Oklahoma Panhandle
Research & Extension Center

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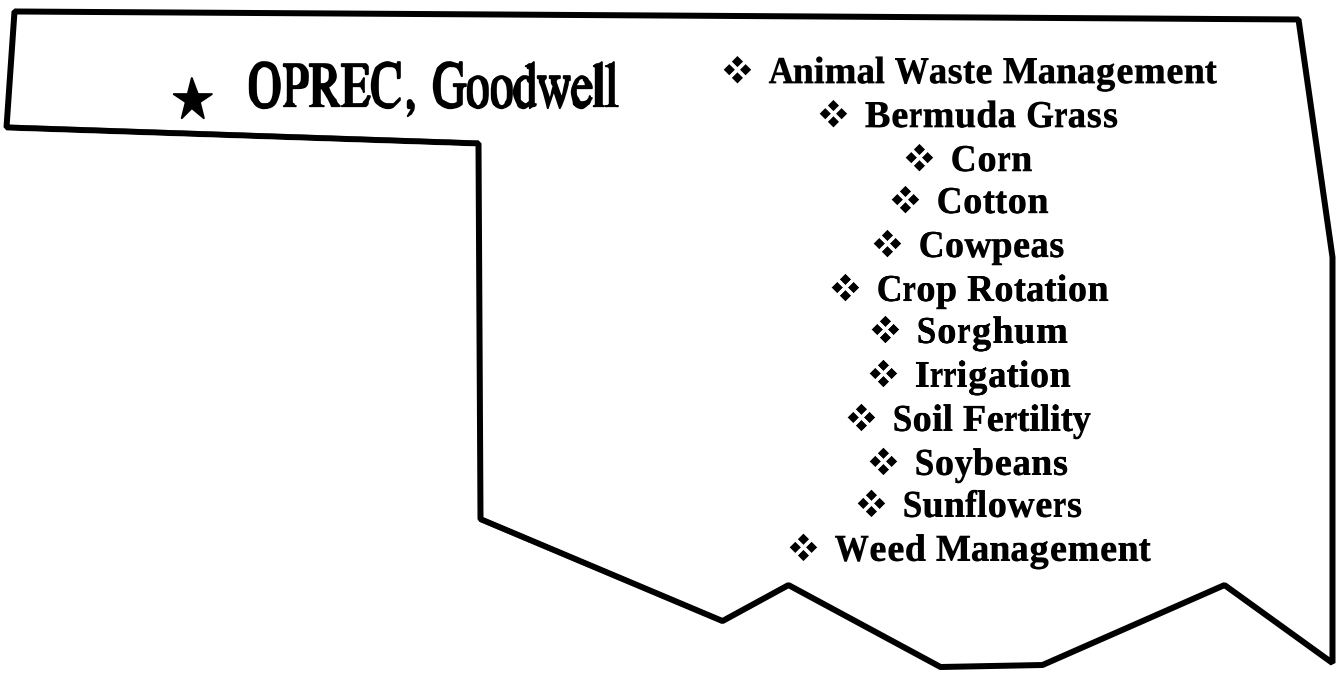

2004 Research Highlights

Division of Agricultural Sciences and Natural Resources
Oklahoma Panhandle Research and Extension Center
Oklahoma State University
Department of Animal Science
Department of Entomology and Plant Pathology
Department of Plant and Soil Sciences
Department of Biosystems and Agricultural Engineering
USDA – ARS

THE OKLAHOMA PANHANDLE RESEARCH AND EXTENSION CENTER
Division of Agricultural Sciences and Natural Resources
Department of Plant and Soil Sciences
Oklahoma Agricultural Experiment Station
Oklahoma Cooperative Extension Service
Oklahoma State University

The Division of Agricultural Sciences and Natural Resources (DASNR) at Oklahoma State University has had a long history of working cooperatively with Oklahoma Panhandle State University (OPSU). A Memorandum of Agreement in July 1994 strengthened this cooperation and outlined the major missions of each entity. OPSU's teaching and the research and extension provided by OSU through the Oklahoma Panhandle Research and Extension Center (OPREC) constitutes a true partnership in solving agriculture problems in the Oklahoma Panhandle. DASNR plans to continue this relationship well into the future.

The Department of Plant and Soil Sciences with support from the Oklahoma Agriculture Experiment Station has invested significantly in buildings, parking lot, tractors, farm machinery, and irrigation wells in recent years. The department has staffed OPREC with people like Curtis Bensch, Jose Sanchez, Rick Kochenower, Chuck Strasia (Emeritus) and Lawrence Bohl who are addressing critical production issues that are facing Oklahoma producers. The hiring of excellent support staff like Donna George, Matt LaMar, Craig Chestnut and part-time student laborers also plays an important role in making OPREC what it is today.

DASNR faculty from Plant and Soil Sciences, and many other departments use OPREC to conduct research and extension efforts in the panhandle area. Several multi-state and regional research efforts provide critical data important to agriculture. Commodity associations and agriculture industries use the Center hold meetings and other activities. Oklahoma agriculture is being challenged to maintain competitive in the market place. Farm prices, competition for water, pests, sensitivity to environmental stewardship and animal waste issues are among some of the complex factors that are affecting agriculture in Oklahoma. Research and extension programs at OPREC are address management practices to achieve maximum efficiency in crop production, judicious use of animal wastes, as well as identification of potential new crops adapted to the area. Variety development of both hard red and hard white, winter wheat and performance evaluations of bermudagrass, buffalograss, alfalfa, soybean, wheat, grain sorghum, cotton, corn and canola are being conducted. Conservation tillage practices, irrigation management, efficient use of fertilizer and pesticides, and sustainable crop production is also being studied.

While progress has been made in development of research and education programs adapted to the panhandle area, the agriculture landscapes is constantly changing and much more work will need to be initiated. Your continued support of our research and extension programs will help us better serve the panhandle area.

James H. Stiegler
Professor and Head

Oklahoma Panhandle Research and Extension Center

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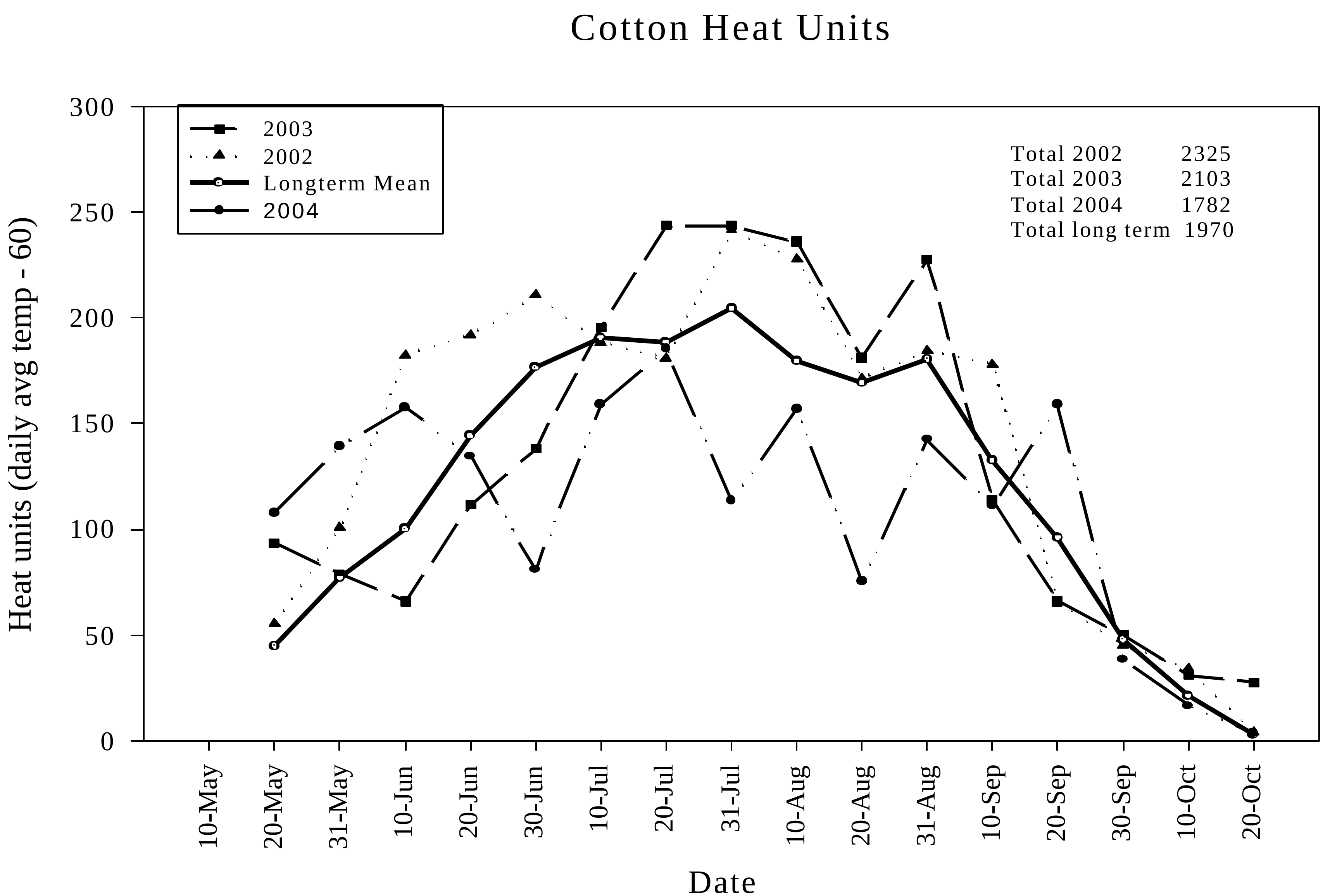
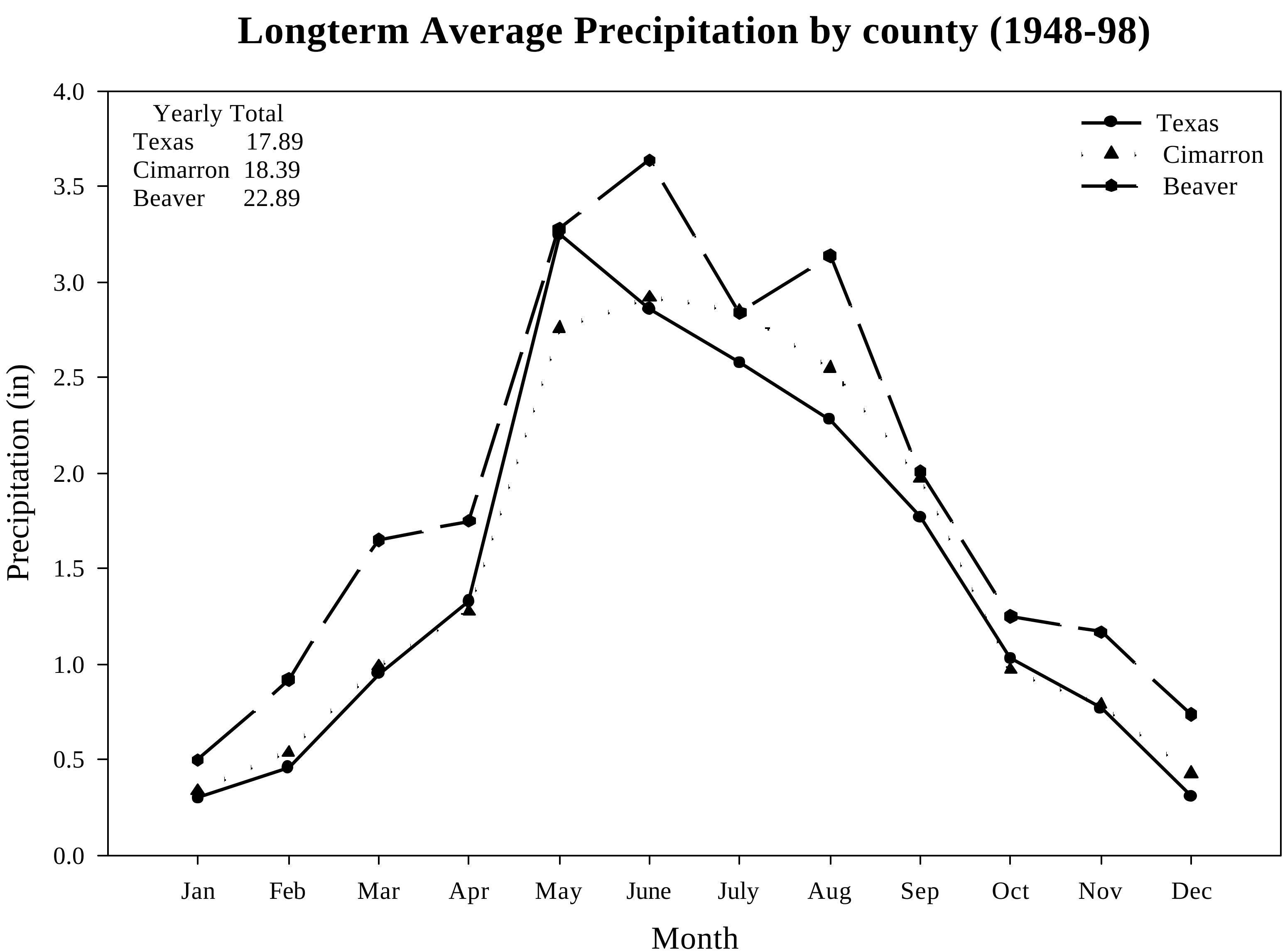
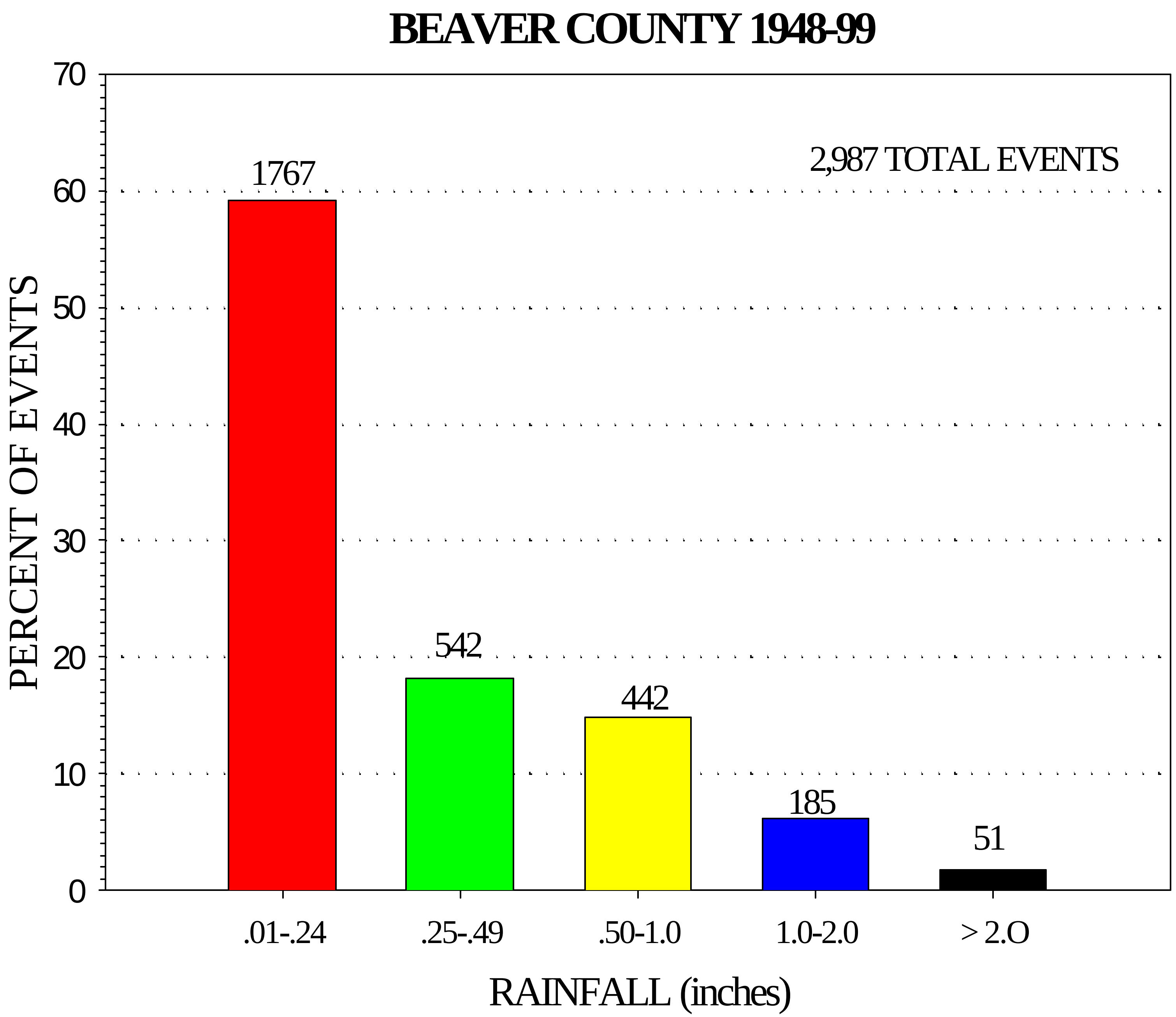
Climatological data for Oklahoma Panhandle Research and Extension Center, 2003.

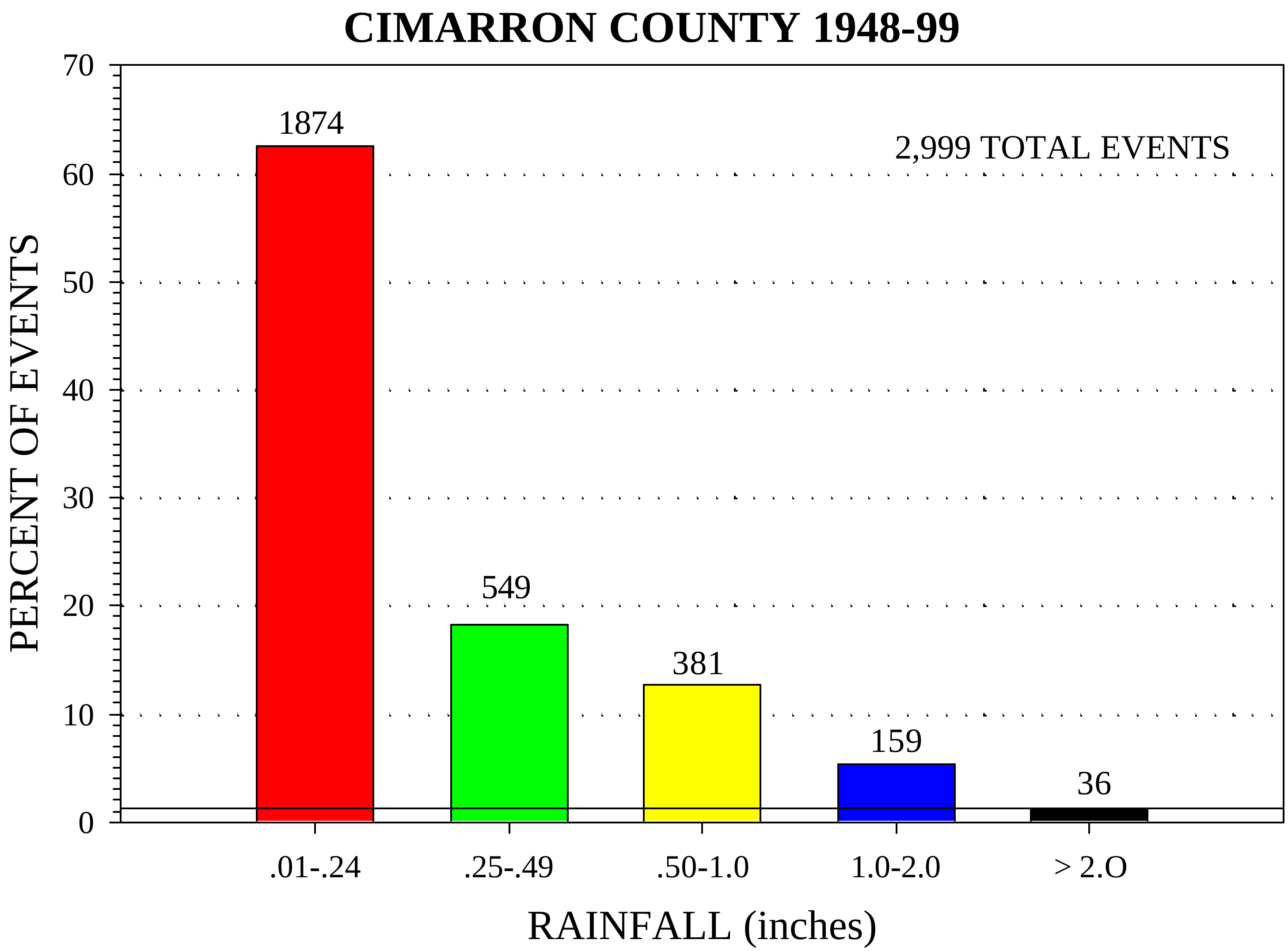
Month	Temperature				Precipitation			Wind	
	Max	Min	Max. mean	Min. mean	Inches	Long term mean	One day total	AVG mph	Max mph
Jan	74	13	52	24	0.03	0.30	0.03	10.0	47.0
Feb	80	3	48	21	0.21	0.46	0.10	11.5	51.4
March	82	14	61	31	1.33	0.95	1.10	12.1	51.1
April	87	23	72	41	0.55	1.33	0.37	15.1	67.3
May	98	36	80	51	1.84	3.25	0.52	13.3	55.1
June	95	47	82	58	5.26	2.86	1.04	11.6	53.9
July	108	58	97	66	1.87	2.58	1.41	12.7	43.0
Aug	103	55	93	65	1.19	2.28	0.52	10.9	60.0
Sept	96	37	81	53	1.62	1.77	0.56	12.2	53.4
Oct	93	23	75	45	0.14	1.03	0.09	11.1	44.5
Nov	81	11	58	31	0.56	0.77	0.56	12.0	49.6
Dec	72	12	52	24	0.18	0.31	0.09	12.3	59.3
Annual total			71	43	14.78	17.9	NA	NA	NA

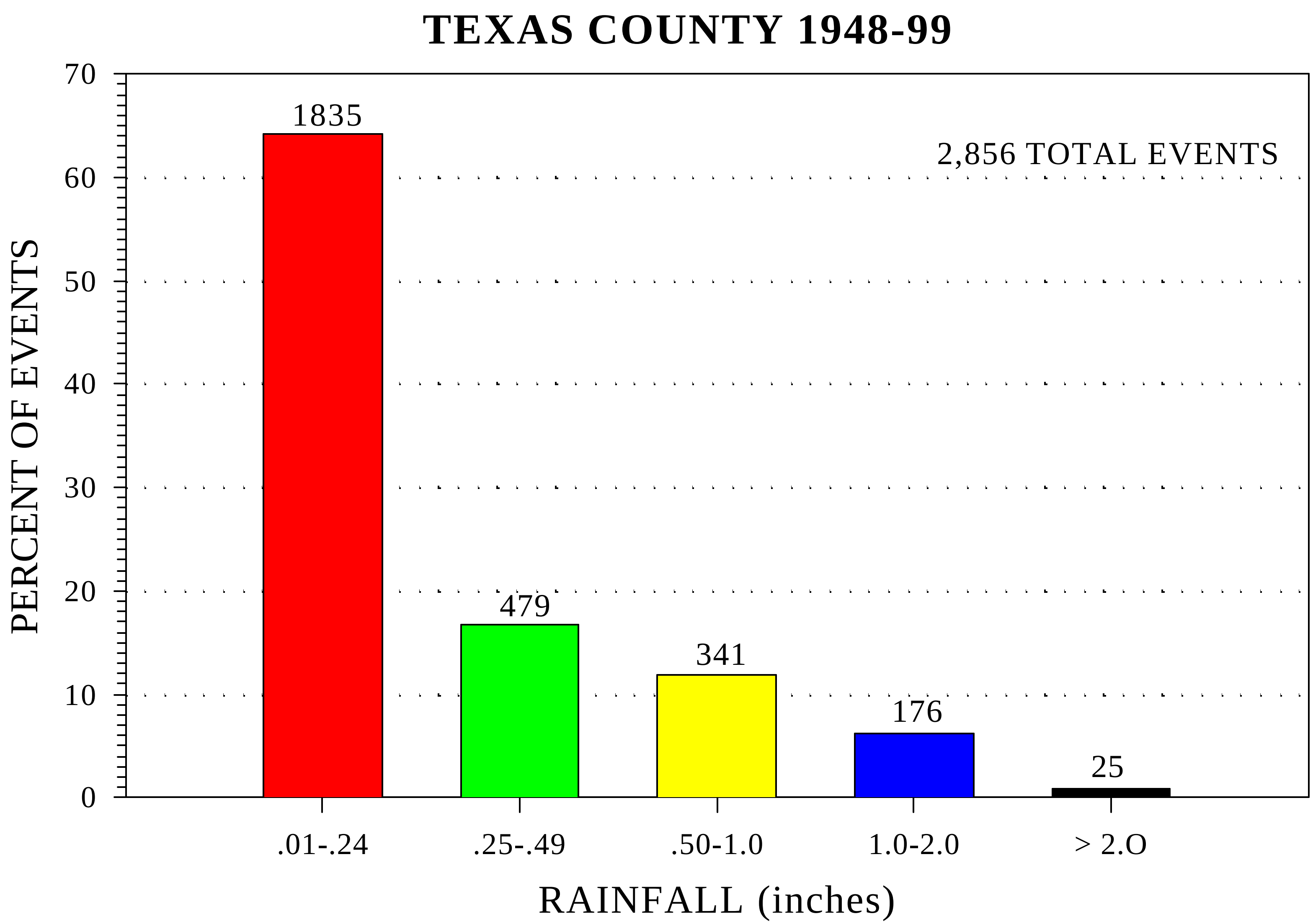
Data from Mesonet Station at OPREC


Cotton Heat Units
2003
2002
Longterm Mean
2004
Total 2002 2325
Total 2003 2103
Total 2004 1782
Total long term 1970
Heat units (daily avg temp - 60)
300
250
200
150
100
50
0
10-May
20-May
31-May
10-Jun
20-Jun
30-Jun
10-Jul
20-Jul
31-Jul
10-Aug
20-Aug
31-Aug
10-Sep
20-Sep
30-Sep
10-Oct
20-Oct
Date


Longterm Average Precipitation by county (1948-98)
Yearly Total
Texas 17.89
Cimarron 18.39
Beaver 22.89
Texas
Cimarron
Beaver
Precipitation (in)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec
Month


BEAVER COUNTY 1948-99
2,987 TOTAL EVENTS
PERCENT OF EVENTS
0
10
20
30
40
50
60
70
1767
542
442
185
51
.01-.24
.25-.49
.50-1.0
1.0-2.0
> 2.O
RAINFALL (inches)


CIMARRON COUNTY 1948-99
2,999 TOTAL EVENTS
PERCENT OF EVENTS
70
60
50
40
30
20
10
0
1874
549
381
159
36
.01-.24
.25-.49
.50-1.0
1.0-2.0
> 2.O
RAINFALL (inches)


TEXAS COUNTY 1948-99
2,856 TOTAL EVENTS
1835
479
341
176
25
PERCENT OF EVENTS
0
10
20
30
40
50
60
70
.01-.24
.25-.49
.50-1.0
1.0-2.0
> 2.O
RAINFALL (inches)

Oklahoma Panhandle Research & Extension Center
2004 Research Highlights

Crops

Appendix

Corn Planting Date

Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell

Previous research indicates that planting corn before the optimum date reduces yields less than planting after the optimum date (Fig. 1). Therefore, in 2000, a long-term study was initiated to determine the effect of planting date and starter fertilizer on corn ensilage, grain yield, and test weight. Six planting dates were selected April (1, 10, 20, 30) and May (10 and 20). On each selected date, corn was planted with and without a starter fertilizer (5 gal/ac 10-34-0) in the row. No yield increases were observed with starter fertilizer in 2000 - 2002. Therefore, starting in 2003 the starter fertilizer treatment was replaced with a 107-day maturity corn hybrid NC^+ 3721B. The use of a shorter season hybrid will determine if corn maturity will influence planting date. Pre-plant fertilizer applications were based on soil test N levels of 250 lb/ac (soil test + applied). P and K are applied to 100% sufficiency based on a soil test. The Dekalb hybrid DK 647BtY was planted in 2000, and in 2001 the hybrid was switched to Pioneer 33B51. Plots were planted in four 30-inch rows by 30 feet long with a target plant population of 32,000 plants per acre. Ten feet of one outside row was harvested for ensilage and the two middle rows harvested for grain.

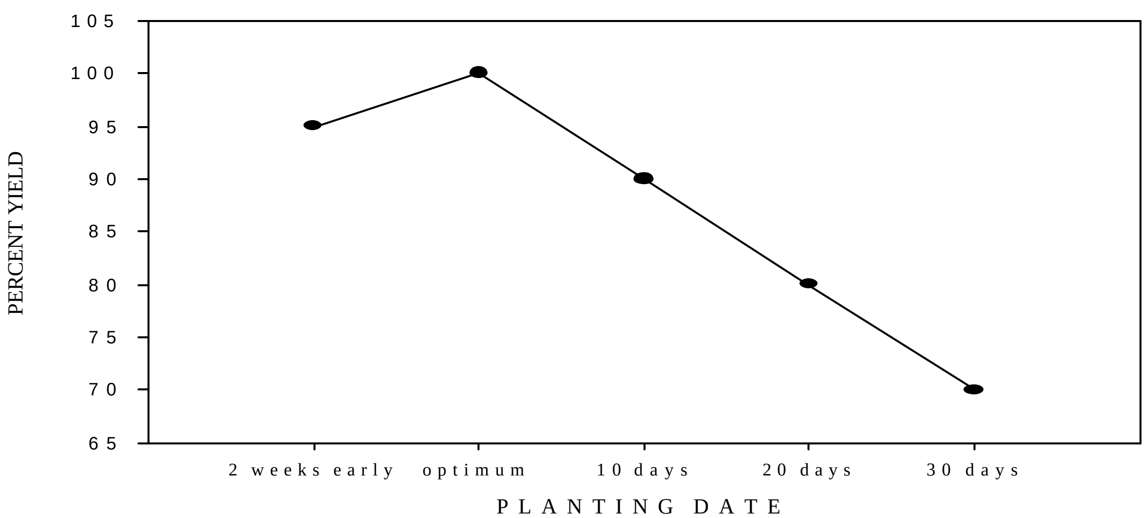


Figure 1. Ten years of grain yields at Lansing, Michigan. Source modern corn production

Aldrich, S.A., W.O. Scott, and R.G. Hoeft. Modern Corn Production. 1986, A & L Publications.

Results

Data not collected in 2002 due to irrigation well problems.

Grain Yield

Climate and hybrid maturity appear to impact which date is optimum for planting corn. The full season (114 day) and short season (107 day) hybrids reacted differently in 2003 and 2004 (Table 1). No difference in grain yield was observed for any planting date in 2003 or 2004 for the full season hybrid (Table 1). Although differences were observed for the shorter season hybrid, with yield significantly reduced when planted after May 1. For the full season hybrid, when the yield environment was lower as in (2000 and 2001), the April 10 planting date had the highest yield, and yield was reduced 15 and 21% when planted May 10 or 20, respectively. With the higher yield environment of 2003 and 2004, the highest yield obtained was on April 10, which was approximately 17% higher when compared to 2000 and 2001 (Table 1). Four-year averages for the full season hybrid also show the highest yield for the April 10 planting date. With the difference in yield environments in the preceding years it is difficult to determine which date is ideal for planting corn. Therefore more years of data are required to determine what effect environment and maturity has on corn planting date.

Table 1. Mean grain yields (bu/ac) for selected years, maturities, and corn planting dates at OPREC.

Planting date	2000 – 01 114 day	2003 – 04 114 day	4-year 114 day	2003 –04 107 day
April 10	175.9 a†	205.2 a†	190.6 a†	176.0 ab†
April 1	167.6 ab	196.9 a	182.2 ab	173.1 ab
April 30	161.7 ab	198.4 a	180.1 ab	183.1 a
April 20	155.2 bc	202.6 a	178.9 bc	178.4 a
May 10	152.6 bc	202.8 a	177.7 bc	160.7 bc
May 20	145.5 cc	192.1 a	168.8 cc	150.2 c

†Yields with same letter not significantly different

Test Weight

Test weight decreased when planted after April 10 but remained above the 56 lb/bu level (data not shown) until the April 20 planting. Lower test weights can be attributed to higher grain moisture at harvest for the later planting dates.

Corn Ensilage

As with grain yield, environment has an impact on which date is optimum for planting corn utilized for ensilage (Table 1). In years when environment for grain yield is low (as in 2000 and 2001), an earlier planting date had significant impact on ensilage yield (Table 1). The April 1 planting date had ensilage yields 17% higher in 2000 – 2001, when compared too 2003 – 2004. In years with a high grain yield environment, planting date had no effect on ensilage yields. When looking at four-year means ensilage yields were significantly lower when planted May 20, and consequently corn should be planted earlier. Although hybrid maturity affected grain yield, no differences in ensilage yield were observed in 2003 and 2004 for either the short or full season hybrid.

Table 2. Mean ensilage yields (tons/ac) for selected years and maturities for corn planting date at OPREC.

Planting date	2000 – 01 114 day	2003 – 04 114 day	4-year 114 day	2003 –04 107 day
April 1	26.7 a†	22.8 a†	25.0 a†	22.0 a†
April 10	25.8 a	22.8 a	24.4 a	23.9 a
April 30	24.4 bc	23.1 a	24.4 a	21.6 a
April 20	25.0 a	24.5 a	24.2 a	22.8 a
May 10	22.3 c	25.2 a	23.5 a	22.9 a
May 20	19.6 d	20.5 a	19.9 b	24.0 a

†Yields with same letter not significantly different

UTILIZING GRAIN SORGHUM IN IRRIGATED CROP ROTATIONS

Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell

In 1999, an irrigated crop rotation study was established to determine if the crop rotation effect reported by researchers in dry-land systems exist under a high yield environment. In 2000, problems with insects, birds, and water well were encountered so data was not collected. Researchers at Kansas State University have reported 12 bu/ac yield increases in grain sorghum rotated yearly with soybeans when proper fertilization is used (Gordon, B., et al., 1999). Researchers at the University of Minnesota have reported yield increases of 12% (138 vs. 122 bu/ac) in corn rotated with soybeans when compared to continuous corn (Porter, P.M., et al., 1997). The crop rotation effect is not clearly understood and has many possible explanations. What is understood are the benefits in weed management, disruption of insect and disease cycles, improved soil physical properties, and increased water use efficiency. Rotations include corn-soybean (CS), corn-sorghum (CM), soybean-sorghum (SM), along with continuous corn (CC), soybeans (SS), and grain sorghum (MM). Plots size was 10 feet by 30 feet long, planted with a John Deere 1710 Maxemerge 4-row 30-inch planter.

Results

Due to herbicide drift all crop results were affected in 2003 and therefore not reported.

The crop rotation effect appears to exist for corn when grown with irrigation (Table 1). Although in years with higher yields the effect is less than for years with lower yields. Corn grain yields for the three years that were harvested (2001-02, 2004) were 19.3% and 18.2% higher when rotated with soybean and grain sorghum respectively. The increase in yields for corn rotated with soybean is similar to what other researchers have found. The increase may be explained by rootworm control in the rotations, although a soil applied insecticide is utilized for rootworm control in the CC rotation. The yield increase for corn rotated with grain sorghum has been unexpected, most researchers do not look at this type of a rotation. The most common rotations generally have used a broadleaf crop or a winter crop in rotation with corn. Weed control in the CS has been the best, but the CM rotation is generally better than with continuous grain sorghum. With limited herbicides for grain sorghum, Johnsongrass infestation is a problem in the MM rotation. Rotations have had no effect on test weight of any crop.

Table 1. Corn grain yield (bu/ac) for Irrigated Crop Rotation Study at OPREC.

Rotation	2001	2002	2004	3-year
SC	137.8 (30.6)	166.7 (14.4)	209.3 (16.7)	171.3
CM	143.2 (35.7)	163.9 (12.5)	202.1 (12.5)	169.7
CC	105.5	145.7	179.6	143.6
Mean	125.5	155.5	189.2	161.5
CV%	16.7	8.2	10.2	7.6
L.S.D.	NS	20.3	NS	10.4

Note: number in () indicates percent yield increase as compared to continuous corn

Neither soybean or grain sorghum yields have been affected by any rotation although yields have been numerically higher for both crops with rotation when compared to continuous crops (Table 2). Future rotations may include sunflowers and/or cotton to determine if these crops have an effect on yields when utilized in rotations.

Table 2. Grain yields (bu/ac) for soybean and grain sorghum for Irrigated Crop Rotation Study at OPREC.

Rotation	2001		2002		2004		3-year	
	Sorghum	Soybean	Sorghum	Soybean	Sorghum	Soybean	Sorghum	Soybean
Continuous	102.7	53.2	147.5	55.5	134.7	36.6	124.2	47.2
SM	119.2	51.9	163.1	56.6	110.9	37.5	128.1	49.3
CS	----	54.4	----	56.6	----	34.6	----	48.7
CM	105.1	----	139.6	----	116.9	----	120.2	----

References:

Gordon, B., D. Whitney, and R. Lamond. 1999. Grain Sorghum Nutrient Management in Reduced Tillage Systems. Proceeding of the 21st Biennial Grain Sorghum Research and Utilization Conference. p 8-10.

Porter, P.M., J.G. Lauer, W.E. Lueschen, J.H. Ford, T.R. Hoverstad, E.S. Oplinger, and R.K. Crookston. 1997. Environment affects the corn and soybean rotation effect. Agron. J. 89:442-449.

Canopy Reduction and Legume Interseeding in Irrigated Continuous Corn

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Department of Plant and Soil Sciences, Oklahoma State University

ABSTRACT

Many alternative management systems have been evaluated for corn (*Zea mays* L.), soybeans (*Glycine max* L.), and wheat (*Triticum aestivum* L.) production, however, most have involved rotations from one year to the next. Legume interseeding systems which employ canopy reduction in corn have not been thoroughly evaluated. One such study was initiated in 1994 at the Panhandle Research Station near Goodwell, OK, on a Richfield clay loam soil, to evaluate five legume species interseeded into established corn: yellow sweet clover (*Melilotus officinalis* L.), subterranean clover (*Trifolium subterraneum* L.), alfalfa (*Medicago sativa* L.), arrowleaf clover (*T. vesiculosum* L.) and crimson clover (*T. incarnatum* L.). In addition, the effect of removing the corn canopy above the ear (canopy reduction) at physiological maturity was evaluated. Canopy reduction increased light interception beneath the corn thus enhancing legume growth in late summer, early fall, and early spring the following year prior to planting. Forage growth from legumes incorporated prior to planting were expected to lower the amount of inorganic nitrogen (N) fertilizer needed for corn production. Crimson clover appeared to be more shade tolerant than the other species, and intereseeding this species resulted in the highest corn grain yields when no N was applied. In the last two years, interseeding crimson clover at physiological maturity, followed by canopy reduction resulted in a 19 bu/ac increase in yield compared to conventionally grown corn with no N applied. In 2004, interseeded crimson clover in conjunction with canopy reduction imposed at physiological maturity and the application of 45 lb N/ac preplant had greater grain yields (185 bu/ac) when compared to the 90 lb N/ac preplant treatment (182 bu/ac).

Materials and Methods

One experiment was established in the spring of 1994 at the Oklahoma Panhandle Research and Extension Center near Goodwell, OK on a Richfield clay loam (fine, montmorillonitic, mesic Aridic Argiustoll). Initial soil test characteristics and soil classification are reported in Table 1. A randomized complete block experimental design with three replications was employed. Plot size consisted of four rows (76 cm) x 7.6 m.

All treatments received 90 lb N/ac (45-0-0) in the fall of 1995 (Table 2). In 1996 and for the remaining years of this experiment, treatments 1-5, 7 and 12 received no N to assess legume N fixation compared to identical treatments with 45 lb N/ac. Each year, corn was planted at a seeding rate of 28000 seeds/ac between late April and early May and irrigated.

At physiological maturity, canopy reduction was imposed by removing the tops of the corn plants just above the ear using a machete (Figure 2). This allowed sunlight to reach the legume seedbed. The tops were allowed to fall to the ground immediately following broadcast legume interseeding. In August, when the corn had reached physiological maturity (determined by periodic monitoring grain black layer formation), five legume species were interseeded by hand at the following seeding rates: yellow sweet clover (*Melilotis officinalis* L.) 40 lb/ac, subterranean clover (*Trifolium subterraneum* L.) 40 lb/ac, alfalfa (*Medicago sativa* L.) 30 lb/ac, arrowleaf clover (*T. vesiculosum* L.) 20 lb/ac and crimson clover (*T. incarnatum* L.) 40 lb/ac. Following interseeding and canopy reduction, 2 inches of irrigation water was applied for legume establishment and to prevent reduction in growth caused by moisture stress. The legume seeds were inoculated prior to planting with a mixture of *Rhizobium meliloti* and *R. trifolii* bacteria. Harvest area consisted of two rows x 25 ft. Harvesting and shelling were performed by hand. Plot weights were recorded and sub-sampled for moisture and nutrient analysis. Subsamples were dried in a forced-air oven at 150°F and ground to pass a 140 mesh screen. Total nitrogen concentration was determined on the 1997, 1998, 1999 grain samples using dry combustion. Nitrogen use efficiency was calculated using the difference method.

Interseeded legumes remained in the field until the following spring when they were incorporated prior to corn planting using a shallow (4 inches) disk. Legumes were only used for ground cover and potential N fixation and as such were not harvested for seed or forage (Figure 3).

Results and Discussion

Grain Yield

Canopy reduction enhanced legume growth in late summer, early fall before corn harvest, and early spring the following year prior to planting due to the increased amount of light let through the canopy. Crimson clover had superior spring growth compared to the other species evaluated as visual biomass production was greater when incorporated in early April prior to planting. No significant grain yield response to applied N was observed in from 1994 to 1997, but by 1998, yields increased 31 bu/ac as a result of applying N (12 vs 13, Table 2). The lack of fertilizer N response at this site restricted the early evaluation of legume N contribution and species comparison.

There was no significant difference between grain yields when tops were cut at physiological maturity compared to the normal practice (5 vs 7, crimson clover with and without canopy reduction, with no N applied) in 1996, 1997 or 1998. However, by 1999, interseeding crimson clover and using canopy reduction resulted in increased yields when compared to that observed where no canopy reduction was employed.

In the last two years of the study, interseeding crimson clover at physiological maturity, followed by canopy reduction resulted in an average yield increase of 19 bu/ac when compared to conventionally grown corn with no N applied (Table 2, 5 versus 12). This yield increase with no N applied using crimson clover would be worth approximately $38/ac with corn grain worth $2.00/bu. At the current N fertilizer and grain prices, this technology is still not affordable to corn farmers, but it could be a viable option when N becomes limiting.

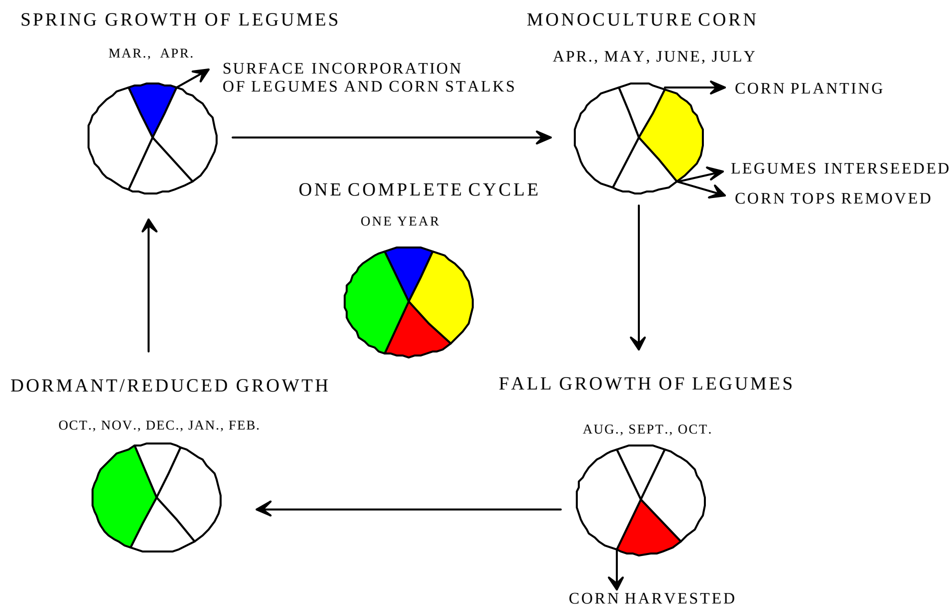
TABLE 1. Initial surface (0-15 cm) soil test characteristics and soil classification at Goodwell, OK.

Location	pH	Total N	Organic C	NH_4-N	NO_3-N	P	K
		----------g kg^{-1}---------		---------------------mg kg^{-1}---------------------			
Goodwell	7.7	1.4	11.7	65	25	29	580

Classification:Richfield clay loam (fine, montmorillonitic, mesic Aridic Ariustoll)

pH – 1:1 soil:water, total N and organic C – dry combustion, NH_4-N and NO_3-N – 2 *M* KCl, P and K – Mehlich III

FIGURE 1. Time schedule for canopy reduction and legume interseeding.



References

Schepers, J.S.; Francis, D.D.; Thompson, M.T. Simultaneous determination of total C, total N and 15N on soil and plant material. Commun. Soil Sci. Plant Anal. **1989**, 20, 949-959.

Moll, R.H.; Kamprath E.J.; Jackson, W.A. Analysis and interpretation of factors which contribute to efficiency of nitrogen utilization. Agron. J. **1982**, 74, 562-564.

TABLE 2. Effect of treatment on corn grain yield at Goodwell, OK, 1994-2004.

Trt.	Legume	Management	N rate, lb/ac	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Avg*
									bu/ac						---------
1	Yellow Sweet Clover	Tops cut at PM	0	164	130	181	109	116	142	49	22	98	83	127	128
2	Subterranean Clover	Tops cut at PM	0	118	158	189	101	99	116	50	34	100	71	132	121
3	Alfalfa	Tops cut at PM	0	130	96	180	109	103	97	42	26	94	82	130	114
4	Arrowleaf Clover	Tops cut at PM	0	167	137	183	110	111	103	39	33	100	78	116	120
5	Crimson Clover	Tops cut at PM	0	72	139	168	95	111	162	63	33	87	86	136	117
6	Subterranean Clover	Tops cut at PM	45	143	160	173	94	118	124	48	28	87	92	164	128
7	Crimson Clover	Normal	0	148	112	170	105	119	142	47	22	84	85	137	123
8	Yellow Sweet Clover	Tops cut at PM	45	95	143	160	91	108	137	76	37	86	86	159	119
9	Alfalfa	Tops cut at PM	45	121	184	177	96	113	150	41	25	98	90	169	133
10	Arrowleaf Clover	Tops cut at PM	45	148	90	177	98	122	157	50	26	85	93	174	127
11	Crimson Clover	Tops cut at PM	45	145	134	192	92	117	148	46	27	85	93	185	132
12	No Legume	Normal	0	143	119	172	111	101	129	49	22	95	73	111	119
13	No Legume	Normal	90	162	159	190	107	132	141	51	36	82	103	182	140
SED				23.6	24.6	23.3	8.5	9.1	21.4	16.4	9.4	10.0	9.3	15.2	17.4
CV				21.4	22.3	16.1	10.25	9.8	19.4	41.4	40.6	13.5	13.3	12.6	17.1

* Average yields do not include 2000 and 2001 when yield levels were far below normal.

*PM – physiological maturity
‡SED- standard error of the difference
†CV – coefficient of variation

EVALUATION OF VARIOUS HERBICIDES AND TIMING OF APPLICATION IN A ROUNDUP READY CORN SYSTEM

Curtis Bensch

An experiment was conducted at the Oklahoma Panhandle Research and Extension Center at Goodwell, OK to examine efficacy of various herbicides in a Roundup Ready corn system. Treatment particulars were:

Crop/Variety: corn / Golden Harvest H-92250Bt/RR
Location: Goodwell, OK
Planting Date: May 11, 2004
Experimental Design: RCB
# of reps: 4
plot size: 10' x 30'
row spacing: 30"
Planting Rate/Depth: 31,000 / 1.5"

Harvest Date: October 8, 2004
Soil Type: Gruver clay loam
% sand/silt/clay: 23-40-37
% OM: 0.8
pH: 7.7
Uniform std. treatment:

Application type	**PRE**	**EPOST**	**POST**
Date applied [mm/dd/yy]	05/14/04	05/26/04	06/14/04
Time [hh:mm – hh:mm]	7:00 pm	8:00 am	8:00 am
Incorporation equipment	na	na	na
Incorporation depth [in]	na	na	na
Air/ 4" Soil temperature [° F]	62/66	75/74	85/85
Relative humidity [%]	40	55	60
Wind [mph, direction]	3-5/N	2-5/N	5/S
Weather [sunny, etc.]	Partly cloudy	Partly cloudy	Sunny
Soil moisture	adequate	adequate	adequate
Crop stage/Height	na	2-leaf/3"	5-leaf/18"
Sprayer type/mph	CO_2 backpack, 3	CO_2 backpack, 3	CO_2 backpack, 3
Nozzle type/Size	TeeJet 8015vs	TeeJet 8015vs	TeeJet 8015vs
Boom ht/# Noz/Spacing (in)	19" / 4@20"	19" / 4@20"	19" / 4@20"
GPA/PSI	15 / 40	15 / 40	15 / 40
Applied by	Bensch	Bensch	Bensch
Weed Species	Size/leaf/density	Size/leaf/density	Size/leaf/density
*Palmer amaranth	na	1"/ 1-2 leaf/ 15 per 0.1m^2	1-2"/ 1-3 leaf/ 12 per 0.1m^2

Oklahoma Panhandle Research & Extension Center Goodwell, OK

EVALUATION OF VARIOUS HERBICIDES AND TIMING OF APPLICATION IN A ROUNDUP READY CORN SYSTEM							
				Palmer amaranth Control	Palmer amaranth Control	Palmer amaranth Control	GRAIN YIELD
	Rating Date			5/26/04	6/9/04	6/23/04	10/8/04
#	Treatment	Rate	Appl	%	%	%	bu/A
1	Cinch ATZ Steadfast Callisto Atrazine	2 pts 0.75 oz 2 fl oz 16 oz ai	PRE POST POST POST	100	99.3	98.5	207.5
2	Cinch ATZ Steadfast Distinct	2 pts 0.75 oz 2 oz	PRE POST POST	100	99.5	98.0	205.1
3	Cinch ATZ Matrix Roundup WM	2 pts 0.75 oz 26 fl oz	PRE POST POST	100	99.0	98.0	219.2
4	Matrix Roundup WM	0.75 oz 26 fl oz	EPOST EPOST	0	100	96.5	200.9
5	Roundup WM	26 fl oz	EPOST	0	100	50	162.9
6	Untreated check			0	0	0	23.2
			LSD 5%	0	0.8	3.2	25.5
			CV	0	0.7	2.9	10.0

* No crop injury was observed.

* second flush of Palmer amaranth began emerging in trt 5 plots on 6/11 and significantly reduced corn yield.

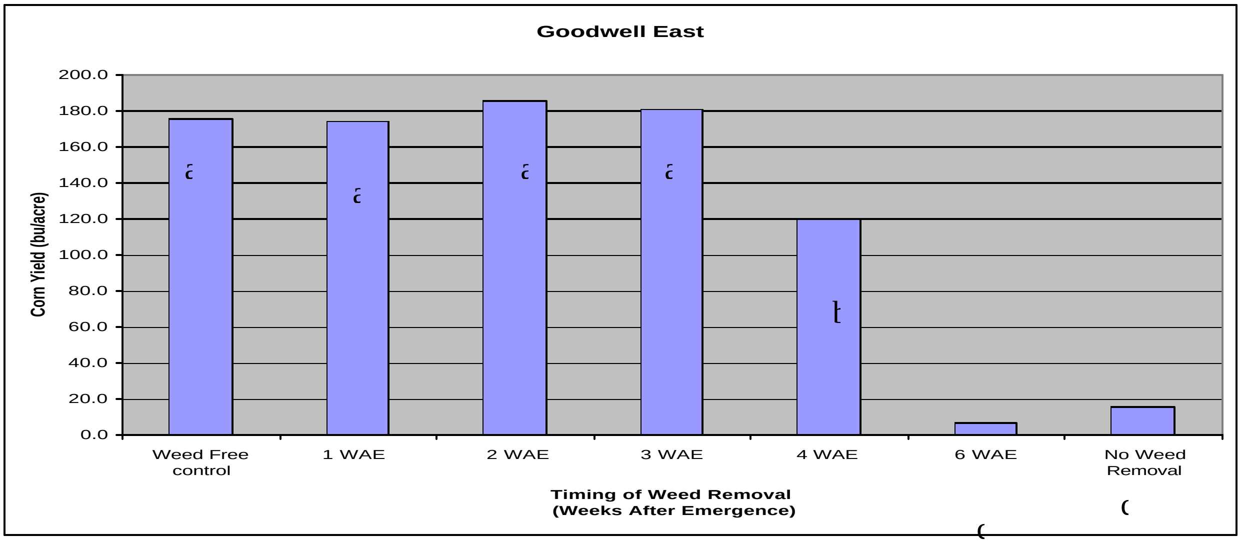
DURATION OF EARLY SEASON COMPETITION OF PALMER AMARANTH IN CORN

Curtis N. Bensch, Oklahoma Panhandle Research and Extension Center, Goodwell

Weeds that germinate and emerge with the crop are more competitive than weeds that germinate and emerge later. As long as the weeds that emerge with the crop are removed (with tillage or herbicides) within a short period of time after crop emergence, crop yield is not significantly reduced. The amount of time that the weed can grow with the crop before competition reduces yield varies among crop and weed species. Some crops grow at rates equivalent to weeds and therefore are not as quickly impacted; while other crops such as corn and cotton are much more susceptible to early season competition. There are also dramatic differences between weeds species as to how competitive they are and how quickly they must be removed from the crop before yields are negatively impacted. Post emergent glyphosate usage in Roundup Ready corn systems is a popular herbicide program used by producers. One question often asked by producers is how quickly can weeds that emerge with the crop start affecting yield, and what is the latest I can wait before I start spraying?

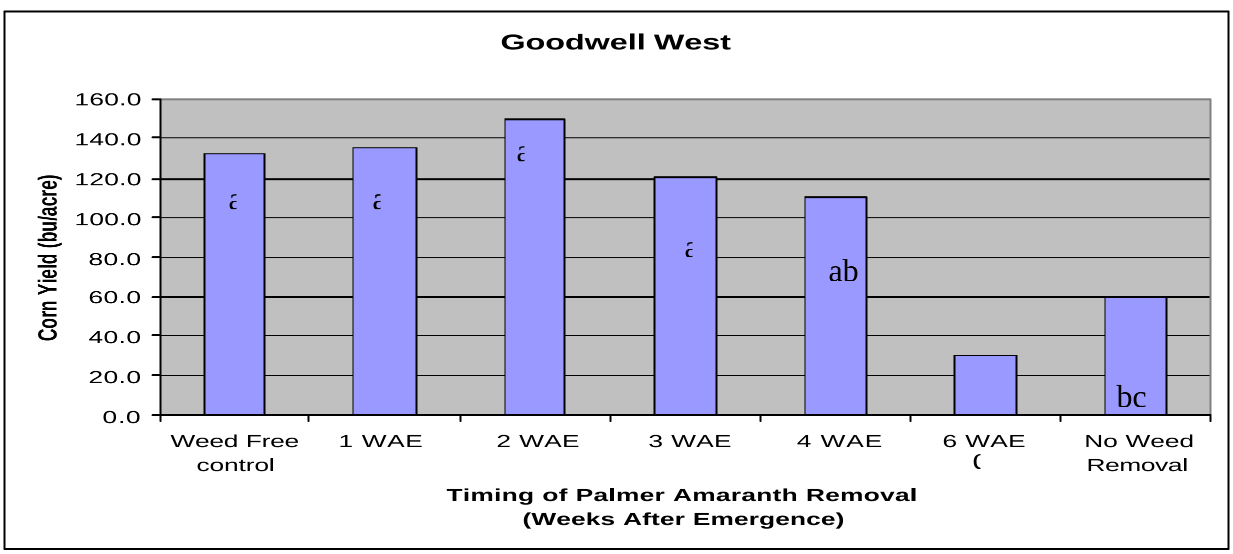
This study examined corn yields as affected by duration of early season competition of Palmer amaranth that emerged with corn. Two experiments (Goodwell east and Goodwell west) were established using a randomized complete block design and four replications. The plot size was 10 feet by 25 feet. A glyphosate resistant Golden Harvest hybrid (H-92250Bt/RR) was planted 1.5" deep using a John Deere 4-row planted and 30 inch spacing at the rate of 31,000 seed per acre on May 5 and May 11 at the Goodwell east and Goodwell west sites, respectively. A dense stand of Palmer amaranth emerged at the same time as the corn on May 12 and May 19, at Goodwell east and west sites respectively. There was no other weed pressure other than Palmer amaranth at either site, and the Palmer amaranth was indigenous to the sites. The Palmer amaranth was removed by hoeing and hand pulling at 1, 2, 3, 4, and 6 week intervals after emergence, and plots were then maintained weed free throughout the remainder of the growing season. Corn yields were not significantly reduced during the first 3 and 4 weeks at the Goodwell east and west sites, respectively (Fig. 1 and 2). Yields appeared to be declining at 3 weeks after emergence at the Goodwell west site; however, this difference was not statistically significant. This data suggests that glyphosate should be applied 2-3 weeks after crop emergence to insure no yield reduction from Palmer amaranth emerging with the crop. It should also be noted that weeds emerging after treatment may still cause yield losses and an additional glyphosate application may be warranted. This research project did not address the impact of late emerging flushes of Palmer amaranth, but future research at OPREC will address this issue.

Figure 1. Corn yield at Goodwell east site as affected by duration of competition of Palmer amaranth.



WAE = weeks after emergence
Treatments with the same letters do not differ at the 5% level.

Figure 2. Corn yield at Goodwell west site as affected by duration of competition of Palmer amaranth.



WAE = weeks after emergence
Treatments with the same letters do not differ at the 5% level.

2004 EVALUATION OF PALMER AMARANTH CONTROL WITH

VARIOUS PRE HERBICIDES AND GLYPHOSATE IN A ROUNDUP READY CORN SYSTEM

Curtis Bensch, Oklahoma Panhandle Research and Extension Center, Goodwell

An experiment was conducted at the Oklahoma Panhandle Research and Extension Center at Goodwell, OK to examine efficacy of various herbicides in a Roundup Ready corn system. Treatment particulars were:

Crop/Variety: corn / Golden Harvest H-92250Bt/RR
Location: Goodwell, OK
Planting Date: May 11, 2004
Experimental Design: RCB
# of reps: 4
plot size: 10' x 30'
row spacing: 30"
Planting Rate/Depth: 31,000 / 1.5"

Harvest Date: October 8, 2004
Soil Type: Gruver clay loam
% sand/silt/clay: 23-40-37
% OM: 0.8
pH: 7.7
Uniform std. treatment:

Application type	**PRE**	**EPOST Glyphosate**	**LPOST Glyphosate**
Date applied [mm/dd/yy]	05/14/04	05/26/04	06/14/04
Time [hh:mm – hh:mm]	7:00 pm	8:00 am	8:00 am
Incorporation equipment	na	na	na
Incorporation depth [in]	na	na	na
Air/ 4" Soil temperature [°F]	62/66	75/74	85/85
Relative humidity [%]	40	55	60
Wind [mph, direction]	3-5/N	2-5/N	5/S
Weather [sunny, etc.]	Partly cloudy	Partly cloudy	Sunny
Soil moisture	adequate	adequate	adequate
Crop stage/Height	na	2-leaf/3"	5-leaf/18"
Sprayer type/mph	CO_2 backpack, 3	CO_2 backpack, 3	CO_2 backpack, 3
Nozzle type/Size	TeeJet 8015vs	TeeJet 8015vs	TeeJet 8015vs
Boom ht/# Noz/Spacing (in)	19" / 4@20"	19" / 4@20"	19" / 4@20"
GPA/PSI	15 / 40	15 / 40	15 / 40
Applied by	Bensch	Bensch	Bensch
Weed Species	Size/leaf/density	Size/leaf/density	Size/leaf/density
Palmer amaranth	na	1"/ 1-2 leaf/ 15 per 0.1m^2	1-2"/ 1-3 leaf/ 12 per 0.1m^2

Oklahoma Panhandle Research & Extension Center
Goodwell, OK

2004 EVALUATION OF PALMER AMARANTH CONTROL WITH VARIOUS PRE HERBICIDES AND GLYPHOSATE IN A ROUNDUP READY CORN SYSTEM

				Palmer amaranth Control	**Palmer amaranth Control**	**Palmer amaranth Control**	**GRAIN YIELD**
	Rating Date			5/26/04	6/09/04	6/28/04	10/08/04
#	**Treatment**	Rate	Appl	%	%	%	bu/A
1	Untreated check			0	0	0	26.5
2	Lexar	2.5 qt/A	PRE	78.8	70.0	56.3	86.3
3	Lexar	3.0 qt/A	PRE	98.5	99.5	94.8	187.5
4	Lexar	3.5 qt/A	PRE	98.3	99.8	94.5	181.9
5	Bicep II Magnum 5.5 SC	2.1 qt/A	PRE	97.5	99.5	92.0	157.9
6	Lumax 3.94 SE	2.5 qt/A	PRE	93.0	96.5	82.5	125.3
7	Lexar Princep 4L	3.0 qt/A 2 pt/A	PRE	93.8	96.8	87.5	138.8
8	Guardsman Max 5SC	3 pt/A	PRE	87.0	97.5	85.0	130.8
9	Harness Xtra 5.6L	2 qt/A	PRE	95.0	98.8	91.3	174.6
10	Keystone 5.25 SE	2.6 qt/A	PRE	97.3	99.3	95.0	186.6
11	Roundup WM AMS	26 fl oz 2 lbs/A	EPOST	99.5	0	0	170.8
12	Roundup WM AMS Roundup WM AMS	22 fl oz 2 lbs/A 22 fl oz 2 lbs/A	EPOST LPOST	99.0	0	100	216.0
		LSD 5% CV		6.7 5.8	18.5 19.5	16.3 16.7	36.0 17.9

-- No crop injury was observed from any herbicide

WINTER WHEAT VARIETY DEVELOPMENT: RELEVANCE TO THE OKLAHOMA PANHANDLE

The Wheat Improvement Team

Now in its seventh year of partnership, the Wheat Improvement Team (WIT) brings eight OSU and USDA-ARS scientists together, with more than 35 scientists on and off campus, to develop winter wheat varieties custom-fit for Oklahoma's wheat industry. Highlights of the 2004 crop included placing several candidate varieties under breeder-seed increase at the OPREC; intensive selection for dual adaptation to grazing and grain-only systems; continued emphasis on unraveling the wheat-aphid-BYDV pathosystem and developing lines resistant to the aphid-BYDV complex; the continued treasure hunt in CIMMYT materials (including a goldmine of new synthetic wheats) for unique and effective genes for leaf rust and stripe rust resistance; a relatively new initiative to understand how resistance to wheat soilborne-mosaic virus might be compromised by the presence of wheat spindle streak mosaic virus; and a gluten protein-based method of predicting premium functional quality. Other traits targeted statewide by the WIT include drought resistance, Asian noodle quality, powdery mildew resistance, coleoptile elongation, timing of first-hollow-stem appearance, and pre-harvest sprouting resistance.

OSU Wheat Variety Releases

The WIT is committed to developing new, improved varieties with adaptation to all wheat-production zones in Oklahoma. The panhandle area, or the High Plains region, is considered one of those zones, unique from others in rainfall pattern, temperature, and disease pressure. Depending on adaptation characteristics, improved varieties are targeted for either the central corridor of the wheat acreage in Oklahoma, the High Plains, or possibly both.

Though final approval of the OAES is forthcoming, we can announce that a new hard white wheat variety named 'Guymon' is under foundation seed increase near Hardesty. One of the hurdles to expansion of the hard white wheat acreage in Oklahoma has been the lack of genetic diversity from which producers can choose to satisfy their specific management needs. Further growth of the HW wheat industry requires aggressive infusion of new varieties to motivate producers to adopt HW wheat varieties as an addition to, or even a displacement of, the HRW varieties they currently grow. Guymon marks the beginning of a new generation of HW wheat varieties expected to emerge from the OSU Wheat Improvement Program. Guymon resulted from the cross, Intrada/Platte, and exceeds the grain yield of Intrada by up to 20% at similar test weight. Guymon is positioned strictly for the panhandle of Oklahoma. Its juvenile plant characteristics are befitting for a dual-purpose management system. Fall forage accumulation up to cattle turnout should approximate, but likely not exceed, that of Intrada; forage regrowth will provide ample winter grazing without breaching winter dormancy. Guymon delivers a relatively high level of wheat protein, exceeding 14.5% in its targeted area. Desirable features of bread baking performance, including water absorption and loaf volume, justify its adoption in commercial, large-scale baking operations, but preliminary evaluation of alkaline noodle performance indicates color stability between Intrada (poor) and Platte (good).

Also under foundation seed increase is the *Clearfield** variety, 'Okfield', which features parentage of 2174 and a sister selection of TAM 110 equipped with tolerance to the imidazolinone class of herbicides. Okfield is a more widely adapted variety than current Clearfield varieties, with exception of areas challenged by wheat soilborne mosaic virus in north-central Oklahoma. It shows exceptional recovery from early-planted grazing systems common in the southern Great Plains. Forage accumulation in the early fall is average, whereas forage regrowth during the grazing period and recovery from grazing are above-average. We do not recommend extremely early seeding of Okfield due to its heat-sensitive germination response. Additional attributes in its favor compared with Above or AP502CL are slightly better tolerance to leaf rust, as evidenced by extended green-leaf retention and later first-hollow-stem stage (i.e., greater dormancy retention) by several days. Okfield also carries the potential to move into more drought-prone environments in the panhandle where 2174 has experienced some difficulty. Its milling and baking characteristics are satisfactory, with above-average kernel size, below-average test weight, intermediate dough strength, and mean wheat protein content of 12.8%. Its protein content is expected to be at least one percentage point higher in the panhandle.

Importance of the Oklahoma Panhandle to OSU Wheat Breeding

The Oklahoma Panhandle offers a unique environment for testing and selecting new varieties. With reduced pressure from foliar diseases, the irrigated breeding trials located at the OPREC provide critical information on "yield potential" of breeding lines, reflecting the upper range of performance. Without irrigation, grain production is primarily limited by drought stress, reflecting the lower end of the yield distribution. Yield potential, however, only partially explains performance under drought. Our breeding strategy is to identify and select lines having improved yield potential in irrigated trials <u>and</u> improved water-use efficiency or drought tolerance in dryland trials, before they are promoted for release.

Approximately 2500 irrigated field plots and 600 dryland plots are dedicated to breeding line evaluation at the Center in 2004-2005. This includes a USDA-ARS sponsored regional nursery containing candidate varieties from public and private breeding programs throughout the Great Plains. This nursery, labeled the Southern Regional Performance Nursery (SRPN), contains 50 entries in 2005, four of which are long-term check varieties. The full SRPN report for all regional locations, including Goodwell, can be found on the USDA-ARS website at http://www.ianr.unl.edu/arslincoln/wheat/default.htm.

For only the second time in the history of the OSU wheat breeding program, we expanded a pivotal mid-generation nursery called the DPON (Dual-Purpose Observation Nursery) to include Goodwell as one of the testing sites, in addition to the traditional sites at Stillwater and Lahoma. Nearly 2000 lines comprise this nursery each year, and they are evaluated under dual-purpose and grain-only conditions as the nursery name implies. Our intent each year is to identify about 250 lines worthy of statewide yield testing in subsequent years. With the proportion of hard white lines in the DPON gradually increasing over the past five years, we decided to relocate the hard white portion of the DPON at Lahoma to Goodwell. Hence, our initial look at hard white breeder lines in conventional yield plots now occurs in the panhandle where this component of our breeding program is targeted. We expect this shift in selection strategy to increase the probability of identifying hard white lines best adapted to *the panhandle. In 2005, the Goodwell component of the DPON was planted on dryland to hopefully skew our selection toward better adaptation to rainfed conditions. What was considered a risky move in the fall of 2004 has turned out thus far to be not much different than planting on irrigated ground! We will re-attempt this practice for the 2005-2006 crop year.*

Finally, the Center continues to serve a critical function to the wheat improvement program by supplying a high-yielding environment for breeder seed multiplication of candidate varieties. We have placed the following candidates under final breeder seed increase in 2005:

> ***OK99212*** *(Tomahawk/2174//Tonkawa), a high-quality HRW wheat with statewide adaptation and almost zero yield loss with grazing,*
> ***OK00514*** *(KS93U206/Jagger), a large-kernel, high test weight, very high quality HRW wheat with statewide adaptation,*
> ***OK00611W*** *(KS93U206/Jagger), a hard white wheat with unusual adaptation and sprouting tolerance to central Oklahoma,*
> ***OK98G508W reselections*** *(Rio Blanco/KSWGRC10), another series of hard white sister selections that have broader adaptation than Guymon but slightly lower yield potential,*
> ***OK93P656H3299 reselections*** *(a Pioneer double-cross), a HRW wheat with the best disease resistance package of the bunch but suspicious quality,*
> ***OK99610*** *(AgSeco 7853/2174), another good disease-resistant HRW wheat with high test weight and outstanding quality,*
> ***OK00421*** *(Tonkawa/GK50), a HRW wheat that yields best in the western third of the state though its disease resistance should allow it to move further east, and*
> ***four Clearfield HRW*** *wheat varieties, all with statewide adaptation and partly derived from 2174, Jagger, Intrada, or Cutter (only one will be eventually released).*

Large plots of all of these candidates are available for observation by visitors to the Center.

SEEDING RATE FOR DRY-LAND DUAL PURPOSE WHEAT IN THE OKLAHOMA PANHANDLE

Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell
Gene Krenzer, Dept. of Plant and Soil Sciences, Oklahoma State University, Stillwater

Dry-land wheat producers in the Oklahoma panhandle utilize wheat in a dual-purpose system when adequate fall moisture is present. In the fall of 2001 a dry-land seeding rate study was established near Keyes, to determine the effect of seeding rate on dual-purpose wheat. The most widely grown dry-land wheat variety (TAM 110) was planted at rates of (30, 45, 60, 90, and 120) pounds per acre. Most producers utilize the 30 and 45 pounds per acre rates. The 60, 90, and 120 pounds per acre rates were used to determine if higher forage production found with increased seeding rates in irrigated systems, would also be exhibited in a dry-land system. Collecting reliable accurate dryland fall forage data has been difficult in this and other studies in the panhandle region due to differences in fall precipitation. Therefore in 2004 focus of the study was changed to determine if planting in mid October or later required increased seeding rates for higher grain yields. With this change in focus another Variety (Intrada) was included in the fall of 2004. Plot size was 5 feet wide by 25 feet long planted with a Hege plot planter, with a planting date in mid September and mid October. In years that forage data was collected in mid December one meter of row from each end of a plot was hand clipped to soil surface and placed in drying oven for 48 hours to determine forage production. After clipping, fencing was removed and cattle were allowed to graze plots until first hollow stem stage, then grain harvested.

Results

Forage

In the fall of 2001 plots were dusted in and never received enough precipitation to sprout and emerge, therefore no data was collected. In the fall of 2002 plots were planted on September 3 with excellent soil moisture, and fall forage was collected December 16. With the excellent planting conditions, and rainfall throughout the fall, forage yield was higher than expected (Table 1). In 2003 planting was delayed until mid September due to rainfall earlier in the month. Forage data was collected on December 18. Forage yields were lower in 2003 with a mean across seeding rates of 950 lbs/ac compared to 3600 lbs/ac in 2002. The yields were so variable that conclusions could not be drawn for 2003 or two-year data.

Table 1. Fall forage production and grain yield at selected seeding rates for dry-land wheat 2002 planted early September.

Seeding rate (lb/ac)	Forage yield (lb/ac)	Grain Yield (bu/ac)
120	4,830	10.9
90	4,220	12.1
60	3,780	11.9
45	3,290	12.0
30	2,700	12.6
Mean	3,760	11.9
CV%	13.7	16.1
L.S.D.	970	3.0

Yields for the fall of 2002 were as high as what has been obtained in irrigated trials in the past at OPREC. As with an irrigated system, increasing seeding rate increased fall forage production in a dry-land environment. The value of increased forage exceeded the cost of additional seed even between the 90 and 120 pound seeding rates. In the future forage data will no longer be collected, this study will be grain only.

Grain

Wheat grain yields have been low for 2003 and 2004, with the highest yield obtained from a mid October planting in 2004 of 17.6 bu/ac (Table 2). Planting date had more effect on grain yield than did seeding rate in 2004 with a 7.5 bu/ac increased yield for the mid October planting when compared to mid September. The yield difference associated with seeding rates was only 2.9 bu/ac for both planting dates, therefore planting date had a larger affect. Test weight was also affected more by planting date with the average test weight for the mid September planting date 1.3 lb/bu higher than mid October (Table 3). It is difficult to explain why in 2004 higher test weight were observed for mid September planting and the higher seeding rates of mid October planting. The difference in test weight is the reason another variety was added in the fall of 2004. The variety Intrada, which has had the highest test weight for the last 4 years of variety trials in the panhandle region, it will help clarify what effect planting date has on test weight. More data is needed in years with more favorable conditions for grain production before any conclusions can be determined. In the fall of 2004 a no-till dryland wheat planting date study, with wheat planted approximately every two weeks from September 1 until mid November was established at OPREC. This additional study will help determine the ideal planting date.

Table 2. 2004 grain yields for dryland wheat evaluating planting date and seeding rate.

Seeding rate (lb/ac)	Planting date	Grain Yield (bu/ac)
90	Mid October	17.6 a
120	Mid October	17.1 ab
45	Mid October	16.4 abc
30	Mid October	15.3 bc
60	Mid October	14.7 bc
30	Mid September	10.6 d
45	Mid September	9.0 de
60	Mid September	8.2 e
120	Mid September	7.9 e
90	Mid September	7.7 e

Yields with same letter are not significantly different

Table 3. 2004 test weights for dryland wheat evaluating planting date and seeding rate.

Seeding rate (lb/ac)	Planting date	Test weight (lb/bu)
60	Mid September	55.9 a
30	Mid September	55.9 a
90	Mid September	55.8 a
45	Mid September	55.7 a
120	Mid September	55.5 a
120	Mid October	55.3 a
90	Mid October	55.2 ab
60	Mid October	54.3 bc
45	Mid October	53.9 c
30	Mid October	53.7 c

Test weights with same letter are not significantly different

PLANTING DATE, SEEDING RATE, AND VARIEY IMPACTS ON FALL FORAGE PRODUCTION AND GRAIN YIELD OF IRRIGATED DUAL-PURPOSE WHEAT

Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell
Gene Krenzer, Dept. of Plant and Soil Sciences, Oklahoma State University, Stillwater

Irrigated wheat is planted in the panhandle region each year to be utilized as fall forage for cattle as well as harvested for grain the next spring. Due to the dual-purpose objective of this production system, it is important to determine how factors such as planting date and seeding rate affect both forage production and grain yield. The objective of this experiment was to determine the effects of seeding rate, planting date, and variety on fall forage and grain production.

To meet experimental objectives, the three most widely grown Hard Red Winter Wheat varieties (HRW) (TAM 107, Custer, and Jagger) and Hard White Winter Wheat (HWW) (Intrada) were planted at rates of 60, 120, and 180 lb/ac. Plots were 5 feet wide by 22 feet long planted with a Hege plot planter. In 2000 plots were planted September 1, October 1, and November 1. These date were chosen to coincide with planting wheat following corn ensilage production, wheat following corn for grain production, wheat planted late due to prevented planting. Low grain yield for the November planting in 2000 prompted us to remove this planting date in subsequent years, and a non-grazed October 1 planting date was added. The second October 1 planting was added to determine yield loss from forage removal. Plots were seeded in 2003, but due to packaging errors no data was collected.

Fall forage measurements were taken by clipping one meter by one-row samples at soil surface from opposing ends of each plot and oven dried for 48 hours (Table 1). Sample area was marked so that subsequent harvests could be collected from the same area. Plots were then mowed with a 5-foot finishing mower to simulate forage removal by grazing. Irrigation applied in the fall of 2000, 2001, and 2003 was 5, 7, and 5 inches respectively.

Table 1. Approximate forage harvest dates for September 1 and October 1 planting dates for OPREC irrigated dual-purpose wheat.

--- Planted September 1 ---	--- Planted October 1 ---
October 7 – 14	December 10 - 15
November 7 – 14	
December 10 - 15	

Results

No difference was observed in predicting forage yield by variety; therefore forage yields are averaged across varieties. Seeding rate and planting date had significant impact on fall forage production (Fig. 1 and 2). Increased forage production from higher seeding rates occurred during the early period of growth (Fig. 2). The difference in forage production between seeding rates did not increase after first harvest, as approximately the same difference was observed after final harvest (Fig 1). The 180 lb/ac seeding rate planted on September 1 resulted in the highest forage production at 3,040 lb/ac of dry matter, and this planting date by seeding rate combination also would allow earlier grazing due to increased early forage production.

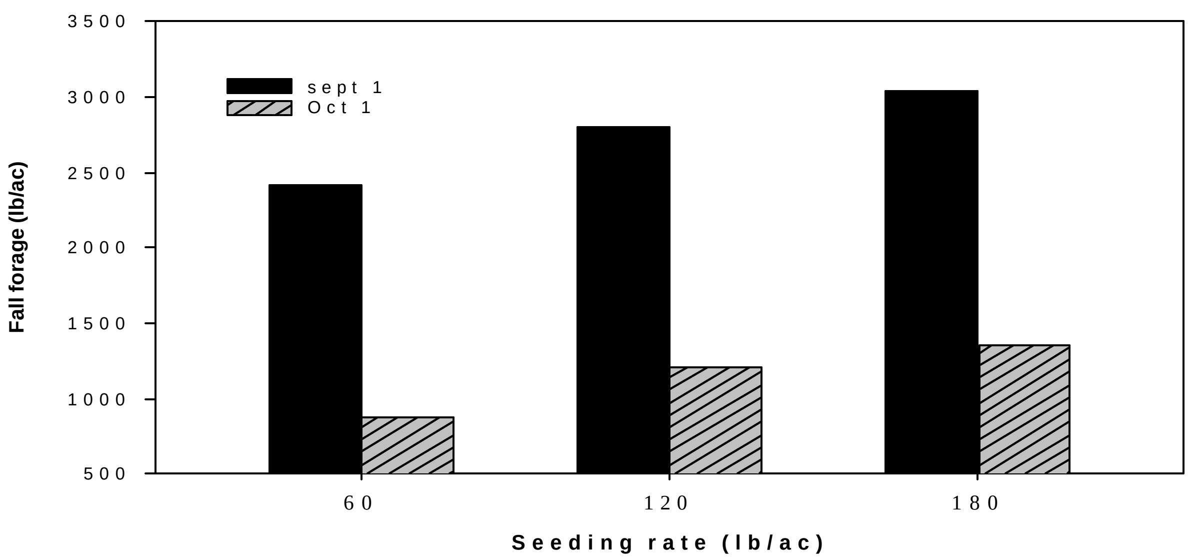


Figure 1. Total fall forage produced by a mid-December sampling date in irrigated dual-purpose wheat at OPREC.

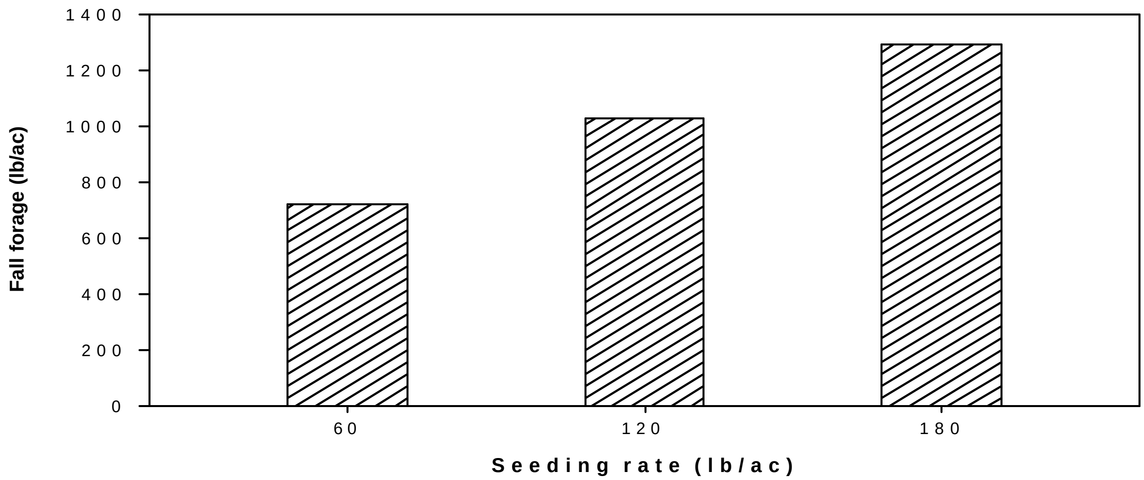


Figure 2. Forage production averaged across variety and year for first harvest (early October for the September 1 planting date in irrigated dual-purpose wheat at OPREC.

Grain yield and test weight were not affected by increased seeding rate (data not shown), but planting date and management system significantly affected grain yield (Table 2). Grain yields were affected by winterkill in all three years grain data was collected. In 2001 forage was 14 inches tall before the second harvest, and with cold temperatures following the removal of large amounts of forage resulted in damage to plots. In 2002, in late February, a week of day time temperatures between 55 - 69° F was followed by a week of night time lows below 10° F. This resulted in extensive freeze damage for most wheat in the region. In 2004 a freeze the night of April 13 also affected most of the wheat in the region. The confounding effect of freeze damage may have influenced results and reduced overall yield, but the occurrence of late-spring freezes in not uncommon to the panhandle region.

Grazing had the largest effect on grain yields (Table 2). The highest yield, 71.2 bu/ac, was obtained with Custer planted October 1 and not grazed. When averaged across varieties grazing reduced wheat yield 9 bu/ac compared to ungrazed wheat for the October 1 planting date. The combination of winterkill, grazing, and earlier planting reduced grain yield 11.2 bu/ac for the September 1 planting grazed as compared to the October 1 ungrazed treatment (Table 3).

Table 2. Mean grain yield for HRW and HWW varieties planted at different dates and receiving different management strategies at OPREC.

Variety	Planting date	Grazed	Yield (bu/ac)
Custer	October 1	No	71.2 a[†]
TAM 107	October 1	No	70.1 a
Custer	October 1	Yes	61.7 b
Jagger	October 1	No	60.1 bcd
Intrada	October 1	No	58.6 bcd
TAM 107	October 1	Yes	57.6 bcd
TAM 107	September 1	Yes	56.7 bcd
Intrada	October 1	Yes	54.6 cde
Custer	September 1	Yes	53.6cde
Intrada	September 1	Yes	53.1cde
Jagger	September 1	Yes	52.0 de
Jagger	October 1	Yes	50.1e
		Mean	58.3

[†]Yields with same letter not significantly different

Intrada had the least yield reduction due to grazing with approximately a 7% decrease when grazing wheat planted at same time (Table 2). Custer, Jagger, and TAM 107 yields were reduced 13.5, 16.7, and 17.8% respectively when grazed. When utilizing wheat as dual purpose crop the grain yield was approximately 4% lower when planted on September 1 as compared to October 1, but no statistical difference was observed. Therefore, if wheat was utilized as a dual-purpose crop, September 1 was a better planting date due to increase in fall forage production.

Table 3. Grain yields averaged across varieties and seeding rates in the irrigated dual-purpose wheat trial at OPREC.

Planting date	Grazed	Yield (bu/ac)
October 1	No	65.0 a[†]
October 1	Yes	56.0 b
September 1	Yes	53.8 b
	Mean	58.3

[†]Yields with same letter not significantly different

Test weights were most affected by variety selection with Intrada having test weights 3.0 pounds per bushel higher than next highest variety (Table 4). Since seeding rate and planting date had no significant effect on test weight, growers concerned with test weight can plant according to their forage and grain yield objectives and meet test weight objectives through variety selection . In the fall of 2005 a new study was initiated at OPREC looking at seeding rates up to 300 lb/ac (5 bushels), results are in another report.

Table 4. Test weight averaged across seeding rates of each variety for the irrigated dual-purpose wheat trial at OPREC.

Variety	Test weight (lb/bu)
Intrada	61.4 a[†]
Custer	58.4 b
Jagger	58.0 c
TAM 107	57.8 c
Mean	58.9

[†]Yields with same letter not significantly different

WHEAT LIGHT INTERCEPTION

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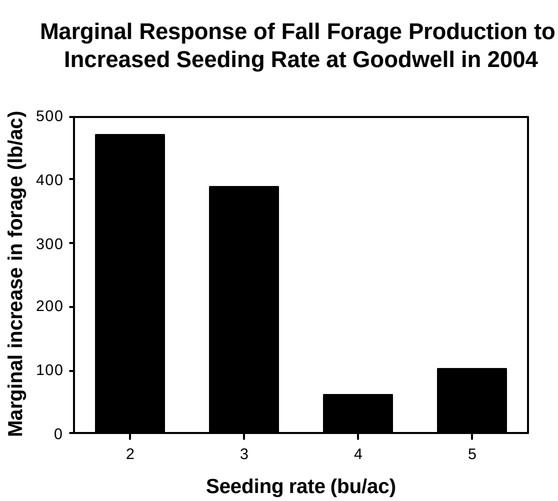
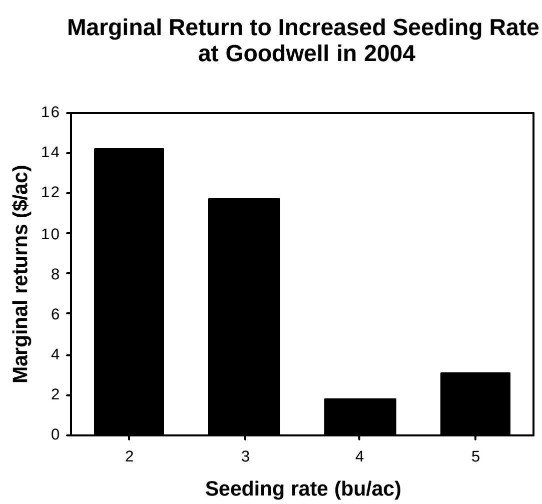
Research conducted in the Panhandle region of Oklahoma over the past few years has indicated that fall forage production is significantly increased by increasing seeding rate (PT 2003-2). The highest seeding rate used in prior experiments, however, was 3 bu/ac; therefore, a study was initiated in 2004 to determine the response of fall wheat forage to increased seeding rates up to 5 bu/ac. The trial was planted September 4 at Goodwell, OK using the variety Intrada. Results from the fall of 2004 indicate that significant marginal increases in total fall forage production can be obtained by increasing seeding rates up to 3 bu/ac, but the feasibility of increased seeding rate depends entirely upon seed costs. For example, if we assume a value of $0.03/lb for forage production, the marginal return for increasing seeding rate from 1 to 2 bu/ac was roughly $14/ac. An additional $12/ac was gained by increasing the seeding rate from 2 to 3 bu/ac, and would likely be feasible using most seed sources in Oklahoma. Marginal returns past this point, however, were less than $4/ac and would have, at best, been a break-even proposition.





More data is needed to determine if these results are applicable across a wide range of environments and varieties, but the response of increased forage production for seeding rates up to 3 bu/ac look promising for dual-purpose wheat farmers.

EVALUATION OF CHEMICAL FALLOW HERBICIDES FOR CONTROL OF PALMER AMARANTH

Curtis N. Bensch, Oklahoma Panhandle Research and Extension Center, Goodwell

Elimination of tillage during the fallow period between crops helps to increase soil moisture by reducing evaporation and increasing water infiltration. Weed control is accomplished by using herbicides instead of tillage. Use of herbicides with residual effect may decrease the number of herbicide applications necessary to maintain weed free conditions. An experiment was conducted to evaluate different herbicides options for controlling Palmer amaranth during the fallow period. Roundup was sprayed on all plots 5 weeks after harvest to control existing weeds, then Balance Pro, Valor, Callisto, Axiom, Ally XP, Atrazine, and Spartan herbicides were applied 6 weeks after wheat harvest at various rates (Table 1) and evaluated 4 weeks and 8 weeks after treatment for Palmer amaranth control. Precipitation after herbicide application was above average. The palmer amaranth stand was variable across the study site and may have artificially inflated weed control estimates of some herbicides (thus the high CV). Balance Pro at 3 fl oz per acre and Ally XP at 0.1 oz wt per acre were the only two herbicides providing better than 90% control at 4 and 8 weeks after treatment. These herbicides at the reduced rates provided poor Palmer amaranth control.

Table 1. Palmer amaranth control during chemical fallow of wheat stubble at OPREC.

Herbicide	Rate	Palmer Amaranth Control	
		4 WAT	8 WAT
Balance Pro	3 fl oz/A	99	97
Balance Pro	1.5 fl oz/A	25	18
Valor	2 dry oz/A	69	59
Valor	1 dry oz/A	0	0
Callisto	6 fl oz/A	13	6
Callisto	3 fl oz/A	0	0
Axiom	20 dry oz/A	3	3
Axiom	10 dry oz/A	23	21
Ally XP	0.1 dry oz/A	100	98
Ally XP	0.05 dry oz/A	60	55
Atrazine 4L	1 quart/A	25	33
Atrazine 4L	0.5 quart/A	0	3
Spartan	4 dry oz/A	0	0
Untreated		0	0
	LSD (0.05)	25	26
	CV	76	75

NO-TILL VS MINIMUM-TILL DRY-LAND CROP ROTATIONS

Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell

In 1999, a study was started to evaluate four different dry-land cropping rotations and two tillage systems for their long-term sustainability in the panhandle region. Rotations evaluated include Wheat-Sorghum-Fallow (WSF), Wheat-Corn-Fallow (WCF), Wheat-Soybean-Fallow (WBF), and Continuous Sorghum (CS). Soybean and corn have not been successful in this study; therefore in 2004 cotton replaced soybean and sunflower replaced corn in the rotations. Tillage systems include no-till and minimum tillage, beginning in 2004 one half of the no-till plots were strip-tilled for planting of summer crops. Two maturity classifications were used with all summer crops in the rotations until 2001, at which time all summer crops were planted with single maturity hybrids. Most dry-land producers in the panhandle region utilize the WSF rotation. Other rotations would allow producers flexibility in planting, weed management, insect management, and marketing.

Results

No corn or soybean data was collected in 2001 – 03.

Data from the Oklahoma Climatological Service indicated the summers (June – August) of 1999 through 2002 have been some of the driest in the last 53 years. Precipitation for these years has averaged 43% of the long-term mean, with 2001 at 16.5% (Table 1). In 2003 and 2004 precipitation was 107% and 118% of the long-term mean respectively. Although rainfall was above the long-term mean in 2003, it was not received at critical growth stages of grain sorghum and consequently yield was affected.

Table 1. Summer growing season precipitation at OPREC

Month	1999	2000	2001	2002	2003	2004	Long-term mean
June	2.85	2.29	0.61	1.32	5.26	3.82	2.86
July	0.20	0.76	0.00	2.52	1.87	2.43	2.58
August	0.75	1.09	0.66	0.27	1.19	2.87	2.28
Total	3.80	4.14	1.27	4.11	8.32	9.12	7.72

Wheat

2003 was the only year in which differences were observed in wheat yield, with the WBF rotation having the highest yield at 66.1 bu/ac (Table 2). The WBF rotation yield increase may be attributed to having no biomass grown in the summer of 2001, while corn and grain sorghum both had significant biomass. Consequently more soil moisture was stored in the soil profile. Although statistical differences were not observed, numerical differences were observed between tillage treatments in corn and grain sorghum. In 2004 wheat yields were reduced by a freeze on April 13. May was also one of the driest on record with only 0.15 inches of rainfall. There were no differences in yield do to tillage in 2004. The WCF had higher yields (averaged across treatments) than WBF with 28.0 and 18.0 bu/ac respectively. There was no difference in wheat yields in 2000 and 2001(data not shown) among rotations or tillage treatments with a yield of 27 and 40 bushel per acre respectively.

Table 2. Wheat yields (bu/ac) dry-land tillage and crop rotation study at OPREC.

Rotation	Tillage	2004	2003	4-year
WBF	Tilled	22.1	63.8 ab	37.9
WCF	No-till	26.9	51.8 bc	37.0
WCF	Tilled	29.2	44.5 cd	35.5
WBF	No-till	13.9	66.1 a	35.4
WSF	No-till	23.2	48.8 c	35.0
WSF	Tilled	25.2	31.7 d	31.6
	Mean	23.4	51.1	35.4
	L.S.D.	NS	13.6	NS

Grain Sorghum

From 1999 – 2003 grain sorghum was the only summer crop successfully harvested except for 2002. No-till yields tended to be higher during the period but no statistical difference was observed, but the difference was greater in 1999 when yields were the highest (Table 3). In 2004 grain sorghum yields were the highest since 1999. With producer interest growing in strip-till in irrigated systems, it was decided to convert one half of each no-till plot too strip-till for the crop season of 2004. This study is just looking at the affect of strip-till; therefore, all fertilizer was applied with sprayer on the soil surface. There was a significant difference among tillage treatments in 2004 with no-till sorghum having the highest yield of 54.8 bu/ac (Table 4). The difference in yield for strip-till vs. minimum till was greater than the difference between no-till and strip-till. This difference may indicate that when fertilizer is applied by strip-till it will compare to no-till, another study will be initiated in 2005 to more effectively compare strip-till with fertilizer applied vs. fertilizer applied on surface. Planting was delayed in 2004 due to a lack of soil moisture therefore an early maturity sorghum was utilized instead of the normal medium maturity.

Table 3. Grain yields of grain sorghum (bu/ac) for dry-land tillage and crop rotation study at OPREC.

Tillage	1999	2000	2001	2003	4-year
No-till	56.2	20.4	31.1	21.0	32.2
Tilled	47.8	20.1	25.8	20.6	28.6
CV %	6.3	20.4	13.2	29.2	NA
L.S.D.	NS	NS	NS	NS	NS

Table 4. Yields of summer crops for dry-land tillage and crop rotation study at OPREC.

Tillage	Grain Sorghum (bu/ac)	Cotton (lbs/ac)
No-till	54.8	165.6
Strip-till	44.2	193.9
Minimum till	28.0	196.3
Mean	42.3	185.2
CV %	6.4	17.4
L.S.D.	6.1	NS

Cotton

Cotton was planted for the first time in 2004 into marginal soil moisture conditions, and the resulting stands were less than ideal. Some cotton did not emerge until rainfall in late June with only 50-60% percent of any plot yielding cotton. Yields were not adjusted for reduced population fruit set. Yields may have been higher with adequate stands. There was no difference in yields between tillage treatments (Table 3).

Sunflower

Due to planter and herbicide problems, no sunflowers were harvested in 2004.

TIMING OF DRYLAND STRIP-TILLAGE IN THE HIGH PLAINS

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With the interest growing in strip-till in the panhandle, a study was initiated in the fall of 2003 to determine if timing of strip-till would affect yield of summer row crops. Producer interest is growing due the ability to apply fertilizer at the same time that strip-till is done. One of the concerns many producers have with no-till is that nitrogen (N) is tied-up in the crop residue when surface applied. Nitrogen tie-up is eliminated with strip-till due to the N being placed below seeding depth (generally 3 – 8 inches). Many irrigated producers in the region are doing strip-till from late fall to early spring. This study was designed to determine what affect strip-till (no fertilizer applied) at different dates would have on grain sorghum yield. Fertilizer for all treatments was applied on the surface with sprayer. Grain sorghum was selected as the crop to be grown, because it is the most widely grown summer row crop in the region. Four dates were selected for strip-till September, November, January, and March. No-till was also included so comparisons could be made. Plots were two rows by 40 foot long and strip-tilled with an Orthman two-row one-tripper at a depth of 7 inches.

Results

The highest grain sorghum yield in 2004 was from the no-till treatment (Table 1). Yield for no-till was approximately 31% larger when compared to the highest yield obtained from strip-till. The higher yield for no-till is most likely due to more higher moisture availability. No differences in grain yield were observed from timing of strip-till. Yields may be increased in other strip-till studies in the future when fertilizer is applied with strip-till.

Table 1. Grain sorghum yield from timing of dryland strip-till experiment at OPREC.

Timing	Grain Sorghum (bu/ac)
No-till	62.5 a[†]
March	47.6 b
November	45.5 b
September	42.1 b
January	37.9 b

[†]Yields with same letter not significantly different

IMPACT OF PLANTING DATE AND VARIETY SELECTION ON COTTON YIELDS IN THE HIGH PLAINS

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J.C. Banks, Southwest Research and Extension Center, Altus

In recent years cotton acres have increased in the high plains region. However, there was no data available for variety selection or the effect planting date would have on yields and quality of cotton. Therefore, in 2003 six cotton varieties (DP 555 B/R, PM 2280 B/R, PM 2266 RR, ST 2454 RR, PM 2145 RR, and PM 2167 RR) were planted on two dates, May 10 and May 30. These dates were selected because of the number of long-term cotton heat units available (1970 units) for the period from May 10 to October 20 is lower than in the traditional cotton producing areas. Therefore with limited heat units, maximizing those units is key to successfully growing cotton in this region. Generally, if planting before May 10 in the high plains, soil temperatures are lower than required by cotton for germination, and planting after May 30 not enough heat units would be accumulated to reach maturity. Many producers are growing cotton due to the lower water requirement for cotton compared to irrigated corn; therefore, maximum irrigation applied for this study was limited to 9 inches. Plots were planted in 2-rows by 25 feet long, with tractor powered two-row cone planter. In the 2003 plots were hand harvested and in 2004 mechanically stripped.

Results

It appears cotton can be successfully grown in the high plains, even with years like 2004 when the total heat units were 188 less than the long-term mean. The lower heat units in 2004 are in contrast to 2003 when total heat units were 133 higher than the long-term mean (heat unit graph is in climate section of highlights). With these decreased heat units in 2004, planting date severely affected cotton lint yield (Table 1). In 2003 variety had a bigger impact on lint yield than did planting date. Generally in 2003, lint yields of each variety were equal at both planting dates (Table 1). The varieties (PM-2145RR, PM-2167RR, and PM-2266RR) had higher yields than did (DP-555B/R, PM-2280B/R, and ST-2454RR). In 2004 planting date had the largest impact on lint yield, with the May 10 date approximately 2.5 times higher than May 30 when averaged across varieties (Table 1).

Table 1. Cotton lint yields (lbs/ac) for year, variety, and planting date at OPREC.

Variety	Planting Date	2003	2004	Two-year
PM 2145 R	5/10	1,087 a[†]	1,153 a[†]	1,120 a[†]
PM 2266 RR	5/10	1,029 a	1,049 a	1,039 a
PM 2167 RR	5/10	1,033 a	1,024 a	1,029 a
PM 2280 B/R	5/10	746 bc	1,025 a	885 ab
DP 555 B/R	5/10	664 bc	1,102 a	883 ab
ST 2454 R	5/10	859 b	813 ab	836 abc
PM 2167 RR	5/30	998 a	403 b	701 bc
PM 2266 RR	5/30	885 b	434 b	659 bc
ST 2454 R	5/30	795 b	468 b	632 bc
PM 2145 R	5/30	923 a	281 b	602 bc
DP 555 B/R	5/30	613 bc	502 b	558 c
PM 2280 B/R	5/30	747 bc	310 b	529 c

[†]Yields with same letter not significantly different

This years report also contains the loan rates for all varieties at each planting date (Table 2). The loan rate is a reflection of quality, the higher the rate, the lint is of higher quality. The difference in loan rate was also affected by planting date more than variety selection in 2004. Also included is gross value of lint per acre.

Table 2. Gross returns for cotton varieties and planting date in 2004 at OPREC.

Variety	Planting Date	2004 yield (lb/ac)	Loan Value	Dollars/ac
PM 2145 R	5/10	1,153	0.4489	517.58
PM 2266 RR	5/10	1,049	0.4550	477.30
PM 2167 RR	5/10	1,024	0.4345	444.93
PM 2280 B/R	5/10	1,025	0.4195	429.99
DP 555 B/R	5/10	1,102	0.3604	397.16
ST 2454 R	5/10	813	0.4210	342.27
DP 555 B/R	5/30	502	0.3730	187.25
ST 2454 R	5/30	468	0.3674	171.94
PM 2266 RR	5/30	434	0.3583	155.50
PM 2167 RR	5/30	403	0.3695	148.91
PM 2280 B/R	5/30	310	0.3326	103.11
PM 2145 R	5/30	281	0.3321	93.32

Introducing Legume Cover Crops into Large Scale Grain-Cattle Production Systems

S. D. Kraich, J. E. Sanchez*, T. C. Willson, C. A. Strasia, C. Raines, C. Bensch, M. Lamar, and J. Nusz. Oklahoma State University

ABSTRACT

Regional and site-specific factors impact the management and performance of legume cover crops. In the Oklahoma High Plains, studies showing their feasibility, benefits, and integrative effects are rare. A field trial was conducted near Guymon in Texas County, OK to evaluate four potentially adaptable forage cover crops including yellow sweetclover (Melilotus officinalis), berseem clover (Trifolium alexandrinum), crimson clover (Trifolium incarnatum), and cowpea (Vigna unguiculata). Our results indicate that yellow sweetclover and cowpea can be easily adaptable to High Plains' conditions; however, planting time and residue management should be carefully evaluated.

Introduction

Texas County in the Oklahoma Panhandle is the largest agricultural producing area in the state and one of the nation's agricultural leaders, with farm receipts exceeding $1.0 billion annually. The downside to this tremendous agriculture activity is that the predominant grain-cattle production systems are far from sustainable. Crop production relies heavily on external inputs and the county is by large a net importer of animal feed from neighboring states.

Early in the summer, after wheat harvest, the soil is typically left fallow (unplanted) until the following spring when corn is planted. This fallow strategy, which is commonly used throughout the High Plains, prevents farmers from utilizing summer precipitation efficiently and reduces the opportunity to produce additional forage. In addition, the lack of biological activity and increased soil degradation associated with intense herbicide applications and tillage make the fallow period an undesirable management strategy for the Southern High Plains region.

We are proposing the introduction of legume cover crops to help mitigate the negative impact of the fallow period after wheat harvest and to enhance the sustainability of grain-cattle operations. Cover crops have been rarely studied in the Oklahoma Panhandle; thus, we plan to evaluate four potentially adaptable legume species: sweet clover, berseem clover, crimson clover, and cowpea. Successful establishment of legume cover crops will allow farmers to extend their grazing season. Cattle normally graze on young wheat from December to March. Interseeding cover crop into wheat stubble immediately after harvest would make grazing possible during late summer and early fall. The four legumes were selected for their potential to perform well under high temperature conditions, their ability to produce large quantities of high quality biomass, livestock preference and low bloating potential, and their ability to tolerate drought conditions.

Our main objective was to identify legume cover crops that can be successfully introduced and managed in the Oklahoma High Plains. Success was measured in terms of biomass quantity and quality, winter survival and expansion of the grazing period, agronomic viability, and soil quality improvement.

Materials and Methods

For practical and demonstration purposes, this research was established in half of an irrigated circle (approximately 24 ha) in 2003 and in a full small irrigated circle (approximately 34 ha) in 2004. The participating farmers insisted that research of this magnitude will allow proper management on the scale to which they are accustom to working. In addition, this size creates a more credible experiment and results for other farmers in the area. The research design was four randomized replicated entries for each cover crop and the control treatment. Yellow sweetclover (Melilotus officinalis), berseem clover (Trifolium alexandrinum), crimson clover (Trifolium incarnatum), and cowpea (Vigna unguiculata) were planted in 2003 and 2004 while sunhemp (Crotalaria juncea) was planted only in 2003 due to difficulties in seed availability.

The production viability of the cover crops in response to climate and agronomic practices was measured according to various performance parameters including final plant populations, biomass yield, and weed suppression abilities. Above ground biomass samples were taken just prior to grazing. During the grazing period, forage yield were periodically measured from sampling areas protected with metal enclosures. Biomass samples were analyzed for moisture and quality including protein and nitrate content. Stockers' performance were measured based on the length of the grazing period. The response variables were weight gains and possible livestock health related problems influenced by the type of diet (legume forage); for example, disorders associated with bloating.

Soil samples were taken in all treatments at various depths to measure selected soil biological and chemical indicators of quality, including total organic C and N, labile N pool size, and soil fertility parameters. Laboratory incubations using soil samples collected early in the following spring (at the 0-10 cm depth) were implemented to determine changes in the labile N pool size due to the presence or absence of a cover crop. Erosion potential was determined annually using USDA-NRCS formulas based on the amount of crop residue left in the soil measured by the line transect method.

Results

Early in July of 2003 and 2004, the legumes were no-till planted after wheat harvest. Wheat residue cover prior to planting averaged 95% in 2003 and 100% in 2004. The excessive amount of wheat residue coupled with high summer heat resulted in minimal germination (Table 1).

Table 1. Final plant populations of legume cover crops.

Legume	Plant population
Berseem clover	8
Cowpea	5
Crimson clover	6
Sunhemp	3
Yellow sweetclover	5

In 2003, 7.6 cm of irrigation water was applied to all the legumes while it was not needed in 2004 due to higher precipitation and lower temperatures in July and August (Table 2). In 2003, cowpea and sun hemp germinated by August 15 and the clovers a month later. In 2004, the cowpea and the clovers germinated earlier (late July) than the previous year; due to wetter and milder temperature conditions. In both years, the clovers reached their maximum fall growth by mid October. Cover crop biomass in the fall was small (Table 3); and in 2004 biomass was even smaller than in 2003 due to the higher amount of wheat residue that negatively affected germination. Protein content in the legumes ranged from 17% in cowpea, 18% in yellow and crimson clovers and sunhemp, and 19% in berseem clover; compared to 16% in the volunteer wheat.

Table 2. Monthly precipitation and average temperature near the experimental site

Legume	Precipitacion (mm)		Temperature (^oC)	
	2003	2004	2003	2004
January	0	1	2	1
February	5	3	1	2
March	29	45	7	10
April	12	30	14	12
May	52	2	19	21
June	132	105	21	22
July	44	70	28	24
August	22	73	26	22
September	38	79	19	21
October	4	16	15	14
November	15	83	6	5
December	5	18	3	3

Table 3. Biomass of legume cover crops and the control treatment

Legume	Biomass (kg ha^{-1})
Berseem clover	524
Cowpea	607
Crimson clover	590
Sunhemp	535
Yellow sweet clover	533
Control	2,234

In a nearby related study at the Oklahoma Panhandle Research and Extension Center, cowpea (1,535 and 2,557 kg ha^{-1} in 2003 and 2004 respectively) and sun hemp (2,140 kg ha^{-1} in 2003) biomass production was considerably higher using similar seeding rates and under dryland conditions. The soils in this case have had considerably less residue cover and germination was near optimum.

Early in November 2003, ninety six head of cattle were released into the entire experimental area. Since more than 70% of the biomass was volunteer wheat, we decided that the limited legume growth did not justify fencing and grazing management by individual legume. The cattle were removed early in February after 82 days of grazing. Overall weight gain was 0.82 kg per head per day and there was no indication of any health related problem associated with grazing.

All the legumes except yellow clover were winter killed. Yellow clover produced a significant amount of additional biomass (1,434 kg ha^{-1}) during the following spring prior to corn planting; indicating that this specie can be successfully introduced into the area's predominantly wheat/cattle-corn cropping system. We contend that frost seeding of yellow clover into wheat may be a more desirable strategy to avoid the high amount of residue after wheat harvest and the high summer temperature during germination. Successful establishment of legume cover crops is likely to improve the soil's capacity to produce plant available inorganic N. The labile N pool, measured at 70 days of incubation, was reduced from 18.1 mg kg^{-1} at the start to 6.1 mg kg^{-1} at end of the experiment. This indicates the inclusion of a productive legume (low C:N ratio) is needed to counterbalance the effect of the large amount of residue with high C:N ratio entering the soil (from wheat and corn) that may be immobilizing inorganic N into organic forms.

Conclusions

•Summer planting is not a desirable strategy for introducing clover cover crops in the High Plains region.

•Cowpea is a promising forage crop that can be successfully planted late in spring to early summer in the High Plains if residue cover is limited and adequate amount of soil moisture is available.

•Yellow clover is the most promising winter legume; however, further studies are needed to identify the best planting time.

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Development of Sustainable Dryland Cropping Systems in the High Plains

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ABSTRACT

Water is the primary limiting factor in High Plains' agriculture. Previous investigations of water conservation practices have generally considered the effect of each practice in isolation and have not attempted to combine them into holistic management systems. This long-term project will develop and compare sustainable dryland cropping systems where practical techniques are combined; making crop and livestock production more diverse, biologically active, and productive; as well as conserve and enhance soil and water resources. Our research plan spans multiple disciplines to evaluate the alternative cropping systems based on their agronomic, economic and risk performance, ability to enhance soil quality, reduce environmental impacts, and farmers' perceptions regarding the adoption of these methods. This project is expected to develop into a research and educational platform to encourage the adoption of more sustainable cropping systems and enhance collaboration among scientists, extension specialists, and producers throughout the High Plains.

Introduction

The risk of partial or complete crop failure is unavoidable when farming in semiarid regions; thus, farmers place a high priority on minimizing this risk (1). Inadequate water supply driven by limited and erratic precipitation in combination with high evaporation potential, is the major limiting factor affecting dryland agricultural production in the High Plains of the United States. Technologies that diminish soil quality exacerbate the water availability problem since they also reduce the soil's ability to store water. Soil scientists have established that a soil with 1 to 2% organic matter can hold only about 17 to 25% of rain than the same soil with 4 to 5% organic matter (2). Declines in soil organic matter also negatively impact nutrient cycling processes, soil structure, and other important chemical, physical, and biological properties. A number of production practices including crop intensification, opportunity cropping, reduced tillage, enhanced residue management techniques, proper plant population and nutrition, adequate grazing management, drought resistant cultivars, and efficient weed control can be used to increase water use efficiency while enhancing soil quality in dryland systems. Many studies have reported substantial benefits of implementing these practices separately. However, studies showing their integrated effect are rare, as are studies evaluating their logistical and economic efficiencies as systems. As a result, producers are often reluctant to adopt more than one or two practices at a time; for example, no-till and/or fertilization. Existing soil and water conservation techniques are at or near their practical limits; therefore, it is essential for the long-term sustainability of High Plains dryland agriculture to consider a wider integration of sustainable agricultural technologies to further improve water conservation and precipitation use efficiency as well as enhance soil quality.

The main objective of this project is to develop sustainable dryland cropping systems for the South Central High Plains while providing a centrally located research/educational platform to promote effective collaboration among scientists, farmers, and extension personnel. Specific objectives include:

•Perform production, economic, and risk evaluations of the alternative dryland cropping systems to determine their feasibility and economic performance under local conditions.

•Identify, measure, and compare key indicators of soil quality and ecosystem health associated with sustainable dryland systems that have the potential to provide ecosystem services to society including those related to soil and air quality improvements.

•Assess farmers' perceptions regarding the adoption of alternative dryland production systems and identify new approaches to enhance producers' involvement in future extension programs.

Materials and Methods

The long-term Dryland Cropping Systems Ecological Research (DCER) project was established in the fall of 2003 at the Oklahoma Panhandle Research and Extension Center (OPREC) located near Goodwell, OK. The main goals of the DCER are to test alternative dryland cropping systems and management strategies aimed at achieving greater precipitation use efficiency, nutrient cycling efficiency, and productivity while providing enhanced environmental benefits. For practical and demonstration purposes, this research was established in a 77 ha (192 acres) area with each plot consisting of approximately 1.6 ha (4 acres). The experimental design is a four- replication split-split-plot randomized complete block, with main plots for two three-year rotations, subplots for each year in the rotation, and sub-subplots for two management strategies. A 3-year flexible rotation consisting of hard winter wheat/spring oat-grain sorghum/forage sorghum-forage cowpea will be compared to a 3-year fixed rotation consisting of hard winter wheat-grain sorghum-fallow. The fixed rotation, where crops are planted regardless of soil water status, is commonly used throughout the region. In contrast, crops in the flexible rotation are planted when soil moisture prior to planting is favorable. For example, oat may be planted in the spring if sufficient soil moisture was not available for wheat planting the previous fall. Two management strategies, conservative and aggressive, are applied to both cropping systems and used to determine the appropriate plant nutrition and plant population strategies for optimal plant biomass production. Both systems will use minimal pesticide applications based on an integrated pest management approach. Limited grazing of young wheat, spring oat, forage sorghum, or cowpea will be allowed when adequate amounts of biomass are produced. Reduced tillage, preferably no-till, will be used throughout the DCER. Soil water content up to 1.2 m in 0.30 m increments is measured weekly using gypsum blocks in each plot.

The production viability of rotations and management strategies are evaluated based on various performance parameters including final plant populations, weed suppression abilities, insect and disease control, crop yields and yield components, and economics risk and profitability. Stockers' performance will be measured based on the length of the grazing period for each crop. The response variables to be studied include weight gains and body condition scores, blood metabolite levels, and intake rate. Insect pests and diseases will be monitored and the information used to make management decisions according to damage threshold. Also changes in insect community structure will be determined for each system. Soil water distribution, leaf area, and canopy temperature readings will be taken periodically for each crop of the various cropping systems. Weed population densities and categorization by species will be performed several times each year.

Soils of all treatments will be sampled in the spring at various depths to measure selected soil biological and chemical indicators of quality, including total organic C and N, labile C and N pool sizes, and soil fertility parameters. The labile C and N pools are determined using long-term aerobic incubations (3). Nematode populations as responses to selected treatments will be determined by extracting soil sub-samples using the centrifugation-flotation technique (4) and counted under a stereoscopic microscope. Soil samples will also be taken periodically to monitor changes in microbial activity in selected treatments. Soil physical attributes, indicators of soil quality that will be measured, include: water holding capacity, water infiltration rates, bulk density, soil resistance to penetration, erosion potential, and snow/rain catching capacity. Erosion potential will be determined annually using USDA-NRCS formulas based on the amount of crop residue left in the soil measured by the line transect method. The snow and rain catching capacity will be determined by the amount of precipitation received that is realized as soil moisture content at any given time, especially prior to planting.

Preliminary Results

It is yet premature to recognize any conclusive differences between the two cropping systems (flexible vs fixed). However, some of the early results are promising. For example, the inclusion of forage cowpea in rotation with wheat and sorghum in the flexible rotation (compared to the fallow period in the fixed rotation) has not reduced the soil moisture to a level that would be unfeasible to plant wheat in the fall of 2004. The amount of summer and fall precipitation has been above the historical average to date (Table 1). Thus, we contend that if rainfall in the summer and fall of any given year is near the historical average then the introduction of forage cowpea in rotation with wheat and grain sorghum has a high probability of success. The question remains for years with low precipitation. Keeping a fallow period until soil moisture becomes available may be a reasonable option during long droughts.

Table 1. Historic monthly precipitation (in mm) at the Oklahoma Panhandle Research and Extension Center

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. precip. (1910-2004)	10	12	23	33	72	64	66	60	44	33	17	11
2004	1	3	45	30	2	105	70	73	79	16	83	18

The first wheat crop was planted in mid October 2003 when soil moisture reached about 50% field capacity for the 1.2 m profile. Unfortunately, only traces of precipitation were received from that point until the end of grain filling in mid May 2004. Overall, this lack of water resulted in relatively low wheat yields. However, an important difference was observed between the aggressive (2,290 kg ha^{-1}) and the conservative (2,014 kg ha^{-1}) management systems. The forage cowpea was planted in early June 2004 when soil temperature averaged 21 ^{o}C and soil moisture reached 50% field capacity (Fig. 2). The favorable soil moisture at planting and the additional precipitation received during the summer resulted in excellent plant populations and forage yield. The cowpea in the aggressive management system showed a superior competitive advantage against weeds (compared to the conservative system) due to its higher plant population. As a result, biomass production of forage cowpea in the aggressive system was 3.7 t vs 2.9 t of dry matter in the conservative system; weed biomass was 0.4 t and 2.0 t (dry matter) respectively. Sorghum yield was only 4% greater in the aggressive management (3936 kg ha^{-1}) when compared to the conservative management (3793 kg ha^{-1}); however, a greater competitive advantage over weeds in the aggressive system was observed in several contiguous plots.

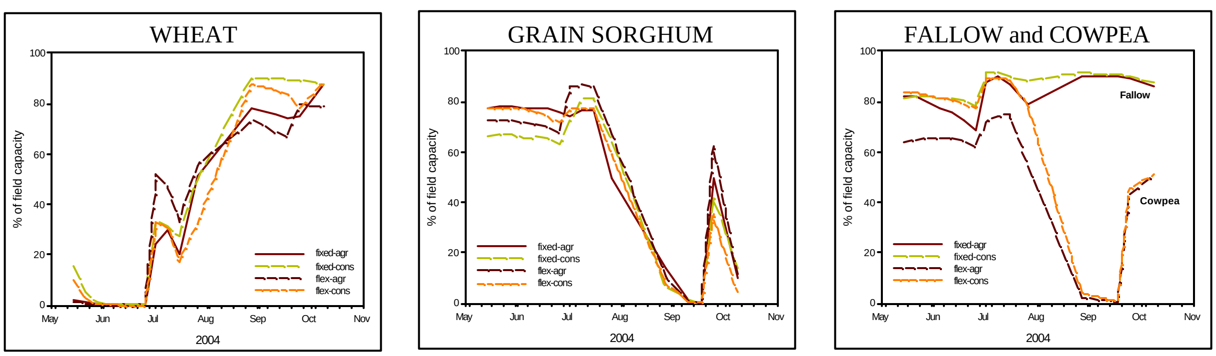

Figure 2. Changes in soil moisture content due to cropping system management

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CHANGES IN SODIUM ADSORPTION RATIO FOLLOWING ANNUAL APPLICATIONS OF ANIMAL MANURES

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OBJECTIVES

1. To evaluate the effect of annual applications of animal manures on soil electrical conductivity (EC) and sodium adsorption ratio (SAR) estimated from saturated soil-paste extracts.
2. Evaluate the effects of long-term land application of swine and beef waste on biological, chemical, and physical properties of the soil.

INTRODUCTION

Livestock production is an important component of agriculture production in the southern Great Plains. Current livestock production includes beef, dairy, and swine; ascribed to livestock production is the disposal of large amounts of manure annually. Land application of manure derived nutrients for crop production systems has been a common practice for many livestock producers in this region. Generally, when manure is land applied as part of a crop production system the quantity is determined as a function of the nitrogen (N) or phosphorus (P) needed. However, soluble salts must also be accounted for in the animal waste management system. The semi-arid climatic conditions that occur in the Great Plains may be susceptible to salt additions from recent agricultural developments. Therefore, particular attention needs to be made in respect to the practice of applying animal manures in the southern Great Plains. For the first objective, the soluble salts levels in the soil profile will be evaluated for swine and beef waste-nutrient management programs in the southern Great Plains. Further attention will focused on sodium (Na) because of its dispersive potential in soils, which may destroy the physical properties of soil and limit sustainable agricultural production.

PROCEEDURE

Field experiments were conducted at the Oklahoma Panhandle Research and Extension Center (OPREC) near Goodwell, OK (36°35 N, 101°37 W, and elevation 992 m). Mean annual precipitation and temperature at the station are 435 mm and 13.2 °C, respectively. The predominant soil series at this site is a Richfield clay loam (fine, smectitic, mesic, Aridic Argiustoll) on 0-2% slopes. Established in 1995, a randomized complete block design with repeated measures was used to determine the effects of annual applications of beef manure (BM), swine effluent (SE), and anhydrous ammonia (AA) on soil properties. Corn (*Zea mays* L.) was planted annually, under conventional tillage methods. Beef manure, SE, and AA were applied to provide 0, 56, 168, and 504 kg N ha^{-1} yr^{-1}; beginning in 1995 and has continued annually to the same plots. Selected initial soil chemical characteristics are given (Table 1). Anhydrous ammonia was soil injected in Feb.-Mar. of each year; while BM was applied and incorporated prior to annual planting, and SE was surface applied at approximately the 6-leaf (V6) growth stage of corn. Soil samples were obtained in the spring of each year prior to treatment application from 4.6 m by 9 m treatment plots at depths of 0-15, 15-30, 30-45, and 45-60 cm depths. The 60 –120 cm depth was treated as a composite sample. Saturated soil paste extracts were used to determine pH, EC, Na, Ca, Mg, K, CO_3 and HCO_3; and manure samples were evaluated for moisture-content, pH, EC, Na, Ca, Mg, K, P, total N (TN), total carbon (TC), NH_4-N, and NO_3-N (Table 2). Total K, P, Na, Ca, and Mg of manures were determined from nitric acid digestions (EPA 3050B) and are included in Table 2. Total dissolved salts (TDS) were calculated to provide an estimated amount of salt contributing to soil salinity. The quantity of manure and effluent as well as Na, Ca, Mg, K, and TDS applied annually for each manure treatment are listed in Table 3.

RESULTS:

Cumulative Effects of Manure Additions:

Manure applied ranged from 4 to 37 Mg ha^{-1} for BM and from 73 to 527 m^3 ha^{-1} of SE annually (Table 3). At the highest loading rates BM and SE contributed 90 and 115 kg Na ha^{-1} yr^{-1}, respectfully. Total sodium additions ranged from 58 to 575 kg Na ha^{-1} after five annual manure applications, as a function of loading rate and manure source. Sodium additions per hectare were greater for SE applications relative to BM when applied at similar loading rates. For other nutrients at similar loading rates, BM contributed more Ca, Mg and P per hectare than did SE; whereas SE contributed greater quantities of K and TDS when compared to BM (Table 3). Anhydrous ammonia was assumed to contribute only $NH_{3\ (g)}$ to the soil system.

Sodium Adsorption Ratios:

Sodium adsorption ratios (SAR) have been altered following five cumulative, annual manure additions at the 0-15 cm depth (Table 4). Soil SAR increased linearly with SE additions; however it decreased linearly with additional AA loading, while BM loading remained unchanged with additional manure loading (Figure 1 and Table 4). Although SAR increased with additional SE loading, only at the high SE loading rate was the increase significantly greater than AA and BM at similar loading rates (Figure 1). The increase to the SAR from SE above BM at similar loading rates corresponds to a greater amount of Na being applied with SE applications (Table 3); whereas no Na was added with the AA applications.

The SAR of the high SE loading rate resulted in differences when compared to the low SE loading rate; however the SAR at the medium SE rate was not significantly different than the high rate (Table 4). Although SAR for the 168 kg ha^{-1} annual loading rate was not significantly less than the highest rate it followed the trend of increasing SAR with an increased SE loading rate. Sodium adsorption ratios, for soil following AA applications was significantly lower than BM and SE treated soils at the high and medium loading rates at the 0-15 cm depth (Figure 1). However, SAR values for the low SE loading rate were comparable to high AA the rate; and the low AA rate was significantly higher than the high AA rate at this soil depth (0-15 cm) after five cumulative applications (Table 5). Sodium adsorption ratio responses illustrated in Figure 1 demonstrate the loading rate influence on Na accumulation.

Sodium adsorption ratios for all AA, BM, and SE loading rates were compared to a control. Because initial data for SAR was not measured (Table 1), the control equals the mean of all 0 N rates at 0-15 cm. When SAR was compared to the control, only SE and AA at the high loading rate were distinguished from other treatments (Figure 2). The SAR trend was to increase with SE and decrease with AA applications. While the high SE and AA loading rates are the only treatments with SAR values significantly different from the control SAR, it is evident that if the trend is continued, the medium SE loading rate is at risk of increasing SAR above the control as well. This SAR trend may become greater each year at the 0-15 cm depth if annual applications continue.

Demonstrated SAR responses to increased loading rates from regression equations are found in Figure 1; however the SAR response information is for the cumulative annual applications. The SAR response as a function of the loading rate over time corroborates this information (Figure 3). The SAR responses in a three year period found in Figure 3 indicate that SAR ranges seasonally; although, SAR still increased with SE applications, decreased with AA applications, and BM applications have maintained relatively level SAR values after five cumulative annual load rate applications as observed in Figure 1. The SAR responses to seasonal soil profile changes indicate that a comparison to a control may be needed to effectively evaluate 'real' SAR increases. While SAR had considerable range, the increasing separation of SAR values at these loading rates is evident. Only SAR's at the high SE loading rate have increased above the control after five annual applications (approx.~2500 kg N ha^{-1}) at the 0-15 cm depth (Figure 3). While SAR changes were small and below the commonly held 13% where soil dispersion occurs, these changes can be used to evaluate potential declines to soil quality status.

Table 1 Initial soil characteristics of a Richfield clay loam at the 0-15 cm depth.

Characteristics		Continuously cropped, conventionally tilled system
pH		7.18
NH_4-N	mg kg^{-1}	10.7
NO_3-N	mg kg^{-1}	55.4
P	mg kg^{-1}	34.3
K	mg kg^{-1}	634
Mg	mg kg^{-1}	747
Ca	mg kg^{-1}	2512
TN	g kg^{-1}	1.2
TC	g kg^{-1}	12.3

Sodium adsorption ratios responses to AA applications have also decreased the pH (Table 4) with a corresponding increase in the amount of soluble Ca and Mg in the extract solution. The decreasing SAR for AA applications was facilitated by increasing quantities of soluble Ca and Mg while maintaining Na levels (Table 4). Additionally, SAR responded to the high AA loading rate applications because soil Ca and Mg increased greater than four-fold (~4.4) relative to the found with the SE and BM treatments at similar loading rates (Table 4). The

SAR of AA applications also have increased in NH_4-N (Table 4) which has likely facilitated the replacement of exchangeable Na.

Electrical Conductivity:

Soil EC changed due to AA at the high loading rate (Table 4). The soil EC increase of 2.35 dS m^{-1} at the high AA loading rate above all other treatments was of co-result of soil pH decreases and NH_4-N accumulations; which tended to increase Ca, Mg, K, and Na in solution. Soil EC was not significantly affected by BM and SE at current loading rates.

CONCLUSIONS

At the highest loading rates BM and SE contributed 90 and 115 kg Na ha^{-1} yr^{-1}, respectfully. Sodium was added in greater quantities when SE was used as an N source when compared to BM; however BM contributed more divalent cations to the soil system. Sodium adsorption ratios increased linearly with SE additions; however AA decreased SAR linearly with increasing loading rates, while BM has remained unaffected by loading rates. The trend for SAR to increase with SE loading and decrease with AA loading is a cause for concern.

If SAR continues to increase above the control with SE loading these soils will become sodic in the future. However, if SAR continues to decrease with AA loading these soils may become severely acidic; additionally, soluble nutrient leaching may occur under irrigation while maintaining repeated loading rate applications. The slow increase of SAR above the control in SE amended treatments can be deterred by management practices such as increased water infiltration to enhance Na leaching.

The soil EC increase of 2.35 dS m^{-1} at the high AA loading rate above all other treatments was of co-result of soil pH decreases and NH_4-N accumulations; which tended to increase Ca, Mg, K, and Na in solution. Soil EC was not significantly affected by BM and SE at current loading rates.

Table 2 Selected characteristics of beef manure (BM) and swine effluent (SE) used over five years on experiments located at OPREC, Goodwell, OK.†

		BM (16)‡		SE (298)	
pH		8.02	±0.17	8.19	±0.13
EC_m§	$dS\ m^{-1}$	14.84	±1.19	9.46	±0.98
Moisture content¶	$kg\ Mg^{-1}$	658.9	±27.8	7.5	±1.2
Na	$mol\ Mg^{-1}$	161	±8	1267	±133
Ca	$mol\ Mg^{-1}$	785	±70	360	±67
Mg	$mol\ Mg^{-1}$	203	±15	200	±40
K	$mol\ Mg^{-1}$	443	±20	3000	±80
P	$mol\ Mg^{-1}$	178	±15	280	±13
TDS	$kg\ Mg^{-1}$	33.9	±2.3	8.4	±0.5
TN	$kg\ Mg^{-1}$	31	±2	136	±4
TC	$kg\ Mg^{-1}$	344	±30	261	±16
NH_4-N	$mmol\ L^{-1}$	.	.	45.3	±1.3

† Numbers based on manure dry-weight, except NH_4-N.
‡ Number of samples.
§ Electrical conductivity of manure (EC_m). BM required a 1:2 manure: H_2O ratio.
¶ Moisture content is equal to kg solids Mg^{-1} manure.

Table 3 Annually applied beef manure (BM) and swine effluent (SE) to a conventionally tilled, continuously cropped corn production system located at OPREC, Goodwell, OK. Total dissolved solids (TDS) is a estimate of salt loading.

			Application Amount					
Source	N		Na	Ca	Mg	K	P	TDS
	$kg\ ha^{-1}$	$Mg\ ha^{-1}$	———	———	——— $kg\ ha^{-1}$ ———	———	———	———
BM	56	4	10	83	13	46	15	413
	168	12	30	253	40	137	44	1239
	504	37	90	756	119	422	134	3716
		$m^3\ ha^{-1}$						
SE	56	73	16	8	3	64	5	1827
	168	176	38	19	6	155	11	4430
	504	527	115	56	19	464	34	13277

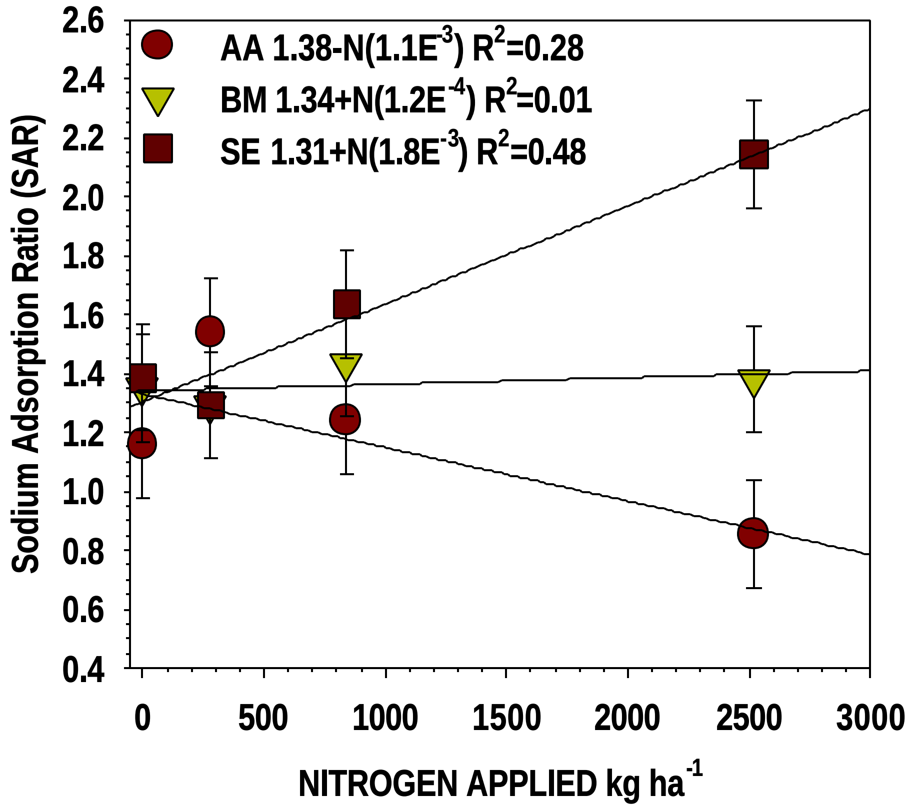

FIGURE 1 Sodium adsorption ratio (SAR) at 0-15 cm depth in 2000 as a function of cumulative annual applications of anhydrous ammonia (AA), beef manure (BM), and swine effluent (SE) in a continuously cropped, conventionally tilled corn production experiment located a OPREC, Goodwell, OK (n=3).

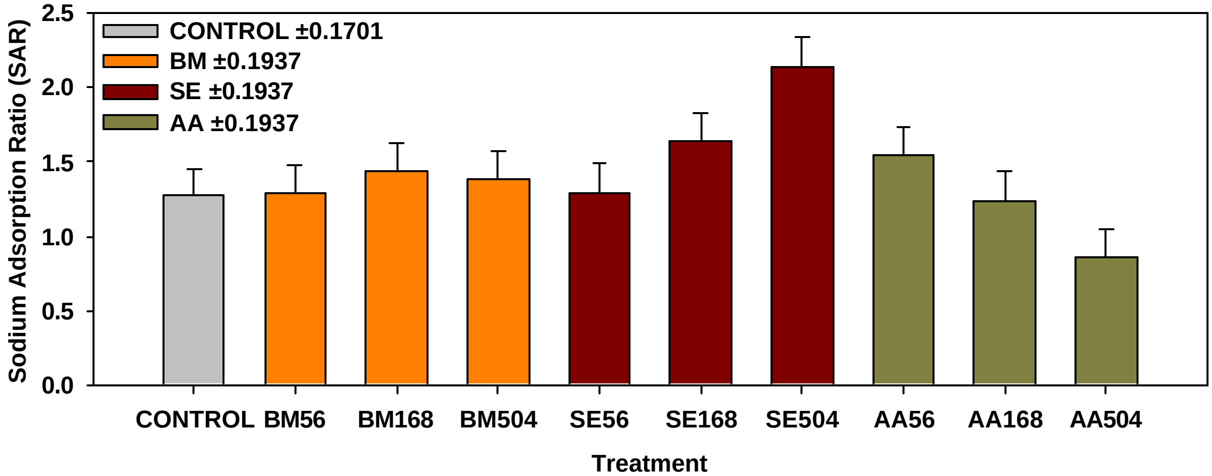

Figure 2 The cumulative effect of five annual applications of beef manure (BM), swine effluent (SE), and anhydrous ammonia (AA) at 56, 168, and 504 kg N ha^{-1} yr^{-1} on sodium adsorption ratio (SAR) at the 0-15 cm depth when compared to the control plot. The control plot is the average of all 0 N rates.

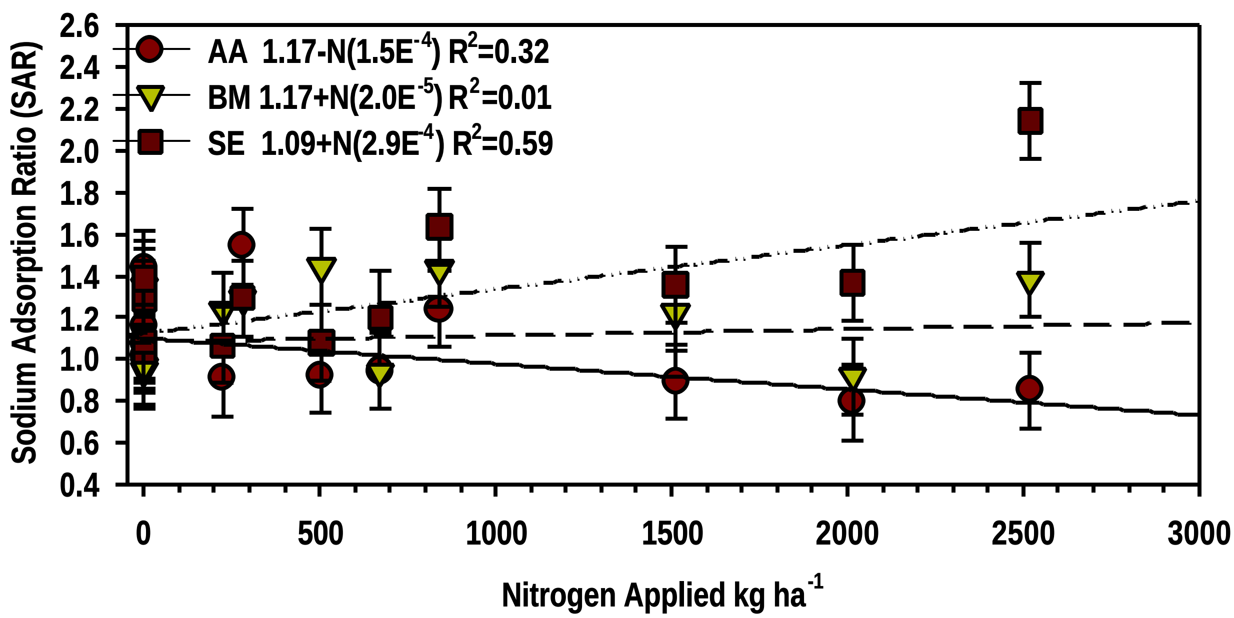

Figure 3 Sodium Adsorption Ratio (SAR) at the 0-15 cm depth as a function of cumulative annual applications of anhydrous ammonia (AA), beef manure (BM), and swine effluent (SE) in a continously cropped, convetionally tilled corn production system located at OPREC, Goodwell, OK. Data represents three years of cumulative applications.

Table 4 Cumulative soil characteristics after five annual applications of anhydrous ammonia (AA), beef manure (BM), and swine effluent (SE) of a continuously cropped, conventionally tilled corn production system.

			---------------Saturated paste extract---------------							2M KCl‡		----------MIII§----------				LECO¶	
Source	N	pH_e	EC	SAR	HCO_3	Na	Mg	Ca	K	NH_4-N	NO_3-N	P	K	Mg	Ca	TN	TC
	kg ha^{-1}		dS m^{-1}		----------mmol L^{-1}---------					------------------mg kg^{-1}-----------------						g kg^{-1}	
AA	0	7.18	0.75	1.16	.	1.8	1.0	1.5	1.0	3.1	7.2	36	691	909	2457	1.3	11.0
AA	56	7.87	0.95	1.56	0.78	2.6	1.2	1.7	1.0	3.7	12.8	26	588	783	2189	1.1	10.4
AA	168	6.86	1.13	1.23	0.79	2.4	1.5	2.2	1.1	4.1	26.2	38	646	837	2340	1.2	10.7
AA	504	5.94	3.55	0.83	0.09	3.0	5.1	7.8	2.1	140.0	151.6	45	623	802	2252	1.4	9.3
BM	0	7.71	0.98	1.36	1.01	2.5	1.4	2.0	1.1	1.8	9.0	35	736	963	2658	1.3	11.0
BM	56	7.29	0.96	1.29	1.22	2.3	1.3	1.9	1.3	3.1	10.9	62	680	878	2428	1.3	11.5
BM	168	7.68	1.00	1.42	1.16	2.5	1.3	1.9	1.5	4.0	17.9	70	773	899	2582	1.2	11.7
BM	504	7.29	1.01	1.39	0.86	2.4	1.2	1.7	2.2	4.0	26.6	156	914	905	2889	1.6	14.1
SE	0	7.56	0.83	1.38	1.46	2.2	1.0	1.6	0.9	2.5	8.3	22	667	908	2467	1.1	10.3
SE	56	7.43	0.76	1.30	.	2.0	0.9	1.4	0.9	2.5	6.9	32	740	981	2916	1.1	9.6
SE	168	7.58	1.09	1.62	1.22	3.1	1.3	2.5	1.6	3.1	11.6	33	876	1013	3077	1.2	9.8
SE	504	7.92	1.20	2.18	0.86	3.7	1.1	1.8	2.4	3.7	8.2	81	888	766	2143	1.2	11.0

Buffalograss Performance in the Southern Great Plains Utilizing Swine Effluent as a Nutrient Source

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OBJECTIVES:

1. To evaluate the effect of annual applications of animal manures on Buffalograss performance and quality under a high yield potential systems.
2. Evaluate the effects of long term application of swine effluent on the long-term forage stand persistence; including the biological, chemical, and physical properties of the soil.

INTRODUCTION:

According to the 1992 Census of Agriculture (USDA-NASS) reports there were; 18,780 total swine (*Sus scrofa domesticus*) in Beaver, Cimarron, and Texas Counties. As of the 2002 census the reported total was 1,227,732 swine for the same region. With the large increase of swine production in the last ten years management strategies have been sought to most effectively utilize the resources. Of particular interest is swine effluent (SE), with less than 5% solids by weight. Swine effluent is usually stored in lagoons prior to land application as a nutrient source in crop production systems. Currently, land applications are applied to meet the N or P requirements needs of the crop species growing. With current mandates regarding nutrient levels in the soil, producers concerned about land-use resources need alternative uses for SE utilization. One, such use is to land apply SE to a high yielding forage production system. The objectives of this study are to evaluate the yield and quality of buffalograss (Bison, *Buchloe dactyloides* [Nutt] Engelm.) following additions of SE as an N fertilizer.

PROCEEDURE:

Forage plots were arranged in a random split-plot design with four replications. Buffalograss, established in 1998, on a Richfield clay loam soil (fine mesic aridic Argiustolls) on 5 X 10 ft plots utilized a center-pivot irrigation system. Swine effluent and urea were surface applied at N rates of 0, 50, 150, and 450 lbs N ac^{-1}. The 50 and 150 lb N ac^{-1} were applied prior to the first harvest period; while the 450 lb N ac^{-1} rate was split applied in the month prior and post harvest of the first cutting. Harvesting occurred approximately every 28 days beginning in June through September. Sub-sampling of forage clippings occurred weekly at the onset of harvesting. Monthly samples were used to estimate forage yield. All samples were analyzed for crude protein (CP), acid digestible fiber (ADF), and neutral digestible fiber (NDF).

RESULTS:

Average yields for buffalograss increased linearly with increasing N additions. Forage production was similar for SE additions when compared to urea as an N source (Figure 1). Ammonia volatization was a concern when utilizing SE as a nutrient source since a large percentage of the N in SE is in the NH_4^+ form which would be susceptible to volatilization loss in a high pH soil. Based on these results for a forage production system, volatilization may not be a significant concern when SE is used as an N source.

The average CP, ADF, and NDF levels for buffalograss are listed in Table 1. There was a linear increase in CP with increasing nitrogen additions each year demonstrating that the addition of nitrogen to buffalograss does help to improve forage nutritive values (Figure 2). No significant differences were found between the two N sources, SE and U, for the 2001 thru 2003 growing seasons. Not only did the addition of N fertilizers help to improve the nutritive values but there was also a linear increase in the dry-matter yield (DMY) of buffalograss with increasing amounts of nitrogen fertilizer. Soil moisture was integral to these sustained yields.

Generally CP and NDF are inversely proportional therefore when CP is low NDF will be high. This response was observed in 2001-2003 harvest seasons where CP levels were greatest at the first harvest then decreased throughout the growing season with an average CP content of approximately 10%. It should be noted that buffalograss CP did not exceed 12% at anytime during the growing season. As with many forage species, CP levels for buffalograss decreased throughout the growing season with the lowest levels at the end of the growing season (Figure 3).

CONCLUSIONS:

Results indicate that buffalograss forage yields and quality is similar to urea N additions. Swine effluent was shown to increase forage yields and improve forage nutritive values with increasing N additions. After, five cumulative annual N applications buffalograss continues to produce yields above expectations. Buffalograss is a native range forage in semi-arid regions that is capable of performing in high yielding forage production systems when SE contributes N and is periodically irrigated.

Table 5 Buffalograss forage nutritive values from 2001-2003; where yield, crude protein (CP), acid digestible fiber (ADF), and neutral digestible fiber (NDF) were measured. These are seasonal values are the average of the 50, 150, and 450 lb N ac^{-1} applications.

Year	Yield (ton ac^{-1})	CP (%)	ADF (%)	NDF (%)
2001	4.0	10.9	36.0	66.4
2002	7.5	10.1	38.7	70.6
2003	6.6	10.1	38.6	69.2

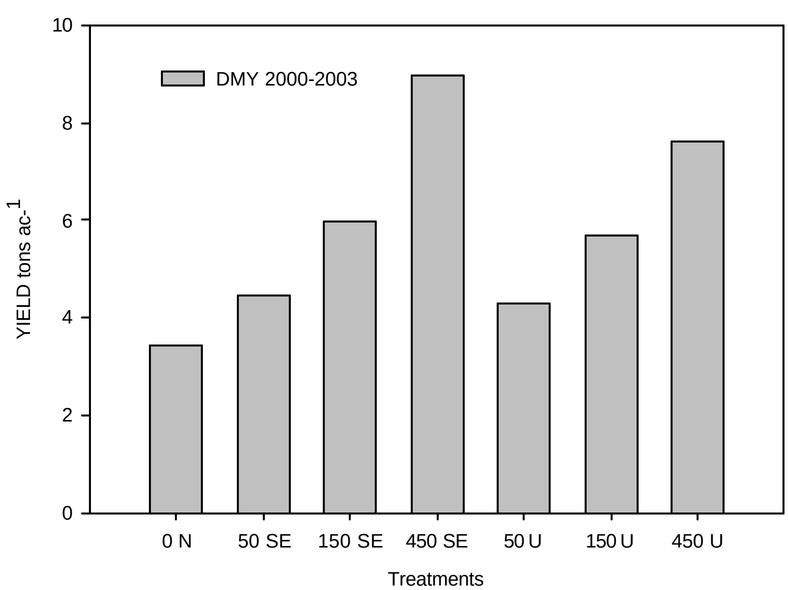

Figure 1. Buffalograss dry-matter yield (DMY) averaged for 2000-2003 when swine effluent (SE) and urea (U) were applied at 0, 50, 150, and 450 lb N ac^{-1}. There was no significant difference between N sources at the same application level.

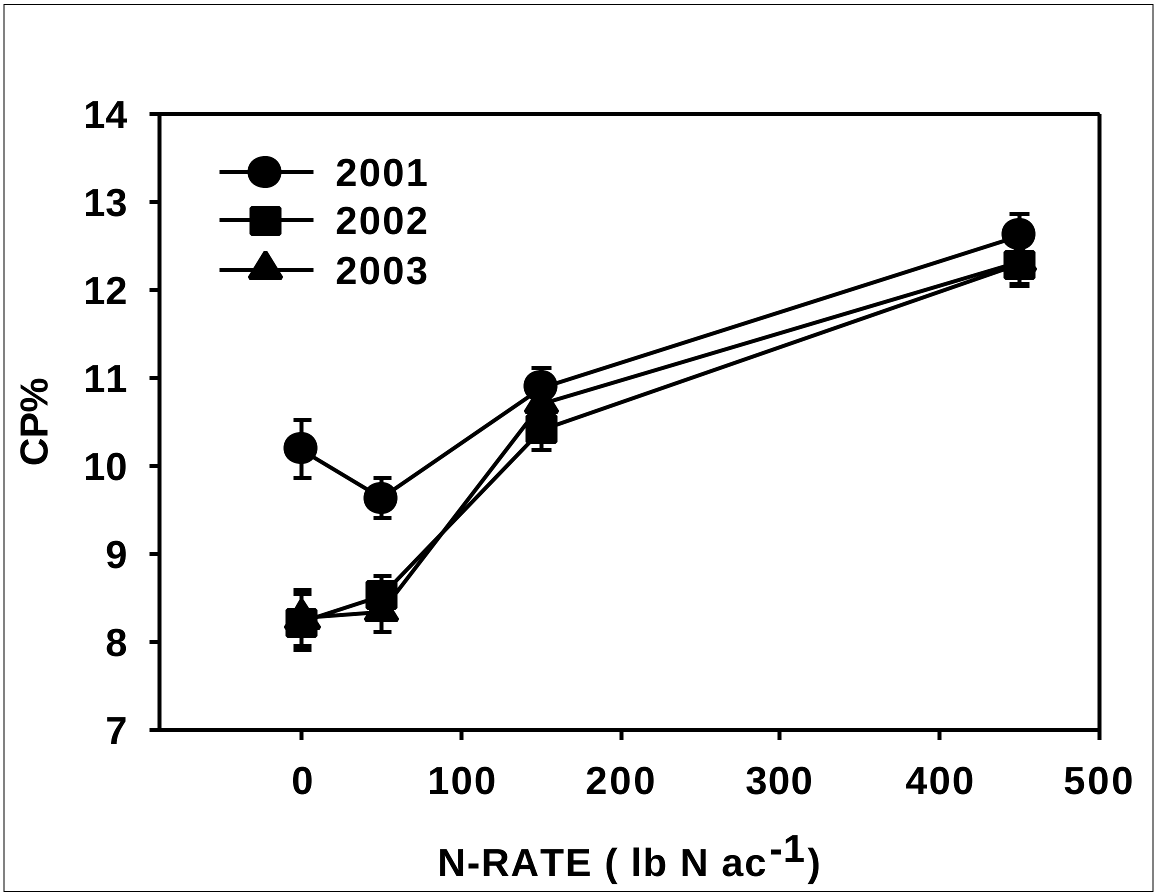

Figure 2. Buffalograss crude protein (CP) versus nitrogen rate. CP increased linearly with nitrogen additions. There was no significant difference between N sources at the same application level.

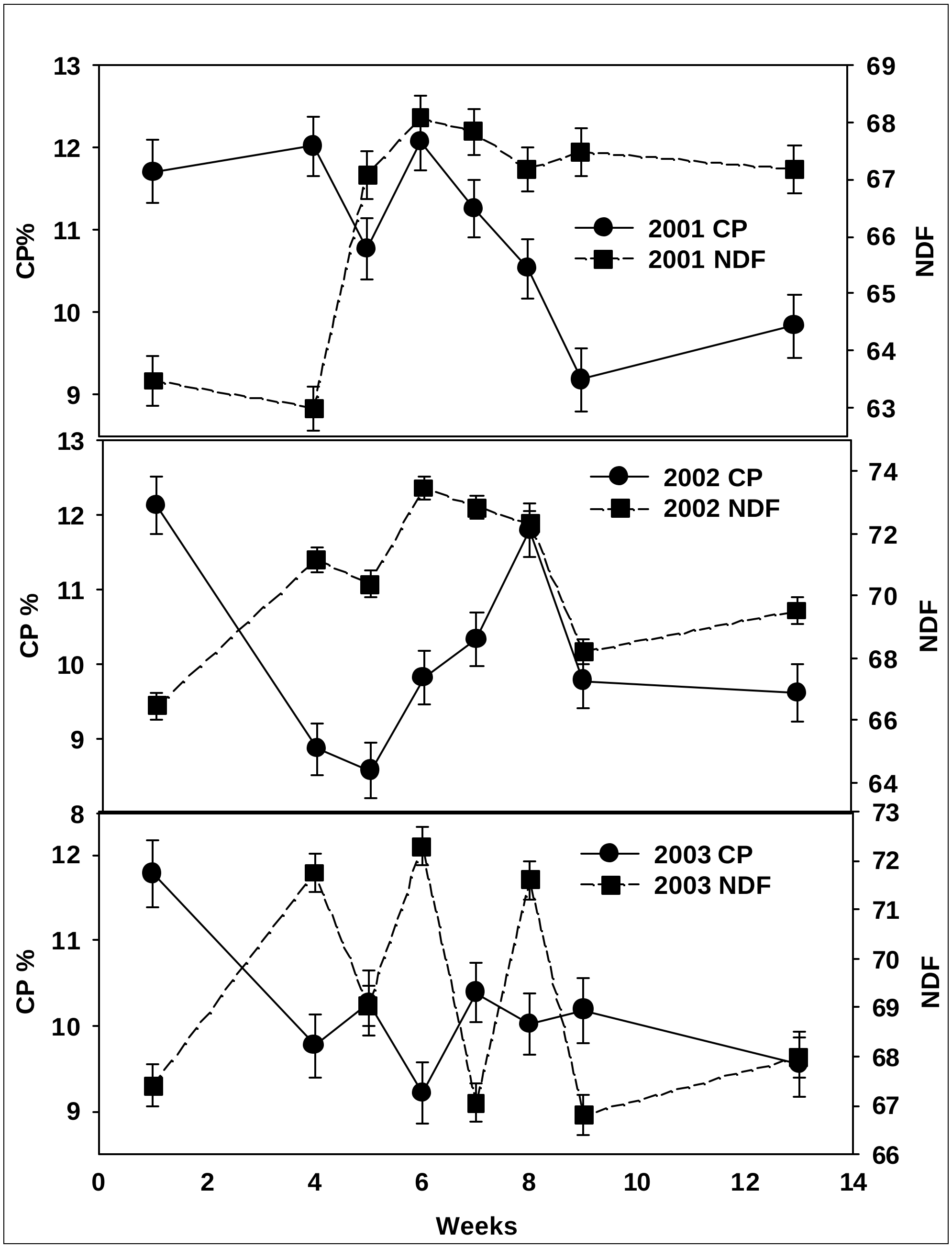

Figure 3. Buffalograss quality comparing crude protein (CP) versus neutral detergent fiber (NDF) over time. Weeks 1, 4, 8, and 12 are the monthly harvests. Week 1=June, Week 4=July, Week 8=August, and Week 12=September.

OKLAHOMA CORN PERFORMANCE TRIALS, 2004

PRODUCTION TECHNOLOGY CROPS

OKLAHOMA COOPERATIVE EXTENSION SERVICE
DEPARTMENT OF PLANT AND SOIL SCIENCES
DIVISION OF AGRICULTURAL SCIENCES & NATURAL RESOURCES
OKLAHOMA STATE UNIVERSITY

PT 2004-11 November 2004 Vol. 16, No.11

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TRIAL OBJECTIVES AND PROCEDURES

Each year the Oklahoma Cooperative Extension Service conducts corn performance trials in Oklahoma's corn producing areas. In 2003 a dryland trial was added at Blackwell, in 2004 trial was near Tonkawa. These trials provide producers, extension educators, industry representatives, and researchers with information on corn hybrids marketed in Oklahoma. Company or brand name, entry designation, plant characteristics, and maturity information, was provided by the companies (Table 3,4). Oklahoma State University did not verify this information. For disease resistance consult company representatives. Company participation was voluntary, therefore some hybrids marketed in Oklahoma were not included in the test.

Irrigated test plots were established at the Oklahoma Panhandle Research and Extension Center (OPREC), Goodwell, Joe Webb farm, near Guymon, and a dryland trial near Tonkawa. Fertility levels, herbicide use, and soil series (when available) are listed with data. At OPREC and the Webb location, two rows 25 feet long were seeded at the target population of 32,000 plants/ac, and 20 feet of both rows were harvested. At the Blackwell location two rows 25 feet long were seeded at target population of 25,000 plants/ac, 20 feet of both rows were harvested. The ensilage trial was seeded the same as grain trial at OPREC and 10 feet of one row was harvested for yield. Experimental design was a randomized complete block with four replications. Grain yields are reported as bu/ac of shelled grain (56 lbs/bu) adjusted to moisture content of 15.5%. This is consistent with U.S. No. 1 grade corn standards. Corn ensilage was harvested at the early dent stage with average moisture content of 70.8 %. Ensilage production is reported as tons/ac adjusted to 65% moisture. This is consistent with current ensiling practices.

GROWING CONDITIONS

Panhandle

The planting period was characterized by excellent topsoil moisture from rainfall received in April. Most producers used some pre-irrigation to obtain desired subsoil moisture levels. Soil temperature of 61° F on April 1 at the two-inch depth was consistent with observations in previous years. Most corn in the region was planted in April with short delays due to rainfall. During the growing season rainfall was excellent from mid June until mid August 1 (Table 1) with some areas receiving significantly more rain than OPREC. With the abundant precipitation most producers in the area reduced irrigation from mid June until mid August, although more irrigation was needed in May and early June that normal. The panhandle region had several yield reducing hailstorms from mid May until early July, although OPREC didn't have hail for the second year in a row. Pollination period (July 1 through July 15) temperatures for 2004 were similar to 2002, which were below or near the long-term average (Fig. 1). High moisture corn was cut with minor delays from weather in late August and early September. However, delays of 3 weeks or more were common for dry corn harvest due to cool temperatures and rain in late September and October for the second year in a row. The growing conditions had an affect on ensilage quality in 2004 with grain protein 1.3% higher in 2004 than 2003 (8.6% compared to 7.3%) and ADF 1.2% lower (31% compared to 32.2% in 2003).

Tonkawa
The planting period had ideal soil moisture and soil temperatures, followed by more rainfall than long-term average for the growing season (Table 2). Most corn was harvested in late August and early September without major delays.

RESULTS

Grain yield, test weight, harvest moisture, and plant populations for the Blackwell, OPREC, and Webb trials are presented (Tables 5-7). Yields in the panhandle trials were excellent in 2004. Yields for the Tonkawa trial were reduced due to inadequate weed control. Plant populations at all locations were lower than target due to removal of all double plantings.

Ensilage yields ADF, TDN, and energy values are reported (Table 8). Crude protein is not reported, because no difference existed and all hybrids were near the average of 8.6%.

Small differences in yield or other parameters should not be overemphasized. Least Significant Differences (L.S.D.) are shown at the bottom of each table. Unless two entries differ by at least the L.S.D. shown, little confidence can be placed in one being superior to another. The coefficient of variability (C.V.) is provided as an estimate of the precision of the data with respect to the mean. To provide some indication of yield stability, 2-year means are provided in tables 5, 6, and 7. Producers interested in comparing hybrids for consistency of yield should consult these tables.

The following people have contributed to this report by assisting in crop production, data collection, and publication; Donna George, Leann Leach, Lawrence Bohl, Matt LaMar, Jason Weirich, Chad Fowler, and Craig Chestnut. Their efforts are greatly appreciated.

Figure 1. Daily OPREC high temperatures for July 1 through July 15, 2001 through 2004, and long-term mean.

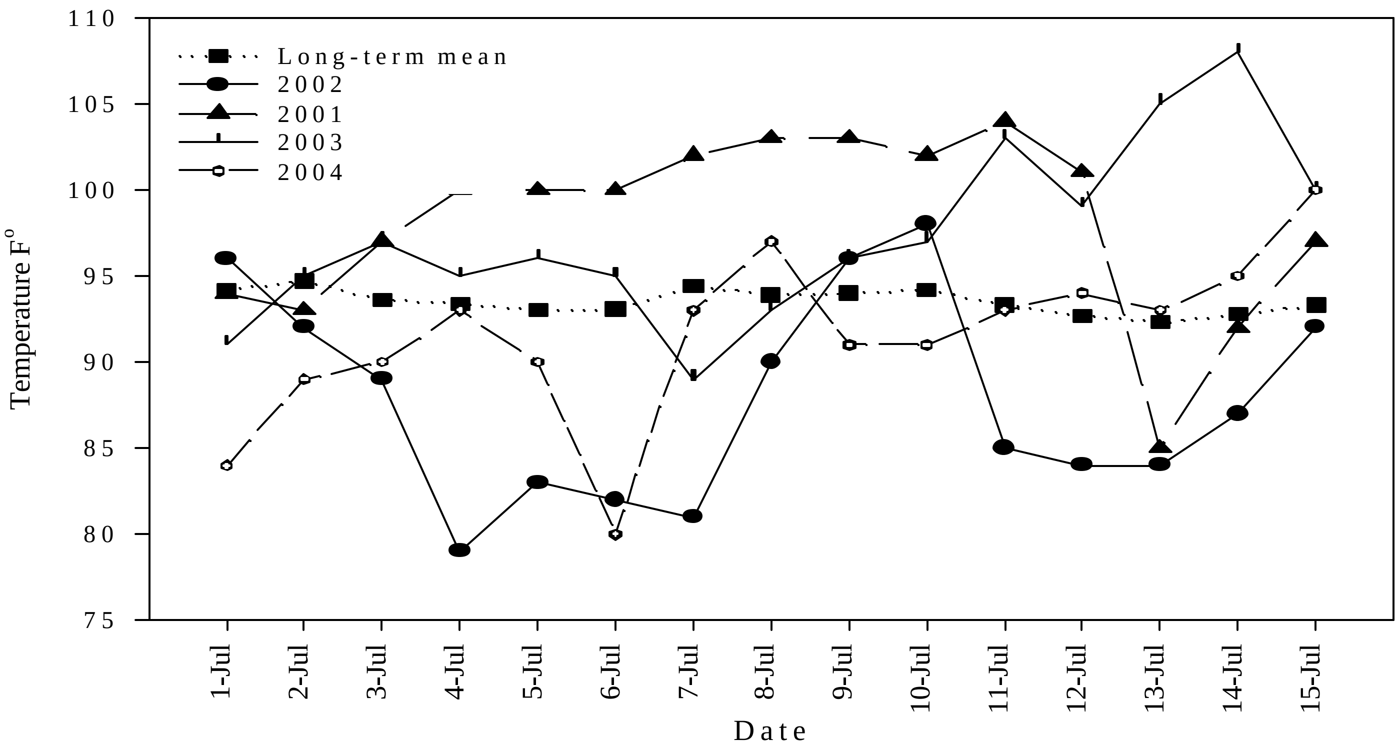


Table 1. Rainfall and irrigation for irrigated corn performance trial locations, 2004.

Location	April	May	June	July	Aug	Total
Long-term mean	1.33	3.25	2.86	2.58	2.28	12.30
Texas county	2.12	0.15	3.82	2.43	2.87	11.39
Irrigation						
OPREC	2.0	3.0	2.0	2.0	1.0	10.0
Joe Webb*	0.0	2.0	3.0	5.0	5.0	15.0

* Joe Webb trial 4 inches of pre-irrigation

Table 2. Rainfall at Tonkawa dryland corn performance trial, 2004.

Location	April	May	June	July	Aug	Total
Long-term mean	3.28	5.83	4.05	2.68	3.19	19.03
2004	5.19	2.25	8.31	4.34	3.42	23.51

Table 3. Characteristics of Corn Hybrids in Blackwell Corn Performance Trial, 2004.

Company Brand Name	Hybrid	Plant Characteristics				MATURITY	
		SV	SS	SG	EP	Days	GDD*
Garst Seed Company	8590RR	3	1	3	M	106	<2600
Garst Seed Company	8451RR	3	3	3	M	111	2600-2699
Dekalb Genetics	DKC 50-20 RR2/YGCB	2	3	3	M	100	<2600
Dekalb Genetics	DKC 52-47 RR2/YGCB	3	3	3	M	102	<2600
Dekalb Genetics	DKC 57-84 YGCB	3	4	4	M	107	<2600
Dekalb Genetics	DKC 63-52 RR2/YGCB	3	4	5	M	110	2600-2699

* Plant Characteristics: SV - Seedling Vigor; SS - stalk strength; SG - stay green; EP - ear placement (Low, Medium, High)
Rating scale for above characteristics except ear placement 1 = excellent - 9 = poor

Table 4. Characteristics of Corn Hybrids in Panhandle Corn Performance Trials, 2004.

Company Brand Name	Hybrid	Plant Characteristics				MATURITY	
		SV	SS	SG	EP	Days	GDD*
High Plains Hybrids	KS 3131 CRW	1	2	2	M	110-120	2600-2699
High Plains Hybrids	KS 5151 CRW	1	1	1	M	110-120	2600-2699
High Plains Hybrids	EXP 1150 RB	1	1	1	M	110-120	2600-2699
High Plains Hybrids	KS 119 RR	3	2	2	M-H	110-120	2600-2699
Triumph Seed Co., Inc	1536 CbRR	2	2	2	M	110-120	2600-2699
REA Hybrids	1953	4	3	3	H	90-110	< 2600
REA Hybrids	3052	2	2	1	M	90-110	< 2600
Stauffer Seeds	2721	3	2	3	M	110-120	2600-2699
Garst Seed Company	8292YGI	2	3	2	H	110-120	2600-2699
Garst Seed Company	8377YGI/RR	2	4	3	M	110-120	2600-2699
Garst Seed Company	8225YGI/RR	3	3	3	M	110-120	2600-2699
Garst Seed Company	8270 RR	3	2	2	H	110-120	2600-2699
Garst Seed Company	8383YGI	2	3	3	M-H	110-120	2600-2699
Frontier Hybrids, Inc.	F-3175	1	1	2	M	110-120	2600-2699
Frontier Hybrids, Inc.	F-3250	1	1	2	M	110-120	2600-2699
Dekalb Genetics	DKC 63-52 RR2/YGCB	3	4	5	M	110-120	2600-2699
Dekalb Genetics	DKC 60-19 RR2/YGCB	3	3	5	M-L	110-120	2600-2699
Asgrow Seed	RX752YG	3	4	5	M	110-120	2600-2699
Triumph Seed Co., Inc	1866Bt	2	2	2	H	110-120	2600-2699
Triumph Seed Co., Inc	1416 Bt	2	2	2	M	110-120	2600-2699

* Plant Characteristics: SV - Seedling Vigor; SS - stalk strength; SG - stay green; EP - ear placement (Low, Medium, High)
Rating scale for above characteristics except ear placement 1 = excellent - 9 = poor

Table 5. Grain Yield and Harvest Parameters from Tonkawa location Oklahoma Corn Performance Trials, 2004.

Company Brand Name	Entry Designation	Maturity	Grain Yield bu/ac	Test Weight lb/bu	Harvest Moisture	Plant Population plants/ac
Garst Seed Company	8451RR	111	131.7	54.5	14.7	23,500
Dekalb Genetics	DKC 63-52 RR2/YGCB	110	123.8	57.5	11.3	22,900
Garst Seed Company	8590RR	106	110.0	56.3	11.5	23,000
Dekalb Genetics	DKC 52-47 RR2/YGCB	102	100.8	55.3	10.5	23,400
Dekalb Genetics	DKC 57-84 YGCB	107	97.3	55.4	11.6	23,300
Dekalb Genetics	DKC 50-20 RR2/YGCB	100	84.8	55.4	11.4	22,900
	Mean		108.1	55.7	11.8	23,200
	CV%		9.8	5.5	15.2	3.8
	L.S.D.		15.9	NS	NS	NS

Cooperator: Bob Diemer

Soil Series: Mclain Silt Loam

No-Tillage Practices: Following soybean in 2003

Soil Test: N: 12 P: 54 K: NA pH: 5.2

Fertilizer: N: 110 lbs/ac P: 0 K: 0

Herbicide: 2qt/ac Cinch ATZ Lite (Preemergence)

Planting Date: March 22, 2004

Harvest Date: September 1, 2004

Table 6. Grain Yield and Harvest Parameters from OPREC location Oklahoma Corn Performance Trials, 2004.

Company Brand Name	Entry Designation	Grain Yield bu/ac		Test Weight lb/bu		Harvest Moisture	Plant Population plants/ac
		2004	Two year	2004	Two year		
Triumph Seed Co., Inc	1866Bt	221.3	214.2	57.1	58.0	22.3	25,600
Triumph Seed Co., Inc	1416 Bt	207.1	204.8	55.1	56.0	18.9	27,400
Garst Seed Company	8383YGI	210.1	204.5	56.8	57.2	20.0	27,000
Frontier Hybrids, Inc.	F-3175	223.6	203.8	55.9	57.5	24.2	25,600
Asgrow Seed	RX752YG	201.0	201.6	55.8	56.8	19.8	27,600
Garst Seed Company	8270 RR	215.5	200.0	54.9	55.7	23.1	26,800
Frontier Hybrids, Inc.	F-3250	200.6	196.9	57.2	58.1	18.1	26,500
Triumph Seed Co., Inc	1536 CbRR	229.8		54.3		22.2	26,800
Garst Seed Company	8377YGI/RR	227.3		54.9		21.7	26,700
Garst Seed Company	8225YGI/RR	219.8		55.2		21.6	28,500
Garst Seed Company	8292YGI	215.0		55.4		22.5	26,300
Dekalb Genetics	DKC 63-52 RR2/YGCB	214.0		55.5		19.4	26,800
High Plains Hybrids	KS 5151 CRW	208.2		55.3		19.7	25,900
High Plains Hybrids	KS 119 RR	200.6		55.8		23.8	24,600
Dekalb Genetics	DKC 60-19 RR2/YGCB	192.7		56.6		19.4	25,600
High Plains Hybrids	KS 3131 CRW	190.2		56.1		19.7	28,500
High Plains Hybrids	EXP 1150 RB	186.1		56.4		20.3	26,600
REA Hybrids	1953	126.5		55.0		12.4	24,600
	Mean	205.0	203.7	55.7	57.0	20.7	26,500
	CV%	6.3		1.4		6.5	7.9
	L.S.D.	18.3	NS	1.1	0.76	1.9	NS

Cooperator: OPREC

Soil Series: Richfield Clay Loam

Conventional tillage: Following soybean in 2003

Soil Test: N: 45 P: 26 K: 1192 pH: 5.2

Fertilizer: N: 200 lbs/ac P: 40 lbs/ac K: 0

Herbicide: 2qt/ac Cinch ATZ Lite (Preemergence)

Planting Date: April 15, 2004

Harvest Date: September 21, 2004

Table 7. Grain Yield and Harvest Parameters from Joe Webb location Oklahoma Corn Performance Trials, 2004.

Company Brand Name	Entry Designation	Grain Yield bu/ac		Test Weight lb/bu		Harvest Moisture	Plant Population plants/ac
		2004	Two year	2004	Two year		
Frontier Hybrids, Inc.	F-3175	263.1	220.5	56.5	57.2	21.6	27,500
Triumph Seed Co., Inc	1866Bt	270.1	218.8	57.1	57.0	20.6	23,700
Triumph Seed Co., Inc	1416 Bt	226.6	204.3	55.0	56.2	18.8	26,600
Asgrow Seed	RX752YG	225.0	200.5	56.8	56.5	18.8	27,900
Garst Seed Company	8383YGI	220.6	188.3	56.1	56.5	18.4	29,300
Garst Seed Company	8270 RR	214.5	187.6	54.5	54.4	21.1	26,700
Frontier Hybrids, Inc.	F-3250	196.0	182.2	55.6	56.5	21.2	26,800
Stauffer Seeds	2721	246.8		55.6		17.8	27,200
Garst Seed Company	8292YGI	234.9		54.8		21.9	28,400
Dekalb Genetics	DKC 63-52 RR2/YGCB	233.8		55.5		19.4	28,600
Garst Seed Company	8225YGI/RR	229.9		54.1		20.5	27,000
High Plains Hybrids	KS 5151 CRW	224.7		55.2		18.8	29,300
Garst Seed Company	8377YGI/RR	222.6		55.2		19.1	28,200
High Plains Hybrids	KS 3131 CRW	222.2		56.0		18.7	25,800
Triumph Seed Co., Inc	1536 CbRR	220.3		56.3		19.6	26,200
Dekalb Genetics	DKC 60-19 RR2/YGCB	211.8		56.7		18.5	29,700
High Plains Hybrids	KS 119 RR	196.6		54.5		22.7	25,500
High Plains Hybrids	EXP 1150 RB	194.3		56.1		19.7	28,500
REA Hybrids	1953	144.6		54.7		12.2	27,800
	Mean	221.0	200.3	55.6	56.3	19.4	27,400
	CV%	9.3		1.2		3.8	10.8
	L.S.D.	29.2	21.9	0.9	0.8	1.1	NS

Cooperator: OPREC

Soil Series: Richfield Clay Loam

Strip-Till: Following wheat and sunflowers in 2003

Soil Test: N: NA P: NA K: NA pH: NA

Fertilizer: N: 230 lbs/ac P: 0 K: 0

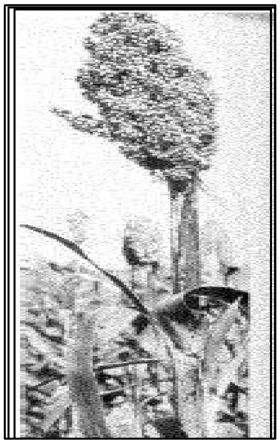
Herbicide: 1.5qt/ac Harness Extra (Preemergence)

Planting Date: April 20, 2004

Harvest Date: Grain September 20, 2004; Ensilage August 20, 2004

Table 8. Ensilage Yields and Quality Panhandle Corn Performance Trial, 2004.

Company Brand Name	Entry Designation	YIELD Tons/ac 2004	YIELD Tons/ac Two-year	Plant Population plants/ac	ADF * %	TDN * %	Energy Values *MCl/lb Maint.	Energy Values *MCl/lb Lact.	Energy Values *MCl/lb Gain
Garst Seed Company	8270 RR	24.8	27.2	25,600	41.9	56.2	0.54	0.57	0.28
Frontier Hybrids, Inc.	F-3175	29.5	26.6	26,200	33.2	63.0	0.64	0.65	0.37
Garst Seed Company	8383YGI	22.7	25.5	26,100	32.9	63.3	0.64	0.65	0.38
Triumph Seed Co., Inc	1866Bt	27.2	25.5	27,700	27.0	67.9	0.71	0.70	0.44
Frontier Hybrids, Inc.	F-3250	24.8	24.8	26,100	33.2	63.0	0.64	0.65	0.38
Asgrow Seed	RX752YG	21.9	23.4	27,700	30.9	64.9	0.67	0.67	0.40
High Plains Hybrids	KS 119 RR	26.3		27,800	33.6	62.7	0.63	0.64	0.37
High Plains Hybrids	KS 5151 CRW	25.3		26,900	25.7	68.9	0.73	0.71	0.45
REA Hybrids	3052	24.4		28,000	34.3	62.1	0.63	0.64	0.36
High Plains Hybrids	KS 3131 CRW	24.3		26,700	29.3	66.1	0.69	0.68	0.42
Dekalb Genetics	DKC 60-19 RR2/YGCB	24.2		31,000	29.0	66.3	0.69	0.69	0.42
Garst Seed Company	8377YGI/RR	24.1		28,500	38.5	66.7	0.69	0.69	0.42
Triumph Seed Co., Inc	1416 Bt	24.1		25,900	27.3	67.6	0.71	0.70	0.44
Garst Seed Company	8292YGI	23.8		26,000	28.8	66.4	0.69	0.69	0.42
Garst Seed Company	8225YGI/RR	23.0		25,800	31.8	64.1	0.66	0.66	0.39
Dekalb Genetics	DKC 63-52 RR2/YGCB	22.9		26,500	32.3	63.8	0.65	0.66	0.38
High Plains Hybrids	EXP 1150 RB	22.7		24,800	33.2	63.0	0.64	0.65	0.38
Triumph Seed Co., Inc	1536 CbRR	22.0		27,100	30.1	65.5	0.68	0.68	0.41
REA Hybrids	1953	21.0		25,100	25.6	69.0	0.73	0.71	0.45
	Mean	24.1	25.5	26,800	31.0	64.8	0.67	0.67	0.40
	CV%	9.9	12.8	7.3	14.9	5.5	8.0	6.0	12.0
	L.S.D.	4.0	NS	NS	7.6	5.9	0.09	0.07	0.08



GRAIN SORGHUM PERFORMANCE TRIALS IN OKLAHOMA, 2004

PRODUCTION TECHNOLOGY CROPS

OKLAHOMA COOPERATIVE EXTENSION SERVICE
DEPARTMENT OF PLANT AND SOIL SCIENCES
DIVISION OF AGRICULTURAL SCIENCES & NATURAL RESOURCES
OKLAHOMA STATE UNIVERSITY

PT 2004-12 | December 2004 | Vol. 16, No.12

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TRIAL OBJECTIVES AND PROCEDURES

Each year, performance trials for hybrid grain sorghums are conducted by the Oklahoma Cooperative Extension Service to provide producers, extension educators, industry representatives, and researchers with information for hybrid grain sorghums marketed in Oklahoma.

Performance trials are conducted at eight locations in Oklahoma: Altus, Blackwell, Cherokee, Enid, Goodwell, Homestead, Keyes, and Tipton. Dry-land trials are conducted at all locations, with an additional irrigated trial at Goodwell. The Cherokee and Homestead locations are unique trials to evaluate certain hybrids (generally early and medium maturity) for planting in late April. In 2004 a trial was planted at Enid to evaluate hybrids for use as a double crop. The panhandle dryland trials were planted later than desired due to wet soil conditions, therefore the full season hybrids were never planted.

Grain sorghum hybrids entered (Table 1) were assigned by companies to their respective maturity groups (early, medium, and late) and trial locations, therefore, all hybrids are not in all locations. Hybrids tested at the Cherokee, Homestead, and Enid locations were determined by Oklahoma State University. Companies submitted all hybrid characteristics presented in Table 1. This information was not determined or verified by Oklahoma State University. Company participation was voluntary; therefore some hybrids marketed in Oklahoma were not included in the test. Each maturity group was tested in a randomized complete block design with four replications. Plots were 2 rows: (40-inches wide at Tipton and Altus, with 30-inch rows at all other locations) by 25 feet. Plots were trimmed to 20 feet prior to harvest.

Target populations are listed with results of respective locations. Cooperating producers, fertilization, cultural practices, soil series, and herbicide use on all trials are listed with the results tables. Rainfall data from the nearest Mesonet site are also listed. Tractor powered cone planters were used to plant all trials with seeding rates adjusted for trial location. Trials were harvested with a (Massey-Ferguson 8) plot combine.

NEW IN 2004

The early-planted trial at Enid was replaced with a double crop trial. Two locations were used for early-planted trials, Cherokee and Homestead. The trial at the Enid location was replaced by a double crop trial, planted following wheat harvest. Trail at Blackwell, and OPREC (dryland) were harvested, but results are not shown. Sorghum Midge affected Blackwell results during the flowering stage. The shorter season hybrids were affected more than the medium or full season, but all were affected. High temperatures in late August and early September affected the OPREC location.

GROWING CONDITIONS

Moisture

Soil moisture conditions were good during the planting season for most of the state except the panhandle region. In the panhandle, the early portion of the planting period (late May to mid June) soils moisture was inadequate for germination. From mid June to early July planting delay's occurred due to rainfall, this period is when most sorghum is planted in the panhandle. As the season progressed rainfall was adequate for most of the state to obtain outstanding yields. North central Oklahoma had the highest dryland yields, with yield of 130 bu/ac reported for early-planted grain sorghum. Double crop yields were also near 100 bu/ac at the Enid trial. The panhandle yields were affected by high temperatures and lack of rainfall during the August 10 to September 20 time frame. The Tipton location was harvested but no data reported due to windstorm induced lodging in early August. The dryland trial at OPREC was harvested and yields ranged from 10.7 to 36.7 bu/ac for the early maturity and 16.5 to 35.8 bu/ac for mediums. The data for the dryland location at OPREC was highly variable and therefore not reported.

Insects

Statewide no major insect problems occurred, but sorghum midge were found at the Blackwell location and had a significant affect on yield. The early hybrids were not harvested. The medium and full season hybrids yields ranged from 3 to 34 bu/ac, but data was highly variable and thus not reported.

RESULTS

Yields were average or better for most locations in 2004 for sorghum that was planted early and harvested before October 1. Delays in harvest occurred after October 1 due to rainfall, with most sorghum in the panhandle not harvested until December. Most double crop sorghum in Oklahoma was also harvested in December. With the delays in harvest, quality was affected. Test weights were significantly lower after the harvest delays.

Grain yields are reported both as pounds per acre and bushel per acre threshed grain, adjusted to moisture content of 14.0% (Tables 2-7). Test weight, plant population, and the number of heads per acre at harvest are reported. Bird damage and lodging are also reported when present at a location.

Different plant populations at each location precluded comparison between locations. Comparisons across maturity groups were not conducted. Producers should note that late maturing hybrids will generally yield more than early and medium maturity hybrids. However, the availability of moisture at critical crop development periods often influences yield more than the yield differences associated with maturity groups.

When choosing a maturity group, the type of cropping system, planting date, planting rate and potential moisture should be taken into consideration. For more information consult Fact Sheet **No. 2034** Grain Sorghum Planting Rates and Dates, and Fact Sheet No. **2113** Grain Sorghum Production Calendar.

Small differences in yield or other characteristics among hybrids should not be overemphasized. Least Significant Difference (L.S.D.) is a statistical test of yield differences and are shown at the bottom of each table. Unless two hybrids differ by at least the L.S.D. shown, little confidence can be placed in one hybrid being superior to another and the difference is probably not real.

The coefficient of variation (C.V.) is provided as an estimate of the precision of the data with respect to the mean for that location and maturity group. To provide some indication of yield stability, 2-year mean for yield and test weight is provided where trials have been conducted more than one year and more than 3 entries per maturity group. Producers interested in comparing hybrids for consistency of yield in a specific area should consult these tables.

*The following people have contributed to this report by assisting in crop production, data collection, and publication: Donna George, Lawrence Bohl, Rocky Thacker, Toby Kelly, Alton Young, Roger Don Gribble, Chad Fowler, Jason Weirich, Bart Cardwell, and Chuck Strasia. Their efforts are greatly appreciated. Also would like to thank the **Oklahoma Grain Sorghum Commission** for their financial support.*

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Table 1. Seed source and hybrid characteristics of grain sorghums in the Oklahoma Grain Sorghum Performance Trials, 2004. All hybrids are susceptible to birds and are single cross.

Company Brand Name	Hybrid	Seed Color	Endo-sperm	Days to Mid-bloom	Greenbug Resistance	Trial Location
Early maturity						
Asgrow Seed	Reward	Bz	Hy	56	none	2
Frontier Hybrids, Inc	F-303C	C	Y	59	E	1
Seed Resource	SR 251	Bz	Hy	60	C & E	1
Seed Resource	SR 255c	W	Hy	60	C	1
Asgrow Seed	Seneca	Bz	HY	59	C	2
Walter Moss Seed Co. LTD	M-927-ER	R		54		3
Sorghum Partners Inc	KS 310	BZ	HY	58	C&E	1
Sorghum Partners Inc	251	R	N	52	none	1
Sorghum Partners Inc	K35-Y5	Y	HY	59	C&E	1
Dekalb Genetics Corp.	DKS 36-00	Bz	HY	59	C,E,I	2
Asgrow Seed	Pulsar	Bz	HY	60	C,E,I	2
Dekalb Genetics Corp.	DKS 37-07	Bz	HY	60	C,E,I	2
Frontier Hybrids, Inc	F-270E	Bz	Y	58	E	1
Medium maturity						
Sorghum Partners Inc	NK 6641	R	N	67	C	1
Sorghum Partners Inc	NK 6673	Bz	HY	67	C	1
Frontier Hybrids, Inc	F-457E	R	Y	64	E	1
Sorghum Partners Inc	KS 585	Bz	HY	67	C, E	1
Dekalb Genetics Corp.	DK 44	Bz	HY	67	C, E	1
Seed Resource	SR 420	Bz	HY	65	C,E	1
Sorghum Partners Inc	NK 5418	Bz	HY	66	C,E	1
Seed Resource	SR 510	BZ	HY	68	C,E	1
Late maturity						
Asgrow Seed	A567	Bz	Hy	71	None	4
Frontier Hybrids, Inc	F-700E	R	R	70	E	1
Walter Moss Seed Co. LTD	M-29-MB	Bz		82		2
Sorghum Partners Inc	K 73-J6	R	Y	73	C,E	1
Dekalb Genetics Corp.	DKS 54-00	Bz	HY	72	C,E,I	4
Asgrow Seed	A571	Bz	HY	72	None	4
Dekalb Genetics Corp.	DKS 53-11	Bz	HY	71	C,E,I	4
Sorghum Partners Inc	NK 7633	Bz	HY	73	None	1
Sorghum Partners Inc	NK 7655	Y	HY	72	C	1

Trial locations: 1 – all; 2 – panhandle only; 3 – (Altus, Tipton, Blackwell); 4 – irrigated only (OPREC)
Seed Color: Br – Brown; W – White; Y – Yellow; Bz – Bronze; R – Red; C – Cream
Endosperm: HW – heterowaxy; W – waxy; HY – Heteroyellow; Y – Yellow; N – Non-waxy
Maturity group: Early (less than 60 days to mid-bloom); Medium (60 – 70 days to mid-bloom); Late – (70+ days to mid-bloom)
Greenbug Resistance: Biotype hybrid is resistance too

Table 2. Results from Altus Grain Sorghum Performance Trial, 2004.

Company Brand Name	Entry Designation	Grain Yield bu/ac		Test weight lb/bu		Plant Population plants/ac	Head Population heads/ac	Harvest Moisture
		2004	Two-year	2004	Two-year			
Early								
Sorghum Partners Inc	KS 310	56.0	50.1	55.7	54.6	34,100	1.27	9.7
Sorghum Partners Inc	K35-Y5	63.3	45.6	57.4	55	31,900	1.66	10.1
Frontier Hybrids, Inc	F-303C	52.7	37.0	57.3	54.6	27,500	1.06	9.6
Frontier Hybrids, Inc	F-270E	43.1	35.5	56.4	53.7	20,800	1.42	9.9
Seed Resource	SR 251	71.8		59.0		33,700	1.36	10.9
Seed Resource	SR 255c	59.9		57.3		31,100	1.15	10.5
Sorghum Partners Inc	251	42.8		55.8		34,500	1.13	9.7
	Mean	55.7	42.1	57	54.4	30,400	1.29	10.1
	C.V.%	12.7	20.0	1.1	2.5	8.2	15.5	6.2
	L.S.D.	10.5	9.0	0.9	NS	3,700	0.30	NS

Company Brand Name	Entry Designation	Grain Yield bu/ac		Test weight lb/bu		Plant Population plants/ac	Head Population heads/ac	Harvest Moisture
		2004	Two-year	2004	Two-year			
Medium								
Dekalb Genetics Corp.	DK 44	74.5	57.1	57.7	55.8	33,100	1.13	10.0
Dekalb Genetics Corp.	DK 44	70.7	53.7	57.7	55.1	29,100	1.21	10.6
Sorghum Partners Inc	KS 585	65.1	50.9	59.0	56.2	28,600	1.59	10.1
Sorghum Partners Inc	KS 585	60.5	46.9	58.6	55.9	30,200	1.51	10.4
Seed Resource	SR 420	60.2	45.3	58.4	55.3	31,900	1.21	10.2
Sorghum Partners Inc	NK 5418	57.6	43.9	56.7	54.4	32,800	1.56	10.3
Seed Resource	SR 510	51.6	38.3	57.3	55.2	31,300	1.08	10.5
Frontier Hybrids, Inc	F-457E	61.8		57.3		34,000	1.12	10.6
Sorghum Partners Inc	NK 6673	49.6		56.7		32,300	1.17	10.9
Sorghum Partners Inc	NK 6641	48.4		56.9		33,800	1.07	10.4
	Mean	60.0	48.0	57.6	55.4	31,700	1.27	10.4
	C.V.%	14.0	13.0	1.1	1.8	6.1	10.8	9.6
	L.S.D.	12.2	6.3	0.9	1.0	2,800	0.20	NS

Table 2. Results from Altus Grain Sorghum Performance Trial, 2004 continued.

Company Brand Name	Entry Designation	Grain Yield bu/ac		Test weight lb/bu		Plant Population plants/ac	Head Population heads/ac	Harvest Moisture
		2004	Two-year	2004	Two-year			
Late								
Sorghum Partners Inc	K 73-J6	89.9	66.3	57.9	53.3	31,100	1.49	10.8
Sorghum Partners Inc	NK 7633	85.6	58.4	58.1	54.5	30,600	1.49	10.6
Sorghum Partners Inc	NK 7655	79.8	50.4	57.3	54.6	31,900	1.39	10.4
Frontier Hybrids, Inc	F-700E	70.2	48.6	57.4	55.5	31,100	1.21	10.7
	Mean	81.4	55.9	57.7	54.5	31,200	1.39	10.6
	C.V.%	9.7	13.2	1.2	3.1	7.0	8.8	5.6
	L.S.D.	12.6	7.9	NS	1.8	NS	NS	NS

Cooperator: Southwest Research and Extension Center

Soil Series: Tillman Hollister Clay Loam

Conventional tillage Practices: Fallowed following wheat in 2003

Soil Test: N: 76 lbs/ac P: 56 lbs/ac K: 1066 lbs/ac pH: 6.0

Fertilizer: N: 110 lb N/ac P: 22 lbs/ac K: none

Herbicide: Preplant Roundup WeatherMax 30 oz/ac + DyneAmic Nonionic Adjuvant 0.5 % v/v
Preemergence Peak 0.75 oz/ac

Planting Date: May 6, 2004 Target Population: 35,000 plants/ac

Harvest Date: September 9, 2004

Monthly Rainfall (in.)

	2003			2004									
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	**Total**
	0.35	1.17	0.04	3.99	1.96	2.79	2.24	0.02	9.43	3.50	2.31	0.73	**28.53**
Long term mean:	2.37	1.31	0.91	0.84	1.10	1.56	1.92	4.23	3.51	1.76	2.45	3.44	**25.40**

Table 3. Results from Cherokee Grain Sorghum Performance Trial, 2004.

Company Brand Name	Entry Designation	Days To Midbloom	Grain Yield bu/ac	Test weight lb/bu	Plant Population plants/ac	Head Population heads/plant	Harvest Moisture
Dekalb Genetics Corp.	DKS 42-40	65	76.7	59.7	37,200	1.26	8.3
Seed Resource	SR 420	66	75.4	59.2	36,000	1.25	9.9
Dekalb Genetics Corp.	DK 44	67	72.1	59.7	35,100	1.13	8.3
Dekalb Genetics Corp.	DKS 37-07	60	70.0	59.6	36,100	1.07	8.3
Sorghum Partners Inc	K 35-Y5	59	69.5	58.7	32,300	1.64	8.6
Sorghum Partners Inc	KS 585	65	68.1	60.2	33,900	1.44	9.4
Asgrow Seed	Seneca	59	66.8	59.8	29,700	1.26	8.1
Frontier Hybrids, Inc	F-200 E	50	66.2	58.3	26,700	1.57	9.3
Dekalb Genetics Corp.	DK-54-00	72	64.1	57.7	31,200	1.23	10.9
Sorghum Partners Inc	KS 585 WO	65	60.8	60.4	30,500	1.53	7.5
Dekalb Genetics Corp.	DK 44 WO	67	59.8	59.3	30,400	1.11	9.8
Sorghum Partners Inc	KS 310	57	52.1	58.4	36,000	1.14	8.7
Frontier Hybrids, Inc	F-303 C	59	51.7	58.4	28,100	1.13	9.4
Dekalb Genetics Corp.	DKS 29-28C	69	50.5	57.4	38,700	1.10	7.3
Seed Resource	SR 251	62	44.5	57.8	31,800	1.16	13.2
Frontier Hybrids, Inc	F-270 E	54	36.6	57	27,200	1.10	9.7
Sorghum Partners Inc	251	52	31.7	57.1	37,200	1.18	7.6
		Mean	59.8	58.7	32,800	1.25	9.2
		C.V.%	18.9	1.4	8.4	10.30	17.9
		L.S.D.	16.1	1.2	3,900	0.18	2.3

Cooperator: Doug McMurtrey

Soil Series: Pond Creek Silt Loam

No-till Practices: Soybeans in 2003

Soil Test: NA

Fertilizer: N: 90 lbs N/ac P: none K: none

Herbicide 1.25 lbs Atrazine/ac preplant

Planting Date: May 5, 2004 Target Population: 35,000 plants/ac

Harvest Date: September 3, 2004

Monthly Rainfall (in.)

	--------- 2003 --------			------------------------------ 2004									
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	**Total**
	0.90	0.47	1.23	2.59	1.08	3.53	3.86	0.10	3.98	3.41	3.71	0.85	**25.71**
Long term mean:	2.60	2.00	1.20	0.90	1.20	2.90	2.80	4.50	3.90	3.10	3.30	3.00	**31.40**

Table 4. Results from Enid double crop Grain Sorghum Performance Trial, 2004.

Company Brand Name	Entry Designation	Days To Midbloom	Grain Yield bu/ac	Test weight lb/bu	Plant Population plants/ac	Head Population heads/plant	Harvest Moisture	Lodging %
Seed Resource	SR 420	66	87.1	53.7	33,700	1.36	11.2	40
Sorghum Partners Inc	KS 585	65	83.9	54.1	29,100	1.65	10.8	18
Dekalb Genetics Corp.	DK 44	67	79.4	53.0	29,800	1.32	10.2	28
Asgrow Seed	Seneca	59	70.5	53.8	29,900	1.36	9.1	33
Frontier Hybrids, Inc	F-303 C	59	70.3	51.4	33,500	1.20	9.0	30
Dekalb Genetics Corp.	DKS 29-28C	69	68.2	52.8	37,400	1.13	8.8	28
Dekalb Genetics Corp.	DKS 37-07	60	67.9	54.2	25,100	1.50	8.7	13
Sorghum Partners Inc	K 35-Y5	59	64.1	51.0	30,100	1.88	8.2	8
Sorghum Partners Inc	KS 310	57	62.4	53.6	32,900	1.49	8.0	10
Frontier Hybrids, Inc	F-270 E	54	53.5	52.9	24,700	1.39	6.9	35
		Mean	70.7	53.0	30,600	1.43	9.1	
		C.V.%	13.0	2.4	13.5	10.8	13.0	
		L.S.D.	13.3	1.9	6,000	0.22	1.7	

Cooperator: Ed Regier

Soil Series: Reinach Loam

No-till Practices: Double crop following wheat harvest in 2004

Soil Test: NA

Fertilizer: N: 125 lbs N/ac P: none K: none

Herbicide: Cinch ATZ Lite 1.5qts/ac (Preemergence)

Planting Date: June 24, 2004 Target Population: 35,000 plants/ac

Harvest Date: December 4, 2004

Monthly Rainfall during growing season (in.)

	June	July	Aug.	Sep.	Oct.	**Total**
2004	4.61	3.27	4.03	0.34	3.89	**16.14**
Long term mean:	4.26	2.89	3.35	3.39	3.17	**17.06**

Table 5. Results from Homestead Grain Sorghum Performance Trial, 2004.

Company Brand Name	Entry Designation	Days To Midbloom	Grain Yield bu/ac	Test weight lb/bu	Plant Population plants/ac	Head Population heads/plant	Harvest Moisture
Dekalb Genetics Corp.	DKS 37-07	60	80.1	59.8	41,300	1.10	9.7
Dekalb Genetics Corp.	DKS 42-40	65	74.1	59.8	38,800	1.23	10.4
Dekalb Genetics Corp.	DK 44	67	67.6	59.8	31,400	1.19	11.9
Dekalb Genetics Corp.	DK-54-00	72	67.1	52.5	29,600	1.32	15.3
Seed Resource	SR 420	66	66.9	59.9	36,400	1.17	10.5
Sorghum Partners Inc	KS 585 WO	65	63.7	60.3	35,600	1.29	9.9
Sorghum Partners Inc	KS 585	65	63.6	60.3	34,400	1.39	1.48
Seed Resource	SR 251	62	58.6	58.3	34,900	1.12	11.6
Frontier Hybrids, Inc	F-200 E	50	57.8	57.8	24,800	1.78	10.7
Dekalb Genetics Corp.	DKS 29-28C	69	56.5	56.6	38,400	1.11	10.8
Dekalb Genetics Corp.	DK 44 WO	67	55.1	58.8	37,400	1.07	10.2
Asgrow Seed	Seneca	59	54.5	59.4	30,500	1.22	9.5
Frontier Hybrids, Inc	F-303 C	59	54.2	58.3	27,300	1.12	10.1
Sorghum Partners Inc	K 35-Y5	59	53.9	58.8	33,600	1.60	11.8
Sorghum Partners Inc	KS 310	57	47.9	56.8	36,200	1.22	9.7
Frontier Hybrids, Inc	F-270 E	54	47.3	58.4	28,100	1.06	10.4
Sorghum Partners Inc	251	52	43.9	57.5	40,600	1.15	9.4
		Mean	59.6	58.4	34,100	1.24	10.8
		C.V.%	13.9	1.5	7.2	7.6	18.7
		L.S.D.	11.8	1.3	3,500	0.13	2.8

Cooperator: Brook Strader

Soil Series: Pratt Loamy Fine Sand

Conventional tillage Practices: Fallowed following wheat in 2003

Soil Test: NA

Fertilizer: N: 125 lb N/ac P: none K: none

Herbicide: Cinch ATZ Lite 1.5qts/ac (Preemergence)

Planting Date: May 5, 2004 Target Population: 35,000 plants/ac

Harvest Date: September 3, 2004

Monthly Rainfall (in.)

	2003			2004									
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	**Total**
	0.70	0.43	1.17	2.36	1.29	3.72	3.87	0.09	5.51	1.16	2.25	1.23	**23.78**
Long term mean:	2.30	1.70	1.00	0.80	1.10	2.30	2.50	4.20	3.20	2.70	2.80	2.90	**27.50**

Table 6. Results from OPREC irrigated Grain Sorghum Performance Trial, 2004.

Company Brand Name	Entry Designation	Grain Yield bu/ac		Test weight lb/bu		Plant Population plants/ac	Head Population heads/ac	Harvest Moisture
		2004	Two-year	2004	Two-year			
Early								
Frontier Hybrids, Inc	F-303C	156.1	155.2	55.2	57.3	55,100	1.3	13.4
Frontier Hybrids, Inc	F-270E	138.6	137.4	55.0	56.6	48,500	1.6	13.4
Sorghum Partners Inc	K35-Y5	137.5	128.1	53.6	56.0	59,400	1.6	10.6
Sorghum Partners Inc	KS 310	126.8	120.3	53.7	55.4	59,700	1.4	11.1
Seed Resource	SR 255c	155.1		55.6		59,700	1.3	14.1
Seed Resource	SR 251	153.3		56.7		60,400	1.3	13.4
Sorghum Partners Inc	251	112.0		55.0		58,400	1.3	12.5
	Mean	139.9	135.3	55.0	56.3	57,300	1.4	12.6
	C.V.%	5.6	6.0	1.0	1.3	9.9	16.0	8.5
	L.S.D.	11.6	8.5	0.8	0.8	8,500	NS	1.6

Company Brand Name	Entry Designation	Grain Yield bu/ac		Test weight lb/bu		Plant Population plants/ac	Head Population heads/ac	Harvest Moisture
		2004	Two-year	2004	Two-year			
Medium								
Seed Resource	SR 510	161.1	162.0	55.1	57.2	57,300	1.19	12.6
Sorghum Partners Inc	KS 585WO	154.7	156.3	56.7	58.7	53,600	1.40	11.5
Sorghum Partners Inc	KS 585	154.7	151.5	56.8	58.6	54,200	1.36	14.0
Dekalb Genetics Corp.	DK 44	147.9	148.3	53.4	56.1	51,600	1.54	12.8
Dekalb Genetics Corp.	DK 44WO	146.8	146.5	54.3	56.7	60,400	1.37	14.0
Seed Resource	SR 420	139.3	145.4	55.1	57.3	56,000	1.33	13.4
Sorghum Partners Inc	NK 5418	141.4	136.4	51.5	54.9	57,600	1.45	13.8
Frontier Hybrids, Inc	F-457E	145.3		55.1		61,100	1.34	12.9
Sorghum Partners Inc	NK 6673	139.5		53.7		64,100	1.17	12.6
Sorghum Partners Inc	NK 6641	129.9		53.8		59,700	1.33	12.1
	Mean	146.1	149.5	54.5	57.1	57,600	1.35	13.0
	C.V.%	5.4	5.1	1.8	1.7	8.3	12.6	14.7
	L.S.D.	11.4	7.7	1.4	1.0	7,000	0.25	NS

Table 6. Results from OPREC irrigated Grain Sorghum Performance Trial, 2004 continued.

Company Brand Name	Entry Designation	Grain Yield bu/ac		Test weight lb/bu		Plant Population plants/ac	Head Population heads/ac	Harvest Moisture
		2004	Two-year	2004	Two-year			
Late								
Dekalb Genetics Corp.	DKS 54-00	151.3	159.5	53.8	56.1	52,200	1.36	14.6
Dekalb Genetics Corp.	DKS 53-11	151.1	158.0	55.4	57.5	58,200	1.30	13.9
Sorghum Partners Inc	NK 7633	149.1	150.4	55.1	57.3	56,700	1.30	14.5
Sorghum Partners Inc	NK 7655	148.4	148.9	56.3	57.3	59,000	1.44	15.0
Sorghum Partners Inc	K 73-J6	142.7	148.8	53.8	56.3	55,800	1.35	14.1
Asgrow Seed	A571	138.7	146.9	53.6	55.6	57,300	1.27	13.1
Frontier Hybrids, Inc	F-700E	144.8	146.7	54.4	56.7	58,400	1.17	13.9
Asgrow Seed	A567	152.6		53.6		60,400	1.16	13.4
	Mean	147.4	151.3	54.5	56.7	57,200	1.29	14.1
	C.V.%	9.5	7.4	2.9	2.1	5.9	13.0	9.1
	L.S.D.	NS	11.4	NS	1.2	NS	NS	NS

Cooperator: Oklahoma Panhandle Research and Extension Center

Soil Series: Richfield Clay Loam

Conventional Tillage Practices: Planted on fallow soil following Soybeans in 2003

Soil Test: N: 45 lbs/ac P: 26 K: 1192 pH: 7.2

Fertilizer: N: 200 lbs N/ac P: 40 lbs P_2O_5/ac K: 0

Herbicide: Cinch ATZ Lite 1.5qts/ac (Preemergence)

Planting Date: June 14, 2004 Target Population: 70,000 plants/ac

Harvest Date: December 10, 2004

Monthly Rainfall (in.)

	2003			2004									
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	**Total**
	0.14	0.56	0.18	0.02	0.45	1.58	2.12	0.15	3.82	2.43	2.87	2.56	**16.88**
Long term mean:	1.03	0.77	0.31	0.30	0.46	0.95	1.33	3.25	2.86	2.58	2.28	1.77	**17.89**

------- Irrigation (in.) -------

May	Jun.	Jul.	Aug.	Sept.
0.0	1.0	2.0	2.0	2.0

Table 7. Results from Keyes Grain Sorghum Performance Trial, 2004.

Company Brand Name	Entry Designation	Grain Yield bu/ac	Test weight lb/bu	Plant Population plants/ac	Head Population heads/plant	Harvest Moisture	Lodging %
			Early				
Dekalb Genetics Corp.	DKS 37-07	27.0	55.0	19,900	2.23	11.9	28.0
Asgrow Seed	Seneca	21.7	55.4	20,400	2.11	12.6	20.0
Frontier Hybrids, Inc	F-270E	20.8	54.7	20,200	2.01	12.7	0.0
Sorghum Partners Inc	KS 310	19.9	48.9	17,400	2.16	10.9	73.0
Asgrow Seed	Pulsar	19.7	52.7	19,100	2.63	11.8	26.0
Dekalb Genetics Corp.	DKS 36-00	19.0	51.4	18,900	2.61	12.4	47.0
Sorghum Partners Inc	K35-Y5	18.8	51.8	19,500	2.58	13.7	43.0
Seed Resource	SR 255c	17.5	52.9	19,300	1.74	12.3	27.0
Seed Resource	SR 251	17.2	53.1	19,300	1.99	12.1	0.0
Frontier Hybrids, Inc	F-303C	14.8	52.9	19,500	2.19	12.8	50.0
Asgrow Seed	Reward	13.6	47.0	16,200	2.22	9.5	90.0
Sorghum Partners Inc	251	12.5	49.3	17,600	1.82	11.1	93.0
	Mean	18.5	52.1	18,900	2.19	12.0	
	C.V.%	17.7	2.7	3.3	9.1	9.3	
	L.S.D.	5.6	2.4	1,100	0.34	1.9	

Table 7. Results from Keyes Grain Sorghum Performance Trial, 2004 continued.

Company Brand Name	Entry Designation	Grain Yield bu/ac	Test weight lb/bu	Plant Population plants/ac	Head Population heads/plant	Harvest Moisture	Lodging %
			Medium				
Sorghum Partners Inc	NK 5418	20.4	51.3	20,200	2.16	11.6	7.0
Seed Resource	SR 420	15.9	53.4	18,800	1.43	12.4	0.0
Sorghum Partners Inc	KS 585WO	13.8	54.3	13,800	2.69	12.0	0.0
Sorghum Partners Inc	NK 6641	13.1	51.9	20,500	1.79	11.2	0.0
Frontier Hybrids, Inc	F-457E	12.3	53.8	16,700	1.35	12.4	0.0
Sorghum Partners Inc	KS 585	11.9	53.1	13,600	2.48	12.4	17.0
Dekalb Genetics Corp.	DK 44	10.5	51.0	17,500	1.52	11.8	0.0
Seed Resource	SR 510	10.5	52.7	19,200	1.19	12.4	0.0
Dekalb Genetics Corp.	DK 44WO	10.0	49.6	17,900	1.56	12.2	0.0
Sorghum Partners Inc	NK 6673	5.3	47.3	18,600	2.17	11.9	0.0
	Mean	12.4	51.8	18,000	1.83	11.9	
	C.V.%	17.2	2.7	6.3	9.0	6.7	
	L.S.D.	3.7	2.4	1,900	0.28	NS	

Cooperator: Mr. J.B. Stewart

Soil Series: Richfield Clay Loam

Minimum-till Practices: Sorghum-wheat-fallow rotation

Soil Test: NA

Fertilizer: N: 69 lb N/ac P: none K: none

Herbicide: Cinch ATZ Lite 1.5qts/ac (Preemergence)

Planting Date: June 21, 2004 Target Population: 18,000 plants/ac

Harvest Date: December 8, 2004

Monthly Rainfall (in.)

	2003			2004									
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	**Total**
	0.10	0.72	0.35	0.05	0.04	1.03	2.43	0.35	5.15	1.96	2.71	2.50	**17.39**
Long term mean:	0.97	0.79	0.43	0.34	0.54	0.99	1.28	2.76	2.92	2.85	2.55	1.97	**18.39**

OKLAHOMA PANHANDLE WHEAT VARIETY TRIALS, 2003-04

PRODUCTION TECHNOLOGY CROPS

OKLAHOMA COOPERATIVE EXTENSION SERVICE
DEPARTMENT OF PLANT AND SOIL SCIENCES
DIVISION OF AGRICULTURAL SCIENCES & NATURAL RESOURCES
OKLAHOMA STATE UNIVERSITY

PT 2004-9 JULY 2004 Vol. 16, No. 9

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The 2003-04 Panhandle wheat crop may have endured more stress than any in recent history. Drought stress (winter through harvest), a freeze on April 13th, and high temperatures and winds during the grain fill period. Dryland and irrigated yields both were highly variable. Reported dryland yields ranged from 8 to 42 bu/ac and irrigated yields ranged from 19 to 70 bu/ac. Most wheat was planted with good to excellent soil moisture. The lack of rainfall in February through harvest reduced dryland yields of earlier planted wheat. In Cimarron County the October 15 planting had 7.6 bu/ac higher grain yield than September 15 planting in a planting date and seeding rate trial.

Trial Locations

There were 3-variety tests in the panhandle region this year. The dry-land variety test at the Oklahoma Panhandle Research and Extension Center (OPREC, Goodwell) was a wheat-grain sorghum-fallow rotation. The dry-land grain trial at Balko was wheat hay-wheat rotation. An irrigated grain only trial was planted at OPREC. The data was highly variable for OPREC dry-land so is not reported.

Growing Conditions

Most dryland wheat was planted with excellent soil moisture in September following rain in Late August and early September (Table 1). A freeze the evening of April 12 and morning of April 13 affected grain yields of all wheat. Dryland exhibited the most damage with white heads being observed during the heading period. Early maturing wheat tended to exhibit the most damage. The damage to irrigated wheat didn't appear until 10 days to 2 weeks before harvest when large areas of the field would be found laying flat on the ground. The stems were damaged during the freeze and weakened. The stems also could not transport water and nutrients during the grain fill period therefore further reducing yields. Disease was also and issue in the spring with Wheat Streak Mosaic and High Plains Virus found in many fields. Both diseases are vectored by the wheat curl mite, the explains finding both diseases in the same fields.

Grain-filling Conditions

Temperatures were above the long-term averages during the grain-filling period. The mean high temperature for Goodwell was 85° F while the long-term mean is 78.5° F. The long-term mean number of days with high temperatures above 90° F is 4.5. In 2004 there were 14 days above 90° F. Rainfall was significantly below the long-term mean for the region in the month of May (Table 1). The high temperatures, winds that blew most of the month, and lack of rainfall reduced grain yields and test weight. Test weights were average to below average for most varieties if harvested before the rains of late June. When harvesting resumed test weights were reported as low 51 lb/bu.

New Varieties for 2002-03

Varieties included in the trials for the first time were AgriPro Fannin and Overley. Overley is a very large-seeded new variety from Kansas State. Fannin was not quite winter hardy enough for the northern half of the state, especially when planted early and grazed. Deliver and Endurance were in the trials as OSU experimental lines in 2002-03 and released in 2004. Endurance is a very strong performer in a graze plus grain production system. Deliver is a high test weight, good milling and baking awnless variety applicable for grain production as well as forage systems.

Experimental Lines Included

Several OSU candidate cultivars that have potential for release in the next year or two were included in the trials. These were included to evaluate their capability at sites not normally used as test locations in the OSU wheat-breeding program. Characteristics of the experimental lines are available by selecting candidate cultivars on the web at http://www.wit.okstate.edu.

Testing and Reporting Procedures

All plots were planted in 7.5-inch rows with seeding rate indicated in the tables. The purpose of this testing program is to provide Oklahoma wheat producers with performance data on varieties that are presently grown or available in Oklahoma. Within each table varieties are listed in decreasing order for 3-year grain yield average, if available, followed by varieties with 2-year averages, and then varieties having data only for the current year. It is recommended that specific emphasis be given to multi-year averages when selecting varieties. Varieties that consistently rank high over 3-year averages are good choices.

Small differences in yield should not be overemphasized. Least Significant Differences (L.S.D.) are a statistical test of yield differences and are shown at the bottom of each table. Unless two entries differ by at least the L.S.D. shown, little confidence can be placed in one being superior to the other.

Additional Information on Web

For information on coleoptile length and other characteristics of varieties grown in Oklahoma see the "Wheat Variety Characteristic Chart" under Variety information on the Wheat Improvement Team web page at **http://clay.agr.okstate.edu/wheat/wit.html.** This information is updated regularly to give the latest in disease ratings. From the above address you can also connect to the latest fall and full-season forage data.

Cooperation Acknowledged

These data result from cooperative efforts of the Oklahoma Agricultural Experiment Station, Oklahoma Cooperative Extension Service, Oklahoma Wheat Commission, and cooperating producers. The following people have contributed to this report by assisting in crop production, data collection, and publication: Lawrence Bohl, Craig Chesnut, Matt LaMar, Jason Weirich, Chad Fowler, and Jody Dunbar. Their efforts are greatly appreciated.

Table 1. Long-term average and 2003-04 panhandle precipitation data.

PERIOD	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	TOT
BEAVER													
Average	2.84	3.14	2.01	1.25	1.17	0.74	0.50	0.92	1.65	1.75	3.28	3.64	22.89
2003-04	0.56	4.02	1.62	0.27	0.53	0.34	0.18	0.87	2.53	2.99	0.08	5.24	19.23
CIMARRON													
Average	2.85	2.55	1.97	0.97	0.79	0.43	0.34	0.54	0.99	1.28	2.76	2.92	18.39
2003-04	0.28	1.07	2.59	0.10	0.72	0.35	0.05	0.04	1.03	2.43	0.35	5.15	14.16
TEXAS													
Average	2.58	2.28	1.77	1.03	0.77	0.31	0.30	0.46	0.95	1.33	3.25	2.86	17.89
2003-04	1.87	1.19	1.62	0.14	0.56	0.18	0.02	0.45	1.58	2.12	0.15	3.82	13.70

Financial Support by the Oklahoma Wheat Commission

Balko Grain-Only Variety Trial

Cooperator: John Lane Soil Type: Ulysses Silt Loam pH = 7.8

SOURCE	ENTRY	FREEZE DAMAGE[1]	HEIGHT INCHES	PROTEIN %	TEST WT. (LB/BU)	YIELD (BU/A)
COLORADO	AVALANCHE (W)[2]	0.8	21	15.7(19)[3]	58.4(2)	21.0
KANSAS	IKE	1.0	23	16.1(13)	56.3(14)	18.3
TEXAS	TAM 111	1.5	24	16.3(9)	57.0(8)	18.1
WESTBRED	COSSACK	0.8	19	15.3(25)	56.3(14)	17.9
OKLAHOMA	OK02909 CL[4]	0.8	23	15.3(25)	55.6(20	17.9
AGRIPRO	THUNDERBOLT	1.0	23	16.3(9)	57.6(5)	17.6
OKLAHOMA	Ok102	1.0	16	15.7(19)	56.9(10)	17.3
KANSAS	TREGO (W)	0.8	19	15.6(22)	58.2(4)	17.2
KANSAS	LAKIN (W)	1.0	20	15.5(23)	57.0(8)	16.3
OKLAHOMA	OK00618 (W)	1.0	18	16.3(9)	58.6(1)	16.2
AGRIPRO	JAGALENE	1.5	20	16.5(8)	57.5(6)	15.9
OKLAHOMA	2174	1.0	19	16.6(6)	54.9(23)	15.9
KANSAS	STANTON	1.3	20	15.8(17)	56.8(11)	15.8
OKLAHOMA	ENDURANCE	1.0	22	14.9(28)	56.6(13)	15.8
KANSAS	2137	1.0	22	15.7(19	54.9(23)	15.8
AGRIPRO	CUTTER	1.0	21	16.7(5)	56.0(16)	15.3
KANSAS	2145	1.5	19	16.0(15)	55.5(21)	15.3
OKLAHOMA	INTRADA (W)	1.0	17	16.1(13)	58.4(2)	14.4
AGRIPRO	PLATTE (W)	1.0	20	17.1(3)	57.2(7)	14.0
OKLAHOMA	Ok101	1.5	21	15.2(27)	55.7(18)	13.6
OKLAHOMA	DELIVER	0.8	20	15.5(23)	55.9(17)	13.3
OKLAHOMA	OVERLEY	1.0	20	17.3(2)	56.8(11)	12.6
TEXAS	TAM 302	1.0	20	16.6(6)	52.4(28)	12.1
TEXAS	TAM 110	1.0	19	16.0(15)	55.7(18)	11.6
KANSAS	JAGGER	1.0	21	18.0(1)	54.9(23)	11.1
AGRIPRO	AP 502 CL	1.5	19	15.8(17)	54.5(27)	10.9
OKLAHOMA	CUSTER	2.0	19	16.3(9)	54.6(26)	8.4
AGRIPRO	FANNIN	3.0	17	16.8(4)	55.1(22)	5.1
	MEAN	1.2	20	16.1	56.3	14.8
	LSD (0.05)	0.8	1.5	0.5	1.4	3

[1]Freeze damage 0 = none apparent, 4 = severe. [2]W = White wheat variety.

[3]Number in() is rank within column, Protein % = wheat protein on 12% moisture basis.

[4]CL = Variety with Clearfield® gene giving wheat resistance to Beyond herbicide.

Planted September 19, 2003 at 60 lb/a, harvested June 10, 2004.

Partial financial support by the Oklahoma Wheat Commission

Goodwell Irrigated Grain-Only Variety Trial

Cooperator: Oklahoma Panhandle Research and Extension Center, Soil Type: Richfield clay loam, pH = 7.3

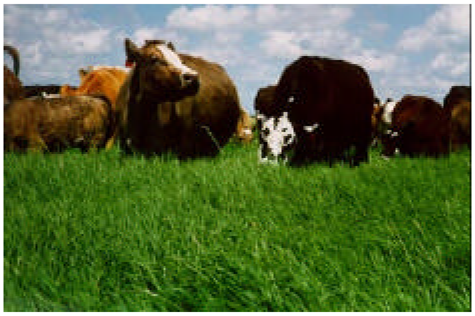
			HEIGHT	PROTEIN	TEST WEIGHT (LB/BU)			GRAIN YIELD (BU/A)		
SOURCE	ENTRY	LODGING	INCHES	%	2003-04	2-YEAR	3-YEAR	2003-04	2-YEAR	3-YEAR
KANSAS	TREGO (W)[1]	1.32	34	14.5(12)[3]	61.5(5)	59.9(2)	60.2(2)	69.8(13)	71.9(7)	72.0
OKLAHOMA	Ok102	0	33	14.6(10)	60.1(16)	58.8(10)	59.2(6)	78.0(3)	71.7(8)	68.6
OKLAHOMA	Ok101	0	36	13.0(28)	60.4(10)	58.8(10)	59.2(6)	72.1(9)	73.5(4)	68.4
KANSAS	LAKIN (W)	1	36	14.6(10)	60.4(10)	58.8(10)	58.9(9)	73.8(7)	75.6(2)	68.0
OKLAHOMA	CUSTER	0	35	14.0(24)	59.5(22)	58.9(8)	58.9(9)	71.9(10)	74.4(3)	67.1
TEXAS	TAM 302	1	34	13.9(25)	56.8(30)	56.9(19)	56.5(16)	58.3(25)	63.3(18)	63.6
OKLAHOMA	2174	0.3	35	14.4(14)	60.2(15)	58.9(8)	59.4(5)	68.8(15)	67.7(12)	63.1
KANSAS	2137	0	34	13.6(27)	59.5(22)	57.8(17)	58.4(12)	70.5(12)	66.8(14)	63.0
TEXAS	TAM 110	1	36	14.1(22)	58.5(27)	55.9(21)	57.3(15)	67.7(17)	67.2(13)	62.2
AGRIPRO	JAGALENE	0	36	14.1(22)	61.7(3)	59.8(3)	59.8(3)	68.9(14)	69.5(11)	60.9
OKLAHOMA	INTRADA (W)	0.8	32	15.1(3)	61.9(2)	60.0(1)	60.3(1)	62.1(23)	62.8(19)	58.4
WESTBRED	COSSACK	0.8	39	14.3(17)	59.9(18)	58.4(13)	59.0(8)	55.1(27)	60.0(20)	58.3
AGRIPRO	CUTTER	0.5	36	15.0(5)	60.9(7)	58.2(15)	58.7(11)	64.0(21)	65.1(15)	57.9
KANSAS	2145	0	34	15.1(3)	59.7(20)	58.3(14)	58.4(12)	64.8(20)	63.5(17)	56.1
KANSAS	JAGGER	2.5	34	15.5(1)	57.9(29)	57.1(18)	57.5(14)	60.9(24)	63.6(16)	55.3
AGRIPRO	THUNDERBOLT	0	38	14.5(12)	60.5(9)	59.3(5)	59.5(4)	46.5(30)	53.5(21)	44.0
AGRIPRO	PLATTE (W)	0	32	15.0(5)	61.6(4)	59.8(3)	-	81.8(2)	75.5(1)	-
TEXAS	TAM 111	0.8	36	14.2(20)	60.4(10)	59.0(7)	-	78.0(3)	73.5(4)	-
COLORADO	AVALANCHE (W)	0	36	14.3(17)	61.3(6)	59.3(5)	-	75.3(6)	72.2(6)	-
OKLAHOMA	ENDURANCE	0.5	37	12.9(29)	59.6(21)	58.0(16)	-	72.4(8)	71.6(9)	-
AGRIPRO	AP 502 CL	0	34	13.8(26)	58.3(28)	56.6(20)	-	71.0(11)	69.6(10)	-
OKLAHOMA	OK00618 (W)	0	35	14.3(17)	62.1(1)	-	-	83.1(1)	-	-
OKLAHOMA	OK00514	0	36	15.2(2)	60.7(8)	-	-	75.5(5)	-	-
KANSAS	STANTON	0	35	14.4(14)	60.0(17)	-	-	68.1(16)	-	-
OKLAHOMA	OK99212	0	36	14.2(20)	60.4(10)	-	-	67.5(18)	-	-
KANSAS	OVERLEY	1.3	36	14.4(14)	60.3(14)	-	-	65.0(19)	-	-
KANSAS	IKE	3.3	35	15.0(5)	58.7(26)	-	-	63.6(22)	-	-
OKLAHOMA	DELIVER	0.8	36	12.9(29)	59.3(24)	-	-	57.7(26)	-	-
OKLAHOMA	OK00614	1.3	35	14.8(8)	58.8(25)	-	-	50.5(28)	-	-
AGRIPO	FANNIN	2	35	14.8(8)	59.8(19)	-	-	50.1(29)	-	-
	MEAN	1	35.2	14.3	60	58.5	58.8	67.1	68.2	61.7
	LSD (0.05)	1	2.5	0.7	0.9	0.8	0.7	9.2	6.9	6

[1](W) = White wheat variety. [2]Lodging rating 0 = none, 4 = 100% lodged.

[3]Protein Number in() is rank within column.

Planted October 2, 2003 at 100 Lb/a, harvested June 11, 2004.

Partial financial support by the Oklahoma Wheat Commission



PRODUCTION TECHNOLOGY--CROPS

PERFORMANCE OF FORAGE BERMUDAGRASS VARIETIES IN OKLAHOMA TESTS, 2002-2004

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BERMUDAGRASS, *Cynodon dactylon* (L.) Pers., is used for pasture and hay over much of the southern USA. This introduced, perennial, sod-forming grass serves as the forage base for many livestock enterprises because of its high forage production capability and the management flexibility that it provides. Bermudagrass varieties may differ in performance characteristics relating to establishment, adaptation, forage production and forage quality. Varieties poorly adapted to an area decline in stand density and productivity one or more years following establishment. Conversely, stands of well-adapted varieties will last indefinitely. Varieties also may differ substantially in forage production capability, and to a lesser degree, in forage quality characteristics. Consequently, deciding which bermudagrass variety to plant is important. To aid in selecting varieties, comparative performance data are reported from field tests conducted over the past few years. Data are also reported for experimental bermudagrass varieties included in performance testing.

DESCRIPTION OF THE TESTS

Forage yield data are reported from three field tests conducted at three sites during the period 2002-2004. Locations and details of the tests are given in Table 1. Information about the bermudagrass varieties in the tests is given in Table 2. Plots in all tests were started by transplanting greenhouse-grown plants about 2 feet apart in each of two rows. The rows were spaced 2 feet apart equidistant from the center of the plot. Yield determinations were made by harvesting growth from an area about 3 feet in width and 10 to 15 feet in length through the middle of each plot. All tests were dryland except Test 2003-1 at the Oklahoma Panhandle Research and Extension Center at Goodwell, OK. Test 2003-1 was irrigated with approximately six acre-inches of water per month through the growing season. All tests received nitrogen fertilizer in the amount of 300 pounds N/acre/year, split into three applications of 100 pounds N/acre. Nitrogen was first applied when the bermudagrasses initiated growth in the spring, usually in mid-April. The second and third N applications followed the first and second harvests, respectively, which usually occurred in early June and early July. Soil pH, phosphorus, and potash levels were maintained at recommended levels based on soil test results. This fertilizer program provided a high yield environment in the absence of yield limiting factors such as low soil moisture, disease and winter injury. The high yield environment was provided so that the bermudagrass varieties could express their genetic potential for forage yield.

RESULTS

Weather Data. Precipitation amounts received at the respective test sites during the reported test years (2002-2004) are given in Table 3. Precipitation received during 2004 at the Chickasha and Haskell dryland sites was very close to their respective norms of 34.8 and 47.2 inches. Brief dry periods have occurred at each site, but prolonged severe drought has not occurred at either site over the duration of the two tests. The severity of winters has been average to milder than average for the respective sites.

Winter Survival. None of the varieties in the respective tests has suffered significant winter injury to date. Differences exist among the varieties in winter hardiness, but none of the test winters has been sufficiently severe to differentiate them based on freeze injury.

Forage Yields. Forage yield data are given in Tables 4 and 5 (Test 2001-1, Haskell, OK), 6 and 7 (Test 2001-2, Chickasha, OK), and 8 (Test 2003-1, Goodwell, OK). The high biomass yields reflect the high yield environment management imposed on the tests. Bermudagrass varieties differed significantly ($P<0.05$) for seasonal total forage yield in each of the three tests. Forage yields of Midland 99, Ozark, and Tifton 44 at the three sites are consistent with previous test results (see listing of previous PT bermudagrass test publications on Page 7) in demonstrating that each has high yield capability when grown in high yield environments. Results from previous testing suggest subtle adaptation differences among the three varieties that influence their performance. Midland 99 has generally had forage yields equal to, or better than, Tifton 44 and Ozark in most of Oklahoma. Ozark has tended to perform better than Midland 99 or Tifton 44 in the Oklahoma Panhandle and other northern parts of the bermudagrass belt.

In Test 2003-1 at Goodwell, the 1st year numerical yields of Vaughn's #1, Greenfield-Nokes, and World Feeder were less than those of Midland 99, Ozark, or Tifton 44, but the differences among these varieties were not statistically different. The performance of the Vaughn's #1, Greenfield-Nokes, and World Feeder relative to Midland 99, Ozark, and Tifton 44 in this test should become more definitive through time. The lower yield of World Feeder compared to the Midland 99, Ozark, and Tifton 44 is consistent with previous test results at Goodwell and other locations.

The experimental strains A12245 and A12246 produced forage yields similar to those of Midland 99, Ozark, and Tifton 44 in Tests 2001-1 (Haskell) and 2001-2 (Chickasha). A12245 generally had earlier growth and maintained a more dense sod than A12246, particularly at Haskell. The experimental strain LCB 84X 16-66 had the highest numerical yield in Test 2003-1 at Goodwell. It was among the highest yielding entries in a previous test at Goodwell (Test 97-1, See PT 2004-3). It's early growth, high forage yield, and maintenance of a dense stand at Goodwell under irrigation make it a candidate for release and use in that environment. It has not performed as well relative to the best standard varieties in tests at Haskell and Chickasha.

Table 1. Location and characteristics of the bermudagrass tests from which data are reported herein.

Test 2001-1	
Location	Eastern Research Station, Haskell, OK
Date Planted	May 16, 2001
Soil Type	Taloka silt loam
Treatments	17 varieties
Experimental Design	Randomized complete block, 4 replications
Irrigated or Dryland	Dryland
Test 2001-2	
Location	South Central Research Station, Chickasha, OK
Date Planted	May 24, 2001
Soil Type	McLain silt loam
Treatments	17 varieties
Experimental Design	Randomized complete block, 4 replications
Irrigated or Dryland	Dryland
Test 2003-1	
Location	Oklahoma Panhandle Research &Extension Center, Goodwell, OK
Date Planted	May 21, 2003
Soil Type	Richfield clay loam
Treatments	11 varieties
Experimental Design	Randomized complete block, 4 replications
Irrigated or Dryland	Irrigated, approximately 6 acre inches/growing season month.

Table 2. Information on commercial and experimental varieties included in bermudagrass tests.

Variety or Brand	Date Released	How Planted	Origin
COMMERCIAL VARIETIES - AVAILABLE FOR FARM USE			
Greenfield- Nokes Variant	--[1]	Sprigs	Robert Seay, Benton Co., AR Extension Director
Midland 99	1999	Sprigs	Oklahoma, Arkansas, Kansas, & Missouri AESs[2]; USDA-ARS[3] & Noble Foundation
Ozark	2001	Sprigs	Missouri, Oklahoma, Arkansas & Kansas AESs; Noble Foundation & USDA-ARS
Tifton 44	1978	Sprigs	USDA-ARS & Georgia AES
Vaughn's #1	Approx. 1994	Sprigs	Terrell Vaughn, Walling, TN
World Feeder	Approx. 1989	Sprigs	Origin: Agricultural Enterprises Corp., Oklahoma City, OK, Current owner: County Line Grass & Cattle Co., Hinton, OK
EXPERIMENTAL VARIETIES – NOT AVAILABLE FOR FARM USE			
A12244	NA	Sprigs	Oklahoma AES
A12245	NA	Sprigs	Oklahoma AES
A12246	NA	Sprigs	Oklahoma AES
ERS 16S-1	NA	Sprigs	Oklahoma AES
ERS 16S-2	NA	Sprigs	Oklahoma AES
ERS 16S-3	NA	Sprigs	Oklahoma AES
ERS 16S-4	NA	Sprigs	Oklahoma AES
ERS 16S-5	NA	Sprigs	Oklahoma AES
ERS 16S-6	NA	Sprigs	Oklahoma AES
ERS 16S-7	NA	Sprigs	Oklahoma AES
ERS 16S-8	NA	Sprigs	Oklahoma AES
ERS 16S-9	NA	Sprigs	Oklahoma AES
ERS 16S-10	NA	Sprigs	Oklahoma AES
LCB 84X 16-66	NA	Sprigs	Oklahoma AES
Shrimplin	NA	Sprigs	Ray Shrimplin, Westphalia, KS[4]

[1] Not the original Greenfield variety; a variant strain with some similarities to Greenfield in growth habit. [2] AES=Agricultural Experiment Station. [3] ARS=Agricultural Research Service. [4] Strain was planted in Westphalia in 1932 with sprigs brought from Oklahoma.

Table 3. Precipitation amounts (inches) received by month for the test locations and test years.

Month	2002	2003	2004	2002	2003	2004
		ERS[1]			OPREC[2]	
January	2.41	0.15	2.29	0.22	0.03	0.02
February	0.80	2.79	1.74	0.36	0.21	0.45
March	3.12	3.62	5.00	0.00	1.28	1.58
April	4.46	1.37	7.22	0.52	0.53	2.12
May	8.70	6.20	1.98	2.06	1.84	0.15
June	2.32	3.12	5.65	1.37	5.26	3.82
July	3.46	0.29	5.86	2.63	1.87	2.43
August	3.54	5.36	2.39	0.28	1.19	2.87
September	1.14	3.49	1.29	2.46	1.62	2.56
October	4.18	3.16	7.75	3.41	0.14	0.64
November	1.03	2.19	4.37	0.11	0.56	3.51
December	3.76	1.86	1.34	0.89	0.18	0.16
		SCRS[3]				
January	2.23	0.06	1.90			
February	0.89	1.13	1.91			
March	1.98	1.55	3.43			
April	4.97	2.23	2.10			
May	2.12	2.99	0.66			
June	4.03	5.32	4.83			
July	3.18	1.01	4.53			
August	1.67	4.38	2.89			
September	3.32	1.02	0.69			
October	8.05	0.40	5.22			
November	0.49	0.78	5.53			
December	2.35	0.84	0.35			

[1]Eastern Research Station, Haskell, OK; [2]Oklahoma Panhandle Research & Extension Center, Goodwell, OK;
[3]South Central Research Station, Chickasha, OK.

Table 4. Forage yields (tons dry matter/acre) of commercial and experimental bermudagrass varieties in Test 2001-1, Eastern Research Station, Haskell, OK. 2004.

Variety	2004 Harvest Dates			Total
	6/1	7/8	8/26	
Commercial Varieties – Available for Farm Use				
Ozark	4.02**	3.23*	3.37*	10.62**
Midland 99	3.87*	3.35*	3.33*	10.54*
Tifton 44	3.93*	3.17	3.26*	10.35*
Experimental Varieties – Not Available for Farm Use				
A-12246	3.33	3.65*	3.54**	10.51*
A-12245	3.57	3.19*	3.21	9.97*
ERS 16S-3	3.62	3.05	3.24	9.90
ERS 16S-10	2.83	3.72*	3.10	9.65
ERS 16S-4	3.13	3.16*	3.33*	9.61
ERS 16S-8	3.40	3.22*	2.84	9.45
ERS 16S-2	3.49	2.76	3.12	9.37
A-12244	3.58	3.01	2.73	9.32
ERS16S-7	2.90	3.38*	2.96	9.23
ERS16S-6	2.44	3.49**	3.20	9.12
ERS16S-1	2.49	3.23*	3.07	8.79
ERS16S-9	2.55	2.87	3.03	8.45
ERS16S-5	2.23	3.23*	2.73	8.18
LCB 84X 16-66	2.67	2.57	2.46	7.70
Mean	3.18	3.19	3.09	9.46
CV (%)	7.62	7.83	6.64	5.17
5% LSD	0.34	0.36	0.29	0.69

**Highest numerical value in column
*Not significantly different from the highest numerical value in the column based on 5% LSD

Table 5. Forage yields (tons dry matter/acre) of commercial and experimental bermudagrass varieties in Test 2001-1, Eastern Research Station, Haskell, OK. 2002-2004.

Variety	Year 2002 4-harvests	2003 4-harvests	2004 3-harvests	Mean
Commercial Varieties – Available for Farm Use				
Ozark	11.71**	10.80*	10.62**	11.04**
Midland 99	11.49*	10.32	10.54*	10.78*
Tifton 44	10.90*	10.22	10.35*	10.49
Experimental Varieties – Not Available for Farm Use				
A-12245	11.44*	11.44**	9.97*	10.95*
ERS16S-4	10.97*	11.10*	9.61	10.56*
ERS16S-10	11.31*	9.84	9.65	10.27
A-12246	10.51	9.38	10.51*	10.13
ERS16S-2	10.61	10.23	9.37	10.07
ERS16S-3	9.89	9.44	9.90	9.74
ERS16S-7	10.89	9.06	9.23	9.73
ERS16S-9	10.62	9.97	8.45	9.68
ERS16S-6	10.20	9.15	9.12	9.49
ERS16S-1	9.73	9.10	8.79	9.21
ERS16S-8	9.29	8.48	9.45	9.08
LCB 84X 16-66	9.61	9.68	7.70	8.99
A-12244	9.03	7.53	9.32	8.63
ERS16S-5	8.13	8.01	8.18	8.11
Mean	10.37	9.63	9.46	9.82
CV (%)	6.89	5.95	5.17	6.10
5% LSD	1.02	0.81	0.69	0.48

**Highest numerical value in column
*Not significantly different from the highest numerical value in the column based on 5% LSD

Table 6. Forage yields (tons dry matter/acre) of commercial and experimental bermudagrass varieties in Test 2001-2, South Central Research Station, Chickasha, OK.

Variety	2004 Harvests 5/25	7/12	8/24	Total
Commercial Varieties – Available for Farm Use				
Midland 99	3.36**	4.70*	2.72**	10.77**
Ozark	2.47*	5.14*	2.45*	10.06*
Tifton 44	2.87*	4.73*	2.38*	9.98*
Experimental Varieties – Not available for Farm Use				
A12246	2.93*	5.28**	2.54*	10.74*
A12245	3.16*	4.46	2.53*	10.15*
ERS16S 03	2.54*	5.14*	1.87	9.54*
ERS16S 04	2.95*	4.24	2.01	9.20
ERS16S 08	2.49*	4.85*	1.76	9.10
ERS16S 01	2.60*	4.46	2.01	9.08
LCB 84X 16-66	2.75*	4.31	1.86	8.91
A12244	2.29	4.19	1.39	7.86
ERS16S 05	0.50	5.11*	1.87	7.47
Avg.	2.57	4.71	2.11	9.40
CV (%)	28	11	11	9
5% LSD	1.04	0.72	0.35	1.25

**Highest numerical value in column.
*Not significantly different from the highest value in the column based on 5% LSD.

Table 7. Forage yields (tons dry matter/acre) of commercial and experimental bermudagrass varieties in Test 2001-2, South Central Research Station, Chickasha, OK. 2002-2004.

Varieties	Year 2002 4 Cuts	Year 2003 4 Cuts	Year 2004 3 Cuts	Mean 2003-04	Mean 2002-04
Commercial Varieties – Available for Farm Use					
Midland 99	10.97	10.91*	10.77**	10.84*	10.88*
Tifton 44	11.72*	10.19*	9.98*	10.08*	10.63*
Ozark	--[1]	10.36*	10.06*	10.21*	-
Experimental Varieties – Not Available for Farm Use					
A12246	12.04*	10.95*	10.74*	10.85**	11.24**
A12245	11.82*	11.05*	10.15*	10.60*	11.01*
ERS 16S 03	11.44*	11.22**	9.54*	10.38*	10.73*
ERS 16S 04	12.44**	10.14*	9.20	9.67	10.59*
ERS 16S 08	9.98	9.67	9.10	9.38	9.58
ERS 16S 01	10.37	9.24	9.08	9.16	9.56
LCB 84X 16-66	10.08	8.74	8.91	8.82	9.24
ERS 16S 05	9.79	9.05	7.47	8.26	8.77
A12244	9.73	8.30	7.86	8.08	8.63
Mean	10.94	9.98	9.40	9.69	10.08
CV (%)	8	10	9	10	9
5% LSD	1.30	1.49	1.25	0.94	0.72

**Highest numerical value in column.
*Not significantly different from the highest value in the column based on 5% LSD.
[1]Ozark yields were not measured in 2002 due to herbicide injury. Plots had recovered by start of the 2003 growing season.

Table 8. Forage yields (tons dry matter/acre) and early season percent greenup of bermudagrass varieties in Test 2003-1, Oklahoma Panhandle Research & Extension Center, Goodwell, OK. 2004.[1]

Variety	2004 Harvest Dates June 9	July 13	Aug. 17	Total	% Greenup[2] 3/23/04	3/31/04
Commercial Varieties – Available for Farm Use						
Ozark	4.19	3.36*	2.92	10.47*	10	73
Midland 99	3.70	3.81**	2.82	10.33*	6	70
Tifton 44	4.43	2.92	2.81	10.16*	1	68
Vaughn's # 1	3.90	2.46	2.63	8.99	1	48
Greenfield-Nokes[3]	4.80	1.96	2.14	8.90	1	75
World Feeder	4.09	2.26	2.36	8.71	1	68
Experimental Varieties – Not Available for Farm Use						
LCB 84X 16-66	4.74	3.24	3.59**	11.57**	8	75
A 12245	3.51	3.27	3.07*	9.85*	3	63
Shrimplin	2.77	1.69	1.26	5.72	10	85
Mean	4.01	2.77	2.62	9.41	4	69
CV (%)	30	11	17	15	64	16
5% LSD[4]	NS[5]	0.45	0.66	2.07	4	16

**Highest numerical value in column.
*Not significantly different from the highest value in the column based on 5% LSD.
[1]Midland and Greenfield were included in test but not harvested due to mechanical contamination. Plots were re-established in 2004.
[2] Visual estimates of the percentage of plots with new growth.
[3]Not the original Greenfield variety; a variant strain with some similarities to Greenfield in growth habit.
[4]Any two means within a column are significantly different at the 95% probability level if their difference is ≥ the LSD value.
[5]NS=No statistically significant difference among varieties.

Additional information on forage bermudagrass and related topics is contained in these publications available from your Cooperative Extension Office:

PT 2004-3	Performance of Forage Bermudagrass Varieties in Oklahoma Tests, 1998-2003.[1]
PT 2003-3	Performance of Forage Bermudagrass Varieties in Oklahoma Tests, 1998-2002.[1]
PT 2002-3	Performance of Forage Bermudagrass Varieties in Oklahoma Tests, 1998-2001.[1]
PT 2001-9	Performance of Forage Bermudagrass Varieties in Oklahoma Tests, 1998-2000.[1]
PT 2000-8	Performance of Forage Bermudagrass Varieties in Oklahoma Tests, 1995-99.[1]
PT 98-14-01	Performance Of Forage Bermudagrass Varieties In Oklahoma Tests, 1995-1997.[1]
PT 96-9	Performance Of Forage Bermudagrass Varieties In Oklahoma Tests, 1992-1995.
F-2117	Forage Quality Interpretations
F-2568	Protein-Nitrogen Relationships in Forages
F-2583	Bermudagrass Varieties for Oklahoma
F-2587	Bermudagrass for Grazing or Hay

[1] Available online at http://pss.okstate.edu/publications/bermudagrass.html

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Goodwell

Soybean Variety Tests 2004

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Table 5. Early Season Roundup Ready Soybean Production Goodwell, OK 2004.[2]

Variety	Maturity Group	Harvest Date	Height in Inches	Shattering[3] Score	Lodging[3] Score	Seeds/ Lb.	Yield in[1] Bu/Acre
93M50	3.0	10/20	25	2	1	2400	62.7
93M92	3.0	10/20	25	0	0	2550	57.0
AG3602	3.6	10/20	29	0	0	2750	61.9
AG3905	3.9	10/20	29	0	1	2700	59.7
DKB36-52	3.6	10/20	34	0	1	2650	50.2
AG3802	3.8	10/20	28	1	1	2600	61.4
DKB38-52	3.8	10/20	29	0	0	2700	57.4

[1]Mean yield = 58.6 Bu/acre, LSD @ .05 = 9.0 Bu/acre, C.V. = 8.7%
[2]Planted May 20, 2004 on a 30” row spacing. Harvested as ready. Supplemental irrigation used as needed at this location.
[3]0 = no shattering or lodging, 5 = very severe shattering or lodging.
[4]Varieties 93M50 and 93M92 are from Pioneer Hi-Bred International Inc.; Asgrow AG3602, AG3802, AG3905, Dekalb DKB36-52, DKB38-52 are from Monsanto.

Table 5. Full Season Roundup Ready Soybean Production Goodwell, OK 2004[2]

Variety[4]	Maturity Group	Height in Inches	Shattering[3] Score	Lodging[3] Score	Seeds/ Lb.	Yield in[1] Bu/acre
AG4403	4.4	36	2	1	3350	42.3
DG33B52	5.2	36	1	4	2850	41.6
AG4801	4.8	30	2	1	2850	41.5
AG5605	5.6	28	1	1	3650	40.7
DG38K57	5.7	42	2	2	3300	39.9
AG4201	4.2	34	3	2	2700	38.2
DG3583NRR	5.8	40	1	2	3200	37.1
G5012RR/N	5.0	44	1	2	2450	36.9
G5812RR/N	5.8	42	1	2	2550	36.5
DG3562NRR	5.6	40	1	2	2900	35.5
DG3600NRR	5.9	42	1	3	2600	34.8
DG3535NRR	5.3	40	1	3	3150	34.7
95B42	5.0	44	1	3	3100	32.8
AG4102	4.1	32	3	1	2550	30.1
AG4903	4.9	28	1	1	3250	29.7
95M80	5.0	46	1	2	3000	27.8
AG5905	5.9	30	1	1	3200	26.7

[1]Mean yield = 35.7 Bu/acre, LSD@.05= 8.2 Bu/acre, C.V.= 13.9 %.
[2]Planted May 20,2004 on a 30" row spacing. Harvested all plots on November 6, 2004. Supplemental irrigation used as needed at this location.
[3]0= no shattering or lodging, 5= very severe shattering or lodging.
[4]Variety 95M80 & 95B42 are from Pioneer Hi-Bred International Inc.; Dyna Gro33B52, 3535NRR, 3562NRR, 38K57, 3583NRR & 3600NRR are from UAP Midsouth Dyna Gro Seed Co.; Garst 5012RR/N & 5812RR/N are from Garst Seed Co.; Asgrow AG4102, AG4201, AG4403, AG4801, AG4903, AG5605 & AG5905 are from Monsanto.

SUNFLOWER PERFORMANCE TRIALS IN OKLAHOMA, 2004

PRODUCTION TECHNOLOGY CROPS

OKLAHOMA COOPERATIVE EXTENSION SERVICE
DEPARTMENT OF PLANT AND SOIL SCIENCES
DIVISION OF AGRICULTURAL SCIENCES & NATURAL RESOURCES
OKLAHOMA STATE UNIVERSITY

PT 2005-2 January 2005 Vol. 17

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Two sunflower performance trials (irrigated and dryland) were conducted in 2004 at the Oklahoma Panhandle Research and Extension Center (OPREC) near Goodwell, Oklahoma. Companies marketing sunflowers were invited to participate and enter hybrids on a voluntary fee-entry basis. Tests were financed in part by the entry fees from the sunflower companies. Information presented in this publication on maturity, oil type, and other hybrid characteristics were supplied by the seed companies.

Grain yield and percent oil content were determined using a randomized complete block design experiment with three replications (dryland) and four replications (irrigated). The sunflower hybrids were seeded in two row plots (30 inch row spacing) and 30 feet in length using a tractor powered cone planter. The irrigated trial was double cropped sunflower following wheat harvest, and was planted July 13 at a target population of 23,000 plants per acre. The dryland trial was planted July 2 on ground fallowed after wheat harvest 2003 at a target population of 17,000 plants per acre. Roundup ultramax herbicide was applied at 20 fl oz/acre to kill emerged weeds prior to planting. Spartan at 3 oz/acre plus Dual II Magnum 0.75 pt/acre was applied premergent for weed control. Lorsban 4E insecticide was applied at 1 pt/acre at the R4 stage of sunflower growth and then reapplied one week later to control the sunflower moth. The dryland site was harvested October 27, and the irrigated site December 3 using a Massey-Ferguson plot combine. Extensive rainfall during November delayed harvest on the irrigated site. Grain yield (pounds/acre), percent oil content, and actual plant populations were determined (Tables 1 and 2). The irrigated study had lower yields than expected probably due in part to volunteer wheat that was not treated because of the wet weather, and the actual plant population that emerged was lower than optimal for irrigated conditions.

Small differences between means of reported data should not be over emphasized. Results of the statistical analyses of variance are reported in terms of a least significant difference (LSD). If two means differ by more than the LSD (.05), such a difference would be due to chance variation only 5% of the time. Therefore, it is 95% probable that the observed difference is due to the hybrid. The coefficient of variability (CV) is another statistic that is provided as an estimate of the precision of replicated trials. Treatments with a CV less than 20% are usually acceptable for performance comparisons. Treatments with a CV greater than 20% provide only a rough guide to hybrid performance.

The following people have contributed to this report: Lawrence Bohl, Jason Nusz, Jason Weirich, Chad Fowler, Corey Johnson, Zach Hegwood and Donna George. Their efforts are greatly appreciated.

Table 1. Hybrids entered and results of dryland Oklahoma Sunflower Performance Trial, 2004.

Company	Hybrid	Maturity	Oil type	Grain yield (lb/ac)	Oil %	Plant Population
Garst	Hysun 454	103	NuSun	1,519	40.1	11,809
Garst	Hysun 450	102	NuSun	1,500	40.6	15,391
Triumph	675	95-105	NuSun	1,495	42.6	17,811
Triumph	665	95-105	NuSun	1,459	40.2	21,006
Garst	Hysun 424	99	NuSun	1,452	40.5	16,263
Triumph	645	95-105	NuSun	1,377	42.9	17,715
Triumph	636	85-95	NuSun	1,346	40.3	14,617
Garst	F10016NS	99	NuSun	1,263	37.4	15,972
Garst	4704NS	97	NuSun	1,081	35.2	15,682
			averages	1,388	40.0	16,252
			LSD	445	1.2	7,018
			C.V. %	18.5	1.6	25

Cooperator: Oklahoma Panhandle Research and Extension Center

Soil Series: Gruver Clay Loam

Tillage: No-Till; Planted on ground fallowed after wheat 2003

Fertilizer: N: 100 lbs/ac P: 0 K: 0

PRE Herbicide: 1 pint Dual II Magnum + 3 oz Spartan

Insecticide: 1 pint Lorsban 4E applied at the R4 sunflower stage and repeated one week later

Planting Date: July 2, 2004 Target Population 17,000

Harvest Date: October 27, 2004

	Precipitation	
Month	2004	Normal
May	0.15	3.25
June	3.82	2.86
July	2.43	2.58
August	2.87	2.28
Sept.	2.56	1.77
Oct.	0.64	1.03
Totals:	12.47	13.77

Table 2. Hybrids entered and results of irrigated Oklahoma Sunflower Performance Trial, 2004.

Company	Hybrid	Maturity	Oil type	Grain yield (lb/ac)	Oil %	Plant Population
Garst	Hysun 454	103	NuSun	1,770	45.7	9,323
Triumph	665	95-105	NuSun	1,631	45.5	11,210
Garst	Hysun 424	99	NuSun	1,663	44.6	11,728
Triumph	645	95-105	NuSun	1,446	47.5	12,381
Triumph	636	85-95	NuSun	1,443	45.0	9,907
Garst	F10016NS	99	NuSun	1,411	44.4	12,527
Garst	Hysun 450	102	NuSun	1,400	44.1	10,424
Garst	4704NS	97	NuSun	1,157	41.1	12,383
Triumph	675	95-105	NuSun	1,140	47.9	12,164
			averages	1,451	45.1	11,339
			LSD	308	1.0	2,271
			C.V. %	14.6	1.6	13.7

Cooperator: Oklahoma Panhandle Research and Extension Center

Soil Series: Gruver Clay Loam

Tillage: NoTill; planted following 2004 wheat harvest

Fertilizer: N: 100 lbs/ac P: 0 K: 0

PRE Herbicide: 1 pint Dual II Magnum + 3 oz Spartan

Insecticide: 1 pint Lorsban 4E applied at the R4 sunflower stage and repeated one week later

Planting Date: July 13, 2004 Target Population 23,000

Harvest Date: December 3, 2004

Precipitation

Month	2004	Normal	Irrigation
May	0.15	3.25	4.0
June	3.82	2.86	4.0
July	2.43	2.58	4.0
August	2.87	2.28	0
Sept.	2.56	1.77	0
Oct.	0.64	1.03	0
Totals:	12.47	13.77	12.0

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