51.7	46.1	60.9	53.5	25.4	45.8	20.6	32.7	23.0	39.2	31.2
4. Fluroxypyr & Dicamba	0.75 + .5	89.6	19.3	63.6	67.5	76.6	43.4	60.0	64.6	5.4	20.3	32.9	42.4	19.1	30.8
5. Fluroxypyr + 2,4-D	0.25 + 1	95.6	13.5	64.8	31.5	80.2	22.5	51.4	85.0	11.1	41.4	3.2	63.2	7.2	35.2
6. Picloram + Dicamba	0.25 + .5	97.6	98.6	99.8	100.0	98.7	99.3	99.0	76.5	84.7	69.2	79.2	72.8	82.0	77.4
7. Picloram + 2,4-D LVE	0.25 + 1	100.0	93.8	100.0	100.0	100.0	96.9	98.5	98.2	79.0	88.5	68.5	93.3	73.7	83.5
8. Glyphosate + Dicamba	1.5 + 1*	44.5	43.8	73.6	51.8	59.1	47.8	53.4	34.3	23.6	27.6	9.2	30.9	16.4	23.7
9. Glyphosate + 2,4-D LVE	1.5 + 1*	95.6	9.2	68.3	30.1	82.0	19.7	50.8	75.1	24.4	12.6	29.7	43.9	27.0	35.5
LSD=0.05		29.0		33.0		19.1		13.6	31.0		32.0		19.1		13.5

COMPARISONS OF RATES AND TIMINGS OF APPLICATION AND TANK MIXES OF PEAK FOR WEED CONTROL IN GRAIN SORGHUM

by
Randall Currie

SUMMARY

All treatments provided early-season control of red root pigweed. However, subtle interplay of sorghum injury and late-season weed control had a significant impact on yield.

INTRODUCTION

Although sulfonlyurea herbicides have enjoyed widespread use in most crops in the last decade, until recently none have been developed for use in grain sorghum. Peak is a pre- or postemergence sulfonlyurea herbicide that will be marketed soon for weed control in sorghum. Many herbicides used in sorghum have some potential for crop injury or nonperformance. Therefore, weed control and crop injury of several tank mixes of Peak were compared to common post- and preemergence sorghum herbicides.

PROCEDURES

Sorghum was planted as described in Table 1, and herbicide treatments were applied as described in Tables 2 and 3. Approximately 5-10 red root pigweed from 2-4 inches in height per square foot were present at the time of postemergence herbicide application.

Within 2 days of planting, 0.07 inches of rain fell. This was the only rain that fell within the first 2 weeks of planting. Within a week of postemergence applications of herbicide, 1.8 inches of rain fell, followed by 1.2 inches the day after postemergence application.

Table 1. Crop information, Garden City, KS, 1995.

Crop Name	Sorghum
Variety	DK56
Planting Date	6-8-95
Planting Method	JD Max EmergeII
Rate, Unit	22600/A
Depth, Unit	1/2 in.
Row Spacing, Unit	30 in.
Soil Temp., Unit	69°F at 5 in.
Soil Moisture	Dry surface, good below
Emergence Date	< 7 days

Table 2. Application information for preemergence treatments in sorghum, Garden City, KS.

Application Date	6-8-95
Application Method	Windshield sprayer
Application Timing	Preemergence
Air Temp., Unit	62°F
Wind Velocity, Unit	NE, 10 mph
% Cloud Cover	100%
Application Equipment:	
Pressure, Unit	35 lb psi
Nozzle Type	XR
Nozzle Size	8002
Nozzle Spacing, Unit	20 in.
Boom Length, Unit	10 ft
Boom Height, Unit	18 in.
Ground Speed, Unit	4 mph
Carrier	H_20
Spray Volume, Unit	12 GPA
Propellant	CO_2

Table 3. Application information for postemergence treatments in sorghum, Garden City, KS, 1995.

Application Date	6-28-95
Application Method	Broadcast
Application Timing	Postemergence
Air Temp., Unit	85°F
Wind Velocity, Unit	S, 10 mph
Soil Temp., Unit	75°F at 5 in.
Soil Moisture	Good
% Cloud Cover	40%
Application Equipment	Windshield sprayer
Pressure, Unit	35 lb psi
Nozzle Type	XR
Nozzle Size	8002
Nozzle Spacing, Unit	20 in.
Boom Length, Unit	10 ft
Boom Height, Unit	18 in.
Ground Speed, Unit	4 mph
Carrier	H_20
Spray Volume, Unit	12 GPA
Propellant	CO_2

RESULTS AND DISCUSSION

Scant rain fall was enough to incorporate preemergence treatments, and the substantial rainfall prior to and following postemergence herbicide applications should have enhanced their ability to provide preemergence and postemergence activities. This may have biased the test toward postemergence treatments.

Although injury was seen, it was not consistent across rates of herbicide used (Table 4). For example, several treatments containing 0.018 lbs/a Peak caused injury, whereas others did not. Also, some treatments containing double this amount did not injure sorghum. Furthermore, this injury did not translate consistently into a difference in yield. This is not inconsistent with other studies with many other herbicides for weed control in sorghum.

All treatments provided good early-season control of red root pigweed (Table 5). However, by 7 weeks after planting, a 2 lb/acre treatment of Duel had lost its control. This is consistent with other work not shown here. Although Duel or any other herbicide in this family of herbicides can provide pigweed control, it is not consistent or season-long. All other treatments provided season-long control of red root pigweed.

Treatments followed by B did not statistically increase yield over the untreated control (Table 6). Treatments followed by an A provided excellent yield enhancement.

Table 4. Injury to sorghum from herbicide treatments, Garden City, KS, 1995.

	Treatment	Rate lb AI/acre	Appl. Time	6-20 %Stand Reduct	6-20 %Height Reduct	7-4 %Injury	7-12 %Stand Reduct	7-12 %Height Reduct
1	Dual	2	Pre Em	14.88	6.94	0	15.20	1.87
2	Dual + Peak	2.00+0.018	Pre Em	18.04	2.78	13.8	36.78	12.05
3	Dual + Peak	2.00+0.027	Pre Em	16.52	1.39	22.5	33.47	14.32
4	Bicep	3.60	Pre Em	15.42	12.50	5.0	10.72	6.21
5	Bicep Lite	3.00	Pre Em	16.03	4.17	16.3	11.50	6.08
6	Bicep Lite + Peak	3.00+0.018	Pre Em	20.72	19.44	33.8	12.41	15.41
7	[Dual + Peak] + Sequestrene	[2.00+0.27]+ 1.50	[Pre Em]+ Post Em	20.74	13.89	27.5	36.87	24.24
8	[Dual] + Peak + Sun-it II	[2.00]+0.018+ 2.00	[Pre Em]+ Post Em	30.98	12.50	20.3	44.67	19.50
9	[Dual] + Peak + Sun-it II	[2.00]+0.027+ 2.00	[Pre Em]+ Post Em	8.85	9.72	11.3	13.77	17.73
10	[Dual] + Peak + Sun-it II	[2.00]+0.036+ 2.00	[Pre Em]+ Post Em	19.00	5.56	28.8	18.34	15.51
11	[Dual] + Peak + Sun-it II + Atrazine	[2.00]+0.018+ 2.00+0.75	[Pre Em]+ Post Em	26.77	11.11	36.3	26.35	21.38
12	[Dual] + Peak + Banvel + Activator 90	[2.00]+0.018+ 0.25+0.25% v/v	[Pre Em]+ Post Em	12.08	8.33	10.0	21.26	11.34
13	Marksman	0.80	Post Em	17.27	18.06	5.0	11.68	4.86
14	Hand Cultivate			22.82	20.83	0.0	4.09	11.55
15	Check			0.00	4.17	0.0	4.43	3.96
	LSD .05 =			18.33	14.25	2.7	21.20	14.11

Table 5. Percent of pigweed control in sorghum, Garden City, KS, 1995.						
	Treatment	Rate lb AI/acre	Appl. Time	7-12-95	7-26-95	8-9-95
					- % -	
1	Dual	2.00	Pre Em	94.64	37.50	62.50
2	Dual + Peak	2.00+0.018	Pre Em	98.21	100.00	87.50
3	Dual + Peak	2.00+0.027	Pre Em	97.50	83.33	91.67
4	Bicep	3.60	Pre Em	100.00	100.00	100.00
5	Bicep Lite	3.00	Pre Em	100.00	83.33	87.50
6	Bicep Lite + Peak	3.00+0.018	Pre Em	100.00	100.00	100.00
7	[Dual + Peak] + Sequestrene	[2.00+0.27]+1.50	[Pre Em]+Post Em	88.39	45.83	83.33
8	[Dual] + Peak + Sun-it II	[2.00]+0.018+2.00	[Pre Em]+Post Em	98.21	91.67	91.67
9	[Dual] + Peak + Sun-it II	[2.00]+0.027+2.00	[Pre Em]+Post Em	94.64	91.67	91.67
10	[Dual] + Peak + Sun-it II	[2.00]+0.036+2.00	[Pre Em]+Post Em	98.21	100.00	100.00
11	[Dual] + Peak + Sun-it II + Atrazine	[2.00]+0.018+2.00+0.75	[Pre Em]+Post Em	100.00	100.00	95.83
12	[Dual] + Peak + Banvel + Activator 90	[2.00]+0.018+0.25+0.25% v/v	[Pre Em]+Post Em	95.09	100.00	95.83
13	Marksman	0.80	Post Em	95.09	100.00	91.67
14	Hand Cultivate			26.79	58.33	95.83
15	Check			13.46	4.17	8.33
	LSD .05=			27.48	36.22	15.70

Table 6. Effects of Peak treatments on sorghum yields, Garden City, KS, 1995.

	Treatment	Rate lb AI/acre	Appl. Time	Yield bu/acre
1	Dual	2.00	Pre Em	37.5B
2	Dual + Peak	2.00+0.018	Pre Em	47.9AB
3	Dual + Peak	2.00+0.027	Pre Em	40.6B
4	Bicep	3.60	Pre Em	57.8A
5	Bicep Lite	3.00	Pre Em	46.7B
6	Bicep Lite + Peak	3.00+0.018	Pre Em	52.5A
7	[Dual + Peak] + Sequestrene	[2.00+0.27]+1.50	[Pre Em]+Post Em	47.8AB
8	[Dual] + Peak + Sun-it II	[2.00]+0.018+2.00	[Pre Em]+Post Em	46.7B
9	[Dual] + Peak + Sun-it II	[2.00]+0.027+2.00	[Pre Em]+Post Em	56.0A
10	[Dual] + Peak + Sun-it II	[2.00]+0.036+2.00	[Pre Em]+Post Em	59.2A
11	[Dual] + Peak + Sun-it II + Atrazine	[2.00]+0.018+2.00+0.75	[Pre Em]+Post Em	55.0A
12	[Dual] + Peak + Banvel + Activator 90	[2.00]+0.018+0.25+0.25% v/v	[Pre Em]+Post Em	48.0AB
13	Marksman	0.80	Post Em	51.9AB
14	Hand Cultivate			51.8AB
15	Check			39.7 B
	LSD .05=			12.3

CROP ACREAGE TRENDS IN SOUTHWEST KANSAS

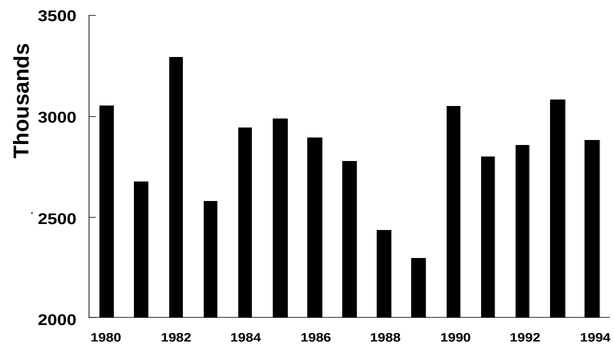
by

James D. Sartwelle, III, and Curtis R. Thompson

Irrigated and nonirrigated cropland acreage in southwest Kansas has changed dramatically in the past 15 years. Although percentages among crops have shifted with time, producers have planted the vast majority of cropland to wheat, corn, grain sorghum, alfalfa, other hay, and soybeans. Other crops such as sunflowers, oats, barley, rye, and dry edible beans represent most of the remaining cropland acreage in the 22-county Southwest Extension Area.

Increased planting flexibility likely will be incorporated into 1995/1996 farm legislation. Many producers will be interested in production trends for other major crops, as they decide whether to incorporate new crops to their operations.

Wheat, harvested acres, SW Kansas Extension Area, 1980-1994.



Source: Kansas Ag Statistics

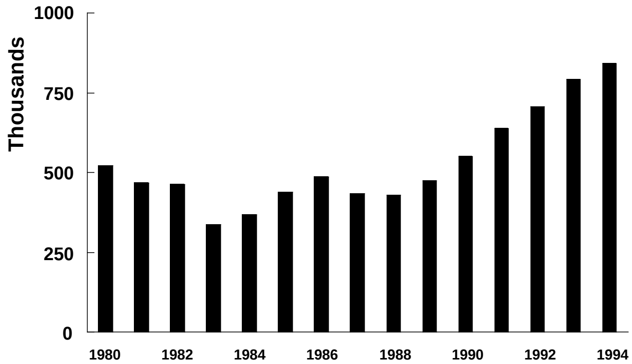
WHEAT

Wheat dominates southwest Kansas crop production both in acreage and value of production. Farmers harvested more than 2.88 million acres of wheat in 1994. From 1980 through 1994, harvested wheat acres peaked in 1982 (3.29 million) and bottomed out at 2.30 million acres in 1989. Wheat acreage has been on a level trend since 1990. 1994 wheat acreage fell into the following three categories: summer fallow, 66%; irrigated, 20%; and continuously cropped, 14%. The top five wheat counties (with respect to harvested acres) were Ford, Finney, Greeley, Gray, and Scott. Those five counties represented one-third of the total wheat acreage in southwest Kansas.

CORN

Corn acreage has increased steadily in southwest Kansas since 1983. From a low that year of 336,400 acres harvested, acreage increased with time to 840,400 acres harvested in 1994. Acres devoted to corn have increased every year since 1988 and have increased 97.5% during that period. Haskell, Gray, Finney, Meade, and Edwards counties accounted for 47% of the area acreage in 1994. Nearly all corn production in southwest Kansas occurs on irrigated ground--more than 97% in 1994. Nonirrigated corn acreage has increased in the area: from 1,600 acres in 1980 to 19,100 acres in 1994. As government program changes unfold and farmers know more about corn's role in wheat-summer crop-fallow rotations, nonirrigated corn could account for a more significant portion of the area's total corn production.

Corn, harvested acres, SW Kansas Extension Area, 1980-1994.

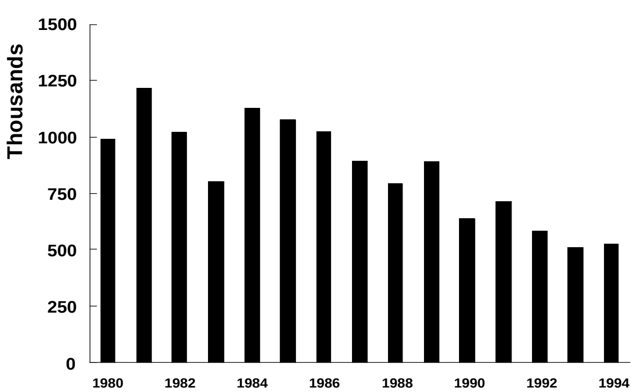


Source: Kansas Ag Statistics

GRAIN SORGHUM

Because of the arid nature of the area, grain sorghum has been an important crop to southwest Kansas for decades. Since 1984, however, harvested acres of grain sorghum have decreased more than 53%. Between 1980 and 1994, sorghum acreage ranged from 1.21 million acres in 1981 to 508,200 acres harvested in 1993. Nonirrigated sorghum gained production share from 1980 to 1994 at the expense of irrigated acreage. Observers might detect a shift from irrigated sorghum to irrigated corn during that period. Over two-thirds of the area grain sorghum acreage was nonirrigated in 1994, up from one-half in 1980. The use of grain sorghum in wheat-summer crop-fallow rotations has contributed to that increase. Stevens, Morton, Gray, Ford, and Seward counties accounted for more than 46% of the 22-county grain sorghum acreage total in 1994.

Grain sorghum, harvested acres, SW Kansas Extension Area, 1980-1994.

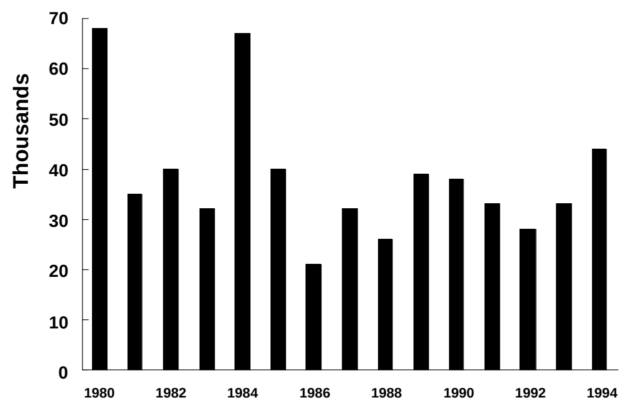


Source: Kansas Ag Statistics

SILAGE

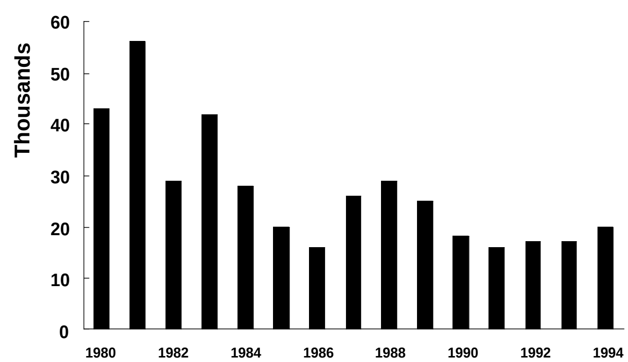
Confinement livestock operations use most of the silage produced in the area. Harvested acres of corn and sorghum silage have been stable since 1985. Scott, Stanton, Kearny, Grant, and Finney counties comprised the top five counties in corn silage acreage and accounted for more than 60% of the area total silage acres. Over one-half of harvested sorghum silage acres in southwest Kansas during 1994 were in Hodgeman, Comanche, Finney, Grant, and Scott counties.

Sorghum silage, harvested acres, SW Kansas Extension Area, 1980-1994.



Source: Kansas Ag Statistics

Corn silage, harvested acres, SW Kansas Extension Area, 1980-1994.

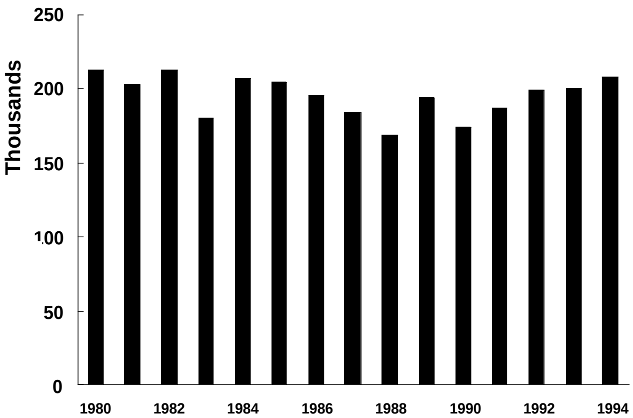


Source: Kansas Ag Statistics

ALFALFA

Alfalfa is another major cash crop in southwest Kansas. Again, sizable cattle feeding and dairy operations in the area provide a ready market for alfalfa hay. Additionally, producers and hay brokers routinely ship alfalfa hay and pellets produced in the area out of Kansas. Between 1980 and 1994, harvested alfalfa acreage ranged from a high of 213,300 acres in 1982 to a low of 169,200 acres in 1988. As is the case with many other crops, alfalfa acreage has varied greatly with time in response to price trends. Coinciding with a sustained period of high hay prices, alfalfa acres have increased steadily since 1990, growing more than 19% in a 5-year span. More than 63% of 1994 alfalfa acreage was found in Finney, Gray, Pawnee, Edwards, and Ford counties.

Alfalfa hay, harvested acres, SW Kansas Extension Area, 1980-1994.

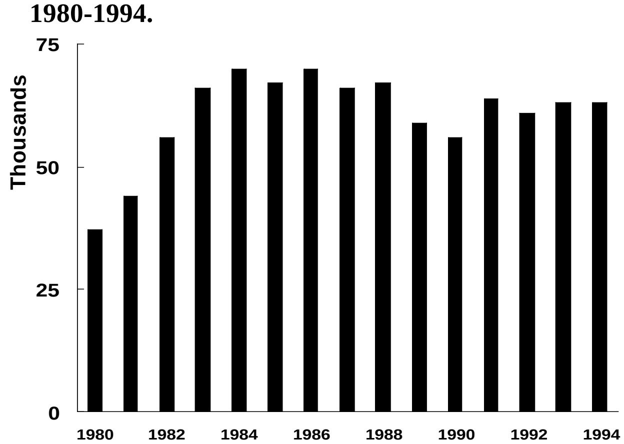


Source: Kansas Ag Statistics

OTHER HAY

Other hay production occupies a sizable portion of southwest Kansas cropland. Acreage devoted to hay other than alfalfa has been remarkably consistent, ranging from 60,600 to 70,400 acres in 10 of 12 years since 1983. Other hay production tends to be located in parts of the area that are home to larger numbers of beef cows. Southwest Kansas' top five other-hay producing counties during 1994 (representing more than 45% of 22-county total production) were Comanche, Kiowa, Meade, Ford, and Clark counties.

Other hay, harvested acres, SW Kansas Extension Area, 1980-1994.

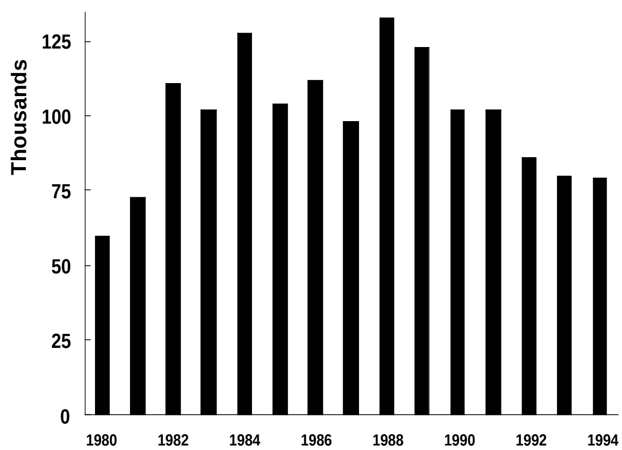


Source: Kansas Ag Statistics

SOYBEANS

Soybeans have been grown in southwest Kansas for decades, although the crop has not found its way into widespread production across the 22-county area. From 1980 through 1994, harvested soybean acreage peaked at 132,700 acres in 1988. Since 1988, soybean acreage has declined more than 40%, settling at 79,300 acres in 1994. More than 47% of soybean acreage was found in Edwards, Pawnee, and Kiowa counties in the eastern part of the area. Finney and Gray counties finished out the top five, and together accounted for 71% of the area total.

Soybeans, harvested acres, SW Kansas Extension Area, 1980-1994.



Source: Kansas Ag Statistics

SUNFLOWERS (OIL AND CONFECTIONARY), OATS, BARLEY, TRITICALE, RYE, AND DRY EDIBLE BEANS

Sunflowers (oil and confectionary), oats, barley, triticale, rye, and dry edible beans finish out the list of reported crops in southwest Kansas. Combined, these crops accounted for approximately 40,000 acres (32,000 acres of sunflower) of cropland in the area during 1994. The future for sunflower production may be the brightest among these other crops. As markets continue to develop and scientists and processors identify more uses for its by-products, this crop could fit into many farmers' crop mixes. Potential acreage expansions for the other crops are less certain, although the use of oats, rye, and triticale for grazing cattle will most likely continue.

RECOVERY OF FROZEN WHEAT

By
Merle Witt

A severe freeze on April 10-11, 1995, with temperatures down to 19° F for 6 hours caused a great deal of stem damage to jointed wheat, with a short section at the base of stalks just above ground level being killed. Questions came in about whether removal of the upper foliage would somehow help the plant to recover. Although we advised against mowing, questions persisted. Therefore, on April 14, 1995, we mowed 38 varieties of wheat down to a 2-inch height to compare with normal unmowed areas, using three replications for each.

Mowing caused a maturity delay of approximately 10 days, which was harmful to wheat productivity. Results in Table 1 show that mowing at this stage caused an average reduction in final plant height of 24%. Grain test weights averaged 3% less, and ultimately, grain yields were found to be reduced by an average of 66%.

Mowing off wheat that has some freeze damage to supposedly help it recover is perhaps analogous to cutting off a broken arm to help in its recovery. Don’t do it!!!

Table 1. Recovery of freeze-damaged wheat - with and without mowing, Garden City, KS, 1995.

Variety	Mature Height (inches)		Test Wt (lb/bu)		Yield (bu/acre)	
	Mowed	Not Mowed	Mowed	Not Mowed	Mowed	Not Mowed
Agripro Coronado	22	27	54.4	55.1	7.7	20.5
Agripro Laredo	20	26	50.2	52.8	5.6	25.3
Agripro Longhorn	22	27	50.2	51.2	5.1	21.9
Agripro Ogallala	22	28	53.8	56.2	9.6	32.3
Agseco 7805	22	30	51.5	54.7	5.7	23.2
Agseco 7853	20	30	53.3	56.2	6.1	23.7
Agseco 9001	24	30	53.3	53.7	10.4	28.3
Colby 94	27	33	52.7	54.1	9.0	27.6
AWWPA Rio Blanco	21	27	54.6	55.2	10.5	25.8
AWWPA W88-2619W	24	30	55.0	55.1	14.9	31.6
Voyager	22	29	52.9	54.0	4.6	17.5
2163	20	27	49.8	51.8	5.5	29.5
Akron	22	31	51.8	54.3	8.7	28.6
Arapahoe	25	32	53.0	54.8	13.7	28.6
Blend SW1	24	32	54.1	55.0	5.8	26.3
Blend SW2	20	29	47.7	53.7	4.1	19.7
Blend SW3	23	28	54.7	56.4	13.7	27.8
Blend SW4	21	28	52.5	53.4	6.7	25.5
Cimarron	23	30	53.8	54.5	12.0	32.7
Custer	20	27	52.2	55.2	6.3	18.5
Halt	17	27	52.9	53.0	3.2	18.8
Ike	23	30	54.4	55.6	9.8	30.5
Jagger	21	28	53.6	53.6	12.0	21.7
Jules	25	31	50.3	54.7	9.0	31.0
Karl	21	28	55.2	56.5	6.1	22.6
Karl 92	20	26	55.2	55.9	7.7	20.6
KS91H153-2	20	28	53.5	56.2	7.0	23.2
KS92P0263-137	22	30	54.8	55.2	11.0	29.7
Larned	22	31	50.4	55.0	3.5	18.2
Niobrara	27	33	49.9	54.3	19.6	32.4
Newton	19	29	50.2	52.8	2.3	20.0
Scout 66	21	32	49.6	54.0	4.1	17.4
TAM 107	21	26	50.6	54.4	5.0	19.5
TAM 200	23	27	55.9	56.0	11.9	28.7
Tonkawa	22	28	55.1	55.6	6.8	21.5
Vista	22	30	54.7	55.0	16.6	33.8
Yuma	22	30	50.3	52.8	8.0	29.5
Arlin	22	28	54.3	54.5	6.9	18.1
Average	22	29	52.8	54.5	8.4	24.7

SHORT-SEASON CORN POPULATIONS

by
Merle Witt

Early-season corn plots were established to evaluate grain yields with various planting rates. Population levels of 28,000, 32,000, 36,000, and 40,000 plants/acre were established under full irrigation with Pioneer 3751, a hybrid with 98-day relative maturity. Counter insecticide was applied at 15 lbs/acre at planting for rootworm control and Prowl/Bladex herbicide applied at 1/1 lb/acre for weed control. Planting dates during the 3 years were 4/23/93, 5/6/94, and 5/5/95.

The two center rows of four-row plots were harvested in October, and resulting grain yields shown in Table 1. Data for the 3-year period indicated that the highest grain yields for this 98-day hybrid were produced at the 40,000 plants/acre population.

Table 1. Short-season corn responses to high population under full irrigation at Garden City, KS.

	Grain Yields (bu/acre)			
Plants/Acre	1993	1994	1995	3 year avg.
28,000	140	198	141	160
32,000	154	209	152	172
36,000	163	220	153	179
40,000	172	231	157	187
Mean	157	215	151	175
LSD (.05)	14	12	8	

CROP VARIETY TESTS – HIGH YIELDERS 1996

by
Merle Witt and Alan Schlegel

Brief lists of the highest-yielding crop varieties at Garden City and Tribune from recent variety tests are presented for quick reference. More complete information on these and other crops is published in Kansas Crop Performance Test reports. Some top yielders are shown here for: alfalfa, standard corn hybrids, short-season corn hybrids, grain sorghum on dryland, grain sorghum under irrigation, soybeans, oats, wheat on dryland, and wheat under irrigation.

STANDARD CORN HYBRIDS

GARDEN CITY

High 10 (2-yr av. 1993-1995)		Bu/A	Days to Silk
Wilson	1910	212	74
CIBA	4662	211	75
DeKalb	DL715	211	74
Mycogen	8240	208	76
Pioneer	3162	208	73
Ohlde	510	207	76
Triumph	2010	205	76
Wilson	2330	205	77
Deltapine	G-4673B	204	74
Cargill	8327	203	76

TRIBUNE

High 5 (2-yr av.)		Bu/A	Days to Silk
Pioneer	3162	190	83
Pioneer	3225	183	84
Cargill	7777	182	84
DeKalb	DK652	182	85
Deltapine	G-4673B	179	85

High 5 (3-yr av.)		Bu/A
Pioneer	3162	194
Deltapine	G-4673B	187
Deltapine	4581	180
Cargill	7997	179
Cargill	7697	179

SHORT-SEASON CORN HYBRIDS

GARDEN CITY

High 5 (2 yr av. 1994-1995)		Bu/Acre	Days to Silk
DeKalb	DK580	192	71
Deltapine	4450	185	72
NC+	4616	177	72
Cargill	4327	157	70
Bo-Jac	135	151	69

GRAIN SORGHUM—DRYLAND

GARDEN CITY

High 10 (3yr av.1993-1995)		Bu/Acre	Days to Bloom
Casterline	SR319E	86	69
Northrup King	KS714Y	75	74
ICI	5616	72	68
DeKalb	DK-41Y	69	71
Pioneer	8771	65	62
Triumph	TR459	65	67
Cargill	607E	64	67
Pioneer	8699	62	62
Asgrow	Seneca	61	67
Mycogen	T-E Elite	61	64

TRIBUNE

High 5 (3yr av.1993-1995)		Bu/Acre
Pioneer	8699	80
Deltapine	1482	76
Mycogen	T-E Hardy	76
Pioneer	8771	75
DeKalb	DK-38Y	75
DeKalb	DK-40Y	75

High 5 (2 yr av.1994-1995)		Bu/Acre	Days to Bloom
Mycogen	T-E Hardy	68	73
Pioneer	8699	65	69
DeKalb	DK-38Y	65	71
Cargill	737	65	80
Ohlde	222C	63	73

GRAIN SORGHUM—IRRIGATED

GARDEN CITY

High 10 (3yr av. 1993-1995)		Bu/A	Days to Bloom
Casterline	SR324E	140	70
Deltapine	1506	135	66
Wilson	535Y	132	67
DeKalb	DK-48	130	68
DeKalb	DK-66	128	74
Pioneer	8310	128	69
Pioneer	8118	126	74
DeKalb	DK-54	124	71
DeKalb	DK-56	124	71
DeKalb	DK-58	123	72
Mycogen	444E	123	68

TRIBUNE

Irrigated tests not harvested in 1995.

FORAGE SORGHUM

High 5 (2 yr av. 1994-1995)		Tons/A	Days to Bloom
Century II	Hygrachop	34	87
Northrup King	KF429	32	89
Century II	Sweetall	30	89
DeKalb	FS-25E	30	91
Casterline	Supersile	29	89

OATS–IRRIGATED

GARDEN CITY

High 5 (2yr av. 1994-1995)	Bu/A
Don	86
Bates	81
Dane	81
Premier	79
Larry	77

ALFALFA

GARDEN CITY

High 10 (2 yr.av. 1994-1995)		Av. Annual tons/A
MBS	PG14372 Exp.	9.37
Drussel	Reward	9.27
Mycogen	TMF Generation	9.21
ABI	ABI 9045 Exp	9.19
MBS	PG19047 Exp	9.18
NC+	Jade	9.16
Pioneer	90W3PRI Exp	9.15
Casterline	ProGro 424	9.14
America's Alfalfa	Aggressor	9.06
Great Plains	Key	9.04

WHEAT—DRYLAND

GARDEN CITY

High 10 (3-yr av. 1993-1995)	Bu/A
Ike	54
Agripro Ogalla	53
Vista	53
Arlin (white)	51
Agripro Tomahawk	51
AGSECO 7853	51
Arapahoe	51
Yuma	51
TAM 107	50
Karl 92	49

TRIBUNE

High 10 (2-yr av.)		Bu/A
Jules		50
	137	48
Vista		48
	2163	47
Quantum	XH1520 Exp.	47
	Ogallala	45
Cimarron		45
TAM	200	45
Yuma		45
Arapohoe		44

High 10 (3-yr av. 1993-95)		Bu/A
Vista		53
Jules		53
TAM	200	51
	2163	50
Arapahoe		49
Agripro	Ogallala	49
Cimarron		49
Karl	92	47
Yuma		47
AGSE10	7805	47

WHEAT—IRRIGATED

GARDEN CITY

High 10 (2-yr av. 1993-1994)		Bu/A
Ike		76
AGSECO	7853	74
Karl	92	73
Agripro	Laredo	70
Arlin	(white)	69
Karl		69
Agripro	Tomahawk	69
Agripro	Longhorn	68
Agripro	Ogallala	68
	2163	68

TRIBUNE

High 10 (2-yr av.)		Bu/A
	137	63
Cimarron		55
AgriPro	Pecos	54
Ike		52
Jagger		52
Karl	92	51
Karl		51
TAM	200	51
AgriPro	Ogallala	50

High 10 (3-yr av.)		Bu/A
AgriPro	Pecos	63
Cimarron		61
Karl	92	61
Karl		60
	2163	60
TAM	200	59
AgriPro	Ogallala	57
Arlin	(white)	56
AGSECO	Mankato	55
Yuma		55

SOYBEANS

GARDEN CITY

High 5 (3yr av. 1993-1995)		Maturity Group	Bu/A
Ohlde	3431A	III	55.6
Golden Harvest	H-1388	III	52.2
K1235		IV	50.9
Sparks		IV	50.8
Pioneer	9393	III	50.1

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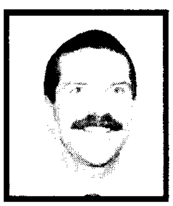

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