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Southwest Research-Extension Center

FIELD DAY

1995

Report of Progress
739

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.

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.

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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1995 RESEARCH-EXTENSION CENTER STAFF

Patrick Coyne	Head
Paul Hartman	Area Extension Director
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
Kelly Kreikemeier	Animal Scientist
Ray Mann	Professor Emeritus
Charles Norwood	Agronomist-Dryland Soil Management
Alan Schlegel	Agronomist-in-Charge, Tribune
Phil Sloderbeck	Extension Specialist, Entomology
Curtis Thompson	Extension Specialist, Crops and Soils
Lisa Wildman	Research Associate, Corn Entomology
Merle Witt	Agronomist-Crop Production
Carol Young	Extension Home Economist

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Dennis Tomsicek, Agricultural Technician
Marilyn Vass, Agricultural Technician
Carl Warner, Gen. Maintenance & Repair Tech. I
Julie White, Agricultural Technician

Southwest Research-Extension Center
4500 East Mary, Bldg. 924
Garden City, KS 67846
316-276-8286
Fax No. 316-276-6028

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WEATHER INFORMATION FOR GARDEN CITY

by
Dennis Tomsicek

Precipitation for 1994 totaled 18.94 inches, or 1.03 inches above average. The wettest month was July with 3.92 inches, and the driest was March with 0.16 inches. Snowfall for the year was 13.72 inches, which was below the average of 17.71 inches. The greatest snowfall amounts of 3.50 inches were received on April 5 and 12.

Air temperature was above normal for 9 months of the year. The warmest month was August, with a mean temperature of 78.2° and an average high of 92.0°. The coldest month was February, with a mean temperature of 28.7° and an average low of 14.2°. Temperature deviation from the average was greatest in March, when the mean temperature was 5.8° below average.

There were 5 days during the year when temperatures were above 100°, with the highest being 105° on July 2. Temperatures were below zero on 3 days during the year, with the lowest being -4° on January 31. No record high or low temperatures were recorded in 1994.

The last spring freeze (32°) was on May 1, 4 days later than average. The first fall freeze (32°) was on October 9, which was 2 days earlier than average. The frost-free period was 161 days, which was 6 days shorter than the average.

Open pan evaporation from April through October totaled 72.04 inches, which was 1.72 inches below the average of 73.76 inches. Average wind speed for the year was 5.3 m.p.h. compared to the average of 5.5 m.p.h..

A complete 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) Average		Mean		Extreme		Wind MPH		Evaporation inches	
Month	1994	Avg.	Max.	Min.	1994	Avg.	Max.	Min.	1994	Avg.	1994	Avg.
January	0.36	0.33	45.1	13.5	29.3	27.9	67	-4	4.8	4.8		
February	0.23	0.45	43.3	14.2	28.7	32.8	75	-3	6.0	5.5		
March	0.16	1.15	62.2	31.9	47.1	41.3	80	15	4.7	7.0		
April	2.47	1.56	66.3	37.5	51.9	52.7	92	14	6.8	7.0	7.34	8.75
May	2.41	3.11	76.9	52.2	64.4	62.2	92	32	5.0	6.4	9.24	10.67
June	3.32	2.87	90.7	63.0	76.8	72.4	103	57	5.3	6.0	12.97	12.89
July	3.92	2.60	90.8	61.7	76.3	77.9	105	49	4.9	5.2	13.13	14.19
August	2.47	2.16	92.0	64.5	78.2	75.4	104	54	5.2	4.5	13.24	11.66
September	1.24	1.59	82.2	52.8	67.5	66.6	96	34	5.5	4.9	9.45	8.84
October	1.09	0.98	71.3	42.2	56.7	55.0	95	29	5.6	4.8	6.67	6.76
November	0.71	0.76	56.1	28.7	42.4	41.1	75	14	5.6	4.8		
December	0.56	0.35	49.6	22.2	35.9	30.7	67	13	4.1	4.5		
Annual	**18.94**	**17.91**	**68.9**	**40.4**	**54.6**	**53.0**			**5.3**	**5.5**	**72.04**	**73.76**

Average latest freeze in spring	April 27	1994:	May 1
Average earliest freeze in fall	Oct. 11	1994	Oct. 9
Frost-free period	167 days	1994:	161 days

All averages are for the period 1961-90.

WEATHER INFORMATION FOR TRIBUNE

by

David Frickel and Dale Nolan

Precipitation for 1994 totaled 18.76 in. or 2.80 in. above normal. Precipitation was above normal in 6 months. The wettest months were April, June, and July with 3.71 in., 4.12 in., and 3.79 in. respectively. The largest single amount of precipitation was 1.42 in. on April 10 and the greatest single amount of snowfall of 7.0 in. was reported on April 12. The greatest monthly amount of snowfall, 16 in., was also received in April. Snowfall for the year totaled 27.5 in. with a total of 34 days of snow cover. The longest consecutive period of snow cover was for 8 days beginning January 26 and ending February 3.

The air temperature was above normal for eight months of the year with August being the warmest month with a mean temperature of 74.5° and an average high temperature of 91.4°. The coldest month was February with a mean temperature of 27.1°, an average high of 43.6° and an average low of 10.5°. Only two record low temperatures were set, 21° on April 27 and 33°on September 22. No record high temperatures were set in 1994.

Deviation from the normal was greatest in February when the mean temperature was 4.4° below normal. There were 6 days above 100°, one in June, two in July, and three in August. The 30-year average is 10 days of above 100°. There were 65 days of 90° temperature and above compared to the 30-year average of 63 days. The lowest temperature for the year was -6° on February 9 and the highest was 103° on July 2 and August 28. The last day of 32° or less in the spring was on May 1 which is two days earlier than the normal date and the first day of 32 °or less in the fall was October 9 which is six days later than the normal date. The frost-free period was 161 days which is eight days more than the normal of 153 days.

Open pan evaporation from April through September totaled 77.62 in. which was 5.95 in. above the normal of 71.67 in. Wind speed for the same period averaged 5.4 mph compared to the normal.

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

	Precipitation inches		Temperature (°F) 1994 Average		Normal		1994 Extreme		Wind MPH		Evaporation inches	
Month	1994	Normal	Max.	Min.	1992	Avg.	Max.	Min.	1994	Avg.	1994	Avg.
January	0.52	0.36	45.1	13.3	43.3	14.2	66	-3				
February	0.17	0.40	43.6	10.5	48.7	18.7	72	-6				
March	0.27	0.99	61.1	25.7	56.6	25.4	82	9				
April	3.71	1.13	63.9	32.7	67.5	35.1	89	11	5.8	6.6	6.51	8.82
May	1.37	2.69	76.2	47.0	76.0	45.3	94	30	5.9	6.0	14.51	10.95
June	4.12	2.71	89.9	57.6	86.9	55.3	101	50	5.1	5.7	17.84	13.71
July	3.79	2.60	89.5	56.2	92.7	61.3	103	45	4.6	5.5	15.10	15.64
August	0.80	1.98	91.4	57.7	89.9	59.2	103	48	5.4	5.2	13.30	13.01
September	0.29	1.54	84.0	47.6	81.3	49.9	96	33	5.5	5.4	10.36	9.55
October	2.69	0.74	69.3	35.4	70.4	37.3	92	25				
November	0.72	0.49	51.8	24.1	54.7	25.3	76	9				
December	0.31	0.33	48.0	19.8	44.9	16.6	68	11				
Annual	**18.76**	**15.96**	**67.8**	**35.6**	**67.7**	**37.0**			**5.4**	**5.7**	**77.62**	**71.67**

Average latest freeze in spring[1]	May 3	1994:	May 1
Average earliest freeze in fall	October 3	1994:	October 9
Average frost-free period	153 days	1994:	161 days

[1]Starting in 1993, latest and earliest freeze is 32° F. Average precipitation and temperature are 30-year averages (1961-1990) calculated from National Weather Service. Average latest freeze, wind, and evaporation are for the same period calculated from station data.

ALTERNATIVE CROPS FOR THE ROTATION OF TWO CROPS IN 3 YEARS

by
Charles Norwood

SUMMARY

Dryland corn in the rotation of two crop in 3 years yielded less than grain sorghum in 1991, a dry year. In 1992, 1993, and 1994, corn usually yielded more than grain sorghum. Dryland soybean and sunflower yielded well in 1992 and 1993, but rainfall was above average. Sunflower yields also were satisfactory in 1994, but soybean yields were marginal. No tillage has the potential to increase yields of all crops and is required for adequate corn yields in a dry year and for soybean and sunflower because of conservation compliance. However, soybean and sunflower may not produce sufficient crop residues for conservation compliance even with no tillage. Dryland corn looks promising, but research is needed under more severe climatic conditions.

INTRODUCTION

The wheat-sorghum-fallow system of two crops in 3 years is superior to the wheat-fallow system of one crop in 2 years in terms of yield and profit, particularly when combined with reduced or no tillage. There is interest in incorporating other crops into the rotation. A long-term study was begun in 1991 to evaluate dryland corn, sunflower, and soybean in this rotation. Grain sorghum is included as a control. This report is a summary of the first 4 years of the study.

PROCEDURES

The wheat-corn-fallow, wheat-sorghum-fallow, wheat-sunflower-fallow, and wheat-soybean-fallow cropping systems were compared from 1991 through 1994 (soybean and sunflower were destroyed by predators in 1991). All systems included conventional- (CT), reduced- (RT), and no-tillage (NT) treatments. A postharvest treatment of 2.0 lbs/a atrazine was applied to the stubble remaining from the previous wheat crop for the RT and NT treatments in corn and sorghum and was followed by tillage as necessary for weed control in the RT treatment. An early preplant application of 1.6 lbs/a Bladex + 0.5 lbs/a atrazine followed the atrazine in the NT treatment in corn and sorghum. Alachlor or propachlor can be substituted for the Bladex, as can other suitable herbicides. The RT and NT soybean and sunflower treatments thus far have utilized only postemergence herbicides such as Landmaster and Roundup for weed control during fallow.

Hybrids and varieties planted were Warner BR 744 grain sorghum, Garst 8714 corn (105 day maturity), Cargill SF100 sunflower, and Olde 3431 soybean. The crops were planted at rates to result in 25000, 18000, and 17000 plants/a for sorghum, corn, and sunflower, respectively. Sixty lbs/a of soybean were planted. The soil type was a Ulysses silt loam with a pH of 7.8 and an organic matter content of 1.5%.

RESULTS AND DISCUSSION

Yields are presented in Table 1. Dry conditions reduced yields, particulary of corn, in 1991. The other years had above average precipitation, thus yields were higher than can usually be expected. Grain sorghum yielded substantially more than corn in 1991, but the yield difference narrowed as tillage was reduced. Corn yields were 24%, 54%, and 59% of the respective CT, RT, and NT sorghum yields. Thus, no-till is mandatory for adequate corn yields in a dry year such as 1991. The year 1992 was one of the wettest on record, and corn yields were much greater than sorghum yields; corn yields of this magnitude will rarely, if ever, occur again. Corn yielded more than sorghum in 1994; in 1993 yields were roughly equivalent.

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

Crop	1991	1992	1993	1994	Avg
			— bu / a —		
Corn					
CT[1]	10.3a[2]	139.1a	94.5	83.5b	81.9
RT	27.4ab	111.6b	94.1a	100.6a	83.4
NT	36.8b	147.6a	104.8a	101.2a	97.6
Grain Sorghum					
CT	43.8b	9.0a	95.5a	67.7b	76.5
RT	50.4b	87.3a	88.3b	78.8a	76.2
NT	61.9a	101.1a	91.1ab	86.8a	85.2
Soybean					
CT	—[3]	36.1a	27.3a	14.2b	25.9
RT	—	29.2b	29.6a	17.5b	25.4
NT	—	38.2a	26.8a	21.3a	28.8
Sunflower			— lbs / a —		
CT	—	1575b	3155b	1811c	2180
RT	—	1696ab	3102b	1921b	2240
NT	—	1872a	3300a	2502a	2558

[1]CT = Conventional tillage, RT = Reduced tillage, NT = No tillage.
[2]Yields for the same crop within a column followed by the same letter do not differ at the 0.10 level of probability.
[3]No yield because of predator damage.

Soybean and sunflower were destroyed by rabbits and birds in 1991. Soybean yielded well in 1992 and 1993, because of above normal rainfall, whereas yields were lower in 1994. A yield of at least 20 bu/a is probably necessary for soybean to have any chance as a dryland crop. Soybean produces little crop residue, and conservation compliance requirements will make soybean a difficult crop to incorporate into dryland systems. Sunflower also produces low amounts of residue but probably will produce more consistent yields than will soybean. The yield of sunflower was rather low in 1992, considering the above average rainfall, but yields were excellent in 1993 and 1994. Soybean responded to a reduction in tillage only in 1994, but NT sunflower yielded more than CT sunflower in all years.

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YIELD OF DRYLAND CORN AS AFFECTED BY TILLAGE, PLANTING DATE, AND PLANT POPULATION

by
Charles Norwood

SUMMARY

Early planting resulted in maximum dryland corn yields in 3 of 4 years. In the driest year, there was no difference in yields from the first and last planting dates. Yield was decreased by high plant populations in the driest year and increased by increased populations in the other years. No tillage resulted in increased yield and was mandatory for adequate yield in the driest year.

INTRODUCTION

Dryland corn is not grown commonly in southwest Kansas, because it lacks drought tolerance. However, with adequate rainfall, corn will produce more grain than will sorghum. Also, the market price of corn is usually higher than that of sorghum. Farmers who grow irrigated corn and are forced to reduce their irrigated acres may want to consider dryland corn. Little is known about date and rate of planting for dryland corn. Therefore, a tillage x date x rate of planting study was begun in 1991. Data are presented for the 1991-1994 period.

PROCEDURES

Dryland corn (Garst 8714, maturity 105 days) was planted on three dates, approximately May 1, May 15, and June 1, and thinned to populations of 12000, 18000, and 24000 (11000, 13000, and 18000 in 1991) plants/a in a wheat-corn-fallow system. Conventional- and no-till treatments were included. The study is superimposed on the study discussed in the preceding article.

RESULTS AND DISCUSSION

PLANTING DATE

Similar yields were produced from the first and last planting dates in 1991 (Table 1). The first two dates produced the highest yields in the other years. Yields were lowest from the second planting date in 1991 because of stress at pollination. Yields from the third date were improved, because rain in August occurred at a critical growth stage, whereas corn from the first two dates was stressed, and the rain came too late to improve yields. Yields from the third planting date in 1992 were substantially lower, because wet soil caused a delay in planting until June 11. Thus, earlier planting results in maximum yields in years of “normal” climatic conditions. In dry years, yield depends on whether stress occurs during critical growth stages, not on the specific planting date. Thus, corn planted earlier will not always produce more grain than corn planted later. However, in most years, maximum yields will result from corn planted between May 1 and May 15.

PLANT POPULATION

Yield declined with increased plant population in the dry year of 1991, whereas yield increased with population in most comparisons in the other years. Because it is not possible to predict climatic conditions for the growing season, and because a high population can result in low yields in a dry year, plant populations for dryland corn should not exceed 12000 plants/a. This population produced yields approaching 50 bu/a in the driest year and from about 80 to over 100 bu/a in the other years.

Table 1. Effect of tillage, planting date, and plant population on dryland corn yield, Garden City, KS 1991-1994.

Plant Population	D_1[1] CT	D_1 NT	D_1 Mean	D_2 CT	D_2 NT	D_2 Mean	D_3 CT	D_3 NT	D_3 Mean	Mean CT	Mean NT	Mean Mean
						— bu / a —						
1991												
11000	25.2	47.0	36.1	17.6	36.6	27.1	28.4	45.9	37.1	23.7	43.2	33.4
13000	17.6	44.2	30.9	10.3	36.8	23.6	28.3	39.6	34.0	18.7	40.2	29.5
18000	19.5	35.0	27.2	10.1	33.9	22.0	19.0	39.6	29.3	16.2	36.2	26.2
Mean	20.8	42.1	31.4	12.7	35.8	24.2	25.2	41.7	33.5	19.5	39.9	29.7
1992												
12000	126.1	112.3	119.2	129.0	117.6	123.3	92.6	103.1	97.8	115.9	111.0	113.5
18000	145.6	150.1	147.8	139.1	147.6	143.3	128.2	118.5	123.4	137.6	138.7	138.2
24000	165.8	173.8	169.8	156.5	175.9	166.2	122.8	136.8	129.8	148.4	162.2	155.3
Mean	145.8	145.4	145.6	141.5	147.0	144.3	114.5	119.5	117.0	134.0	137.3	135.6
1993												
12000	81.8	77.4	79.6	79.4	94.0	86.7	71.0	69.0	70.0	77.4	80.2	78.8
18000	86.0	99.8	92.9	94.5	104.8	99.6	93.7	97.8	95.8	91.4	100.8	96.1
24000	101.3	113.0	107.2	101.9	109.0	105.5	80.6	101.7	91.2	94.6	107.9	101.3
Mean	89.7	96.7	93.2	91.9	102.6	97.3	81.8	89.5	85.6	87.8	96.3	92.1
1994												
12000	69.1	104.8	86.9	78.4	95.3	86.8	63.9	83.0	73.5	70.5	94.3	82.4
18000	75.4	120.1	97.8	83.5	101.2	92.3	71.5	96.2	83.8	76.8	105.8	91.3
24000	62.8	110.2	86.5	76.5	119.4	97.9	73.4	90.6	82.0	70.9	106.7	88.8
Mean	69.1	111.7	90.4	79.5	105.3	92.4	69.6	89.9	79.8	72.7	102.3	87.5

	Year 1991	1992	1993	1994
	— LSD(0.10) —			
Tillage	11.3	12.7	12.1	8.4
Date	4.6	9.1	6.4	8.2
Population	5.0	8.4	9.0	10.1
Tillage x Date	ns[2]	s	ns	ns
Tillage x Population	ns	s	s	s
Date x Population	ns	ns	s	s
Tillage x Date x Population	ns	ns	s	s

[1] D_1, D_2, D_3 = Planted in early, mid, and late May, respectively. CT = Conventional tillage, NT = No tillage.
[2] s = interaction significant at the 0.10 probabilty level, ns = not significant.

TILLAGE

Higher yields usually resulted from no tillage. Mean yields doubled with no tillage in 1991 and increased 41% (30 bu/a) in 1994. Although no-till may not result in a yield increase every year, it should be considered a mandatory practice so that adequate yields can be produced in a dry year.

NITROGEN MANAGEMENT IN A WHEAT-SORGHUM-FALLOW ROTATION

by
Alan Schlegel and David Frickel

SUMMARY

Grain yields of wheat and grain sorghum were increased substantially by application of N fertilizer. Although responses were not observed every year, wheat yields averaged across 3 years were increased up to 19 bu/a. Grain sorghum yields were increased by 24 bu/a in 1993 and 31 bu/a in 1994. Tillage had no effect on wheat yields; however, grain sorghum yields in 1 year were greater with reduced than with no tillage.

INTRODUCTION

This study was initiated to determine N fertilizer requirements for wheat and grain sorghum grown in a wheat-sorghum-fallow rotation in west-central Kansas under reduced and no tillage. Past research at this station had shown limited response to N fertilizer. However, the potential for N response increasess with continued N removal in grain without application of supplemental N.

PROCEDURES

The study was a split plot design with tillage as the main plots and N treatments as subplots. Plot size was 20 by 60 ft. The two tillage systems were reduced and no tillage. Nitrogen fertilizer as urea was broadcast in the spring on wheat and near planting of grain sorghum. The N rates applied were 25, 50, and 100 lb N/a to either wheat or grain sorghum or 25 and 50 lb N/a 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. A sample of grain collected at harvest was dried, ground, and analyzed for N content; results are reported as grain protein (% grain N times 6.25). 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 DISCUSSION

Wheat yields in 2 out of 3 years were increased by N rates up to 100 lb N/a (Table 1). Averaged across all years, wheat yields were increased 19 bu/a by the highest rate of N fertilizer. Grain protein was increased from 10.0% in the control up to 11.6% with 100 lb N/acre applied to wheat. Application of N to sorghum also had a positive residual effect on subsequent wheat yield and grain protein. Tillage had no effect on wheat yield in any year.

Grain sorghum yields were increased 25 bu/a by 100 lb N/a applied to sorghum when averaged over 2 years (Table 2). In contrast to wheat, tillage may have an effect on grain sorghum yields. In 1993, but not 1994, grain yields were considerably lower with no-till than reduced tillage. However, averaged over both years, no significant tillage effect or tillage by N interaction occurred in either year.

Table 1. Wheat response to N fertilizer and tillage in a wheat-sorghum fallow rotation, Tribune, KS 1992-94.

Treatment		Grain Yield				Grain Protein			
		1992	1993	1994	1992-94	1992	1993	1994	1992-94
N Rate		- - - - bu / a - - - -				- - - - - - % - - - - - -			
Wheat	Sorghum								
- lb / a -									
0	0	24	44	20	29	10.0	10.2	9.8	10.0
0	25	29	42	20	30	10.1	9.9	9.4	9.8
0	50	28	46	19	31	9.7	10.3	9.2	9.8
0	100	28	53	30	37	10.4	10.8	9.1	10.1
25	0	29	45	28	34	10.4	9.5	9.9	10.0
25	25	26	56	30	38	11.0	10.6	9.7	10.4
50	0	27	57	41	42	11.3	10.6	10.6	10.8
50	50	29	60	45	45	11.6	10.7	10.9	11.1
100	0	29	66	48	48	11.7	10.8	12.2	11.6
LSD.05		5	11	5	4	0.9	1.1	0.7	0.6
Tillage									
Reduced		28	52	32	37	10.6	10.2	10.1	10.3
No-till		28	53	31	37	10.8	10.6	10.1	10.5
LSD.05		5	12	5	6	1.1	2.0	0.5	0.6

Table 2. Grain sorghum response to N fertilizer and tillage in a wheat-sorghum fallow rotation, Tribune, KS 1993-94.

Treatment		Grain Yield		
		1993	1994	1993-94
N Rate		- - - - - bu / a - - - - -		
Wheat	Sorghum			
- lb / a -				
0	0	37	57	47
0	25	45	71	58
0	50	49	82	66
0	100	58	88	73
25	0	42	56	49
25	25	46	77	62
50	0	50	59	54
50	50	63	72	68
100	0	66	66	66
LSD.05		6	10	5
Tillage				
Reduced		56	69	63
No-till	46	70	58	
LSD.05		7	13	9

NITROGEN MANAGEMENT OF DRYLAND WINTER WHEAT

by
Alan Schlegel, John Havlin[1], and Kevin Dhuyvetter[2]

SUMMARY

Research was initiated in 1993 to determine the N fertilizer requirement for dryland winter wheat grown under reduced tillage systems in western Kansas. Application of N fertilizer increased grain yields by 15 to 20 bu/a when residual soil N was low (< 5 ppm NH_4+NO_3 in 2 ft profile). Wheat yields were increased by N rates up to 80 lb N/a, with the best method and time of application being fall injection and the poorest being broadcast (either winter or spring). No positive yield benefit was observed with N application on sites with residual soil N above 5 ppm.

PROCEDURES

Research was initiated in 1993 to determine the N fertilizer requirement for dryland winter wheat grown under reduced-tillage systems. Five sites in western KS in conjunction with farmer cooperators were selected that tested low to medium in residual soil N levels. These sites were planted to winter wheat in the fall of 1993. 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. All plots were machine harvested, and grain yields were adjusted to 12.5% moisture.

RESULTS AND DISCUSSION

Application of N fertilizer increased grain yields by 15 to 20 bu/a at two sites (Table 1) that were low in residual soil N (< 5 ppm NH_4+NO_3 in 2 ft profile). Wheat yields were increased by N rates up to 80 lb N/a. The best time/method of application was fall injection, and the poorest was broadcast (either winter or spring).

No positive yield benefit was observed in the two sites testing medium in residual soil N (5-10 ppm). At one site, yield decreased with increasing N rate, and the other site had poor yields because of moisture stress. Nitrogen application had no effect on the one site with residual soil N >10 ppm.

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[1]John Havlin, Department of Agronomy, Kansas State University, Manhattan.
[2]Kevin Dhuyvetter, Northeast Area Extension Office, Manhattan.

Table 1. Effect of time and method of N application and N rate on grain yield of dryland winter wheat at five locations in western KS, 1994.

Time/Method of Application	N Rate	Grain Yield Nolan	Mai	Wallace	SunEast	SunWest	Mean
	lb/a	---------- bu/a ---------					
Fall Inject	20	30	40	23	16	39	30
	40	38	39	29	19	37	32
	60	38	42	36	15	37	34
	80	46	42	41	12	38	36
	100	40	36	43	16	34	34
Winter Broadcast	20	27	45	21	15	38	29
	40	32	42	26	16	40	31
	60	33	42	32	18	38	33
	80	30	42	29	20	38	32
	100	37	45	30	16	39	33
Spring Inject	20	30	41	25	16	39	30
	40	30	41	31	17	38	31
	60	33	40	33	19	38	33
	80	38	36	37	17	38	33
	100	35	36	34	19	39	33
Spring Broadcast	20	25	43	17	18	42	29
	40	27	39	27	19	40	31
	60	32	42	29	18	39	32
	80	39	40	34	16	39	33
	100	35	39	36	18	36	33
Control	0	22	40	16	16	42	27
Soil NH_4+NO_3 (fall) (ppm in 0-2 ft)		4.3	11.3	3.7	6.2	8.8	
Residue Cover (% at planting)		44	23	60	61	68	
MAIN EFFECT MEANS							
Time/Method of Application							
Fall inject		36	41	31	15	38	32.1
Winter bdct		30	42	26	17	39	30.7
Spring inject		31	39	29	17	39	31.2
Spring bdct		30	40	27	17	40	30.9
LSD.05		3	4	2	2	2	1.2
N Rate							
0 lb/a		22	40	16	16	42	27.2
20		28	42	22	16	39	29.5
40		32	40	28	18	39	31.4
60		34	42	32	18	38	32.7
80		38	40	35	16	38	33.5
100		37	39	36	17	37	33.2
LSD.05		4	5	2	3	2	1.4

NITROGEN MANAGEMENT OF IRRIGATED WINTER WHEAT

by
Alan Schlegel

SUMMARY

Grain yields of irrigated winter wheat were increased by over 40 bu/a by N fertilization averaged over 4 years. A N rate of 120 lb N/a was sufficient for maximizing grain yield. The best time for applying N was a single application in the early spring. Grain yields were less with all of the N applied in the fall and not increased by split N applications. Grain protein increased linearly with increased N rates. Applying 1/3 of the N late in the growing season (3-way split) generally provided little increase in grain protein.

INTRODUCTION

Nitrogen management of irrigated winter wheat was evaluated from 1991 to 1994 near Garden City. The objectives were to determine the optimal rate and time of N application for irrigated wheat and whether split N applications were beneficial in increasing grain yield and grain protein content.

PROCEDURES

Nitrogen fertilizer was applied annually to irrigated continuous wheat grown on a Mantor fine sandy loam near Garden City. Four rates of N (40, 80, 120, and 160 lb N/acre) as urea were broadcast at four application timings; all fall, all spring (Feeke's growth stage 3 [GS3]), a 2-way split of 1/3 fall + 2/3 GS3, and a 3-way split of 1/3 fall + 1/3 GS3 + 1/3 GS8 (early boot). Plant tiller population and plant height were measured at physiological maturity. The center of each plot was machine harvested, and grain yields were adjusted to 12.5% moisture. Grain samples collected at harvest were analyzed for protein content.

RESULTS AND DISCUSSION

Nitrogen fertilizer increased wheat yields by over 40 bu/a averaged over 4 years (Table 1). Yields increased with increasing N rates up to 120 lb N/a, with no further increase with 160 lb N/a. Spring application of N produced greater yields than applying all of the N in the fall. However, split N applications were no better than a single application in the early spring (GS3).

Grain protein increased linearly with increasing N rates. Protein content was about 10% with 0 and 40 lb N/acre and increased about 1% for each 40 lb increment of N applied. Little difference was seen in grain protein with time of application, except at the highest N rate where the 3-way split application of N tended to produce higher grain protein content.

Plant height was increased by about 8 in. over the control when N was applied at 120 N/a. However, time of N application had no effect on plant height. Tiller population tended to peak at about 3.5 million tillers/a with 120 lb N/a. Applying all of the N at GS3 tended to increase tiller population, and the 3-way split treatment tended to reduce tiller population.

Table 1. Effect of time of N application and N rate on grain yield, grain protein, plant height, and tiller population of irrigated winter wheat, Garden City, KS 1991-1994.

Time of Appl.	N Rate	Grain Yield	Grain Protein	Plant Height	Plant Tiller Pop.
	lb/a	bu/a	%	in.	million/a
Fall	40	56	10.1	30	3.0
	80	67	11.4	32	3.3
	120	70	12.1	32	3.7
	160	71	12.8	33	3.7
GS3	40	62	10.3	30	3.4
	80	70	11.7	32	3.6
	120	75	12.5	33	3.8
	160	68	13.1	32	3.8
Fall (1/3)+	40	58	10.0	30	3.1
GS3 (2/3)	80	71	11.3	32	3.4
	120	70	12.5	33	3.6
	160	71	13.3	32	3.5
Fall (1/3)+	40	55	10.4	30	2.9
GS3 (1/3) +	80	66	11.9	32	3.1
GS8 (1/3)	120	75	12.5	33	3.4
	160	73	13.8	34	3.6
Control	0	32	10.3	25	2.1
LSD.05		7	0.6	2	0.4
MAIN EFFECT MEANS					
Time of Application					
Fall		66	11.6	32	3.4
GS3		69	11.9	32	3.6
Fall+GS3		68	11.8	32	3.4
Fall+GS3+GS8		67	12.1	32	3.2
LSD.05		3	0.3	1	0.2
N Rate					
40 lb/a		58	10.2	30	3.1
80		69	11.6	32	3.3
120		72	12.4	33	3.6
160		71	13.2	33	3.6
LSD.05		3	0.3	1	0.2

EFFICACY OF SELECTED INSECTICIDES AGAINST SECOND GENERATION EUROPEAN CORN BORER, 1994

by

Larry Buschman, Lisa Wildman, and Phil Sloderbeck

SUMMARY

European corn borers averaged only 0.15 larvae per plant in the untreated check, and differences in corn borer numbers among treatments were not significant. However, all of the treatments significantly reduced the percent of plants with tunneling, and nine treatments significantly reduced the amount of tunneling per plant.

PROCEDURES

Field corn, DP3581, was planted on 26 April 1994 at a rate of 32,000 seeds/a in a furrow-irrigated field (Finnup #10) at the Southwest Research-Extension Center, Finney County, Kansas. The field was treated with 2.5 lb + 2 lb ai/a of Atrazine + Dual preplant on 26 April and with Banvel + Tough + Beacon at 0.5 + 1.4 + 0.018 lb ai/a postemergence on 19 May. 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 28 or 29 July, and the double corn borer treatments were made on 22 July and 1 August. Treatment timing was based on the Kansas State University European Corn Borer model, which predicted 25-50% oviposition to occur between 21 July and 23 July. Corn borer moth flight also was monitored using a black light trap, which showed a peak on 19 July.

Simulated chemigation applications of insecticides were made using three Delavan 100/140, 3/4 in., raindrop nozzles mounted on a high-clearance sprayer at tassel height between rows. This system was calibrated to deliver the equivalent of a 0.21 in. irrigation on the two center rows (5730 gal/a). Standard insecticide treatments were applied with a high-clearance sprayer using a 10-ft. boom with three nozzles directed at each row (one nozzle directed at the top and one on each side of the row on 16-in. drop hoses directed towards the ear zone) and calibrated to deliver 20 gal/a at 2 mph and 40 psi. The granular applications were made with electric Gandy® boxes mounted on the high-clearance sprayer using a 7-in. bander directed over each row.

Corn borer control was evaluated by dissecting 15 plants per plot between 23 and 30 September to determine the number of corn borer larvae and length of tunneling per plant. Grain yield was determined by machine harvesting two rows per plot and correcting to 15.5% moisture.

RESULTS AND DISCUSSION

European corn borer numbers were low, averaging 0.15 per plant in the untreated plots, apparently because many of the second generation larvae pupated to produce a third moth flight. Differences in corn borer numbers among treatments were not significant. However, 72% of the plants in the untreated check plots had noticeable corn borer tunneling, and statistically significant differences occurred among the treatments in the percent of plants showing injury and in the amount of tunneling per plant. All of the treatments significantly reduced the percent of plants with tunneling, whereas only nine of the treatments (both rates of RH-5992, the high rate of RH-0345, both rates of Karate, the two applications of Penncap-M, and the simulated chemigation treatments of

Table 1. Efficacy of selected insecticides against second generation European corn borer, Garden City, KS.

Treatment	Rate per A	ECB per Plant	% of Plants Infested[8]	ECB Tunneling per Plant in cm[8]	Grain Yield bu/a
Check Plots	—	0.15	72 a	3.2a	207
Standard Applications					
RH-5992 2F[2]	0.125	0.10	37 bcd	1.4 bc	217
RH-5992 2F[2]	0.25	0.07	28 bcde	1.0 bc	217
RH-2485 2F[2]	0.0625	0.07	42 bc	1.6 abc	209
RH-2485 2F[2]	0.125	0.17	35 bcde	2.0 abc	198
RH-0345 2F[2]	0.50	0.08	37 bcd	1.6abc	208
Furadan 4F[2]	2.00	0.10	37 bcd	2.0 abc	199
Capture 2EC	0.08	0.07	35 bcde	1.3 bc	205
Karate SCO 1EC	0.025	0.03	33 bcde	1.3 bc	205
Karate MSO 1EC	0.025	0.07	28 bcde	1.0 bc	205
Penncap-M 2FM	0.75	0.12	43 bc	1.8 abc	211
Penncap-M 2FM[4]	0.5 + 0.5	0.03	22 bcde	1.0 bc	215
Simulated Chemigation[5]					
MVP[6]	2 qt	0.00	12 de	0.3 c	199
MVP[4,7]	1 qt + 1 qt	0.03	18 bcd	1.1 bc	203
Dipel ES[7]	1 qt	0.05	37 bcd	1.2 bc	198
Granular Applications[5]					
Whirl 5G	5 lb	0.10	38 bcd	12.8 abc	221
Whirl 5G	10 lb	0.03	48 b	2.5 ab	206
Dipel 10G	10 lb	0.18	43 bc	3.2 a	220
F-Test Prob.		0.4328	0.0010	0.0066	0.5948
C.V.		122%	47%	64%	8%

[1] Rate expressed as lb ai/a and applied on 28 July (except where noted).
[2] Triton CS-7 added at a rate of 0.125%.
[3] Bond added at a rate of 2 oz/a.
[4] Two applications applied on 22 July and 1 August.
[5] Rate expressed as amount of product per acre and applied on 29 July (except where noted).
[6] Emulsifed crop oil added to spray solution at a rate of 2 qt/a.
[7] Emulsifed crop oil added to spray solution at a rate of 1 qt/a.
[8] Means within this coumn followed by the same letter are not significantly different at the 5% level based on DMRT.

MVP and Dipel) significantly reduced the amount of tunneling per plant. The granular applications of Whirl and Dipel significantly reduced the percent of plants showing injury, but did not significantly reduce the amount of tunneling in comparison with the untreated plots.

A southwestern corn borer pheromone trap next to the field captured up to 26 moths per night, indicating that they were present in the area. However, no southwestern corn borer larvae were recovered in the 1140 plants dissected in this test.

Grain yields averaged 208 bu/a, and differences among treatments were not statistically significant.

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

by

Larry Buschman, Lisa Wildman, and Phil Sloderbeck

SUMMARY

Comite II was applied as a "banded" treatment to whirl-stage corn with or without Accent or Beacon to control spider mites. The test was conducted as a large-plot strip test in three fields and as a small-plot replicated test in a fourth field. Only one of the four fields with early-season mite populations developed significant mite populations by early August when corn borer sprays were needed. Although the banded treatment seemed to work in the one field with mite populations, the practical usefulness of the treatments in this region remains to be demonstrated.

PROCEDURES

A large-plot strip test was conducted in three different fields in Haskell and Gray Counties north of Copeland, KS. There were three treatments: 1. Comite II at 1.5 pt/a, 2. Comite II at 1.5 pt/a plus Accent at 2/3 oz/a or 3. Comite II at 1.5 pt/a plus Beacon at 0.76 oz/a plus an untreated control. Crop oil concentrate was included with the pesticide applications at 1.5 pt/a in fields 1 and 3, and APSA80 was included with the pesticide applications at 12 oz/a in field 2. The strip plots were 96 rows wide in fields 1 and 2, but 72 rows wide in field 3. In fields 1 and 2, treatments were applied by the grower, Eldon Schmidt, with a spray rig equipped with double fan nozzles, which gave whole plant coverage on the 24-inch plants on 8 and 7 June, respectively. In field 3, treatments were applied by Max Birney, Aerial Spraying Inc. on 15 June with a ground rig set up for spraying Accent on the ground and the lower parts of the plants. Spider mites were counted on 10 plants at each of four sample sites in the center of the strip; 50, 100, 150, and 200 yards from the edge of the field. Counts were made pretreatment and at 1, 2, 4 and 6 weeks posttreatment. The week-6 counts were discontinued for fields 1 and 2, when no mites were found in the fields.

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 three times. There were three treatments: 1. Comite II at 1.5 pt/a, 2. Comite II at 1.5 pt/a plus Accent at 2/3 oz/a or 3. Accent at 2/3 oz/a, plus an untreated control. Crop oil concentrate was included with the pesticide applications at 1.5 pt/a. Treatments were applied with a ground rig with nozzles directed at the bottom half of the 36-inch-high plants on 1 July. Spider mites were inoculated twice using mite-infested leaves collected from a mite-infested corn field. Spider mites were counted on nine plants in each plot. Counts were made pretreatment and at 1, 2, and 4 weeks posttreatment. The week-6 counts were discontinued, when no mites were found in the plots.

RESULTS AND DISCUSSION

Some yellow spotting (cosmetic) of lower leaves occurred in field #2 where the APSA80 was used in combination with Comite II and Accent or Beacon. No spotting occurred in the plot where APSA80 was applied with Comite II only.

In the large-plot tests, low numbers of spider mite were present early in field 2, but only trace numbers were found in fields 1 and 3 (Table 1). Mite populations collapsed in all treatments in fields 1 and 2 (Fig 1), perhaps due to predator mites or thrips. The efficacy of Comite II cannot be evaluated in these fields, except that it did not induce a mite flare-up. In field 3, mite numbers were low initially, but increased dramatically by weeks 4 and 6 (Fig 1). At this late date, the mite numbers were lower in all the Comite-treated strips than in the two untreated strips, but because replication was incomplete, we could not test it for statistical significance.

In the small-plot test, low numbers of mite populations were present early (Table 1). Thereafter, mite numbers declined, and predator mites often outnumbered the spider mites. The efficacy of Comite II cannot be evaluated in these plots, except that it did not induce a mite flare-up.

Only one of the four fields with early-season mite populations developed significant mite populations by early August when corn borer sprays were needed. Although the banded treatment seemed to work in the one field with mite populations, the practical usefulness of the treatments in this region remains to be demonstrated.

Figure 1. Spider mites in four fields banded with Comite II in western Kansas, 1994.

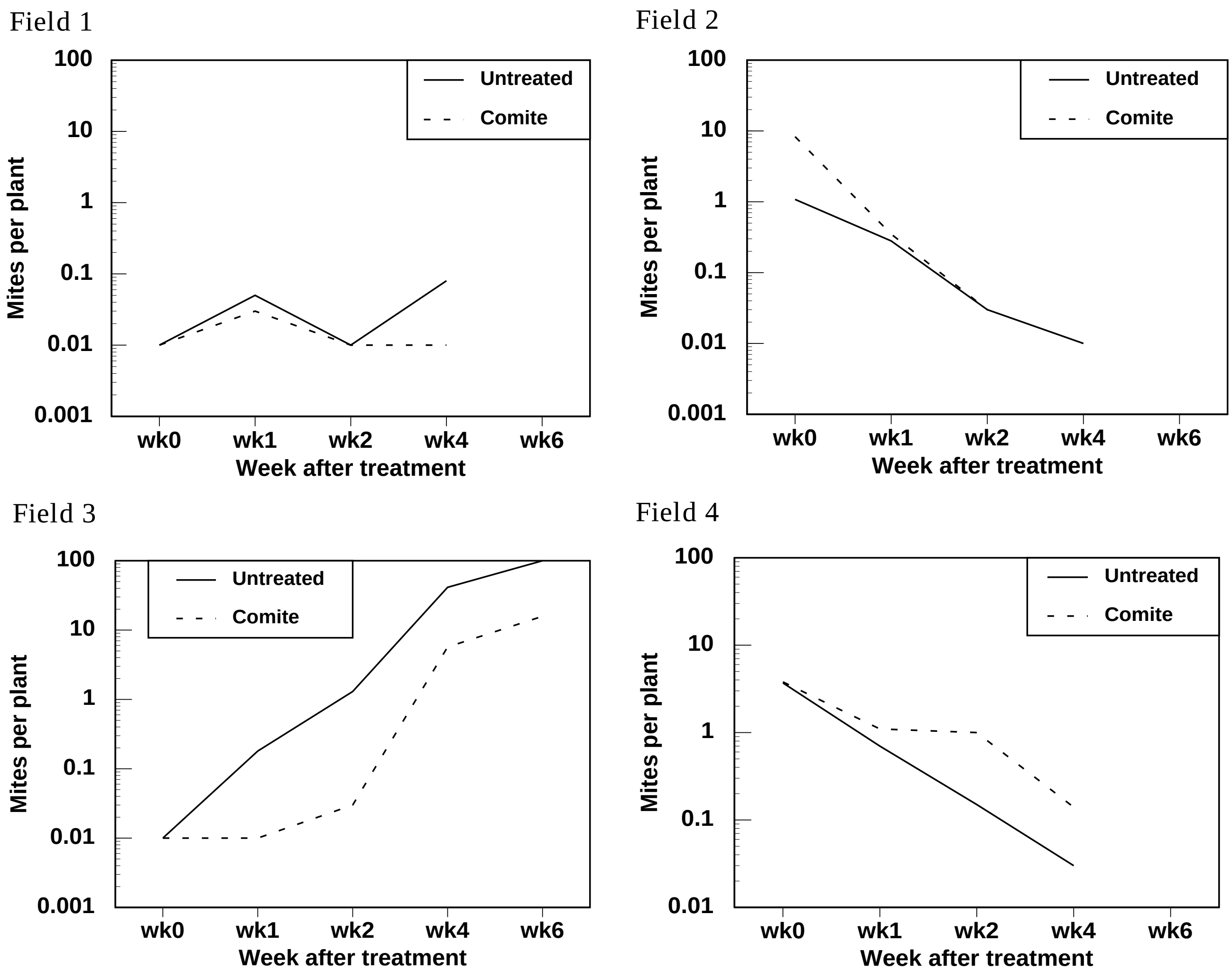


Table 1. Spider mites and mite predators at pretreatment and first-week samples in four fields with four Comite II banding treatments, western Kansas, 1994.

Field	Treatment	Individuals per Plant: Spider Mites	Predator Mites	Lady Beetles	Orius	Thrips	Other Predators
Field 1							
1	Control	0.05	0.0	0.2	0.0	2.5	0.1
2	Comite II	0.02	0.0	0.2	0.1	3.8	0.1
3	Comite II& Accent	0.00	0.1	0.2	0.1	2.1	0.1
4	Comite II& Beacon	0.02	0.0	0.3	0.1	2.1	0.1
Field 2							
1	Control	1.35	0.4	0.5	0.2	1.6	0.2
2	Comite II	8.68	0.8	0.3	0.1	1.2	0.2
3	Comite II& Accent	0.18	0.3	0.3	0.2	1.2	0.2
4	Comite II& Beacon	0.50	0.3	0.4	0.0	1.5	0.3
Field 3							
1	Control	0.18	0.0	0.1	0.1	0.6	0.1
2	Comite II	0.00	0.0	0.2	0.2	1.1	0.1
3	Comite II& Accent	0.10	0.0	0.2	0.2	1.1	0.1
4	Comite II& Beacon	0.05	0.1	0.1	0.1	0.7	0.1
1	Untreated	0.00	0.0	0.1	0.0	1.5	0.0
Field 4							
1	Control	4.37	0.9	0.5	0.7	0.6	0.1
2	Comite II	4.97	0.7	0.4	0.8	0.2	0.2
3	Comite II& Accent	8.70	1.0	0.3	0.7	0.3	0.1
4	Comite II& Beacon	5.97	1.0	0.2	0.7	0.4	0.2

TEST OF SORGHUM SEED TREATMENT FOR GREENBUG CONTROL

by
Phil Sloderbeck, Merle Witt, and Larry Buschman

SUMMARY

Three different sorghum hybrids treated with two different rates of Gaucho insecticide were evaluated at the Southwest Research-Extension Center near Garden City, Kansas during the summers of 1993 and 1994. Both the 2 oz and 4 oz rates of Gaucho were effective at reducing greenbug numbers, when populations occurred on seedling plants within 2 weeks of planting. During both years of the study, the 4 oz rate continued to suppress greenbugs for 70 to 80 days after planting on the greenbug-susceptible hybrid. Treatments also reduced corn leaf aphid numbers in 1993, but not in 1994. Grain yields of the greenbug-susceptible hybrid were improved significantly by the 4 oz rate of Gaucho in 1993, when the greenbugs had exceeded 1000 per plant in the untreated plots, but not in 1994 when the highest levels observed were about 300 greenbugs per plant.

INTRODUCTION

The following trial was conducted to test a new insecticide, Gaucho (imidacloprid), for use as a seed treatment to protect sorghum from greenbugs and corn leaf aphids. The trial utilized three sorghum hybrids to determine the insecticide's impact on pest numbers and grain yields of greenbug-resistant (both biotypes E and I) and nonresistant sorghum.

PROCEDURES

Seed of three different sorghum hybrids untreated (control) or treated with 2 or 4 oz ai of Gaucho per cwt were furnished by Gustafson, Inc. The hybrids used in the study were NC+ 271 a greenbug-susceptible hybrid, DK 56 a Biotype E-resistant hybrid and Cargill 607E a Biotype E and I-resistant hybrid. The seed also was treated with Captan and Concept, and theDK 56 was additionally treated with Apron.

The plots were planted on 2 June in 1993 and on 24 May in 1994 in a modified Latin square design with three replications. Each plot was two rows wide (5 ft) and 22 ft long. The seed was planted at the rate of 5g per row using a cone planter. The entire plot area was treated with 3 lb ai/a of Ramrod and 1 lb ai/a of Atrazine for weed control.

The plots were monitored several times throughout the season, and insect counts were made when there appeared to be significant levels of insect activity. In 1993, insect counts were made four times. On 15 June, greenbug counts were made by visually searching 10 consecutive plants in each row of each plot. The plants on this date were at about the 2-leaf stage. On 20 July, corn leaf aphid populations were monitored by cutting the whorl out of two plants per plot and counting the number of aphids observed as the leaves were unrolled. On 10-12 August, four plants per plot were examined visually for greenbugs. On 20 August, two plants were cut off at the base and examined visually to estimate greenbug numbers. In 1994, insect counts were made only twice. On 23 July, corn leaf aphid and greenbug populations were monitored by cutting off two plants per plot and counting the number of aphids on the plant and removing the whorl and counting the number of aphids observed as the leaves were unrolled. On 4-5 August, two plants were cut off at the base and examined visually to estimate greenbug numbers. Yield data were collected by machine harvesting the plots on 5 November in 1993 and on 27 October in 1994.

Data were analyzed both as individual treatment means and as grouped means based on seed treatment and hybrid. Mean separation was based on DMRT at 0.05.

RESULTS AND DISCUSSION

In 1993, greenbugs were noted on the sorghum plants a few days after emergence. Counts made on 15 June (13 days after planting) showed a very clear response to the Gaucho seed treatment (Table 1). The main effects of seed treatment were significant; both the 2 oz and the 4 oz rates eliminated immigrating winged greenbugs and kept colonies from becoming established on all three hybrids. The interaction between hybrid and insecticide treatment was not significant. These early-season greenbugs soon disappeared in all plots, and there was no noticeable damage. In late July, corn leaf aphids were present on most plants. The main effects of insecticide treatment was significant; both the 2 oz and the 4 oz rates significantly reduced corn leaf aphid numbers (Table 1). The main effects of hybrid and the interaction between hybrid and insecticide treatment on corn leaf aphids were not significant. Greenbug numbers increased rapidly in mid-August. At this time, the main effects of both hybrid and seed treatment were significant; however, there was also a significant interaction between hybrid and seed treatment. Greenbug numbers were low in the two greenbug-resistant hybrids, but high in the untreated greenbug-susceptible hybrid, which allowed for a much greater effect from Gaucho on the susceptible hybrid (Table 2). Both the 2 oz and 4 oz rates of Gaucho were still effectively reducing greenbug numbers at 70 days after treatment, but only the 4 oz rate was effectively reducing greenbugs 79 days after planting (Table 2). Grain yield was significantly affected by both hybrid and insecticide. The largest yield increase recorded was in the susceptible sorghum hybrid, for which the plots treated with 4 oz of Gaucho yielded 17 bu more than the untreated plots (Table 2). Samples of the greenbugs collected during this period were determined to be Biotype E, thus explaining why the Biotype E and I-resistant hybrid did not show an advantage over the Biotype E-resistant hybrid in either greenbug numbers or yield.

In 1994, an early flight of greenbugs did not occur, and, thus, no data were obtained on early-season control. By late July, corn leaf aphids became noticeable; however, there were no significant treatment effects on corn leaf aphid numbers (Table 3). Counts made on 23 July were probably a little too late to get an accurate evaluation of the treatments on the corn leaf aphid population. At this time, some of the sorghum plants were beginning to push heads out of the boot, leading to the decline of aphid populations in some plots. On 23 July, 60 days after planting, the main effects of both hybrid and seed treatment on greenbugs were significant. However, in greenbug counts made 72 days after planting, only the main effect of hybrid was significant (Table 3). But the individual treatment values indicate that the greenbug-susceptible hybrid treated with 4 oz of Gaucho had a level of greenbugs similar to that of all the greenbug-resistant plots and significantly lower than that of the untreated susceptible hybrid or the untreated susceptible hybrid with only 2 oz of Gaucho. Grain yields in 1994 were not affected by the seed treatment, but did vary significantly among hybrids (Table 3). Lack of a yield response to the seed treatment reflects the relatively low levels of greenbug pressure. The greenbugs collected from the plots during 1994 were again determined to be Biotype E.

In conclusion, whereas both the 2 and 4 oz rates of Gaucho reduced early-season greenbug numbers, only the 4 oz rate suppressed late-season greenbug numbers. The most consistent reductions in greenbug numbers and the highest yield increases were in the greenbug-susceptible hybrid treated with 4 oz of Gaucho. These data tend to indicate that Gaucho would be best utilized on greenbug-susceptible hybrids and that the higher rate will be needed to provide late-season suppression of greenbugs.

Acknowledgments:

Thanks to Terry Pitts and Gustafson, Inc. for furnishing the seed for this study and to Bob Bowling and Gerald Wilde for making the biotype determinations on the greenbugs collected from the plots.

Table 1. Observations on pest populations in Gaucho seed-treatment trial on sorghum, Southwest Research-Extension Center, 1993.

Hybrid	Gaucho Seed Treatment oz/100 lb seed	Winged Greenbugs per Plant 13 days after planting	Nonwinged Greenbugs per Plant 13 days after planting	Corn Leaf Aphids per Plant 48 days after planting
Greenbug-	0	12.3 a	44.7 a	137.3
Susceptible	2	0.3 b	0.0 b	84.7
Hybrid	4	1.0 b	0.0 b	29.0
Biotype E-	0	11.0 a	46.3 a	95.2
Resistant	2	0.3 b	0.0 b	61.2
Hybrid	4	0.3 b	0.0 b	23.0
Biotype I-	0	10.3 a	56.7 a	169.7
Resistant	2	0.0 b	0.0 b	64.3
Hybrid	4	0.7 b	0.0 b	32.2
P-Values forTreatment		0.0001	0.0001	0.1090
Hybrid Summary				
Greenbug-susceptible hybrid		4.6 a	14.9 a	83.7 a
Biotype E-resistant hybrid		3.8 a	15.4 a	59.8 a
Biotype I-resistant hybrid		3.7 a	18.9 a	88.7 a
Seed Treatment Summary				
Control		11.2 a	49.2 a	134.1 a
2 oz Gaucho		0.2 b	0.0 b	70.1 b
4 oz Gaucho		0.7 b	0.0 b	28.1 b
ANOVA Table P-Values				
Hybrid		0.7814	0.7271	0.5695
Seed treatment		0.0001	0.0001	0.0079
Interaction		0.9784	0.8558	0.8378

Table 2. Observations on pest populations and yield in Gaucho seed-treatment trial on sorghum, Southwest Research-Extension Center, 1993.

Hybrid	Gaucho Seed Treatment oz/100 lb seed	Greenbugs per Plant 70 days after planting	Greenbugs per Plant 79 days after planting	Yield bu per acre
Greenbug-	0	409.3 a	1087.0 a	149.4 de
Susceptible	2	288.8 b	965.0 a	146.8 e
Hybrid	4	90.7 c	459.5 b	166.4 ab
Biotype E-	0	41.0 c	76.0 cd	158.5 bcd
Resistant	2	20.4 c	114.0 cd	163.6 abc
Hybrid	4	17.7 c	47.0 d	169.3 a
Biotype I-	0	65.3 c	103.0 cd	145.8 e
Resistant	2	84.6 c	258.0 c	149.8 de
Hybrid	4	48.7 c	242.3 cd	153.8 cde
P-Values for Treatment		0.0001	0.0001	0.0008
Hybrid Summary				
Greenbug-susceptible hybrid		262.9 a	837.2 a	154.2 b
Biotype E-resistant Hybrid		26.4 b	79.0 c	163.8 a
Biotype I-resistant Hybrid		66.2 b	210.1 b	149.8 b
Seed Treatment Summary				
Control		171.9 a	431.0 a	151.2 b
2 oz Gaucho		131.3 a	445.7 a	153.4 b
4 oz Gaucho		52.3 b	249.6 b	163.2 a
ANOVA Table P-Values				
Hybrid		0.0001	0.0001	0.0005
Seed Treatment		0.0041	0.0023	0.0013
Interaction		0.0059	0.0003	0.2091

Table 3. Observations on pest populations and yield in Gaucho seed-treatment trial on sorghum, Southwest Research-Extension Center, 1994.

Hybrid	Gaucho Seed Treatment oz / 100 lb seed	Corn Leaf Aphids per Plant 60 day after planting	Greenbugs per Plant 60 days after planting	Greenbugs per Plant 72 days after planting	Yield bu per acre
Greenbug-	0	46.3	118.5 a	295.8 a	155 bc
Susceptible	2	43.0	32.3 ab	339.5 a	155 bc
Hybrid	4	42.7	40.7 ab	114.8 b	159 abc
Biotype E-	0	16.8	14.0 ab	56.3 b	165 ab
Resistant	2	84.3	17.7 ab	55.8 b	167 a
Hybrid	4	33.0	15.8 ab	34.0 b	165 ab
Biotype I-	0	22.0	60.1 b	99.8 b	150 c
Resistant	2	13.8	13.0 ab	44.5 b	150 c
Hybrid	4	16.5	3.3 c	38.7 b	149 c
P-Values forTreatment		0.0975	0.0020	0.0090	0.0050
Hybrid Summary					
Greenbug-susceptible hybrid		44.7	63.8 a	250.1 a	156 b
Biotype E-resistant hybrid		17.4	15.8 b	48.7 b	166 a
Biotype I-resistant hybrid		44.0	25.7 b	61.0 b	150 c
Seed Treatment Summary					
Control		28.4	64.4 a	150.7	157
2 oz Gaucho		47.1	21.0 b	146.6	158
4 oz Gaucho		30.7	20.0 b	62.5	158
ANOVA Table P-Values					
Hybrid		0.0733	0.0033	0.0009	0.0001
Seed Treatment		0.2894	0.0033	0.1319	0.9107
Interaction		0.1374	0.0597	0.3265	0.9243

EFFICACY TEST OF CORN ROOTWORM INSECTICIDES GARDEN CITY, KANSAS — 1994

by

Larry Buschman, Lisa Wildman, 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 for different insecticide formulations. Unfortunately rootworm damage was low in the plots, and reductions in rootworm damage were not significant.

PROCEDURES

Field corn, DP3581, was planted on 25 and 26 April, 1994 at a rate of 32,000 seeds/a in a furrow-irrigated field (#10) at the Southwest Research- Extension Center, Finney County, Kansas. The field was treated with 2.5 lb + 2 lb ai/a of Atrazine + Dual preplant on 26 April and with Banvel + Tough + Beacon at 0.5 + 1.4 + 0.018 lb ai/a postemergence on 19 May. Plots were 2 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-in. band over the open seed furrow (T-band) or as an in-furrow application.

Rootworm damage was rated on four plants/plot on 1 July, 1994 using the 6-point Iowa scale. Grain yield was determined by machine harvesting each plot and adjusting the yields to bu/a at 15.5% moisture.

RESULTS AND DISCUSSION

Rootworm injury in the untreated plots was moderate, averaging 3.4 in the untreated plots, and the rootworm damage ratings did not differ significantly among treatments (Table 1).

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

Grain yield averaged 167 bu/a and did not differ significantly among treatments.

Table 1. Corn rootworm test, 1994, Garden City.

Insecticide	Oz/ 1000 ft.	Application Method	Rootworm Ratings 1-6 [1]	Yield bu/a
Untreated	—		3.4	160
Force 3G	3	Smartbox T-band	2.8	174
Force 3G	4	Smartbox T-band	2.8	173
Force 3G	3	Conventional T-band	2.7	167
Fortress 5G	3	Smartbox in-furrow	3.0	177
Fortress 5G	6	Smartbox in-furrow	3.0	172
Lorsban l5G	8	Conventional T-band	3.0	159
Counter 20CR	6	Conventional T-band	2.8	157
F-test prob.			0.3503	0.6247
CV			13%	11%

COMPEL™ EVALUATED FOR CONTROL OF CORN ROOTWORM BEETLES AND EFFECTS ON OTHER CORN ARTHROPODS

by
Larry Buschman, Lisa Wildman, and Phil Sloderbeck

SUMMARY

The cucurbitacin bait formulation Compel was applied to half of three fields to control corn rootworm. Compel treatment reduced rootworm beetle numbers to about 0.5 per plant in one of three fields, but in the other two fields, the reductions were not so clear. Corn rootworm injury in the year following Compel treatment was lower in one of the three fields, but the overall effects were not significant. Compel treatment shows some promise in controlling rootworm beetles, but further work will be needed to prove effectiveness in reducing rootworm injury and improving yields. There was no evidence that spider mites or mite predators were affected by the Compel treatment.

INTRODUCTION

This study was conducted to evaluate the efficacy of Compel™ in controlling corn rootworm adults. Compel is a cucurbitacin bait formulation that is mixed with Seven XLR. The study also examined corn rootworm feeding pressure in the year following Compel treatment to determine if the need for soil insecticide was reduced.

PROCEDURES

This paired test was repeated in three large fields of 160-200 a in Haskell Co. Kansas, north of Copeland. The first field was under a 160-a center pivot and planted to Pioneer 3261 in both years. The second field was ca. 200 a, flood irrigated, and planted to Pioneer 3394 in both years. The third field was ca. 200 a, flood irrigated, and planted to Pioneer 3162 in both years. The Compel mixed with Seven XLR (0.75 oz/a or 0.0234 lb ai/a) was applied as a bait using a specially adapted plane with extruder pods that delivered it at a rate of 1 lb/a. Half of each field was treated with Compel, and the other half was left untreated as a control. Compel treatments were made at 1600 h, 1700 h, and 2000 h in the respective fields on 17 July. In each half of the field, two pairs of planter-width strips were identified for detailed observations. These strips were at least 330, 660, and 750 ft from the border between treated and untreated sections in fields 1, 2, and 3, respectively. In fields 1 and 2 , the strips were 2640 ft long and 8 rows wide (40-inch row spacing) for 1.6 a per strip. In the third field, the strips were 2640 ft long and 12 rows wide (30-inch spacing) for 1.8 a per strip. In each half of the field, observations were made at one end of the field in the first pair of strips and at the other end in the second pair of strips.

In 1993, corn rootworm beetles were estimated in two ways: plant counts and yellow sticky trap counts. Plant counts were made by counting beetles on 10 plants in each strip, for a total of 40 plants for each half of the field. Trap counts were made by counting beetles on three Scentry Multigard TM sticky traps in each strip, for a total of 12 traps for each half field. Both observations were made twice each week starting on 16 July (pretreatment) and continuing for 5 weeks (posttreatment). Spider mite damage and mite predators were counted on leaves of the lower half of 10 plants in each strip on 16 and 29 July and 15 Aug. At the end of the season, the strips were harvested to measure field variability in preparation for yield samples in the second year.

In 1994, two pairs of planter-wide strips in each half field were planted with and without soil insecticide, Force 1.5G 8 oz/1000 ft., two pairs of strips in each half field. Rootworm ratings were made on 30 June by digging 10 plants in each strip for a total of 40 plants for each half field. In October, the strips were combine harvested; in each half field, the two untreated strips were harvested together and the two treated strips were harvested together.

For analysis, the statistical model was a two factor randomized complete block design, with soil insecticide treatment (factor B) split on Compel treatment (factor A) and three replicates (fields).

RESULTS AND DISCUSSION

In 1993, pretreatment beetle counts in the treated and untreated sections averaged 2.6 and 3.5 in the first field, 3.2 and 6.8 in the second field, and 3.4 and 4.4 in the third field (Figs. 1 - 3, Table 1). Three days after the Compel treatment, beetle counts were lower in the treated plots, but only in the second field did the counts approach the target of 0.5 beetles per plant. Means across the three fields for 3 weeks posttreatment were not statistically different (P=0.05) for Compel-treated and untreated (Table 3). Beetle counts on the sticky traps also were greatly reduced, and trends were similar to those observed in plant counts above. However, means across the three fields for 3 weeks posttreatment were statistically different (P=0.05) for Compel-treated and untreated (Table 1). The corn in the second field was at late silk stage at treatment, whereas corn in the other fields were at tassel stage when treatments were applied. Unfortunately, a 2-inch rain occurred on the night after application, which may have reduced the effectiveness of the treatments. The center pivot was off for 5 days after the rain. During the remainder of the season, beetle counts remained lower in the treated half of all three fields.

Figure 1. Corn rootworm beetles in field 1, SWREC, 1993.

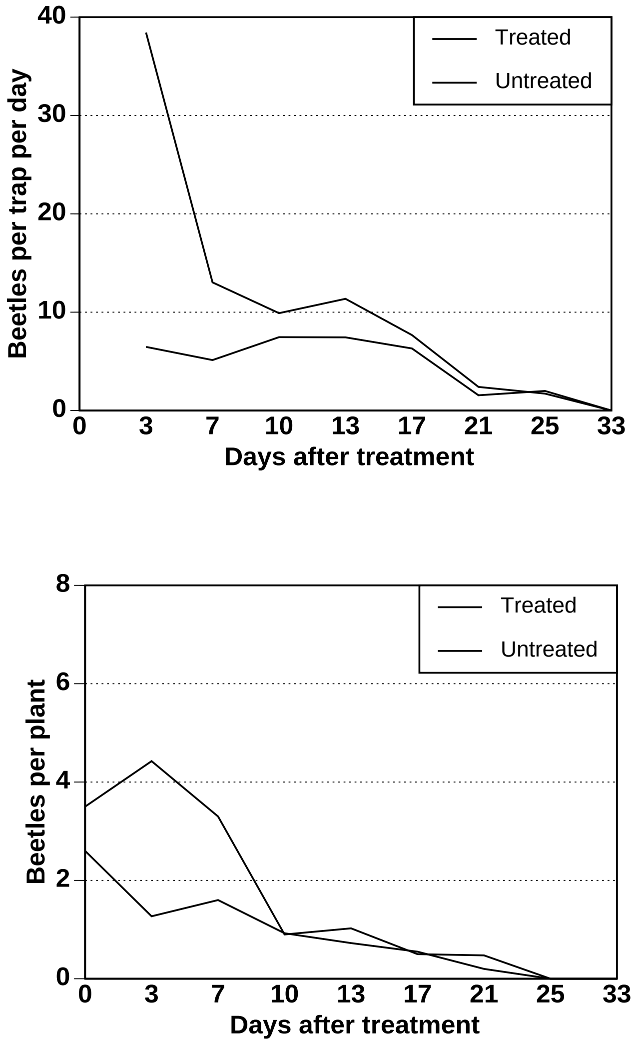


Figure 2. Corn rootworm beetles in field 2, SWREC, 1993.

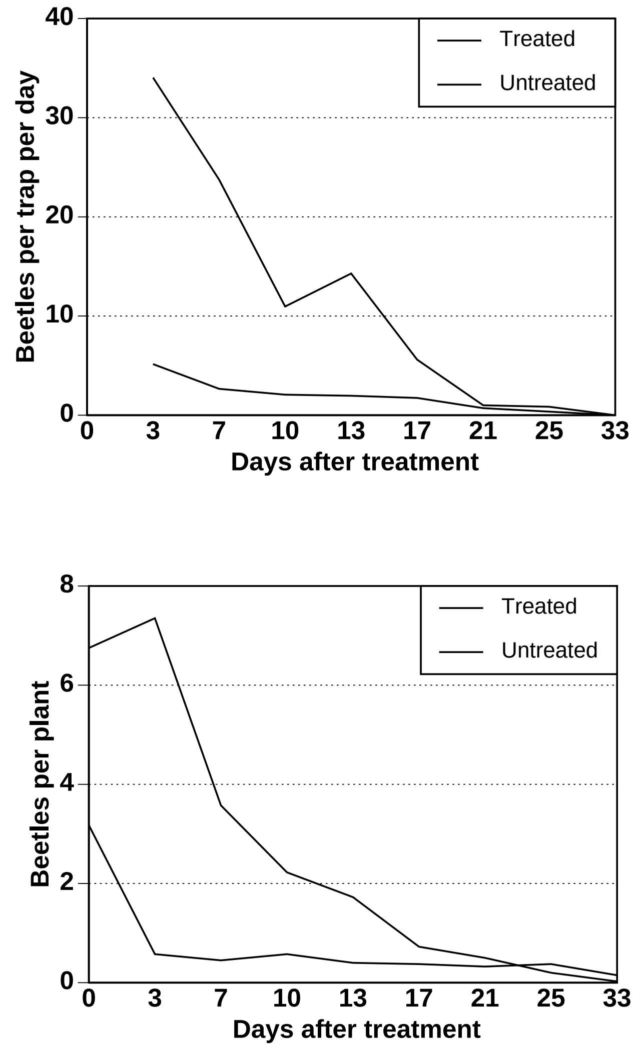
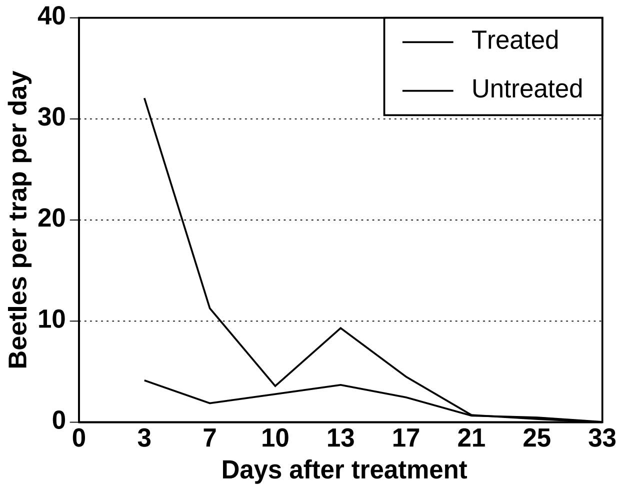
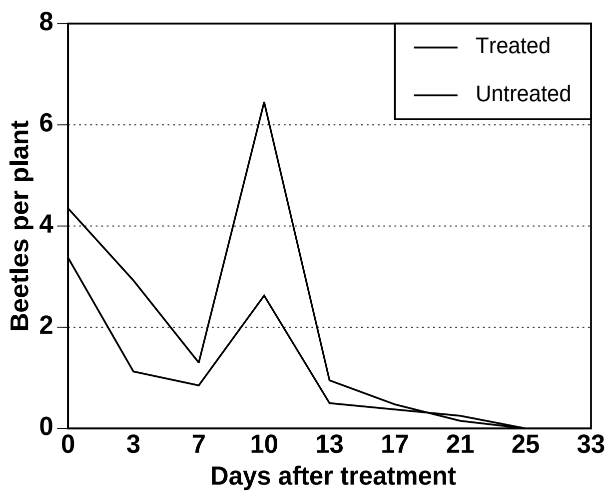


Figure 3. Corn rootworm beetles in field 3, SWREC, 1993.





Spider mite damage was higher in the untreated areas, reflecting pretreatment trends. There was no evidence of spider mite flaring after Compel treatment (Table 2). Predator counts also were unaffected by the Compel treatment.

In 1994, corn rootworm damage ratings were not significantly affected by Compel treatment, but they were significantly affected by soil insecticide treatment (Table 3). However, neither the Compel treatment nor the soil insecticide treatments resulted in significant yield increases. Corn rootworm damage ratings in the year following Compel treatments averaged 3.93, 4.20, and 3.21 in the three fields in the completely untreated strips. These levels of corn rootworm damage have been associated with economic yield losses in other situations. In the second field, plants died from rootworm damage in some places, but other parts of the field were affected less severely. This study suggests that, with irrigation, corn plants are able to recover from root damage and that very little yield loss is associated with rootworm damage up to about 4 on the Iowa rating scale (one whole node of roots destroyed).

The efficacy of Compel treatments is inconclusive. Compel treatment did reduce rootworm beetle numbers to about 0.5 per plant in one of three fields, but in the other two fields, the reductions were not so clear. These differences were probably due to differences in the phenology of the corn in the three fields, the population dynamics of the rootworms in the three fields, and the rain that probably reduced the residual effects of the treatments. Corn rootworm injury in the year following Compel treatment was lower in one of the three fields, but the overall effects were not significant. Compel treatment shows some promise in controlling rootworm beetles, but further work will be needed to prove effectiveness in reducing rootworm injury and improving yields.

Table 1. Corn rootworm beetle numbers in the three test fields divided into sections that were treated and untreated with Compel, Southwest Research-Extension Center, 1993. Plant counts are averaged across 40 plants and trap counts are averaged across 12 sticky traps.

Location and Treatment	Sample Dates								
	7/16	7/19	7/23	7/26	7/29	8/2	8/6	8/10	8/19
Rootworm beetles per plant									
First Field									
Treated	2.6	1.3	1.6	0.9	0.7	0.6	0.2	0.0	0.0
Untreated	3.5	4.4	3.3	0.9	1.0	0.5	0.5	0.0	0.0
Second Field									
Treated	3.2	0.6	0.45	0.6	0.4	0.4	0.3	0.4	0.2
Untreated	6.8	7.4	3.6	2.2	1.7	0.7	0.5	0.2	0.0
Third Field									
Treated	3.4	1.1	0.85	2.6	0.5	0.4	0.3	0.0	0.0
Untreated	4.4	2.9	1.3	6.5	1.0	0.5	0.2	0.0	0.0
Rootworm beetles per trap per day									
First Field									
Treated	-	6.5	5.1	7.5	7.4	6.3	1.6	2.0	0.1
Untreated	-	38.4	13.0	9.9	11.4	7.7	2.4	1.7	0.0
Second Field									
Treated	-	5.2	2.7	2.1	2.0	1.7	0.7	0.4	0.3
Untreated	-	34.0	23.8	11.0	14.3	5.6	1.0	0.9	0.2
Third Field									
Treated	-	7.0	1.6	2.0	2.6	1.7	0.4	0.3	0.0
Untreated	-	32.1	11.3	3.6	9.3	4.5	0.7	0.3	0.0

Table 2. Observations on spider mites and predators of spider mites and other corn insects after Compel treatment, Southwest Research-Extension Center, 1993. Data combined over the three sample fields.

Observation and Treatment	Sample Dates		
	16 July	29 July	15 Aug.
Spider Mite Infest. Leaves-%			
Treated	1.5	10.5	20.3
Untreated	5.5 NS	28.5 NS	45.8 NS
Spider Mite Infest. Area-%			
Treated	7.1	5.7	7.0
Untreated	14.2 NS	6.6 NS	14.6 NS
Predator Mites / 10 Plants			
Treated	14	11	9
Untreated	8 NS	25 NS	15 NS
Lady Beetles / 10 Plants			
Treated	29	47	16
Untreated	28 NS	61 NS	11 NS
Orius / 10 Plants			
Compel Treated	21	9	1
Compel Untreated	56 NS	9 NS	0 NS
Thrips / 10 Plants			
Compel Treated	40	2	0
Compel Untreated	36 NS	1 NS	0 NS
Other Predators / 10 plants			
Compel Treated	82	20	23
Compel Untreated	84 NS	14 NS	2 NS

NS=Differences not statistically significant (p=0.05).

Table 3. Corn rootworm damage ratings on corn roots using the Iowa 1-6 scale in the season following Compel treatments (1994) and grain yields (1993 & 1994), Southwest Research-Extension Center.

Location and Treatment	Rootworms 3 Wk Post-Trt.		Root Rating	Grain Yield	
	per Plant	perTrap		1993	1994
First Field					
Compel Treated	0.88	5.73	-	-	-
Soil Insect. Trt	-	-	2.56	211	196
Soil Insect. Untrt.	-	-	3.69	211	189
Compel Untreated	3.5	1.7	-	-	-
Soil Insect. Trt	-	-	2.65	195	206
Soil Insect. Untrt.	-	-	3.93	195	206
Second Field					
Compel Treated	0.46	2.40	-	-	-
Soil Insect. Trt	-	-	2.93	169	226
Soil Insect. Untrt.	-	-	2.95	169	221
Compel Untreated	2.68	14.95	-	-	-
Soil Insect. Trt	-	-	3.43	185	218
Soil Insect. Untrt.	-	-	4.20	185	221
Third Field					
Compel Treated	0.96	2.55	-	-	-
Soil Insect. Trt	-	-	2.26	177	236
Soil Insect. Untrt.	-	-	2.74	177	240
Compel Untreated	4.4	2.07	-	-	-
Soil Insect. Trt	-	-	2.89	182	233
Soil Insect. Untrt.	-	-	3.21	182	234
ANOVA Table-F-test Prob.					
Field (Rep.)	0.885	0.382	0.247	-	0.072
Compel Treat.	0.076	0.026	0.123	-	0.927
Soil Insect. Treat.	-	-	0.035	-	0.722
Interaction	-	-	0.589	-	0.316
CV	34	23	12%	-	1.4%

NS=Differences not statistically significant (p=0.05).

COMPARISONS OF 64 HERBICIDE TANK MIXES FOR KOCHIA CONTROL IN CRUSTED SOIL IN CORN

by

Randall Currie

SUMMARY

Under conditions of extreme weed pressure, stand reduction from soil crusting can have a devastating effect on herbicide efficacy. However, under these conditions, several treatments did provide outstanding kochia control.

INTRODUCTION

A vigorous healthy crop that emerges before weed pests is a first step to weed control. This is made possible by proper seedbed preparation that allows the placement of corn kernels in moist soil with a soil surface that is dry and friable and free of weeds. This dry soil surface acts like a mulch to inhibit small-seeded weeds. Driving rain can reverse this situation by providing a firm seedbed for small-seeded weeds and causing a crust that impedes corn emergence. The reduced stands further inhibit the crop's ability to compete with weeds by shading. Therefore, when nature caused crusted soil in this study, the objectives were altered to evaluate herbicide tank mixes and the timing of the application for control of kochia in low-population irrigated corn.

PROCEDURES

Corn was planted as described in Table 1. Plots were six rows wide, with herbicide treatments being applied to the center four rows. Corn was planted with apprehension, because soil moisture was adequate for crop germination but insufficient for certain emergence. Encouraged by forecasts of rain, we planted the crop. Unfortunately, the rain came with sufficient force to cause a significant crusting problem. Of the 27,000 kernels/a planted, only 17,000 emerged. Because many of the treatments were already applied and insufficient area was available to repeat the test, we reasoned that crusting was a common situation for producers. So the experiment was continued, with a shift in objectives.

Table 1. Planting information.

Crop Name:	Corn
Variety:	P 3162IR
Planting Date:	5/9/94
Planting Method:	JD Max Emerge II
Rate, Unit:	27,000
Depth, Unit:	1 in.
Row Spacing, Unit:	30 in.
Soil Temp., Unit:	52°F at 5 in.
Soil Moisture:	Fair
Emergence Date:	5/15/94

RESULTS AND DISCUSSION

Overall yields were poor because of insufficient population. Also, every four treated rows were flanked by two untreated rows. These two rows produced shading and water competition to all plots and reduced overall yield. Treatments 1-9 produced outstanding control and were not statistically different from each other. These treatments provided excellent or adequate control of Johnson grass, so that Johnson grass competition did not interfere with the interpretation of kochia control. Although Johnson grass control was rated, it interacted with kochia dramatically and was not distributed evenly enough to provide reliable statistical analysis. Therefore, this analysis was simplified into three categories; 100% control, no control, and control that could not be distinguished statistically. Treatments 8-27 under normal conditions may have produced sufficient control It is difficult to separate the effects of poor Johnson grass control. Although treatments 11, 12, 15, 17, 19, 24, 28, 30, 32, 36, 37, and 60 provided excellent kochia control, they produced poor Johnson grass control and did not yield well.

Although it is difficult to draw statistical inference from Johnson grass control, treatments 6, 10 and 42 provided near perfect control. Also, treatments classed as no control had more Johnson grass present than in the untreated plots. This information also may be useful without statistical analysis.

Some treatments that are often good provided poor control because of emergence of seedling Johnson grass after treatment. However, these seedlings that emerge after the corn is well established often do not reduce yield. However, in the thin corn in this test, this did not appear to be the case. Selection of Johnson grass control treatments based on this study should be done with extreme care.

Table 2. Application equipment information.

Appl. Equipment:	Windshield sprayer
Pressure, Unit:	32 lb. PSI
Nozzle Type:	XR
Nozzle Size:	8004 VS
Nozzle Spacing, Unit:	20 in.
Boom Length, Unit:	10 ft
Boom Height, Unit:	23 in.
Ground Speed, Unit:	3.3 mph
Carrier:	H_2O
Spray Volume, Unit:	20 GPA
Propellant:	CO_2

Table 3. Application information Kochia herbicide test, Garden City, KS 1994.

	EPP	Pre/PPI	Early Post	Post
Application Date:	4/20	5/9	5/25	6/7
Application Method:	Windshield sprayer	Windshield sprayer	Windshield sprayer	Windshield sprayer
Application Timing:	19 days prior to planting	Preplant, PPI	Early postemerge	Postemerge
Air Temp., Unit:	63°F	65°F	68°F	66°F
Wind velocity, Unit:	10-15 mph	E, 10-15 mph	N, 5-10 mph	0-5 mph, variable
Soil Temp., Unit:	56°F	52°, 5 in. deep	61°, 5 in. deep	66°, 5 in. deep
Soil Moisture:	Moderate	Good	Dry on surface	Dry on surface
% Cloud Cover:	50%	83%	20%	10%
Kochia	Height = 1-2” Population = > 100/ft^2		Height=< 3” Population = 17/ft^2	Height=3-4”

Table 4. Effects of 64 herbicide tank mixes on kochia control, Southwest Research-Extension Center, 1994.

Trt #	Treatment	Rate lb/ai/a	Application Stage	Kochia 28 DAP	Kochia 49 DAP	Kochia 57DAP	J. Grass 7/5/94 57DAP	Yield (bu/a) 11/2/94
1	Frontier + Pursuit + Atrazine	.757+.0625+1.0	Preemergence	100.0	99.1	98.6	*	114.1
2	Pursuit +Atrazine + X-77 + 28%N	.0625 + 1 +.25%+1 qt	Early Post	58.8	100.0	100.0	*	108.6
3	Pursuit + X-77 + 28%N+ Frontier + Banvel	.0625+.25%+1.0 qt+.757+.188	Early Post	99.3	97.9	100.0	0.0	105.0
4	Pursuit + X-77 + 28%N + Frontier + Banvel	.0468+.25%+1 qt+.750+.25	Early Post	100.0	93.2	100.0	*	102.9
5	Pursuit+Atrazine+ Frontier + X-77 + 28%N	.0625 +1 +.750+.25%+1 qt	Early Post	100.0	93.8	100.0	*	95.1
6	Frontier + Pursuit + Scepter	.757+.062+.06	Preemergence	95.2	90.9	92.4	100.0	92.1
7	Pursuit + X-77 + 28%N + Buctril	.0625+.25%+1.0 qt+.188	Early Post	98.0	91.5	89.9	0.0	91.8
8	[Frontier + Atrazine] + [Frontier + Beacon]	[1+1]+[.29+.0178]	[EPP] + [Post]	90.4	97.9	98.2	0.0	84.0
9	Beacon + Banvel + Dual + X-77	.0178+.25+2.25+.25%	Postemergence	0.0	100.0	100.0	0.0	84.0
10	Pursuit Plus	0.9463	Preemergence	96.1	89.8	91.4	100.0	83.7
11	Pursuit Plus + Banvel + X-77 + 28%N	.9463+.188+.25%+1.0 qt.	Early Post	100.0	98.4	100.0	*	82.2
12	Accent + Buctril + Prowl + X-77 + 28%N	.016+.25+1.0+.25%+1 qt	Early Post	100.0	93.8	88.0	0.0	81.2
13	Accent + Buctril + X-77 + 28%N	.0314+.25+.25%+1 qt	Early Post	100.0	97.0	59.3	0.0	79.1
14	Tough + Beacon + COC	.5+.0022+1 pt	Postemergence	0.0	59.8	72.8	*	78.6
15	Pursuit + X-77 + 28%N + Banvel	.0625+.25%+1.0 qt+.188	Early Post	99.3	96.4	93.7	*	78.2
16	Pursuit Plus + Scepter	.95+.06	Preemergence	89.7	86.9	79.4	*	78.1
17	Frontier + Pursuit + X-77 + 28%N + Buctril	.757+.062+25%+1 qt+.188	Early Post	100.0	98.4	98.2	*	77.3
18	Pursuit + X-77 + 28%N	.0625+.25%+1.0 qt	Early Post	86.5	66.9	60.6	*	76.2
19	NAF-2 + Atrazine	2.16+1.0	Preplant	100.0	93.5	98.2	0.0	74.4
20	Beacon + Buctril + Dual + X-77	.0178+.25+2.25+.25%	Postemergence	0.0	62.4	70.4	0.0	73.5
21	Scepter + Frontier	.125+.911	Preemergence	93.8	87.8	84.3	*	73.3
22	CGA248757 + COC + Beacon	.0027+2 qt+.0178	Postemergence	17.8	52.2	30.2	*	72.7
23	Frontier + Atrazine	1.29+1.25	Preemergence	93.2	88.9	93.7	0.0	71.7
24	Tough + Atrazine + COC	.5+.16875+1 pt	Postemergence	5.5	100.0	100.0	*	70.6
25	Accent + Beacon + X-77 + 28%N	.016+.38+.25%+1 qt	Early Post	75.2	60.6	72.2	0.0	70.3
26	Beacon + Exceed + Dual + X-77	.0178+.0178+2.25+.25%	Postemergence	2.8	74.3	82.3	*	67.4
27	Tough + Accent + COC	.5+.0041+1 pt	Postemergence	0.0	41.7	46.5	*	66.9
28	Broadstrike/Dual	2.16	Preemergence	94.6	92.6	96.0	*	61.4
29	NAF-72 + Dual	.214+2.0	Postemergence	76.5	84.0	83.0	0.0	61.1
30	Biceplite II + Exceed + COC	2.46+.0268+1 qt	PreEm + Post	90.9	94.2	94.2	*	60.2
31	Bicep	3.634	Preemergence	89.9	85.8	83.0	0.0	59.8
32	Surpass + Atrazine	2.0+1.5	Preemergence	98.5	100.0	96.9	0.0	59.1
33	Pursuit + X-77 + 28%N+ Frontier	.0625+.25%+1.0 qt+.757	Early Post	78.2	53.0	74.7	*	58.8
34	Exceed + Banvel + Dual + X-77	.018+.250+2.25+.25%	Postemergence	0.0	98.4	91.1	0.0	58.4
35	Eradicane/Acetochlor	3.9375	PPI	56.0	29.5	31.5	*	55.2
36	Surpass 100 5SC + Atrazine	2.75+1.5	Preemergence	98.7	97.5	100.0	*	54.9
37	Surpass + Atrazine	1.6+1.5	Preemergence	96.8	93.2	96.8	0.0	54.2
38	Frontier + Pursuit	.757+.0625	Preemergence	90.3	86.3	80.4	*	52.8
39	Sencor DF + Tough + X-77	.094+.60+1 qt.	Early Post	94.9	87.0	82.2	0.0	51.9

Table 4 cont. Effects of 64 herbicide tank mixes on kochia control, Southwest Research-Extension Center, 1994.

Trt #	Treatment	Rate lb/ai/a	Application Stage	Kochia 28 DAP	Kochia 49 DAP	Kochia 57DAP	J. Grass 7/5/94 57DAP	Yield (bu/a) 11/2/94
40	Exceed + Dual + X-77	.036+2.25+.25%	Postemergence	13.1	78.4	65.2	0.0	51.6
41	CGA248757 + COC + Dual II	.0036+2qt+2.25	Postemergence	0.0	30.5	32.0	0.0	50.8
42	Beacon + Dual + X-77	.0178+2.25+.25%	Postemergence	0.0	69.9	59.6	100.0	50.6
43	Sencor DF + Clarity	.094+.25	Postemergence	0.0	66.8	53.5	0.0	49.9
44	Tough + Bladex	.5+.1125	Postemergence	8.7	78.7	88.2	0.0	49.3
45	Exceed + Dual + X-77	.027+2.25+.25%	Postemergence	0.0	48.6	54.0	*	46.2
46	Sencor DF + Marksman	.094+.60	Postemergence	0.0	63.5	43.1	*	45.6
47	Eradicane/Acetochlor	4.375	PPI	47.5	23.5	61.8	*	44.6
48	Sencor DF + Buctril	.094+.25	Postemergence	0.0	81.5	86.5	0.0	44.4
49	CGA248757 + COC + Exceed	.0027+2 qt+.0178	Postemergence	0.0	41.9	47.1	0.0	44.2
50	ICI A 5676 + Atrazine	1.6+1.5	2 weeks EPP	89.4	73.2	84.3	0.0	44.1
51	ICI A 5676 + Atrazine	2.0+1.5	2 weeks EPP	91.4	86.1	86.5	0.0	43.7
52	Tough + Atrazine + COC*	.5+.1125+1 pt	Postemergence	0.0	95.8	98.2	0.0	43.7
53	Surpass 100 5SC + Atrazine	3.25+1.5	Preemergence	96.6	94.1	86.2	*	43.3
54	NAF-72 + Dual	.171+2.0	Postemergence	81.0	68.0	59.1	0.0	42.8
55	Tough + Atrazine + COC	.75+.16875+1 pt	Postemergence	0.0	96.1	97.4	0.0	40.6
56	CGA248757 + COC + Dual II	.0045+2 qt+2.25	Postemergence	11.1	58.6	40.5	0.0	40.3
57	Sencor DF + 2,4-D LVE4	.094+.17	Postemergence	46.5	53.1	44.7	0.0	37.7
58	Exceed + Buctril + Dual + X-77	.018+.250+2.25+.25%	Postemergence	0.0	61.0	46.4	0.0	36.9
59	NAF-72 + Dual	.171+2.0	Preplant	86.8	77.7	86.1	*	36.4
60	Dual + Banvel	2.484+.5015	Preemergence	100.0	100.0	96.4	*	35.1
61	Dual	1.5	Preemergence	0.0	0.0	0.0	*	34.8
62	NAF-72 + Dual	.214+2.0	Preplant	69.4	39.4	59.9	0.0	32.7
63	Frontier	0.757	Preemergence	40.2	26.3	36.8	*	32.6
64	CGA248757 + COC + Dual II	.0027+2 qt+2.25	Postemergence	0.0	69.2	31.1	0.0	29.9
65	Check			0.0	0.0	0.0	0.0	29.2
	LSD 0.05 =			67.0	39.0	44.0	-	27.0

* Statistical analysis of Johnson grass control was not useful for this treatment

** COC = Crop oil concentrate

EFFECTS OF FALL-APPLIED POSTEMERGENCE TREATMENTS FOR BINDWEED CONTROL IN GROWING WHEAT

by
Randall Currie and Curtis Thompson

SUMMARY

All treatments controlled some bindweed. Because of poor potential for wheat yield, the level of bindweed control had little effect on yield. BAS-514 alone or tank mixed with Banvel or 2,4-D provided outstanding bindweed control 9 months after treatment.

INTRODUCTION

Applications of control treatments to healthy, actively growing bindweed 1 full year prior to wheat planting, followed by timely tillage and / or herbicide treatments (every 4-6 weeks) to control seedling bindweed, can constitute a very effective strategy. In many circumstances, however, a poorer rescue choice is thrust on a producer in August or September prior to planting wheat. Even though bindweed can be controlled during those months, it has utilized essential stored soil water, thus reducing potential for wheat yield.

Further, strong cattle prices often encourage early wheat planting to maximize forage production. Banvel at 0.25 lb ai / a is labeled for bindweed control in growing wheat in the fall for rescue situations. Bindweed often is found on fields with poor soils and low production potential. Producers often are reluctant to invest money in these fields and concentrate on more productive fields. Therefore, the objectives of this research were to evaluate fall rescue treatments in growing wheat on poor soils with low fertility.

PROCEDURES

At one location in 92-93 and two locations in 93-94, minimal fallow tillage was performed by the producer prior to planting. No fertilizers were applied. Wheat was planted, and herbicide treatments were applied as described in Table 1. **Many of the treatments applied are not labeled (Table 2). The reader is advised that it is a violation of federal law to use a product inconsistent with its label. Because of the complexity of herbicide labels and the constant flux in their content, the producer is advised to read all label instructions for a herbicide prior to each use.**

RESULTS AND DISCUSSION

Overall, wheat yields were poor. No treatment overcame the handicap imposed by poor soil water management prior to planting. Although wheat was planted in a wheat-fallow rotation, little water was stored during the fallow period, and results might be more appropriately thought of as typical of continuous wheat production. Whereas results were variable from location to location, all treatments controlled some bindweed in the spring following application, averaged over locations. Because of the poor performance of the wheat, it was difficult to show yield differences between treatments. For example; 0.5 lb / a of Banvel alone injured wheat in one of three locations. Banvel used at these rates often produces severe injury. In these studies, the trade-off of crop injury for increased weed control associated with increasing rate of herbicide could not be measured. However, the increase in control associated with increasing rate of dicamba was well defined by the equation % bindweed control = 4.4 + 83.6 (pints of Banvel) (r-square 0.99). Further work will be necessary to define the relationship of wheat yield, wheat injury, and bindweed control. All treatments containing BAS-514 controlled 85 to 100% of the bindweed. But as seen with other treatments, bindweed control did not result in increased wheat yield. This indicates that, in a wheat-fallow system, bindweed should be controlled in the fall after wheat harvest to prevent moisture and nutrient utilization by bindweed during the fallow year. We anticipate that BAS-514 will soon be labeled for use.

Table 1. Crop and application information for small bindweed test, Garden City, KS,1992-93.

Crop Information		
	Location 1, 92-93	**Locations 2 & 3, 93-94**
Crop Name:	Wheat	Wheat
Variety:	TAM 107	TAM 107
Planting Date:	8-31-92	9-9-93
Planting Method:	Great Plains Drill	Great Plains Drill
Rate, Unit:	60 lb / a	60 lb / a
Depth, Unit:	1.5 in.	1.5 in.
Row Spacing, Unit:10”	10 in.	
Soil Temperature, Unit:	65° F	70° F
Soil Moisture:	Good	Dry
Application Information		
Application Date:9-25-92	10-6-93	
Application Method:	Tractor shielded sprayer	Windshield sprayer
Application Timing:	Wheat, 3-leaf stage	Wheat, 3-leaf stage
Air Temp., Unit:	65 °F	90 °F
Soil Temp., Unit:	59 ° F	72 °F
Soil Moisture:	Dry	Dry surface
Application Equipment Information		
Appl. Equipment:	Tractor shielded sprayer	Windshield sprayer
Pressure, Unit:	30 lb psi	30 lb psi
Nozzle Type:	XR FF	XR FF
Nozzle Size:	8004	8004
Nozzle Spacing, Unit:	20 in.	20 in.
Boom Length, Unit:	10 ft	10 ft
Boom Height, Unit:	19 in.	18 in.
Ground Speed, Unit:	4 mph	3.3 mph
Carrier:	H_20	H_20
Spray Volume, Unit:	16.7 GPA	16.7 GPA
Propellant:	CO_2	CO_{2-}

Table 2. 1992-94 Bindweed control and wheat response to fall applied Banvel, 2,4-D and Quinclorac, Garden City.

Trt #	Treatment	Rate lbs ai/a	Location 1		Location 2		Location 3		Avg	
			Control %	Yield bu/a	Control %	Yield bu/a	Control %	Yield bu/a	Control %	Yield bu/a
1.	Check	0	0	10.3	0	14.0	0	8.5	0	10.9
2.	Banvel	0.125*	21.3	16.2a	53.7	17.1π	18.69	7.0	31.2	13.4
3.	Banvel	0.250*	40.7	12.6	23.3	14.9	68.5	5.2	44.2	10.9
4.	Banvel	0.375	74.6	11.3	58.1	13.4	80.1	3.9	70.9	9.5
5.	Banvel	0.500	76.3	12.8	81.6	7.3	96.1	2.7	84.7	7.9
6.	Banvel+2,4-D	0.125 + 0.250*	20.7	14.3	63.1	9.8	64.4	4.9	49.4	9.6
7.	Banvel+2,4-D	0.250 + 0.250*	63.6	17.8a	85.3	10.0	97.4	4.4	82.1	10.7
8.	2,4-D	0.500	31.0	13.6	44.8	10.8	69.2	6.9	48.3	10.4
9.	BAS 514	0.250	85.7	12.7	87.8	8.2	99.5	4.2	91.0	8.4
10.	BAS 514	0.500	89.6	9.2	100.0	9.3	100.0	5.5	96.5	8.0
11.	BAS 514+Banvel	0.250+0.125	95.5	13.7	98.2	12.2	100.0	6.2	97.9	10.7
12.	BAS 514+Banvel	0.250+0.250	91.1	16.0a	100.0	7.7-	100.0	5.5	97.0	9.7
	LSD (.05) =	35.8	5.8	64.0	7.6	29.6	4.3	20.9	3.9	

* Labled treatments for wheat in the fall. In the fall, Banvel can be applied to wheat that is at 3-leaf stage or larger.

HIGH-FREQUENCY, LOW PRESSURE IN-CANOPY SPRINKLER IRRIGATION

by

Marco Vela-Reyes[1], Dennis Tomsicek, and William Spurgeon[2]

ABSTRACT

A 2-year study was initiated in 1993 to examine degradation of reservoir tillage (Dammer-Diker), irrigation frequency, and performance of various in-canopy application modes. Field slope ranged from 0 to 6% (average = 2.6%) for a deep silt loam soil. The 2 years of data show that implanted reservoirs had nearly no storage volume left in the nozzle row by early August for the concentrated application modes of bubble and double-ended sock. Nozzles spaced 5 and 10 ft and operated in the flat-spray mode helped to retain 35% of the initial storage volume of the reservoirs, in the nozzle row, by the end of August. Corn yield was generally lower for the treatments where storage volume was reduced.

INTRODUCTION

LPIC (Low Pressure In-Canopy) irrigation is gaining popularity in the Central High Plains. This irrigation method reduces evaporation loss and energy cost. LPIC may increase application efficiency, but runoff can be a significant problem. When field slope begins to exceed 1-2%, even moderate irrigation amounts (0.75 to 1.0 in.) can cause runoff. Research is being conducted to evaluate the performance of LPIC for various application modes in conjunction with reservoir tillage on field slopes greater than 1%.

The study was initiated to 1)determine the combination of application mode and irrigation frequency that maximizes corn yield for moderate field slopes and 2)evaluate the degradation of implanted reservoirs through the season.

PROCEDURES

Corn (Pioneer 3162) was planted in the first week of May in circular rows to allow nozzles to track down the center of 30-in. rows. The rows were aligned in the same direction as the field slope. Borders were installed between each block of treatments perpendicular to the corn rows (and thus field slope) to allow runoff water to exit the study area.

The study was conducted with field slopes ranging from 0 to 6% and averaging 2.6%. Reservoir tillage (ripping and pitting from a dammer-diker) was installed in all plots on June 24 and 25 in 1993 and 1994, respectively, to help minimize runoff from both rainfall and irrigation.

Nozzles were approximately 2 ft above the ground surface. The four application mode treatments were bubble, sock, flat-spray mode with nozzles spaced 5 ft, and flat-spray mode with nozzles spaced 10 ft. The bubble mode concentrates the water into a small area directly beneath the nozzle (approximately 1.7 ft in diameter). The sock mode also concentrates the water directly beneath the nozzle, with the difference that it delivers water directly to the ground surface by dragging a double-ended sock. The flat spray modes spread the water out over a greater area. Wetted diameters were approximately 20 and 28 ft for the 5- and 10-ft spacings, respectively. The diameter was influenced by the crop, whose interference caused a narrower pattern perpendicular to the rows.

Daily irrigation amounts were 0.27 in., and 3-day amounts were 0.80 in. These amounts were based on a simulated system capacity of 5 gpm/a. This capacity is less than the average peak water use rate of 6.6 gpm/a for the region.

The reduced capacity was used to limit daily application amounts. Yield loss could occur with this reduced capacity in high water-use years.

Blanket irrigations were applied on June 16 (0.75 in.) and June 26, 1993, (0.50 in.) in the 5-ft flat-spray mode. The first irrigation was applied to keep depletion down until the application mode treatments were applied. The second was applied after the reservoirs were installed to help consolidate the air spaces between clods and form more stable reservoirs. Application mode treatments began on July 3.

Blanket irrigations (0.50 in.) were applied with the flay spray mode on June 18 and 20, 1994. This was to keep the depletion down until treatments were applied. Two separate irrigations totaling 0.70 in. were applied to help stabilize the reservoirs after they were installed. Application treatments began on June 29.

The amount of water applied was based on calculated evapotranspiration (ET or estimated crop water use), which was accumulated daily in a water budget. Irrigation and rainfall were subtracted from the accumulated ET (if the daily balance was negative, it was reset to zero). Irrigation began as soon as the calculated depletion exceeded the appropriate irrigation amount. Soil water measurements were taken weekly at 1-ft increments to a depth of 5 ft for each plot.

Implanted reservoir volume was determined by placing plastic in the pits and measuring the amount of water needed to fill the pits. The volume of four pits in each of four rows was measured. Therefore, measurements from two nozzle rows (average of eight pits) and two nonnozzle rows, for the nozzles spaced 5 ft, were used to determine pit volume. Volume measurements were taken on July 2, July 20, August 9, and August 30 in 1993. Measurements in 1994 were taken June 28, July 19, August 8, and August 26.

Forty feet of row were hand harvested from each plot. The samples were taken from the center of each plot. A second sample was taken from the rows halfway between nozzles in the 10-ft flat spray plots. Yields were adjusted to 15.5% moisture and are reported in bu / a.

RESULTS AND DISCUSSION

The cumulative percent reduction in reservoir volume through the irrigation season is shown in Table 1. Reservoir volume in the nozzle row, for sock and bubble modes, was reduced to nearly zero by early August regardless of irrigation frequency. This reduction was due to the combination of field slope (average 2.6%) and the high application rate that both application modes produce. The flat spray application modes resulted in approximately 65% volume reduction in the nozzle row by the end of August.

Peak application rates for the double-ended sock were the highest and were difficult to estimate. Application rates were approximately 94 in. / hr for the bubble mode (assumed wetted diameter of 20 in.) and 7.8 in. / hr for the 5-ft flat-spray mode (assumed wetted diameter of 20 ft). Peak application rates dropped to approximately 5.6 in. / hr for the 10-ft flat-spray mode (assumed wetted diameter of 28 ft). All these intensities greatly exceed the long-term soil infiltration rate, which ranges from 0.3 to 0.5 in. / hr.

Reservoir pits averaged 2 ft apart down the furrow. Average initial volume was 1.3 gal / pit. Pit volume averaged over the representative area, one row (2.5 ft) and distance between pits (2 ft), results in a storage depth of 0.42 in. This is the amount of water that could have been stored by the pits initially during rainfall or flat-spray events. The concentrated application modes of bubble or sock reduced the available storage by half. Only 0.21 in. could have been stored initially during an irrigation, because half of the pits did not receive any irrigation water. Because soil infiltration rates are high initially, amounts larger than the calculated storage depths can be applied.

Irrigation and rainfall amounts for the various time periods of the season are shown in Table 2. Irrigation was slightly greater for the daily irrigation as compared to the 3-day irrigation. The seasonal, cumulative, percent reduction in volume of nonnozzle rows for the sock treatment is an indicator of the rain's effect. Cumulative seasonal reduction averaged 40% over both frequency treatments during the 2 years.

Because these rows did not receive irrigation water, this is a baseline value of reservoir degradation degradation caused by rainfall. Volume reduction in the row next to the nozzlewas slightly higher for the bubble mode (55 to 64%), because alignment problems caused the bubble pattern to overlap occasionally into the adjacent row.

Table 1. Percent cumulative reservoir volume reduction for the 1993 and 1994 seasons, Garden City, KS. NZ=nozzle row, NX=row next to the nozzle, FR=row halfway between 10 ft nozzles. The 10 ft average is a weighted average. The last column is the average cumulative reduction for both irrigation frequencies.

	Daily Irrigation				3 Day-Irrigation				
Treatment	NZ	NX	FR	Avg	NZ	NX	FR	Avg	Avg
<u>1993</u>									
Bubble									
July 2-20	**68**	23	--	46	**83**	36	--	60	53
July 2-Aug 9	**97**	44	--	71	**94**	56	--	75	73
July 2-Aug 30	**100**	60	--	80	**100**	67	--	84	82
Sock									
July 2-20	**72**	26	--	49	**75**	33	--	54	52
July 2-Aug 9	**94**	37	--	66	**94**	42	--	68	67
July 2-Aug 30	**95**	48	--	72	**97**	51	--	74	73
5-ft Flat									
July 2-20	**32**	16	--	24	**33**	38	--	36	30
July 2-Aug 9	**45**	36	--	41	**57**	55	--	56	49
July 2-Aug 30	**66**	52	--	59	**65**	67	--	66	63
10-ft Flat									
July 2-20	**23**	31	20	26	**45**	35	34	37	32
July 2-Aug 9	**52**	45	37	45	**57**	55	59	57	51
<u>1994</u>									
Bubble									
June 28-July 19	86	38	--	62	95	46	--	71	66
June 28-Aug 8	95	47	--	71	97	64	--	81	76
June 28-Aug 26	97	49	--	73	98	67	--	82	78
Sock									
June 28-July 19	81	21	--	51	86	25	--	56	53
June 28-Aug 8	95	29	--	62	97	37	--	67	65
June 28-Aug 26	95	34	--	64	97	43	--	70	67
5-ft Flat									
June 28-July 19	40	24	--	32	54	45	--	49	41
June 28-Aug 8	53	33	--	43	64	48	--	56	50
June 28-Aug 26	59	37	--	48	71	53	--	62	55
10-ft Flat									
June 28-July 19	44	36	32	38	54	38	41	44	41
June 28-Aug 8	64	52	37	51	75	65	54	65	58

Table 2. Rainfall and irrigation amounts, inches, for the 1993 and 1994 seasons, Garden City, KS.

Time Period	Rain	Daily Irr.	3-Day Irr.	Daily Total	3-Day Total
1993					
May 17-June 23	2.89	0.75	0.75	3.64	3.64
June 24-July 1	1.68	0.50	0.50	2.18	2.18
July 2-July 19	2.18	4.34	3.90	6.52	6.08
July 20-Aug 8	1.00	4.59	4.00	5.59	5.00
August 9-Aug 29	1.70	4.59	4.80	6.29	6.50
August 30-Sept 29	3.10	0.00	0.00	3.10	3.10
Total for Season	12.55	14.77	13.95	27.32	26.50
1994					
May 13- May 30	0.73	0.00	0.00	0.73	0.73
May 31-June 27	3.18	1.70	1.70	4.88	4.88
June 28 - July 18	2.98	4.86	4.80	7.84	7.78
July 19 - Aug 7	1.88	4.86	4.00	6.74	5.88
Aug 8 - Aug 25	1.25	4.32	4.80	5.57	6.05
Aug 26 -Sept 25	2.57	1.35	0.80	3.92	3.37
Total for Season	12.59	17.09	16.10	29.68	28.69

Table 3 shows corn yield and average field slope for the different treatments. Yield was generally greatest for the flat-spray treatments, as expected. The 3-day / bubble mode treatment combination tended to yield less than most treatments. This was due partly to reservoir volume degradation and subsequent runoff from plots. Daily irrigations with the bubble mode performed well because the applied water was either infiltrated or stored, so runoff was minimized.

Yield was lowest for daily irrigations with socks. These irrigations quickly eroded the small pits and formed a channel because of constant contact of the sock with wet soil. Double-ended socks are designed to work for large dikes (furrow dams). This treatment was included to evaluate the effectiveness of socks with the implanted reservoirs.

CONCLUSION

Daily irrigations with double-ended socks and implanted reservoirs performed poorly. The effect of field slope was difficult to evaluate with the limited data. As expected, yield was generally greatest when field slope was small and either the 5-ft or 10-ft flat spray mode was used.

Implanted reservoir volume was reduced to nearly zero in the nozzle row by early August for sock and bubble mode treatments regardless of irrigation frequency. Reservoir volume in the nozzle row for flat spray modes was reduced 65% by the end of August. Reservoir volume was reduced 40% in nonnozzle rows of the sock treatment, indicating the degradation effect of rainfall during the season.

Table 3. Average corn yield and field slope for frequency and application mode treatments.

Application Mode Treatment	Daily Irrigation		3-Day Irrigation		Average	
	Yield bu/a	Slope %	Yield bu/a	Slope %	Yield bu/a	Slope %
1993						
Bubble	173	1.9	152	3.0	163	2.5
Sock	146	2.5	163	2.8	155	2.7
5-ft Flat	176	2.2	166	2.8	171	2.5
10-ft Flat	167	2.5	172	2.8	170	2.7
Average	166	2.3	163	2.9	165	2.6
1994						
Bubble	154	2.5	134	3.0	144	2.8
Sock	148	2.2	124	2.8	136	2.5
5-ft Flat	162	2.5	180	2.8	171	2.7
10-ft Flat	174	2.2	182	2.6	178	2.4
Average	160	2.4	155	2.8	157	2.6
2 Yr Average						
Bubble	164	2.2	143	3.0	153	2.6
Sock	147	2.4	144	2.8	145	2.6
5-ft Flat	169	2.4	173	2.8	171	2.6
10-ft Flat	171	2.4	177	2.7	174	2.5
Average	163	2.3	159	2.8	161	2.6

[1] Marco Vela-Reyes, Graduate Student, Kansas State University, Manhattan.
[2] William Spurgeon is currently Director of Research and Development for Teeter Irrigation, Ulysses, KS.

REVITALIZING OLD ALFALFA STANDS WITH INTERSEEDING

by

Curtis Thompson, William Rooney[1], James Shroyer[2], Robert Bowden[3], Bruce Millershaski[4], Alan Imler[5], and Don Yauk[6]

SUMMARY

Interseeding was not a viable or consistent method to thicken up an aging alfalfa stand. Alfalfa seedlings that emerged were counted 2 to 3 weeks after interseeding. Seedling mortality was very high 6 to 11 weeks after interseeding. Autotoxicity from the old alfalfa stand and competition from broadleaf and grassy weeds contributed to this high mortality. Apron seed treatment did not increase original seedling emergence nor did it increase the seedling survivability compared to seedlings established from nontreated seed. Surviving seedlings were stunted severely and did not contribute to forage production.

INTRODUCTION

Thickening an old alfalfa stand with interseeding appears to be a captivating process to many alfalfa producers. The interest in this phenomenon has come and gone several times over the years. However, success with interseeding into old alfalfa stands has been disappointing. The lack of success has been attributed to several factors, such as competition, seeding diseases, and allelopathy or autotoxicity. Several studies have documented evidence of autotoxicity in alfalfa. Autotoxicity has been defined as release of a chemical substance by a plant species that inhibits or delays germination and/or growth of the same plant species. A water soluble compound, medicarpin, has been extracted from alfalfa and has been shown to reduce alfalfa germination and seedling growth.

Recent publicity of interseeding alfalfa into old alfalfa stands occurred in a popular farm magazine. Methods in the article discredited autotoxicity and proceeded to describe a method utilizing a fungicide seed treatment that would eliminate or reduce the affects of seedling diseases such as Pythium and Phytopthora, thus, increasing the success of the interseeding method. The objectives of this study were to: 1. examine the feasibility of interseeding as a method to revitalize an old alfalfa stand; 2. show the affect of Apron seed treatment on the effectiveness of the interseeding method; and 3. determine the effect of the established alfalfa stand on seedling establishment.

PROCEDURES

Six on-farm sites with declining alfalfa stands, three in SW and three in NE Kansas, were selected to test the effectiveness of revitalizing an old stand with interseeding. Apron-treated and untreated seed were planted during early April. Seedling establishment was documented for each location. Treatments in each experiment were arranged as a randomized complete block and replicated four times.

Southwest Kansas experiments compared interseeding with two seed treatments, Apron 1X (treated) and 0X (untreated). Studies were conducted on irrigation in Gray and Haskell Counties and on dryland in Clark County. Studies were planted on April 8, 1994 in Clark and Gray Counties and on April 9 in Haskell County. A 4-ft “Turf Tuf” turfgrass drill with 2-in. row spacing was used to interseed 20 lb/a of alfalfa seed approximately 0.25 in. deep. Alfalfa regrowth was less than 4 in. tall at the time of interseeding. Plot dimensions were 8 by 100 ft. All sites received sufficient precipitation for seedling emergence. Initial alfalfa plant stand (crowns/10.7 ft^2) and seedling emergence (seedlings/1.5 ft^2) were determined from 5 locations within each plot on April 20 (Gray), May 2 (Haskell), and May 10 (Clark). Second seedling counts were made in the identical areas within each plot on June 23 and 24 in Gray and Haskell Counties, respectively.

Northeast Kansas experiments compared interseeding with three seed treatments, Apron 2X (not labeled), Apron 1X, and 0X. Alfalfa at 12 lb/a was planted 0.25 in. deep with a no-till Haybuster drill with 7-in. row spacing at three nonirrigated locations in Riley County on April 1, 1994. Sufficient precipitation was received at all sites for seedling emergence. Early growth on established alfalfa was less than 6 in. at planting. Initial alfalfa stand and seedling emergence were determined from 2 ft^2 and 1 ft^2 areas, respectively, at five sample areas in each plot on April 22 at all NE locations. A second seedling count was taken from the same areas within each plot on May 13. A final seedling count and stand density were taken on July 13 at one of the three locations.

RESULTS AND DISCUSSION

In all six studies, a sufficient number of seedlings emerged (7 to 19 seedlings/ft^2) to provide the potential for encouraging results, assuming that the emerged seedlings established into viable and contributing alfalfa plants (Tables 1 and 2). The Haskell County site had the fewest seedlings emerge, because of the heavy densities of winter annual grass and broadleaf weeds (Table 1).

The Apron seed treatment at the 1X rate in all six studies or the 2X rate in the three NE studies did not affect seedling emergence compared to emergence from untreated seed (Table 1 and 2). Thus, the use of fungicide seed treatments, regardless of the rate, did not contribute to the success of the interseeding method.

Mortality following the initial seedling emergence counts raises the greatest concerns about this interseeding method. Within the six studies, several natural factors contributed to the high mortality rate. Mortality of seedlings in the Clark County site was 100% because of drought following seedling emergence. This would always be a major risk with interseeding into nonirrigated alfalfa stands in western

Table 1. Effect of location and fungicide treatment levels on alfalfa stand count means in southwest Kansas field trials, 1994.

Location and Treatment	April/May † Existing Stand	April/May † Seedling Stand	June 23/24 Seedling Stand
	plants/ft2		
Haskell County	1.4	7.6	1.3
Gray County	1.0	19.3	4.2
Clark County	1.2	11.3	0
L.S.D. (P < .05)	.3	4.0	1.4
	plants/ft2		
1 X Apron	1.2	11.6	1.8
0 X (untreated)	1.2	13.9	1.9
L.S.D. (P < .05)	n.s.	n.s.	n.s.

†Dates counts taken. Haskell County, May 2; Gray County, April 20; Clark County, May 10.

Table 2. Effect of location and fungicide treatment levels on alfalfa stand count means in northeast Kansas field trials, 1994.

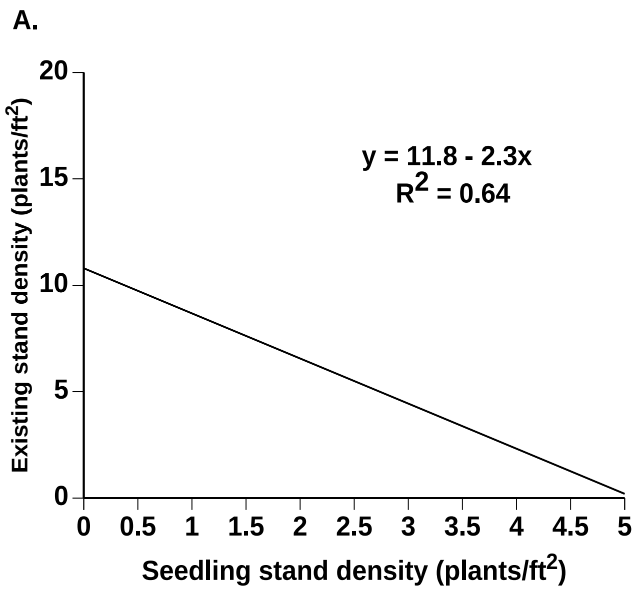
Location and Treatment	April 22 Existing Stand	April 22 Seedling Stand	May 13 Seedling Stand
	plants/ft2		
Central Riley	2.1	15.0	8.2
Western Riley	1.7	14.1	10.3
Northern Riley	2.3	15.9	6.5
L.S.D. (P < .05)	.4	n.s.	1.3
	plants/ft2		
2 X Apron	2.1	15.5	8.9
1 X Apron	2.0	14.8	8.3
0 X (untreated)	2.1	14.9	7.9
L.S.D. (p < .05)	n.s.	n.s.	n.s.

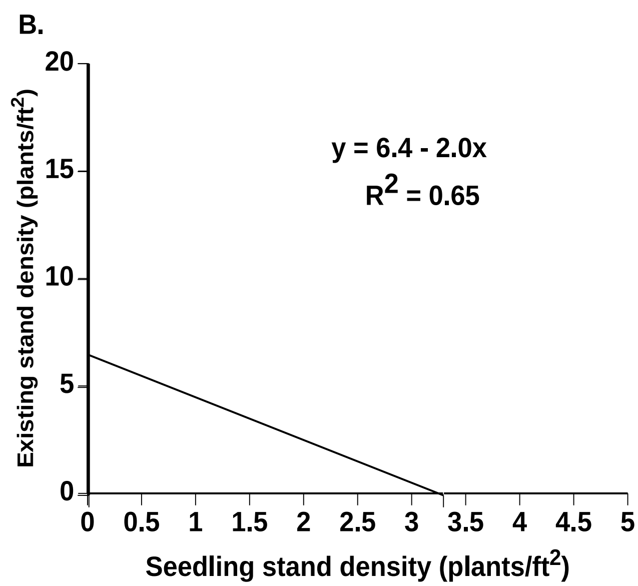
Kansas. Haskell and Gray Counties had 83 and 78% mortality approximately 11 weeks after planting. Competition for light, nutrients, and moisture from the weeds and the old alfalfa plants and autotoxicity from the old alfalfa plants contributed to this high mortality rate. Seedlings remaining at the Gray and Haskell County sites 11 weeks after planting were stunted and were not contributing to forage yield. The seedling numbers were not sufficient to revitalize the alfalfa stand and likely would decline to even lower numbers. Alfalfa stands at both irrigated sites, Gray and Haskell, were destroyed following the July alfalfa harvest.

Seedling mortality at the NE sites ranged from 30 to 59% 6 weeks after planting (Table 2). The differential seedling mortality from the April count to the May count was strongly correlated to the density of old alfalfa plants. As old alfalfa plant numbers increased, the seedling mortality increased. Figure 1 shows the relationship between seedling stand density and existing stand density 6 and 14 weeks after planting at the central Riley County location in NE Kansas. These data show the negative effect from the existing stand and also show that seedling mortality continued to increase from May 13 to July 13.

The results of these six studies suggest that interseeding into a declining or old alfalfa stand is unsuccessful for a variety of reasons. The risk of failure is far too great, when one considers the cost of alfalfa seed and interseeding. The benefits of rotating from alfalfa to another crop to break disease and weed cycles should not be overlooked. The interseeding method does not have rotational benefits. Using the interseeding method to revitalize an old alfalfa stand was not successful or agronomically sound.

Figure 1. Seedling alfalfa stand regressed by existing alfalfa stand density for the central Riley County location. (A) Seedling densities determined on May 13, 1994. (B) Seedling densities determined on July 13, 1994.





[1] William Rooney, Department of Agronomy, Kansas State University, Manhattan.
[2] James Shroyer, Extension Agronomist, Kansas State University, Manhattan.
[3] Robert Bowden, Extension Plant Pathologist, Kansas State University, Manhattan.
[4] Bruce Millershaski, Gray County, Agricultural Agent, Cimarron.
[5] Alan Imler, Haskell County, Agricultural Agent, Sublette.
[6] Dan Yauk, Clark County, Agricultural Agent, Ashland.

PEARL MILLET GRAIN HYBRIDS

by
Merle Witt and William Stegmeier[1]

Pearl millet as a short-statured grain crop has made considerable progress. Experimental hybrids evaluated under dryland conditions were planted on June 8, 1994 and compared with a white-seeded grain sorghum hybrid (Funks 550). Resulting data are given in Table 1.

Several of the dwarfed pearl millets yielded more grain than did the sorghum hybrid. Additional stalk strength is desirable for the pearl millet hybrids.

Table 1. Performance of dwarf pearl millet hybrid in western Kansas, 1994.

			Grain		
Hybrid I.D.	Days to Bloom	% Lodging	Lbs / A	Test Wt.	G / 100 Seeds
Funks 550 Sorghum	59	16	5479	61	2.51
91-3517	60	45	4222	61	1.00
91-3525	61	41	5042	61	0.92
91-3559	63	42	4605	61	1.04
91-3567	64	40	5174	61	1.05
93-0011	60	61	4520	60	0.88
91-3629	65	33	5130	61	0.91
92-0080	65	35	5467	62	0.97
92-0422	65	50	4875	61	1.28
93-0016	60	51	4864	61	0.84
93-1131	64	49	4833	60	1.02
93-0047	62	23	5342	60	1.04
93-0050	63	37	4933	62	1.06
93-0053	61	46	5277	61	0.94
93-0057	63	34	5588	60	0.97
93-0059	61	44	4972	60	0.90
93-0065	62	57	4697	59	0.85
94-0126	62	74	4331	59	0.68
93-0068	63	53	4566	60	0.78
93-0078	64	35	5863	59	0.93
93-1417	65	35	5254	60	0.98
93-0120	64	50	5443	60	0.83
93-0127	62	61	4750	60	0.79
93-0132	61	66	4567	60	0.83
93-0138	62	37	4776	60	0.84
93-0139	67	23	5222	61	0.90
93-0143	64	29	5466	61	0.79
93-0150	63	44	4345	60	0.63
93-0153	65	68	4902	59	0.66
93-0172	67	27	5233	61	0.91
Test Av.	63	44	4991	60	0.96
LSD (5%)	2.4	21.7	918	1.2	0.12

[1] Alternative Crops Breeder / Agronomist, Agricultural Research Center, Hays.

SHORT-SEASON CORN POPULATIONS

by
Merle Witt

Early-season corn plots were established to evaluate the influence of stand levels of 40,000, 36,000, 32,000, and 28,000 plants per acre under full irrigation.

Pioneer 3751, a 98-day relative maturity hybrid, was seeded in replicated split-plot fashion on 4/23/93 and on 5/6/94. Counter insecticide was applied at 15 lbs/a each year at planting for rootworm control and Prowl/Bladex herbicide was applied at 1/1 lb/ai for weed control.

The two center rows of four-row plots were hand harvested in October. Resulting grain yields as bushels per acre are shown in Table 1.

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

	Grain Yields (Bu/Acre)		
Plants/Acre	1993	1994	2-yr. Av.
40,000	172	231	202
36,000	163	220	192
32,000	154	209	182
28,000	140	198	169
LSD (5%)	14	12	

SHORT-SEASON CORN PLANTING DATE

by
Merle Witt

The 1994 date-of-planting study for corn was located in a furrow-irrigated field. The corn hybrid, Pioneer 3751 (98 days to black layer) was planted on three dates. Plots of each date of planting consisted of four 30-inch rows 40 ft long. Seeds were placed 7 1/2 in. apart (27,878 seeds/a) within rows. The center two rows were harvested for grain yields on each of four replications.

Nitrogen fertilizer was applied at the rate of 150 lbs/a. Irrigations were made as necessary to maintain adequate moisture for all planting dates. Ramrod-Atrazine preemergence herbicide was applied to all date-of-planting plots within a day of planting. Buctril/Accent was applied later to each plot for additional weed control, as needed. Counter insecticide was applied at planting time for rootworm control.

Grain yields were adjusted to 15.5% moisture and calculated in bushels per acre. These and other plant growth responses are given in Table 1. Averages from the 3-year period, 1992-1994, are shown in Table 2.

Table 1. Short-season corn responses to three planting dates, Garden City, KS, 1994.

Date Planted	Plant Height	Ear Height	Ear Leaf Length	Ear # Rows	# Kernels per Row	Grain Bu/A	Grain Lb/Bu	Grain G/100
4-25	89	33	28	16.9	38.4	195	60.8	28.8
5-25	107	44	32	16.7	35.8	183	59.5	27.8
6-25	105	42	32	17.3	31.2	123	53.0	27.0
LSD (.0 5)						15		

Table 2. Three-year average (1992-94) responses of short season corn to three planting dates, Garden City, KS.

Date Planted	Plant Height	Ear Height	Ear Leaf Length	Ear # Rows	# Kernels per Row	Grain Bu/A	Grain Lb/Bu	Grain G/100
4-25	84	33	29	16.6	35.5	163	58.5	28.3
5-25	102	42	32	16.6	36.6	173	57.5	28.3
6-25	105	42	34	16.9	30.5	116	52.9	26.3
LSD (.0 5)	2.5	2.3	0.4	n.s.	1.3	8	0.6	0.4

CROP VARIETY TESTS – HIGH YIELDERS 1995

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. 1993-1994)	Bu/A	Days to Silk
Dekalb DK 715	228	73
Wilson 1910	223	73
Ohlde 510	221	74
Deltapine 4662	220	74
Mycogen 8240	219	75
Deltapine G-4673B	216	73
Pioneer 3245	216	74
Mycogen Oro142	216	76
Wilson 2330	215	77
Triumph 2010	214	74
Cargill 8327	214	75

High 10 (3-yr av. 1992-1994)	Bu/A	Days to Silk
Dekalb DK715	237	73
Deltapine 4662	232	74
Wilson 1910	231	73
Deltapine G-4673B	229	73
Wilson 2330	224	77
Pioneer 3245	224	74
Ohlde 300	224	76
Deltapine 4581	223	76
Ohlde 510	223	74
Coop 2345	223	74

TRIBUNE

High 10 (2-yr av.)	Bu/A	Days to Silk
Pioneer 3162	216	85
Pioneer 3346	213	86
Deltapine G-4673B	212	88
Deltapine 4581	211	91
Cargill 8327	208	89
Hyperformer HS 9843	207	89
Cargill 7697	205	85
Casterline CX1253	205	89
Cargill 7997	204	86
Horizon 7711	202	90

High 10 (3-yr av.)	Bu/A
Pioneer 3162	225
Deltapine 4581	219
Deltapine G-4673B	218
Cargill 7697	215
Cargill 7997	213
Crow's 667	212
Casterline CX1237	211
Casterline CX1253	208
Hyperformer HS9843	207
Casterline CX1222	206

SHORT-SEASON CORN HYBRIDS

GARDEN CITY

High 5 (2-yr av. 1993-1994)	Bu / A	Days to Silk
NC+ 4616	210	73
Deltapine 4450	208	74
Casterline CX1186	189	73
Dekalb DK512	185	71
Ohlde 104	179	73

GRAIN SORGHUM—DRYLAND

GARDEN CITY

High 10 (2-yr av 1993-1994)	Bu / A	Days to Bloom	High 10 (3-yr av 1992-94)	Bu / A	Days to Bloom
Hyperformer HSC Cherokee	86	73	Casterline SR 319E	64	69
Casterline SR 319E	85	69	Hyperformer HSC Cherokee	64	73
Northrup-King KS-714Y	83	72	Northrup-King KS-714Y	63	72
Cargill 727	81	75	Dekalb DK-41y	61	69
Hyperformer HY1320	80	76	Cargill 727	61	75
Dekalb DK-41y	78	69	Northrup-King KS506Y	60	65
ICI 5616	75	67	ICI 5616	60	67
Pioneer 8771	775	60	Pioneer 8771	60	60
Cargill 797	74	74	Cargill 797	59	74
Deltapine 1506	73	67	Deltapine 1506	58	67
Triumph TR55Y	73	68			

TRIBUNE

High 10 (2-yr av.)	Bu / A	Days to Bloom	High 10 (3-yr av.)	Bu / A
Dekalb DK-40Y	96	74	Pioneer 8699	90
Pioneer 8699	96	68	Deltapine 1506	87
Deltapine 1506	96	76	Casterline SR 315E	86
Casterline SR 315E	95	78	Cargill 607E	86
Pioneer 8771	93	67	Deltapine 1482	85
Deltapine 1482	92	74	Dekalb DK-40Y	84
Dekalb DK-38Y	90	71	Mycogen T-E Gage	83
Cargill 607E	89	73	Dekalb DK-38Y	81
Mycogen T-E Gage	89	73		
Mycogen T-E Hardy	86	75		

GRAIN SORGHUM—IRRIGATED

GARDEN CITY

High 10 (2-yr av. 1993-1994)	Bu / A	Days to Bloom
Hyperformer HY1320	164	72
Casterline SR324E	160	70
Triumph TR656	156	68
Dekalb DK-66	155	74
Wilson 535Y	154	66
ICI 5503	153	70
Deltapine 1506	153	67
Triumph TR459	153	66
Dekalb DK-54	152	71
Triumph TR826	151	73

High 10 (3-yr av. 1992-1994)	Bu / A	Days to Bloom
Casterline SR324E	158	70
Dekalb DK-66	153	74
Dekalb DK-56	150	71
ICI 5503	150	70
Agripro AP686	149	69
Dekalb DK-54	149	71
Hyperformer Cherokee	146	70
Wilson 535Y	145	66
TX2752 x TX430	144	71
Dekalb DK-48	143	69

TRIBUNE

High 10 (2-yr av.)	Bu / A	Days to Bloom
Wilson 513E	146	71
Mycogen 444E	144	76
Cargill 797	142	80
Deltapine 1506	140	68
Hyperformer HSC Cherokee	140	77
Pioneer 8310	140	76
Dekalb DK-58	137	80
Dekalb DK-51	136	78
Pioneer 8505	132	67
Cargill 837	132	72

High 5 (3-yr av.)	Bu / A
Cargill 837	132
Deltapine 1506	129
Pioneer 8505	127
Dekalb DK-48	122
Cargill 797	121
Mycogen 444E	121

OATS–IRRIGATED

GARDEN CITY

High 5 (3-yr av. 1992-1994)	Bu / A
Don	98
Premier	94
Armor	90
Bates	89
Larry	84
Ogle	84

ALFALFA

GARDEN CITY

High 5 (1994)	Tons / A
MBS PG19047 Exp	10.05
Casterline ProGro 424	10.05
Drussel Reward	10.02
Cal / West 1309 Exp	10.01
NC+ Jade	9.97

WHEAT—DRYLAND

GARDEN CITY

High 10 (2-yr av. 1993-1994)	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
Newton	49
Karl 92	49
AGSECO 7805	49
Agripro Ponderosa	49

High 10 (3-yr av. 1992-1994)	Bu / A
Ike	51
Arlin (white)	49
Yuma	48
AGSECO 7853	48
Newton	47
Arapahoe	47
Agripro Tomahawk	47
AGSECO 7805	47
TAM 107	46
TAM 200	46

TRIBUNE

High 10 (2-yr av.)	Bu / A
TAM 200	53
Vista	52
Jules	51
TAM 107	49
AGSECO 7805	49
Arapahoe	49
2163	49
Trio T13	48
Cimarron	48
Ike	48
Karl 92	48

High 10 (3-yr av. 1992-94)	Bu / A
TAM 200	48
AGSECO 7805	45
TAM 107	44
Cimarron	44
Agripro Tomahawk	43
AGSECO 7853	43
Arapahoe	43
Karl	43
Newton	43
2163	41

WHEAT—IRRIGATED

GARDEN CITY

High 10 (2-yr av. 1993-1994)	Bu / A	High 10 (3-yr av. 1992-1994)	Bu / A
Ike	76	Ike	79
AGSECO 7853	74	AGSECO 7853	73
Karl 92	73	Agripro Laredo	72
Agripro Laredo	70	2163	71
Arlin (white)	69	Cimarron	71
Karl	69	Agripro Tomahawk	70
Agripro Tomahawk	69	Karl	70
Agripro Longhorn	68	Arlin (white)	70
Agripro Ogallala	68	Agripro Longhorn	67
2163	68	Yuma	67

TRIBUNE

High 10 (2-yr av.)	Bu / A	High 10 (3-yr av.)	Bu / A
Agripro Laredo	79	TAM 200	86
Agripro Pecos	79	AGSECO 7846	85
Karl 92	79	Cimarron	85
Agripro Tomahawk	78	Ike	85
Ike	78	Agripro Laredo	84
AGESCO 7846	77	Agripro Pecos	82
Karl	76	Agripro Tomahawk	80
2163	75	2163	79
Cimarron	75	AGSECO 7853	78
TAM 200	75	TAM 107	78

SOYBEANS—IRRIGATED

GARDEN CITY

High 10 (2-yr av. 1993-1994)	Bu / A	Maturity Group	High 10 (3-yr av. 1992-1994)	Bu / A	Maturity Group
Ohlde 3431A	63.6	III	Deltapine DP3456	56.9	IV
Hyperformer HSC398	63.5	III	Dekalb CX458	55.2	IV
Golden Harvest H-1388	60.6	III	Ohlde 3272	51.9	III
Deltapine DP-3456	59.6	IV	Pioneer 9341	51.0	III
Sparks	57.6	IV	KS4390	50.9	IV
Agripro AP4510	57.4	IV	KS3494	50.0	III
KS3494 (K1164)	57.3	III	Ohlde 3750A	49.9	III
Edison	56.8	III	Flyer	48.6	IV
Pioneer 9393	56.3	III	Edison	48.1	III
K1235 Exp	56.2	IV	Williams 82	45.3	III
Dekalb CX458	56.0	IV			

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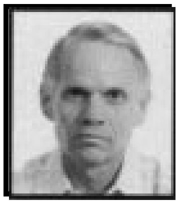
Wilson Hybrids, Inc.



Charles Norwood - Agronomist - Dryland Soil Management. Charles has M.S. and Ph.D. degrees from Oklahoma State University. He joined the staff in 1972. Charles' primary research responsibilities include dryland soil and crop management, with emphasis on reduced and no-tillage cropping systems.

Phil Sloderbeck - Extension Entomologist. Phil received his M.S. from Purdue University and his Ph.D. from the University of Kentucky. He joined the staff in 1981. His extension emphasis is on insect pests of field crops.

Lisa Wildman - Research Associate- Corn Entomology. Lisa received her B.S. from Tarleton State University in Agriculture and her M.S. from Texas A&M University in Plant Breeding. Lisa joined the staff in 1991. Her research responsibilities involve corn insect pest management.

Carol Young - Extension Home Economist and Program Specialist. Carol received her M.Ed. from Wichita State University in educational administration. She joined the staff in 1982 with Extension agent experience in Edwards, Sumner, and Osage counties. Carol promotes programs that benefit families and communities; teaches planning, leadership, and citizen involvement skills.

Alan Schlegel - Agronomist-in-Charge, Tribune. Alan received his M.S. and Ph.D. degrees at Purdue University. He joined the staff in 1986. His research involves fertilizer and water management in reduced tillage systems.

Curtis Thompson - Extension Agronomist. Curtis received his M.S. from North Dakota State University and his Ph.D from the University of Idaho. He joined the staff in 1993. His extension responsibilities include all aspects of soils and field crop production.

Merle Witt - Agronomist - Crop Specialist. Merle received his M.S. at Kansas State University and joined the staff in 1969. He received his Ph.D. from the University of Nebraska in 1981. Merle's research has included varietal and cultural testing of established crops and potential crops for Southwest Kansas.

Agricultural Experiment Station, Kansas State University, Manhattan 66506-4008

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