Oklahoma Panhandle Research & Extension Center

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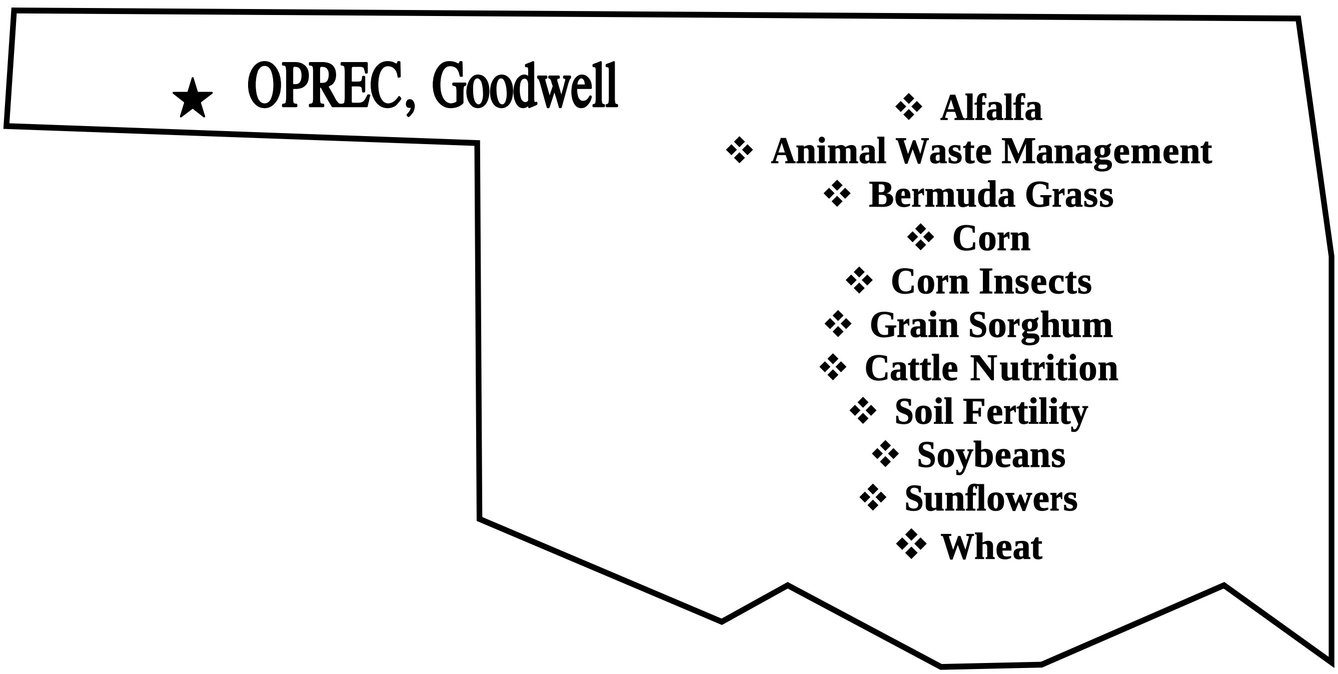

2002 Research Highlights

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)/Oklahoma Agricultural Experiment Station (OAES)/Oklahoma Cooperative Extension Service (OCES) at Oklahoma State University (OSU) have a long history of working cooperatively with Oklahoma Panhandle State University (OPSU). A Memorandum of Agreement that outlined the major missions of each entity strengthened this cooperative effort in July 1994. OPSU's primary role is teaching. OAES is the research arm of the DASNR and is responsible for the fundamental research. OCES transfers technology generated for the research programs to clientele. These three entities complete the spectrum and constitute a true partnership in solving problems related to panhandle agriculture.

The Department of Plant and Soil Sciences with support from OAES and OCES has staffed the Oklahoma Panhandle Research and Extension Center (OPREC) with a Director, Area Crop-Soil Research/Extension Specialist, Area Livestock Extension Specialist, Senior Office Assistant, Senior Station Superintendent, Secretary, Field Foreman, Field Assistant/Equipment Operator, wage payroll, and part-time OPSU student laborers. Graduate students also spend part of the summer conduction research.

Dr. Jose Sanchez assumed the duties as Director of OPREC on July 1, 2002. He directs the overall operations and conducts research and outreach activities in sustainable agriculture. Sanchez came to us from Michigan State University where he was an extension agronomist. He has a BS from the National Agriculture University, Lima, Peru, and a MS and PhD from MSU. Dr. Curtis Bensch joined the team as the Assistant State Specialist/Lecturer on July 1, 2002. He is in a position that is jointly funded by OPSU/OSU. He teaches part-time at OPSU and also conducts research/extension activities at OPREC. He has degrees from OPSU, OSU, and KSU. We were all deeply saddened by the untimely death of Judy Prater this past summer. She will be missed greatly. Donna George, who had been a part time secretary working with Judy, has assumed many of the duties and responsibilities.

OSU faculty in the departments of Plant and Soil Sciences, Entomology and Plant Pathology, Biosystems and Agricultural Engineering, Agricultural Economics, Animal Science, and USDA/ARS continue their research and extension efforts at OPREC and in the panhandle area. Oklahoma agriculture, especially in the Panhandle, is a powerful but rapidly changing economic sector. Agricultural industries are being challenged to maintain competitive market positions. Falling commodity prices, rising pressure from pests and disease, growing competition for water, greater sensitivity to environmental stewardship, increasing animal waste issues, and a shrinking supply of qualified labor are among some of the complex factors that are fundamentally reshaping agriculture in Oklahoma. Development of 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 have been the focal point of both research and extension programs at OPREC. Variety development of both hard red and hard white, winter wheat and performance evaluations of bermudagrass, buffalograss, alfalfa, soybean, wheat, grain sorghum, corn, and canola are being conducted. Conservation tillage, irrigation management, and the efficient use of fertilizer and pesticides are also being studied.

Progress made in development of research and education programs adapted to the panhandle area has been significant since establishing the Center. However, as the agriculture landscapes changes much more work will need to be initiated. Your continued support in our research and extension programs will help us better serve the clientele of the panhandle area.

James H. Stiegler
Professor and Head
Department of Plant and Soil Sciences

Oklahoma Panhandle Research and Extension Center

~Advisory Board~

2001 Oklahoma Panhandle Research and Extension Center

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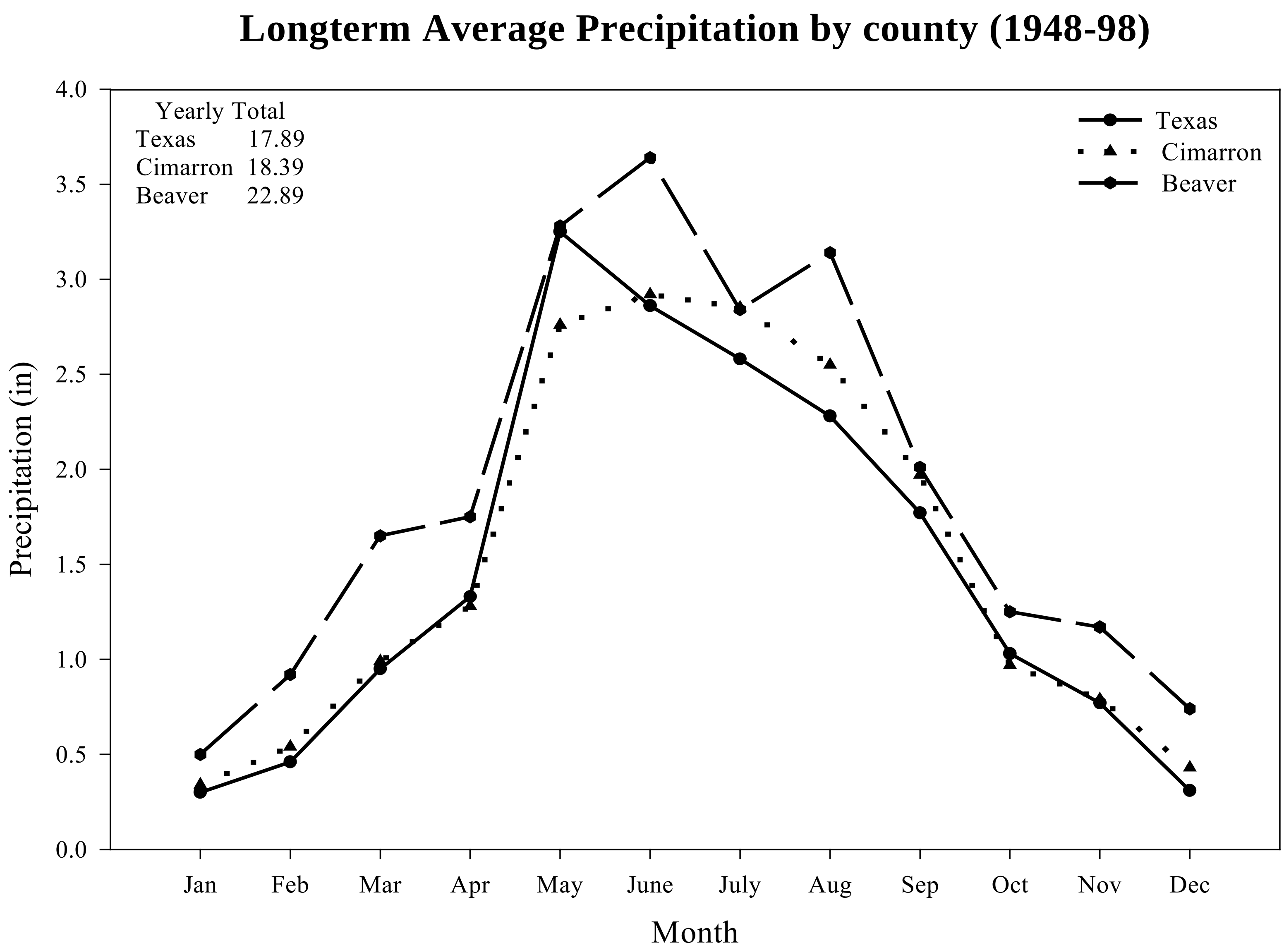
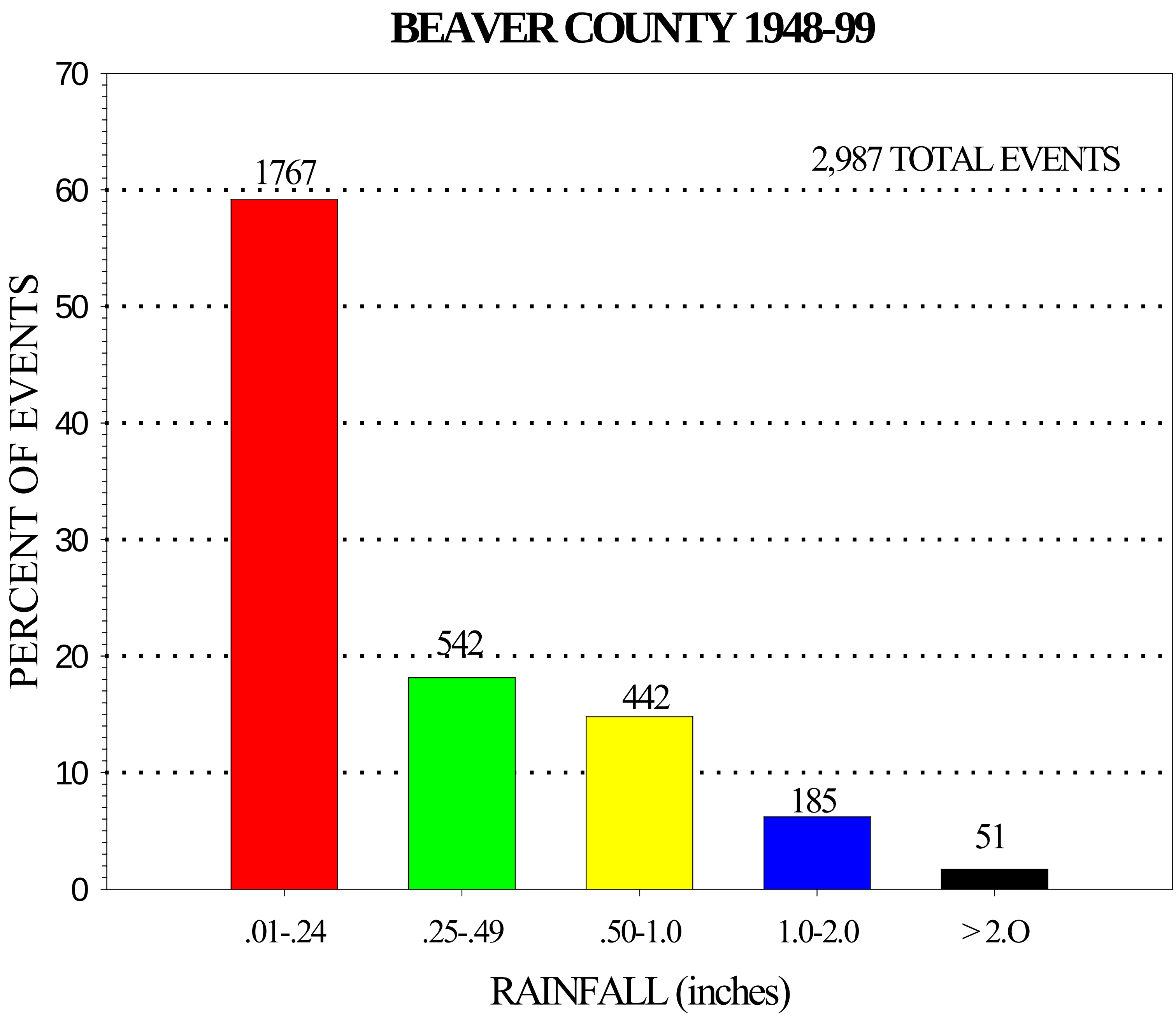
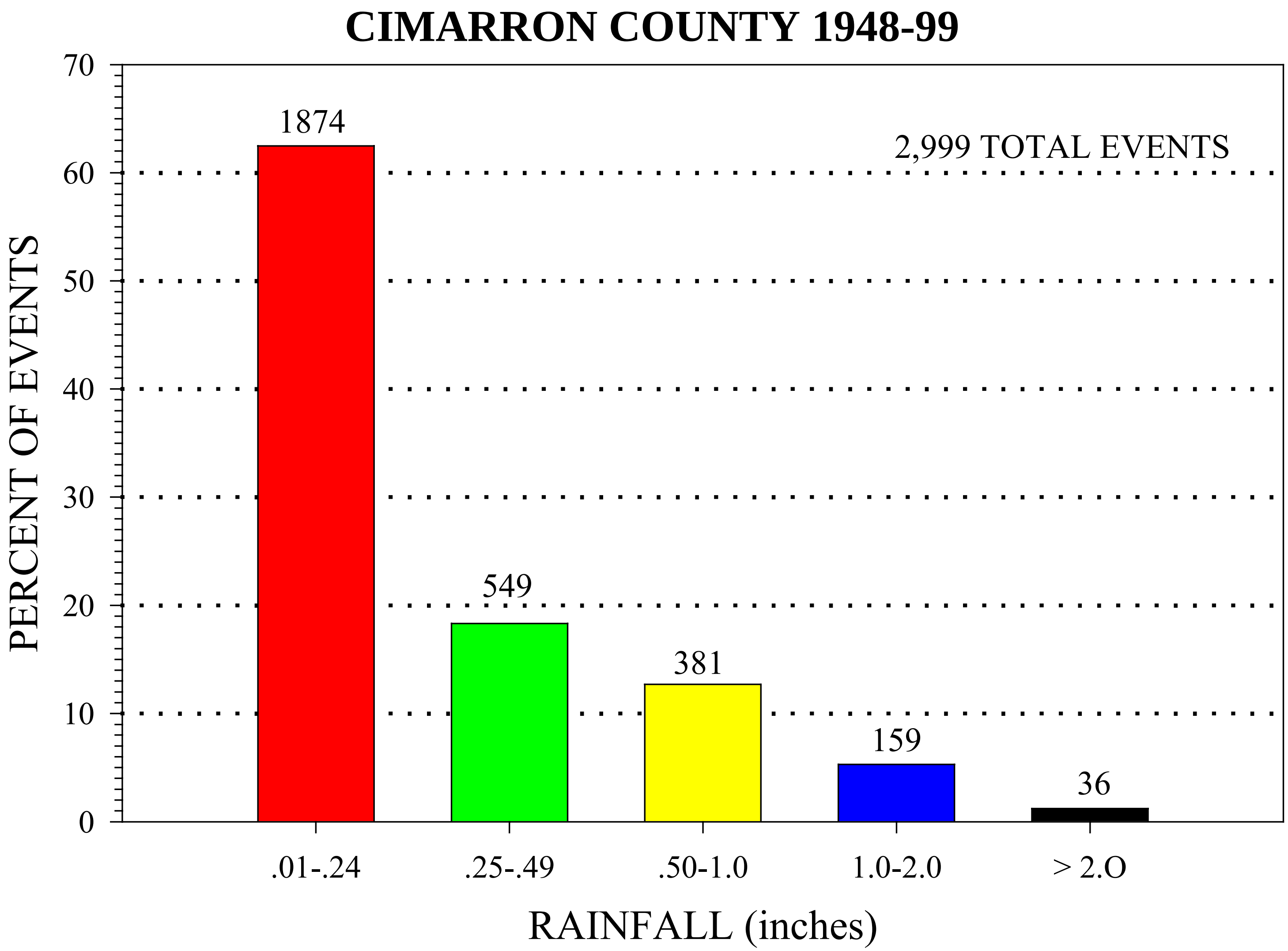
Climatological data for Oklahoma Panhandle Research and Extension Center, 2002.

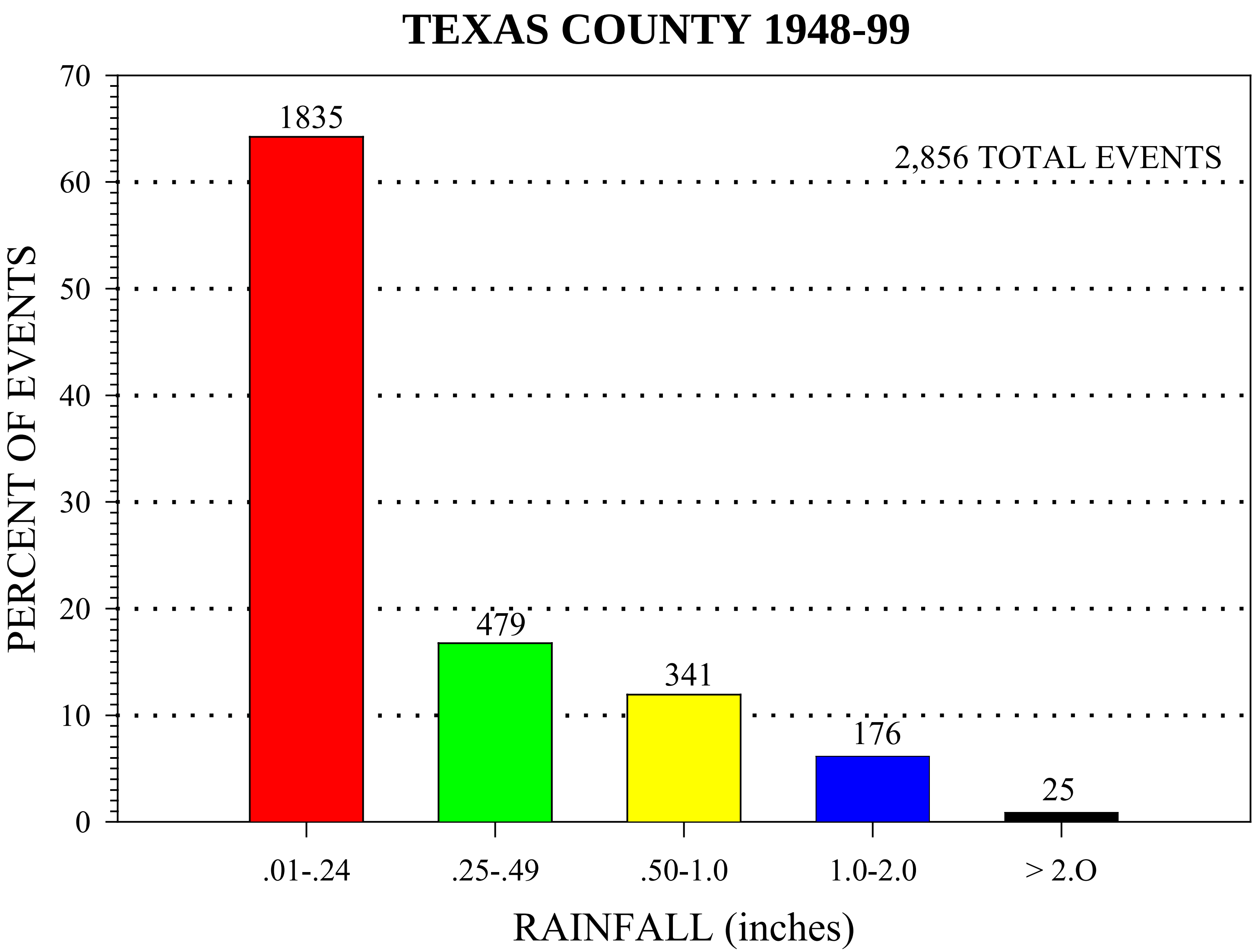
	Temperature				Precipitation			Wind	
Month	Max	Min	Max. mean	Min. mean	2001 Inches	Long term mean	One day total	AVG mph	Max mph
Jan	78	4	50	21	0.22	0.30	0.14	11.5	41.4
Feb	77	7	52	22	0.36	0.46	0.36	14.5	60.3
March	84	2	61	23	0.00	0.95	0.00	14.7	59.0
April	94	20	74	43	0.52	1.33	0.15	16.3	59.6
May	100	36	80	49	2.06	3.25	1.74	16.0	57.4
June	101	53	92	64	1.37	2.86	0.59	16.6	66.1
July	102	60	92	66	4.02	2.58	2.29	12.6	57.2
Aug	101	57	93	64	4.00	2.28	2.24	13.6	47.6
Sept	94	56	82	56	2.46	1.77	1.75	11.8	43.5
Oct	87	27	62	40	3.41	1.03	1.09	10.9	41.9
Nov	78	12	58	30	0.11	0.77	0.06	11.4	43.9
Dec	68	1	45	23	0.89	0.31	0.18	10.6	47.2
Annual total			71	43	19.42	17.9	NA	NA	NA

Data from Mesonet Station at OPREC


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



TEXAS COUNTY 1948-99
1835
479
341
176
25
2,856 TOTAL EVENTS
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
2002 Research Highlights

Crops

Appendix

Canopy Reduction and Legume Interseeding in Irrigated Continuous Corn[1]

M.T. Humphreys, K.W. Freeman, R.W. Mullen, D.A. Keahey, and W.R. Raun*
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 1.32 Mg ha^{-1} increase in yield compared to conventionally grown corn with no N applied. In 1999, interseeded legumes (except subterranean clover) in conjunction with the application of 56 kg N ha^{-1} and crimson clover interseeded without the addition of fertilizer N (with and without canopy reduction) resulted in grain N uptake levels equal to the 112 kg N ha^{-1} treatment.

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

[1] Contribution from the Okla. Agric. Exp. Stn.

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 112 kg N ha^{-1} of urea (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 56 kg ha^{-1}. Each year, corn was planted at a seeding rate of 182,780 seeds ha^{-1} 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.) 44.8 kg ha^{-1}, subterranean clover (*Trifolium subterraneum* L.) 44.8 kg ha^{-1}, alfalfa (*Medicago sativa* L.) 33.6 kg ha^{-1}, arrowleaf clover (*T. vesiculosum* L.) 22.4 kg $ha^{-1}$and crimson clover (*T. incarnatum* L.) 44.8 kg ha^{-1}. Following interseeding and canopy reduction, 5 cm 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 7.6 m. 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 (7). Nitrogen use efficiency was calculated using the difference method (8).

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 1.95 Mg ha^{-1} 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 1.35 Mg ha^{-1} 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 \$99 ha^{-1} with corn grain worth \$0.073 kg^{-1}.

Grain N Uptake

During the initial years of the experiment, treatment effects may have been masked by high inorganic N levels in the soil (Table 1). However, by 1998, interseeding of yellow sweet clover and crimson clover (with and without canopy reduction) without fertilizer N resulted in grain N uptake levels above the check and equal to corresponding legume interseeding with supplemental N (Table 3). In 1999, application of 56 kg N ha^{-1} in conjunction with interseeding of a legume resulted in grain N uptake levels equal to that of the 112 kg N ha^{-1} treatment with the exception of subterranean clover. Interseeding of crimson clover (with and without canopy reduction) without supplemental N also resulted in grain N uptake levels equal to the 112 kg N ha^{-1} treatment.

Although not evaluated in this study, mechanized canopy reduction could decrease the time required for grain to lose moisture since more sunlight would directly come in contact with the corn ears when the tops were removed. When grain moisture is high it can delay harvest and/or significantly increase drying costs. Legume seeding rates, alternative species, method of interseeding and interseeding date will all need to be thoroughly evaluated prior to the mechanization and implementation of this practice.

Since nitrate leaching and soil erosion are becoming major concerns in production agriculture today, this experiment may lead to practices that can decrease both, by lowering the amount of inorganic fertilizer N needed for corn production and reducing the amount of bare soil susceptible to wind and water erosion.

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

TABLE 2. Effect of treatment on corn grain yield at Goodwell, OK, 1994-1999.

Trt	Legume	N rate, kg ha^{-1}	Management	Yield						
				1994	1995	1996	1997	1998	1999	Average
				Mg ha^{-1}						
1	Yellow sweet clover	0	Tops cut at PM*	10.3	8.2	11.4	6.9	7.3	8.9	8.8
2	Subterranean clover	0	Tops cut at PM	7.4	9.9	11.8	6.4	6.3	7.3	8.2
3	Alfalfa	0	Tops cut at PM	8.2	6.0	11.3	6.9	6.5	6.1	7.5
4	Arrowleaf clover	0	Tops cut at PM	10.5	8.6	11.5	7.0	7.0	6.5	8.5
5	Crimson clover	0	Tops cut at PM	4.5	8.7	10.5	6.0	7.0	10.2	7.8
6	Subterranean clover	56	Tops cut at PM	8.9	10.0	10.9	5.9	7.4	7.8	8.5
7	Crimson clover	0	Normal	9.0	7.0	10.6	6.6	7.5	8.6	8.3
8	Yellow sweet clover	56	Tops cut at PM	6.0	8.9	10.0	5.8	6.8	8.6	7.7
9	Alfalfa	56	Tops cut at PM	7.6	11.5	11.1	6.1	7.1	9.4	8.8
10	Arrowleaf clover	56	Tops cut at PM	9.3	5.7	11.1	6.2	7.7	9.9	8.3
11	Crimson clover	56	Tops cut at PM	9.1	8.4	12.1	5.8	7.3	9.3	8.7
12	No legume	0	Normal	8.9	7.5	10.8	7.0	6.4	8.1	8.1
13	No legume	112	Normal	10.1	10.0	12.0	6.7	8.3	8.9	9.3
	SED‡			1.5	1.5	1.5	0.5	0.6	1.3	2.4
	CV†			21.4	22.3	16.1	10.3	9.8	19.4	37.5

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

TABLE 3. Effect of treatment on corn grain N uptake at Goodwell, OK, 1997-9999.

Trt	Legume	N rate, kg ha^{-1}	Management	Grain N uptake 1997	1998	1999	Average
				----------kg ha^{-1}----------			
1	Yellow sweet clover	0	Tops cut at PM*	107	91	115	104
2	Subterranean clover	0	Tops cut at PM	104	81	87	91
3	Alfalfa	0	Tops cut at PM	108	83	75	89
4	Arrowleaf clover	0	Tops cut at PM	112	84	75	90
5	Crimson clover	0	Tops cut at PM	104	91	138	111
6	Subterranean clover	56	Tops cut at PM	107	99	103	103
7	Crimson clover	0	Normal	113	96	117	109
8	Yellow sweet clover	56	Tops cut at PM	99	90	126	105
9	Alfalfa	56	Tops cut at PM	101	91	124	105
10	Arrowleaf clover	56	Tops cut at PM	102	102	143	116
11	Crimson clover	56	Tops cut at PM	102	105	135	114
12	No legume	0	Normal	118	77	97	97
13	No legume	112	Normal	113	116	125	118
	SED[‡]			11.3	10.5	20.5	19.1
	[†]			12.9	13.9	22.3	22.5

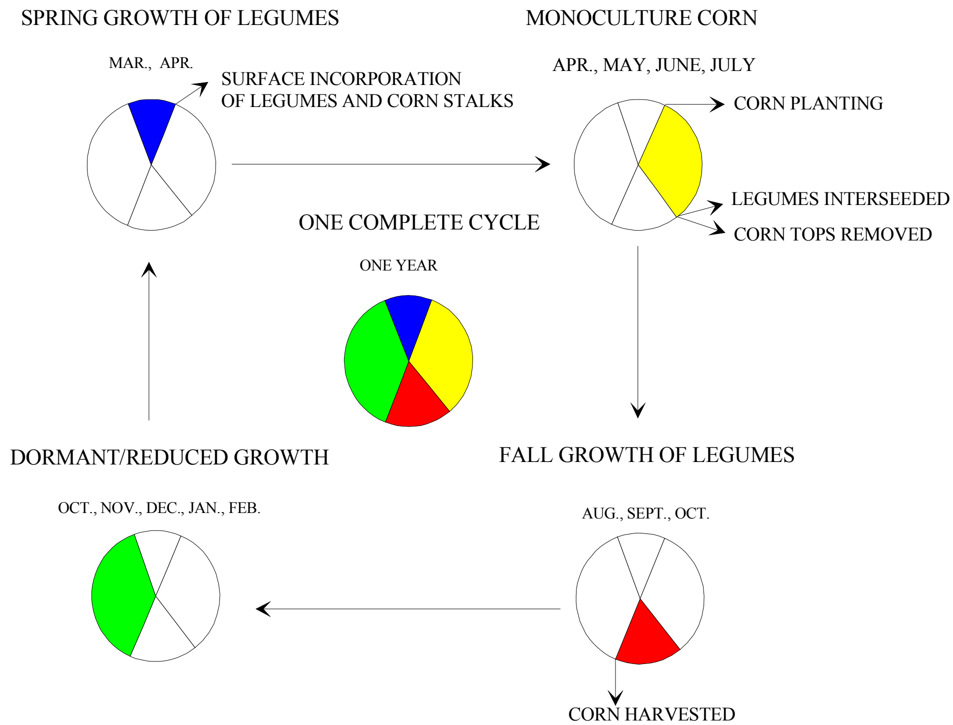
[*]PM – physiological maturity

[‡]SED- standard error of the difference

CV

[†]CV – coefficient of variation

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



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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 have been observed with starter fertilizer. Therefore, starting in 2003 a shorter maturity corn hybrid will be utilized to determine if similar planting date effects exist. Pre-plant fertilizer applications were based on soil test N levels of 250 lb/ac (soil test + applied) and (P and K) will be applied to 100% sufficiency. The Dekalb hybrid DK 647BtY was planted in 2000, 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 is harvested for ensilage production and the two middle rows harvested for grain production.

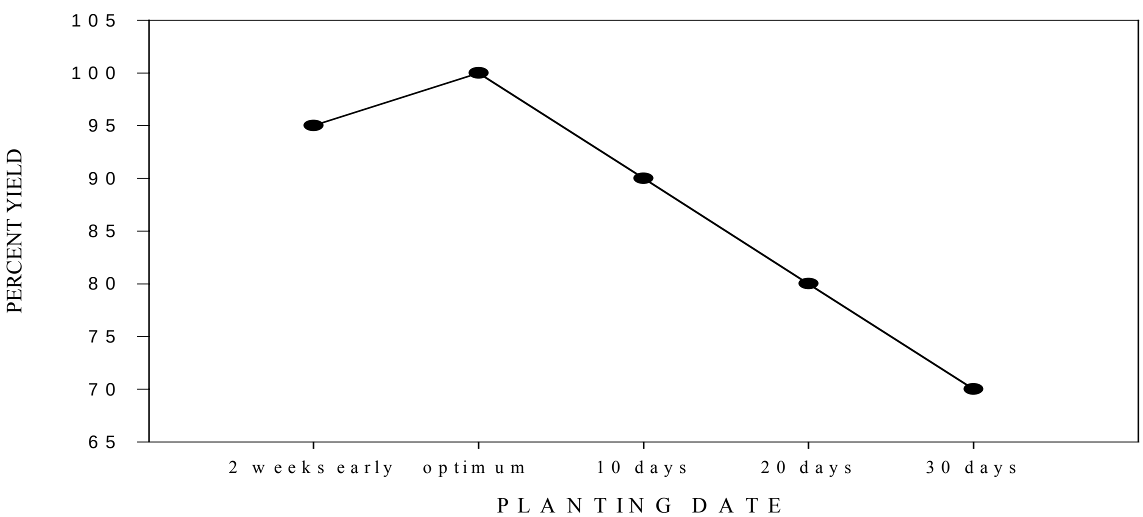


Figure 1. Ten years of grain yields at Lansing, Michigan. Source modern corn production

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

Results

Starter fertilizer has not affected ensilage (Table 1) or grain yield (Fig. 2) in any year, therefore means of planting dates are reported. April 10 appears to be the optimum date for planting with the highest grain yield 164.3 bu/ac obtained on this date. For the first three years, planting April 1 reduced yields 4.5% compared to a 5% reduction for Michigan data. Yields were reduced 14.6% when planted April 20 versus planting on April 10. Yields hold consistent for plantings on April (20, 30) and May 10, with another 15% reduction in yield for the May 20 planting. Test weight also decreased when planted after April 10 but remained above the 56 lb/bu level until the April 20 planting (Table 1). After April 20, test weights were below 56 lb/bu and continued decreasing with each planting date. The highest ensilage yield was also obtained on the April 10 planting date, with yield decreasing for each subsequent planting date. The largest drop in ensilage production, 12.8%, was observed with the May 20 planting when compared to May 10. Soil temperatures at two inches on April 1 were above 60° F in 2000 - 2002, and may differ in subsequent years with different environmental conditions. In 2002 plant and ear heights were measured, indicating the later corn is planted the taller it grows and has a higher ear placement. In 2002 ensilage yields could not be collected so data reported is for years 2000 and 2001. Several more years of data are needed to determine the optimum planting date for ensilage and grain yields.

Figure 2. Corn grain yields by planting date at OPREC.

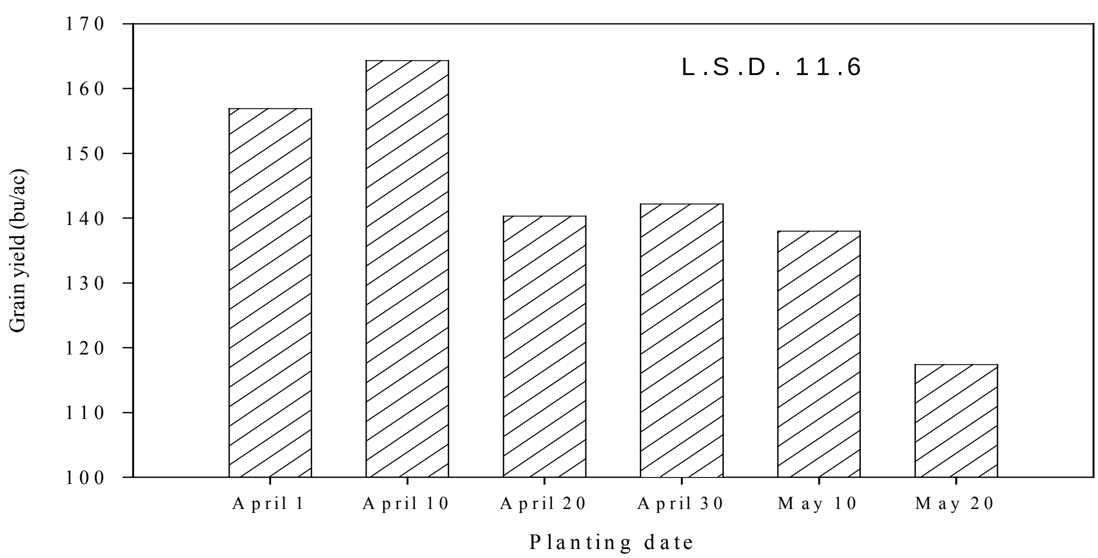


Table 1. Corn ensilage yields and grain test weight by planting date at OPREC.

Planting Date	Ensilage Yield tons/ac 2000-01 only	Test Weight lb/bu
April 1	25.7	57.3
April 10	26.2	57.3
April 20	25.4	56.1
April 30	24.3	55.0
May 10	22.6	53.5
May 20	19.7	52.2
Mean	24.0	55.2
L.S.D.	1.9	1.1

Table 2. Corn plant and ear heights by planting date at OPREC.

Planting Date	Plant height (inches)	Ear height (inches)
April 1	61.7	27.8
April 10	63.3	28.2
April 20	71.1	33.5
April 30	75.8	39.9
May 10	81.2	42.9
May 20	85.0	48.9
Mean	73.0	37.0
L.S.D.	5.9	3.8

LIMITED IRRIGATED CORN

Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell

In the winter of 2000-01 natural gas prices increased dramatically. This increased the interest in growing corn with limited sprinkler irrigation. A study was initiated at OPREC to determine if corn maturity affected yield and test weight when irrigation was limited. Limited irrigation has been described as one half of full irrigation by other researchers, most corn in the region is grown utilizing 18-22 inches of irrigation. In this study irrigation was applied at four rates (3, 6, 9, and 12) inches with one inch applied at each irrigation. Applications were scheduled (Table 1) where all treatments received water at or near pollination. This is the most critical time for corn production. Three hybrids with different maturities Dekalb DKC 57-72 (107 day), Dekalb DK 647 (114 day), and Pioneer 3162 (118 day) were planted. In 2002 Pioneer 3162 was replaced with a shorter maturity hybrid, Pioneer 36F30 (99 day). Plots were planted in four 30-inch rows by 25 feet long at a target population of 25,000 plants per acre in 2001 with the two middle rows harvested for grain yield and test weight. In 2002 target populations were adjusted for each irrigation rate (4-inch 16,800, 6-inch 18,500, 9-inch 22,900, and 12-inch 25,200 plants/ac). By adjusting plant population to irrigation rates higher grain yields for lower irrigation rates may be possible.

Table 1. Date of irrigation application for limited irrigated corn at OPREC.

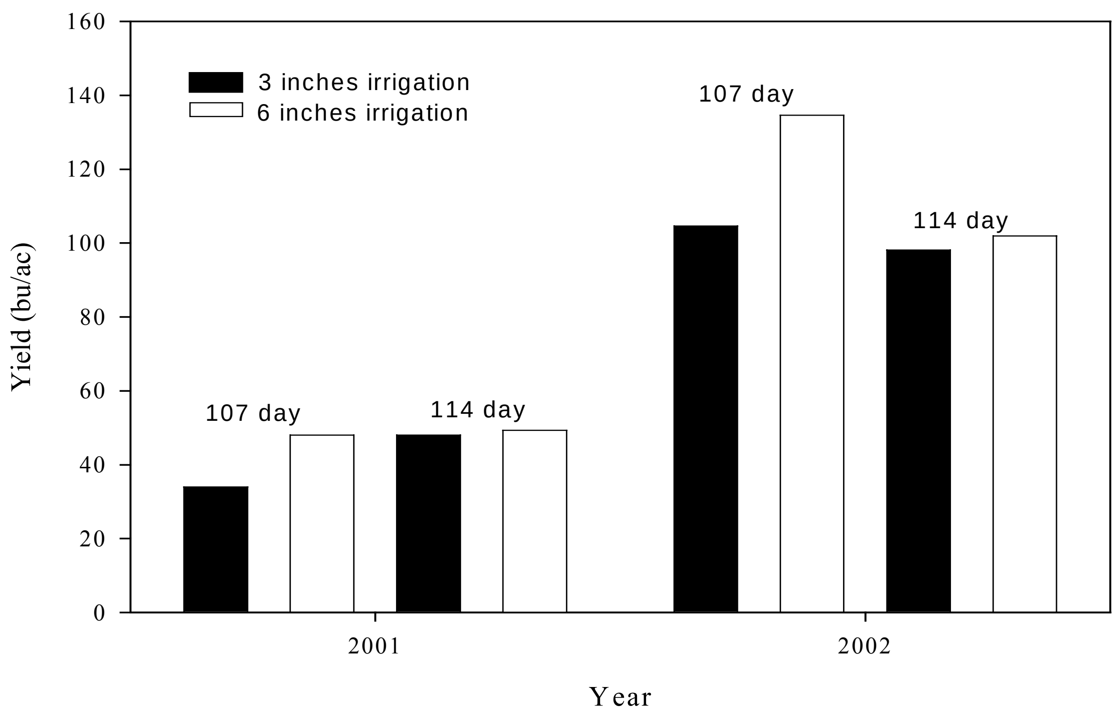
---3 inches ---		--- 6 inches ---		--- 9 inches ---		--- 12 inches ---	
2001	2002	2001	2002	2001	2002	2001	2002
7-4	6-23	7-4	6-11	6-20	6-11	6-13	6-11
7-7	6-30	7-7	6-23	6-27	6-23	6-20	6-23
7-9	7-2	7-9	6-30	7-4	6-30	6-27	6-30
		7-13	7-2	7-7	7-2	7-4	7-2
		7-17	7-7	7-9	7-7	7-7	7-7
		7-22	7-16	7-13	7-16	7-9	7-16
				7-17	7-20	7-13	7-20
				7-22	7-25*	7-17	7-25*
				7-28		7-22	
						7-28	
						7-31	
						8-6	

* New water well had to be drilled so limited to 8 inches of irrigation

Results

Based on Oklahoma Climatological Service data the summer (June, July, and August) of 2001 was the second driest in the last 51 years at OPREC. Rainfall of 1.27 inches was received from June 1 until plots were harvested September 10 therefore yields were not significantly affected by rainfall. In 2002 rainfall was significantly higher 9.39 inches for the same period, therefore the yield for the 3 and 6-inches irrigation rates were 64 and 51% higher in 2002 for the 107 and 114-day hybrids respectively (Fig. 1).

Figure 1. Grain yield for 3 and 6-inch irrigation rates 2001-02 OPREC limited irrigation.



In 2001 maturity and irrigation rates did affect yields with the highest yields being with the 107 and 114-day hybrids (Table 2). The shorter maturity hybrids were able to make more grain with less water than the fuller season 118-day hybrid, therefore in 2002 it was replaced with a 99-day hybrid. In 2002 yields for 9 and 12-inch irrigation rates were reduced when a new well had to be drilled in late July and early August, therefore 12 inch yields will not be reported. Maturity had no effect on grain yield in 2002 although irrigation rates did, therefore means of irrigation rates are reported (Table 3). The highest yields 125.7 bushels per acre were obtained with the 8-inch irrigation rate. Maturity did have an effect on test weight in 2002, but irrigation rate did not, therefore means of hybrids are reported (Table 4). The highest test weight was the 107-day hybrid at 54.1 pounds per bushel. The dramatic difference in grain yields between 2001 and 2002 for the 107 and 114-day hybrids illustrate the importance of collecting more years of data.

Table 2. Corn grain yields for 2001 from limited irrigation study at OPREC.

Maturity day	Irrigation inches	Grain Yield bu/ac
107	12	92.6
107	9	90.6
114	12	89.6
118	12	77.3
114	9	76.5
118	9	73.2
107	6	51.4
114	6	49.3
114	3	48.0
118	3	38.7
118	6	38.0
107	3	34.0
	Mean	63.3
	L.S.D.	10.7
	CV%	11.8

Table 3. Grain yield 2002 limited irrigation study at OPREC.

Irrigation inches	Yield bu/ac
3	101.4
6	115.5
8*	125.7
Mean	114.2
L.S.D.	10.2

* 9 and 12-inch rates limited to 8 inches in 2002

Table 4. Test weight 2002 limited irrigation study at OPREC.

Maturity day	Test weight lb/bu
107	54.1
114	52.6
99	51.7
Mean	52.8
L.S.D.	0.7

EVALUATION OF A TRANSGENIC BT-CORN HYBRID FOR CONTROL OF SOUTHWESTERN CORN BORER

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A transgenic *Bt* corn hybrid was evaluated for control of second generation SWCB on irrigated corn. Plots measured 10 ft x 20 ft and were replicated 4 times in a RCB design. Plots were planted in 30-in rows on 21 May with a cone planter at 26,000 plants per acre. Each plant received approximately 30 newly hatched SWCB larvae using a bazooka gun dispenser on August 5. The larvae were placed on the collars of the leaf just above, and just below the ear. On September 4, ten plants per plot were split from root to tassel and evaluated for the number and length of borer-induced tunnels and borer larvae.

SWCB larvae numbers were significantly reduced in the Herculex™ hybrid and essentially eliminated any tunneling injury to the plants. This event appears capable of providing excellent control of 2nd generation SWCB in the Oklahoma panhandle.

Hybrid/ Transgenic Event	% infested plants	Tunnel length (cm)		# borers/plant
		stalk	ear	
Herculex	60.00 a	8.8 a	1.7 a	0.2 a
Non-Bt isoline	0.25 b	0.2 b	0.0 a	0.0 b
LSD (*P*=0.05)	34.0	6.3	2.6	0.15

Means within same column followed by the same letter are not significantly different according to Fisher's Protected LSD (*P*=0.05).

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, breaking 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

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. All grain yields were higher in 2002 than 2001 for the highest yielding rotation, with grain sorghum at 26.9%, corn 14.1%, and soybeans 4.1% higher. With the higher yields, difference among rotations was less for two-year data when compared to 2001. Corn rotated with soybeans in 2001 was 24.7% higher yielding compared too 15.6% for two years. Corn rotated with grain sorghum had yields 29.6% higher in 2001 and only 14.3% higher for two years. The higher yields associated with the corn-grain sorghum rotation was unexpected, but the higher yields associated with the corn-soybean rotation has been shown by other researchers. 2002 corn plant and ear heights were determined (Table 2). No significant difference exist, however continuous corn heights were shorter with lower ear placement. Rotations have had no effect on test weight of any crop. In 2001 soybeans yields were affected by rotations with yields 15.7% higher when grown in rotation with corn when compared to soybeans grown continuously for 3 years. Although for 2002 and when looking at two years of data no difference exist, but the trend is for lower yields for continuous soybeans. Test weight of soybeans was also affected when comparing the continuous soybeans to soybeans grown in rotation with corn in 2001, but no effect was present in 2002 or for two-year means. Grain sorghum yields or test weight was not affected by any of the rotations, however yields tend to be higher when rotated with soybeans. More years of data are needed to determine if the rotations effect does exist in a high yield environment, specifically the benefits of grain sorghum in rotation with corn.

Table 1. Grain yield and test weights in Irrigated Crop Rotation Study at OPREC.

Treatment	Corn		Soybean		Grain sorghum	
	Yield	Test weight	Yield	Test weight	Yield	Test weight
CM	153.6	56.4			122.3	56.8
SC	152.2	56.8	54.7	52.3		
CC_3	130.5	55.6				
MM_3					130.6	57.2
SM			54.2	52.5	141.2	56.9
SS_3			51.3	53.0		
Mean	145.4	56.5	53.4	52.6	110.2	57.0
L.S.D.	17.2	NS	NS	NS	NS	NS

Note: subscripted number indicates number of years in continuous crop
Yield: bushels/acre; Test Weight pounds/bushel

Table 2. Corn plant and ear height irrigated crop rotation for 2002 at OPREC.

Rotation	Corn plant height (inches)	Ear height (inches)
SC	70.0	31.9
CM	69.3	33.8
CC_3	64.6	31.9
Mean	67.6	32.0
CV %	5.1	11.6
L.S.D	NS	NS

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.

SWINE EFFLUENT APPLICATION IN FORAGE PRODUCTION SYSTEMS

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Introduction

Forage production systems utilizing swine effluent can be an integral part of a swine waste management and cattle production programs in the southern Great Plains. An evaluation of warm-season and cool-season forage production has been ongoing at OPREC since 1998. The objectives of this project are to determine the effectiveness of the swine effluent as a nutrient source relative to urea for forage production systems. The effectiveness of the system is being evaluated by measuring dry matter production (DM), forage quality parameters, and nutrient status in the soil.

Treatments

The treatments compare the effects of annual N applications using swine effluent (SE) and urea (UN) at specified amounts of N (Table 1) to bermudagrass (Midland, *Cynodon dactylon* (L) Pers.) and buffalograss (Bison, Buchloe dactyloides (Nutt) Engelm.), pubescent wheatgrass (Luna, *Thinopyrum intermedium* (Host) Barkworth and Dewey) and orchardgrass (Paiute, *Dactylus glomerata* L.). The high rate of nitrogen (450

Table 1 Forage Production Treatments

Grass Species	Nitrogen (lb $acre^{-1}$ yr^{-1})	Nitrogen source
Buffalograss	0	Swine
Bermudagrass	50	Urea
Orchardgrass	150	
Wheatgrass	450	

lb $acre^{-1}$) is split applied in consecutive months. Forages were harvested at ~28 day intervals, or as needed. Forages are irrigated during the growing season following N applications and as needed.

Results

Increasing applications quantities of SE increased dry matter production equal to UN from 1999 to 2002 with significantly greater yields realized for the warm-season forages relative to the cool-season forages (Figure 1). Both warm- and cool-season species responded similarly in all years to increasing quantities of N application as illustrated in figure 1 where greater than 12 tons acre^{-1} with applications of 450 lb. N acre^{-1}. For all years, neither buffalograss nor bermudagrass, have realized maximum yield at 450 lb. N acre^{-1} per year. This indicates that both species would respond positively to additional units of N however these data does not address the economic or environmental impact of additional units of N. Following four years of data collection, the warm-season forages produce more forage on an annual basis, however to utilize this forage, it must be harvested in-season by grazing livestock, harvested and stored in the form of hay or haylage, or stockpiled in the field for utilization out of the growing season. of from All forages had increased yield responses due to the swine effluent applications. Annual production from the warm-season buffalograss and cool-season wheatgrass indicate they are comparable for total production.

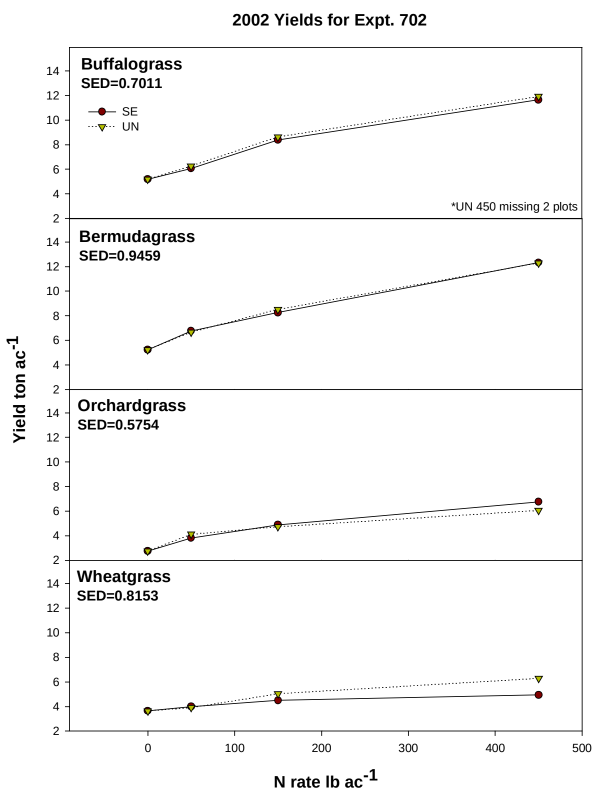

Figure 1. Forage yields for selected species at OPREC for the 2002 growing season.

Dry matter yields were greater for warm-season species than cool-season grasses across all years with the exception of 2000 when harvest the late season harvest was not collected due to failure of irrigation system. This highlights the water limitation of these production systems. It should be noted that both buffalograss and bermudagrass tolerated the drought year and yields in succeeding years have rebounded to levels equal to or greater than 1999 or 2000 (Table 2). Although the total yield for orchardgrass and wheatgrass are lower than the warm-season grasses they could have a valuable place in the forage production system by extending the grazing period from March to early November in combination with the warm-season grasses.

Table 2 Forage Production (tons acre^{-1}) for selected grass species using 150 lb N acre^{-1} at OPREC, Goodwell, OK.

Species	1999	2000*	2001	2002
Buffalograss	6.98	3.57	6.07	8.5
Bermudagrass	5.57	2.93	8.13	8.4
Orchardgrass	5.75	3.74	4.31	4.7
Wheatgrass	6.66	3.91	3.33	4.7
$LSD_{\alpha 0.05}$	0.6	0.4	0.8	-

* Irrigation failure in August 2000 reduced total yields.

Forages were analyzed for crude protein (CP; Table 3), acid digestible fiber (ADF), and neutral digestible fiber (NDF) from which total digestible nutrients (TDN) were estimated. There was a significant difference between years for forage quality however similar trends were seen each year therefore the data for 2001 were selected. Increasing N application did increase crude protein for all forages although there was not a significant difference between SE or UN as an N source. Similar responses were observed for ADF and NDF parameters as well. In all years, the forage quality was better for cool-season grasses than warm-season. Crude protein for orchardgrass was greater than 18% CP at 450 lb. N acre^{-1} whereas buffalograss at the same N application was approximately 13%.

Phosphorus (P) loading of the soil is a concern we are currently evaluating. We have found that forage crops do not remove P additions at the same rate they are added via swine effluent (Fig. 2). At SE applications above 90 lb. N acre^{-1} (100 kg ha^{-1}) the quantity of P added is greater than what is removed via forage harvest and removal.

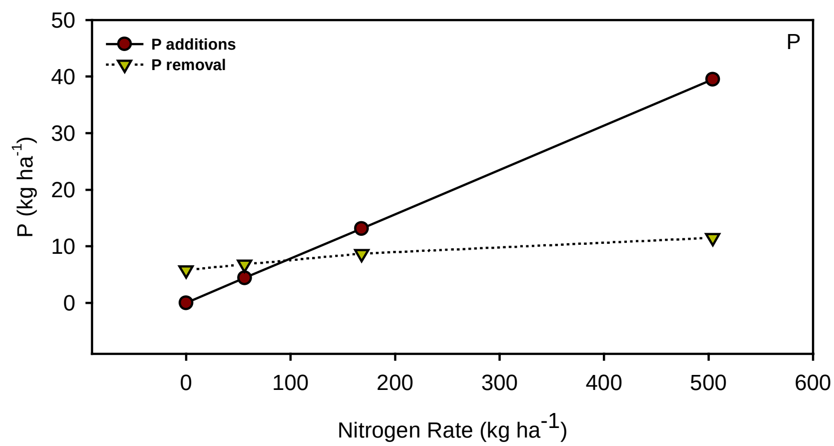

Figure 2. Annual phosphorus removal in buffalograss fertilized with swine effluent averaged across the 1999 and 2000 growing seasons at the OPREC

Table 3 Forage crude protein values for selected grass species at OPREC for 2001**.**

	Forage Species							
	Buffalograss		Bermudagrass		Orchardgrass		Wheatgrass	
N Application	SE	UN	SE	UN	SE	UN	SE	UN
(lb. acre^{-1})	%							
0	8.57	8.57	11.45	11.45	14.58	14.58	16.85	16.85
50	8.71	9.01	13.27	12.19	15.72	15.83	16.79	14.68
150	11.01	10.58	13.59	13.51	16.70	16.85	17.18	17.04
450	12.88	13.04	15.33	15.09	18.78	18.51	18.68	19.23

Therefore, there will eventually be a build of P in the soil that could have negative environmental impacts in the future. Maximum P removal will occur when forage biomass is removed from the field. Other research has demonstrated that grazing livestock remove little P in their biomass.

Conclusions

This work indicates that warm and cool-season production systems can be utilized as part of a swine waste management system. Benefits from this system are crops that respond well to increasing amounts of N supplied from the effluent which is similar to urea fertilizer. Under irrigation large quantities forage biomass can be produced for utilization in a grazing livestock or hay production system. The warm-season forages produced more biomass per unit of N however due to their growth pattern, they have a limited window for production. Incorporating both warm and cool-season grasses in the production system will extend the grazing system. A concern for this production system is the buildup of P in the soil with effluent applications greater than 90 lb. N acre^{-1} this could significantly reduce the quantity of effluent utilized per acre.

Further work must be conducted regarding the economics of the system, water use efficiency and implications of P buildup in calcareous soils however initial work indicates this system could useful in an integrated swine, cattle, forage production system.

Acknowledgements

This work was supported by: Okla. Agr. Expt. Station and USDA-CSREES

GENETIC IMPROVEMENT AND VARIETY DEVELOPMENT IN WINTER WHEAT: RELEVANCE TO THE OKLAHOMA PANHANDLE

The Wheat Improvement Team

The Wheat Improvement Team (WIT) brings nine OSU faculty together, in cooperation with USDA-ARS and several other scientists on and off campus, to develop winter wheat varieties custom-fit for Oklahoma's wheat industry and to apply basic and applied research methods supportive of that goal. Some of the significant breakthroughs realized in 2002 included the release of a new wheat variety, Ok102, bred strictly in Oklahoma and for Oklahoma's wheat and stocker producers; the discovery of new molecular tags for genes controlling leaf rust resistance, coleoptile elongation, and acid soil tolerance; discovery and successful insertion of transgenes into breeding lines that will unlock doors to improving both input and output traits; creation of DNA "libraries" that may hold the genetic answer for resistance to root-rot pathogens and to low-pH soils; and development of imidazolinone-resistant candidate varieties that surpass current Clearfield varieties in yield potential and grain quality.

Our team 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. We now have under final seed increase two candidates targeted specifically for the High Plains, OK98699 and OK95616-56, because their agronomic superiority is best expressed in this region.

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 and improved water-use efficiency or drought tolerance in dryland trials, before they are promoted for release.

Approximately 2850 irrigated field plots and 460 dryland plots are dedicated to breeding line evaluation at the Center. 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), contained 46 entries in 2002, four of which were long-term check varieties. Agronomic performance (grain yield, test weight, and 1000-kernel weight), is summarized in the following table. Six of the 42 breeding lines included candidate varieties from the OSU breeding program, designated by a "OK" prefix. The highest yielding entry in the SRPN at Goodwell last year was the OSU breeding line, OK95616-98-6756 (TAM 108 sib/2180), abbreviated above as OK95616-56. This greenbug-resistant line has performed extremely well in irrigated nurseries in the High Plains, and its optimal adaptation zone is centered in the panhandle area. We are also considering the possible release of OK98699 (Pioneer breeding line/TAM 200//2158 seln), which has performed across several years similar to OK95616-56 under irrigation, but it shows superior performance under dryland conditions. OK98699 has demonstrated exceptional end-use quality, including a moderately high wheat protein level. Thus we believe this candidate will attract producers previously committed to TAM 107 or Jagger. If either line is released by the Oklahoma Agricultural Experiment Station, it will be positioned for this region. The full SRPN report for all regional locations was distributed to breeding programs throughout the Great Plains, which can be found on the USDA-ARS website at http://www.ianr.unl.edu/arslincoln/wheat/default.htm.

Finally, the Center serves a critical function to the wheat improvement program by supplying a high-yielding environment for breeder seed multiplication of candidate varieties. In addition to the two already mentioned, we have placed under final breeder seed increase for 2003 the following candidates: OK96705-99-6738 (2180/OK88803//Abilene), a hard red winter wheat best adapted to central Oklahoma; and OK94P549-21 and OK94P549-11 (Siouxland/Pioneer breeding line//2180), two sister hard red winter wheat lines with statewide adaptation. Large plots of these five 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
Scott Gillen, Oklahoma Cooperative Extension Service, Boise City, Oklahoma

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. Plot size was 5 feet wide by 25 feet long planted with a Hege plot planter, with a planting date in early September. 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. Grain will be harvested in the summer of 2003.

Results

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.

Table 1. Fall forage production at selected seeding rates for dry-land wheat 2002.

Seeding rate (lb/ac)	Forage yield (lb/ac)
120	4,830
90	4,220
60	3,780
45	3,290
30	2,700
Mean	3,760
CV%	13.7
L.S.D.	970

With the excellent planting conditions, and rainfall throughout the fall, forage yield was higher than expected (Table 1). 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 dry-land environment. The value of increased forage far exceeded the cost of additional seed even between the 90 and 120 pound seeding rates. Grain will also be harvested to determine if seeding rate effects yield or test weight. This study will be continued as long as adequate precipitation is received in the fall for forage production.

PLANTING DATE, SEEDING RATE, AND VARIEY DIFFERENCES IN 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. In the fall of 2000, an experiment was initiated to determine the effects of seeding rate, planting date, and variety on fall forage and grain production. Three seeding rates used are 60, 120 and 180 pounds per acre. The three most widely grown Hard Red Winter Wheat varieties (HRW) (TAM 107, Custer, and Jagger) and Hard White Winter Wheat (HWW) (Intrada) were used. Plots were 5 feet wide by 22 feet long planted with a Hege plot planter. Planting dates were September 1, October 1, and November 1 in 2000. In 2001 planting dates where changed to September 1, and two plantings on October 1, one for forage plus grain and the other for grain only. The September 1 planting date coincides with planting wheat following corn ensilage production. The October 1 planting date is reflective of planting wheat following corn for grain harvest. The November 1 planting date was selected to determine grain production on late-planted wheat. After 2000 yields were so low for the November 1 planting, another October 1 planting was added to determine yield loss from forage removal. Forage harvest dates are listed in Table 1. 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. Plots were then mowed with a 5-foot finishing mower to simulate forage removal by grazing. After mowing, the September 1 planting area that was hand clipped was marked so the same area could be hand clipped again for subsequent harvest. Irrigation applied in the fall of 2000, 2001, and 2002 was 5, 7, and 1 inches respectively.

Table 1. Forage harvest dates by planting dates for OPREC irrigated dual-purpose wheat.

--- Planted September 1 ---		--- Planted October 1 ---	
2000	2001	2000	2001
Oct. 12	Oct. 1	Dec. 15	Dec. 19
Nov. 1	Nov. 6		
	Dec. 6		

Results

No differences in forage yields have been associated with varieties, therefore reported forage yields are an average of all varieties. Seeding rate and planting date have the largest impact on fall forage production (Fig. 1). The 180 lb/ac seeding rate planted on September 1 resulted in the highest forage production at 3,040 lbs/ac of dry matter. The increased forage production from the 180 lb/ac seeding rate appears to occur during the early period of growth (Fig 2). The difference in forage production between seeding rates does not increase after first harvest as approximately the same difference is observed after final harvest (Fig 1). The 180 lb/ac seeding rate will also allow earlier grazing due to increased early forage production.

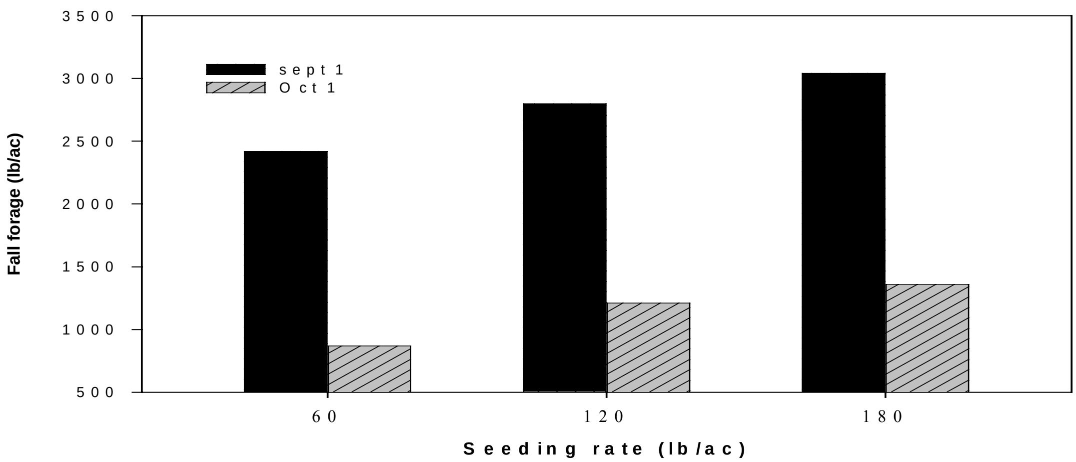

Figure 1. Total fall forage produced by mid-December in irrigated dual-purpose wheat at OPREC.

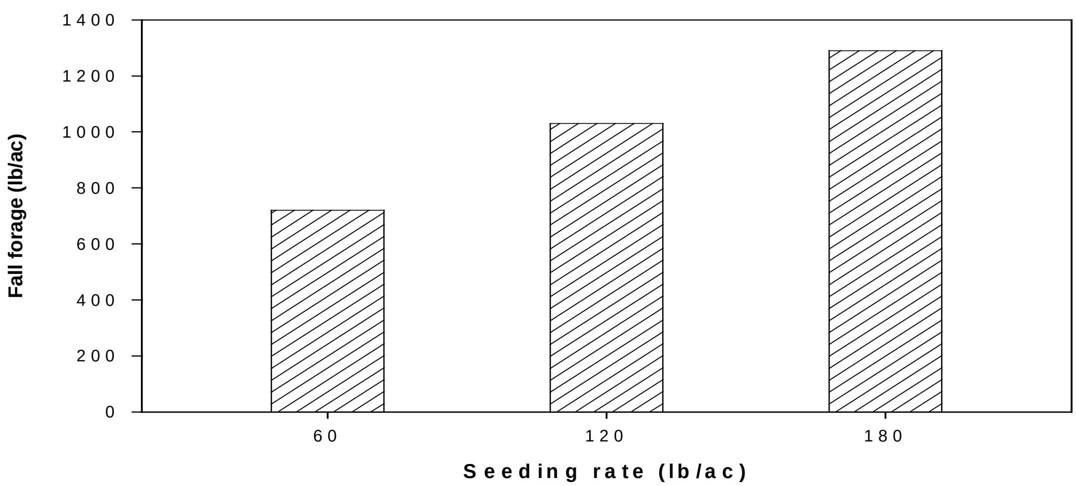

Figure 2. Forage production averaged across variety and year for first harvest (early October for the September 1 planting date in irrigated dual-purpose wheat at OPREC.

Grain yields (Table 2), for the first planting date were affected by winterkill in the plots in both 2001 and 2002. In 2001 forage was 14 inches tall before the second harvest, and with the cold temperatures following removal of large amounts of forage explains damage in the 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. It appears that variety and planting date affect grain yields. The highest yield, 67.7 bu/ac, was obtained with TAM 107 planted October 1, and not grazed (Table 2). When averaged across varieties and planted October 1, grazing reduced wheat yield 12 bu/ac compared to ungrazed wheat. The combination of winter kill, grazing, and earlier planting reduced grain yield 11.4 bu/ac when comparing September 1 planting grazed and October 1 ungrazed (Table 3).

Table 2. Mean grain yield for variety and planting date for irrigated dual-purpose wheat at OPREC.

Variety	Planting date	Grazed	Yield bu/ac
TAM 107	October 1	No	67.7
TAM 107	September 1	Yes	54.6
TAM 107	October 1	Yes	49.9
Custer	October 1	No	67.4
Custer	October 1	Yes	54.5
Custer	September 1	Yes	48.5
Intrada	October 1	No	54.4
Intrada	September 1	Yes	50.0
Intrada	October 1	Yes	49.0
Jagger	October 1	No	54.3
Jagger	September 1	Yes	45.0
Jagger	October 1	Yes	42.1
		Mean	53.1
		L.S.D.	8.4

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

Planting date	Grazed	Yield
October 1	No	60.9
September 1	Yes	49.5
October 1	Yes	48.9
	Mean	53.1
	L.S.D.	7.7

Test weights were most affected by variety selection with Intrada having test weights 2.7 pounds per bushel higher than next highest variety. When evaluating test weight, varieties reacted differently, Jagger, Custer, and Intrada had lowest test weight at September 1 planting date and grazed while TAM 107 had lowest test weight for October 1 planting date and grazed (Table 4). This trial is being continued at OPREC with an additional location added at the Plainsman Research Center at Walsh, CO in 2001. Due to extreme winter kill at Walsh location data was unreliable in 2001-02.

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

Variety	Planting date	Grazed	Test weight lb/bu
Intrada	October 1	Yes	61.1
Intrada	October 1	No	61.0
Intrada	September 1	Yes	60.4
Jagger	October 1	Yes	58.4
Jagger	October 1	No	58.4
Jagger	September 1	Yes	57.5
Custer	October 1	No	58.4
Custer	October 1	Yes	58.0
Custer	September 1	Yes	57.5
TAM 107	October 1	No	57.8
TAM 107	September 1	Yes	57.4
TAM 107	October 1	Yes	56.8
		Mean	58.6
		L.S.D.	0.5

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

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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 include Wheat-Sorghum-Fallow (WSF), Wheat-Corn-Fallow (WCF), Wheat-Soybean-Fallow (WBF), and Continuous Sorghum (CS). Tillage systems include no-till and minimum tillage. All crops will be planted no-till and minimum tillage. Two maturity classifications were used with all summer crops in the rotations to determine optimum maturity classifications. 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 data collected in 2002 due to drought.

Data from the Oklahoma Climatological Service indicated the summers of 1999, 2000, and 2001 have been 3 of the 5 driest summer periods (June – August) in the last 51 years. Precipitation for summers of 1999, 2000, and 2001 was 49, 54, and 19% of long-term mean, respectively (Table 1). There was no difference in wheat yields in 2000 and 2001 among rotations or tillage treatments with a yield of 27 and 40 bushel per acre respectively. The year 2000 was the first year of continuous grain sorghum and it has yet to be harvested, nor was corn or soybeans in 2001. Grain sorghum yields for 1999 - 2001 were higher for full season hybrids than the medium maturity by 6.4 bushels/ac (Table 2). No difference in test weights to tillage have been observed, but medium maturities have been 2.4 lb/bu higher than full season with 55.4 and 53.0 lb/bu, respectively. A yield increase for grain sorghum has been observed due to tillage with a 5.0 bushel/ac increase for no-till across maturities. Grain sorghum yields for 2000 were reduced by poor weed control. The herbicide was never activated. Corn yields have been higher for the 112-day corn than the 108-day corn, however yields from either would not be economically feasible (Table 2). Soybean yields have been the same with both Group III and Group IV soybean (Table 2). It appears after three years of the study that the WSF rotation is best suited for the panhandle region, however if in succeeding years more precipitation is received yield may improve for corn and soybean.

Table 1. Summer growing season precipitation at OPREC

Month	1999	2000	2001	Long-term mean
June	2.85	2.29	0.61	2.86
July	0.20	0.76	0.00	2.58
August	0.75	1.09	0.66	2.28
Total	3.80	4.14	1.27	7.72

Table 2. Yields (bu/ac) from summer crops in dry-land tillage and crop rotation study at OPREC.

Year	----- Soybean -----		----- Corn -----		-- Grain Sorghum --	
	Group III	Group IV	108 day	112 day	Medium	Full
1999	12.3	11.3	2.5	15.6	52.0	61.8
2000	8.3	10.2	5.3	8.6	18.0	17.3
2001	0	0	0	0	28.5	38.7
Mean	6.9	7.2	2.6	8.1	33.6	39.9
L.S.D.	NS	NS	NS	NS	4.4	4.4

SOYBEAN ROW SPACING BY MATURITY GROUP

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Row spacing and maturity group selection are two variables that may affect soybean yields in the Oklahoma panhandle. A field experiment was conducted at the Oklahoma Panhandle Research and Extension Center in Goodwell, OK to examine the effects of row spacing and maturity group on soybean yield and test weight. The experiment was established as a randomized complete block design in a split-plot arrangement with four replications. The plot size was 5 feet by 25 feet. The main plot treatments were row spacing (7.5, 15, and 30 inches), and subplot treatments were maturity group (II, III, and IV). Soybean were planted May 21, 2002 at the rate of 150,000 seed per acre using a Hege plot planter. The group II, III, and IV cultivars were Asgrow 2703, Asgrow 3702, and Asgrow 4602, respectively. The soybean were irrigated throughout the growing season as needed (except for a 3 week period in late July and early August when the irrigation well was inoperable). The group II and group III soybean were harvested on September 26, 2002, and the group IV was harvested October 10. Plot yield, test weight and moisture were determined, and yields adjusted for moisture to 13%. Analysis of variance was conducted using SAS and Proc mixed.

Results

The only treatment difference observed that was statistically significant was maturity group. The group II, III, and IV soybeans yielded 52.3, 52.5, and 58.4 bushels per acre, respectively, when averaged across row spacing (Figure 1). The maturity group yield differences were significant at $\alpha = 0.10$. The 7.5, 15, and 30 inch row spacing soybeans yielded 56.4, 52.2, and 54.3 bushels per acre, respectively, when averaged across maturity group. However, there was no statistical difference in soybean yield due to row spacing. There was also no statistical difference in test weight between maturity group or row spacing.

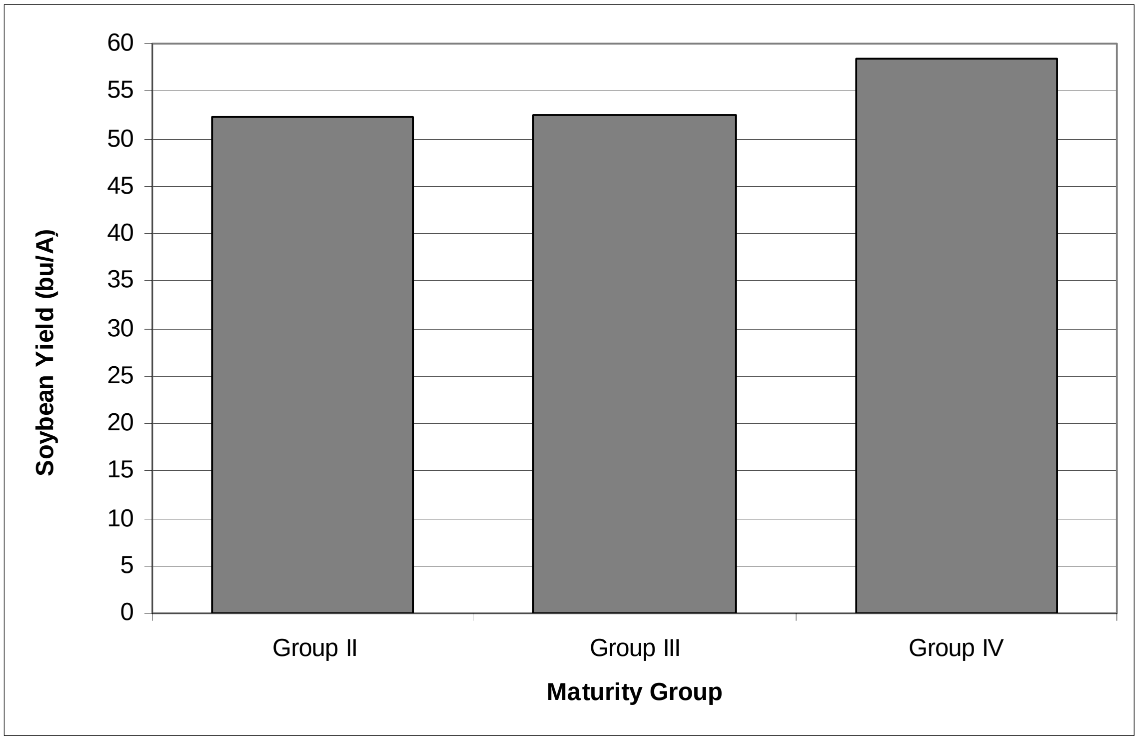

Figure 1. Soybean yield averaged across row spacing for maturity groups II, III, and IV.