Oklahoma Panhandle

Research & Extension Center

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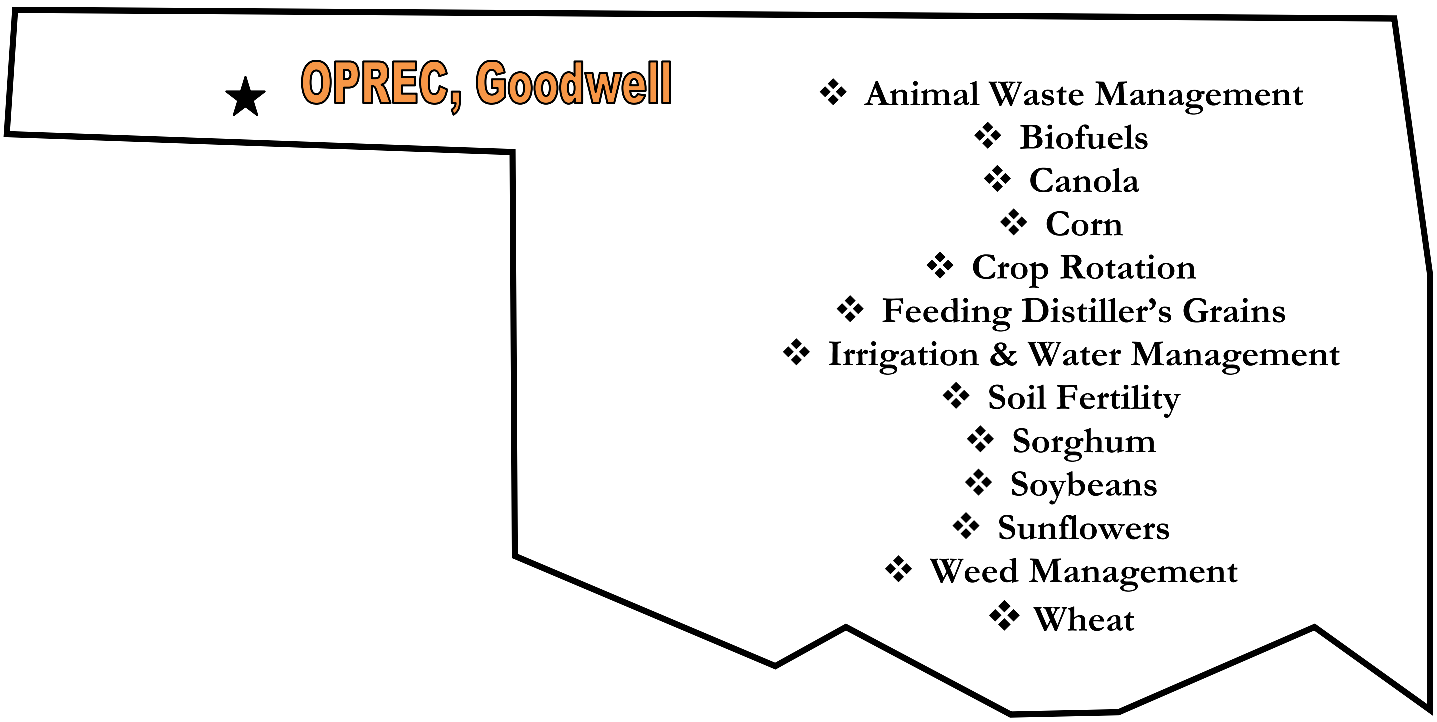
http://oaes.pss.okstate.edu/goodwell



2009 Research Highlights

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

OKLAHOMA PANHANDLE RESEARCH AND EXTENSION CENTER

The Division of Agricultural Sciences and Natural Resources (DASNR) including the Oklahoma Agricultural Experiment Station (OAES) and the Oklahoma Cooperative Extension Service (OCES) at Oklahoma State University (OSU) have a long history of working cooperatively with Oklahoma Panhandle State University (OPSU) to meet the needs of our clientele, the farmers and ranchers of the high plains region. OAES is the research arm of DASNR and continues with the mission to conduct fundamental and applied research for the purpose of developing new knowledge that will lead to technology improvements addressing the needs of the people. The OCES continues to strive to disseminate the research information generated by OAES to the public through field days, workshops, tours, and demonstrations. This has been and will continue to be a major focus of our efforts at the Oklahoma Panhandle Research and Extension Center. Together as a team we have been able to solve many significant problems related to high plains agriculture.

The OPREC is centrally operated within the Field and Research Services Unit (FRSU) of the OAES. The FRSU serves as the back bone for well over 1,000 statewide field and lab based research trials annually. Our unit consists of 18 outlying research stations including the OPREC, the Controlled Environmental Research Lab, the Ridge Road Greenhouse Phase I and Phase II, the Noble Research Center and the Stored Product Research and Extension Center. The FRSU works to provide a central focus for station operations and management with the goal to improve overall efficiency by providing a systematic means for budget management, facility upgrades, consolidation of labor pools, maintenance and repair of equipment and buildings, and other infrastructural needs.

The Oklahoma Panhandle Research and Extension Center at Goodwell is committed to serving the people of the region. Many staff continue to serve our clientele and include; Rick Kochenower Area Agronomy Research and Extension Specialist, Britt Hicks Area Livestock Extension Specialist, and Lawrence Bohl Senior Station Superintendent of OPREC. Other essential OPREC personnel include Donna George Senior Secretary, Craig Chesnut Field Foreman II, Matt Lamar Field Assistant and Equipment Operator, Eddie Pickard Agriculturalist, and several wage payroll and part-time OPSU student laborers. OSU faculties from numerous Departments continue to utilize OPREC to conduct research and extension efforts in the Panhandle area. Additionally, the OPREC continues to serve as a “hub” for our commodity groups and agriculture industries by hosting several informative agriculture related meetings annually.

The DASNR, OAES, and OCES truly appreciate the support that our clientele, farmers, ranchers, commodity groups, industry, and other agricultural groups have given us over the years. Without your support many of our achievements would not have been possible. We look forward to your continued support in the future and to meeting the needs of the research, extension, and teaching programs in the high plains region.

R. Brent Westerman

R. Brent Westerman
Sr. Dir. F&RSU
Oklahoma Agricultural Experiment Station

The staff at OPREC, OAES F&RSU, Department of Plant and Soil Sciences, Department of Animal Science and Department of Biosystems and Ag Engineering at Oklahoma State University would like to thank the companies and individuals listed below, for providing resources utilized in research projects. Their valuable contributions and support allow researchers to better utilize research dollars. This research is important for producers in the high plains region, not just the Oklahoma panhandle. We would ask that the next time you see these individuals and companies that you say thank you with us.

Archer Daniels Midland Company
BASF
Bayer Crop Sciences
Dow Agro Sciences (Jodie Stockett)
DuPont (Jack Lyons and Robert Rupp)
Farm Credit of Western Oklahoma
Gustin Equipment (Sam Gustin, Kevin Allard)
Hitch Enterprises
Steve Kraich
Liquid Control Systems (Tim Nelson)
Midwest Genetics (Bart Arbuthnot)
Monsanto (Ben Mathews, T. K. Baker, Mike Lenz)
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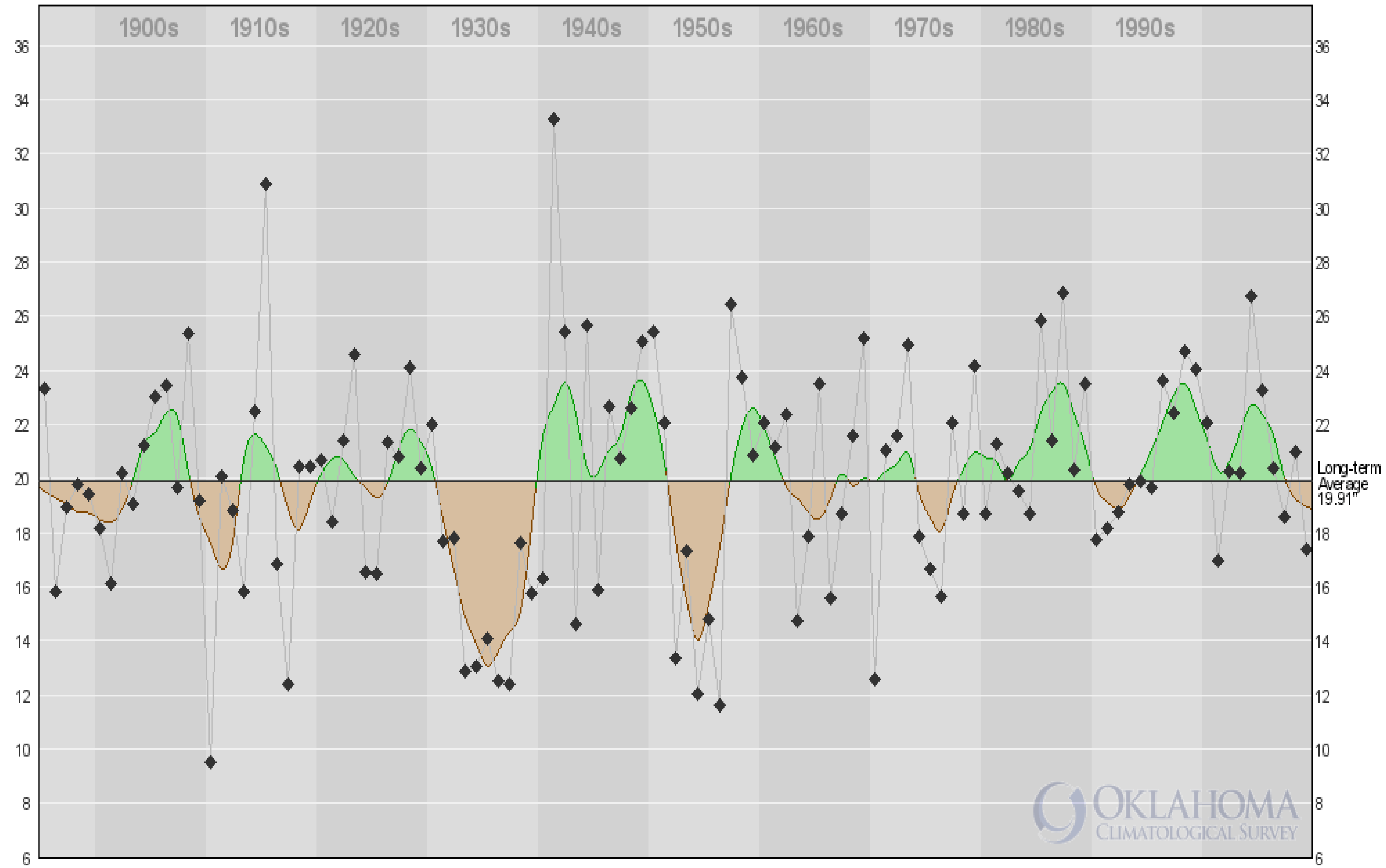
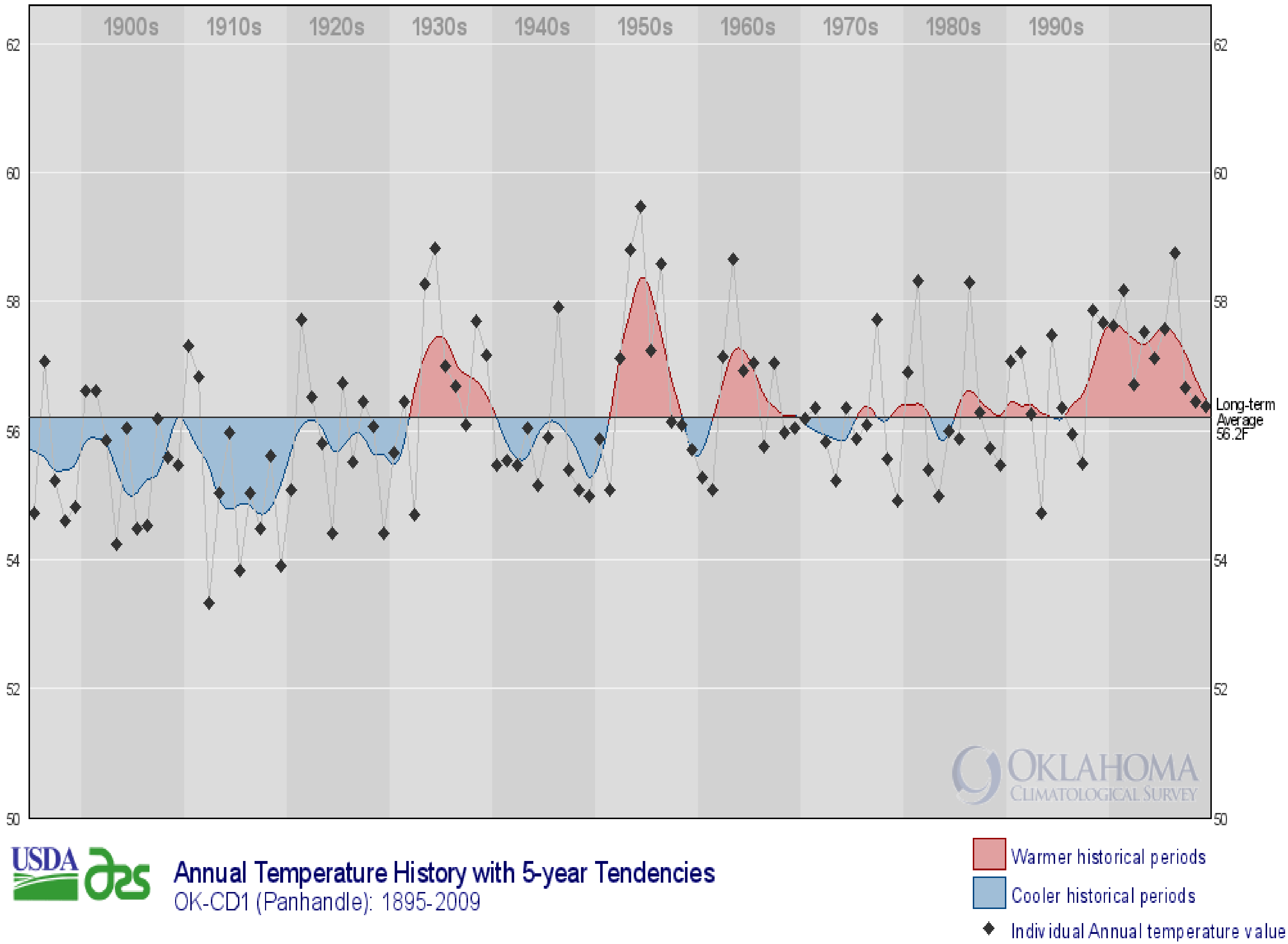


USDA ARS

Annual Precipitation History with 5-year Tendencies

OK-CD1 (Panhandle): 1895-2009



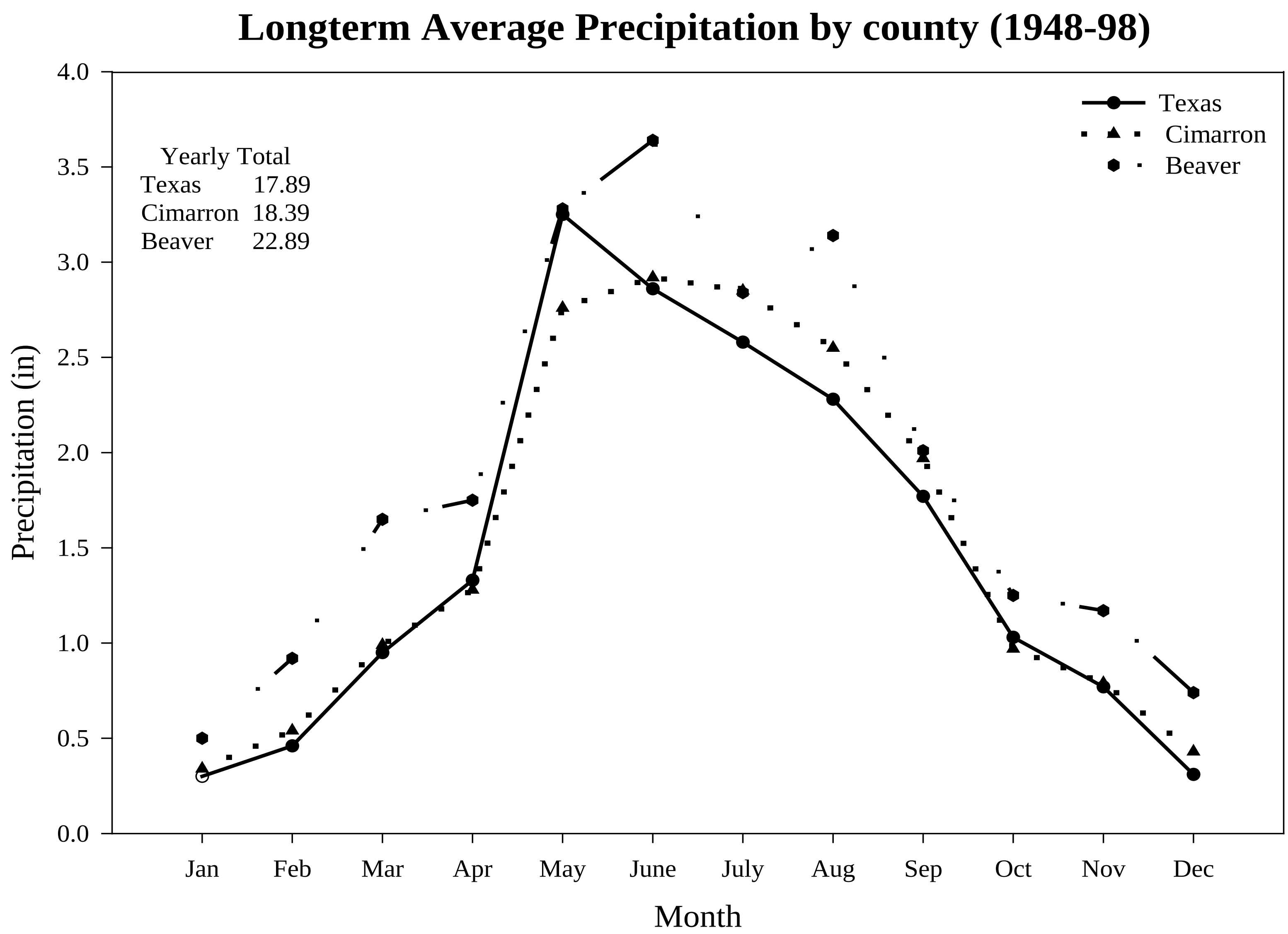
Annual Temperature History with 5-year Tendencies

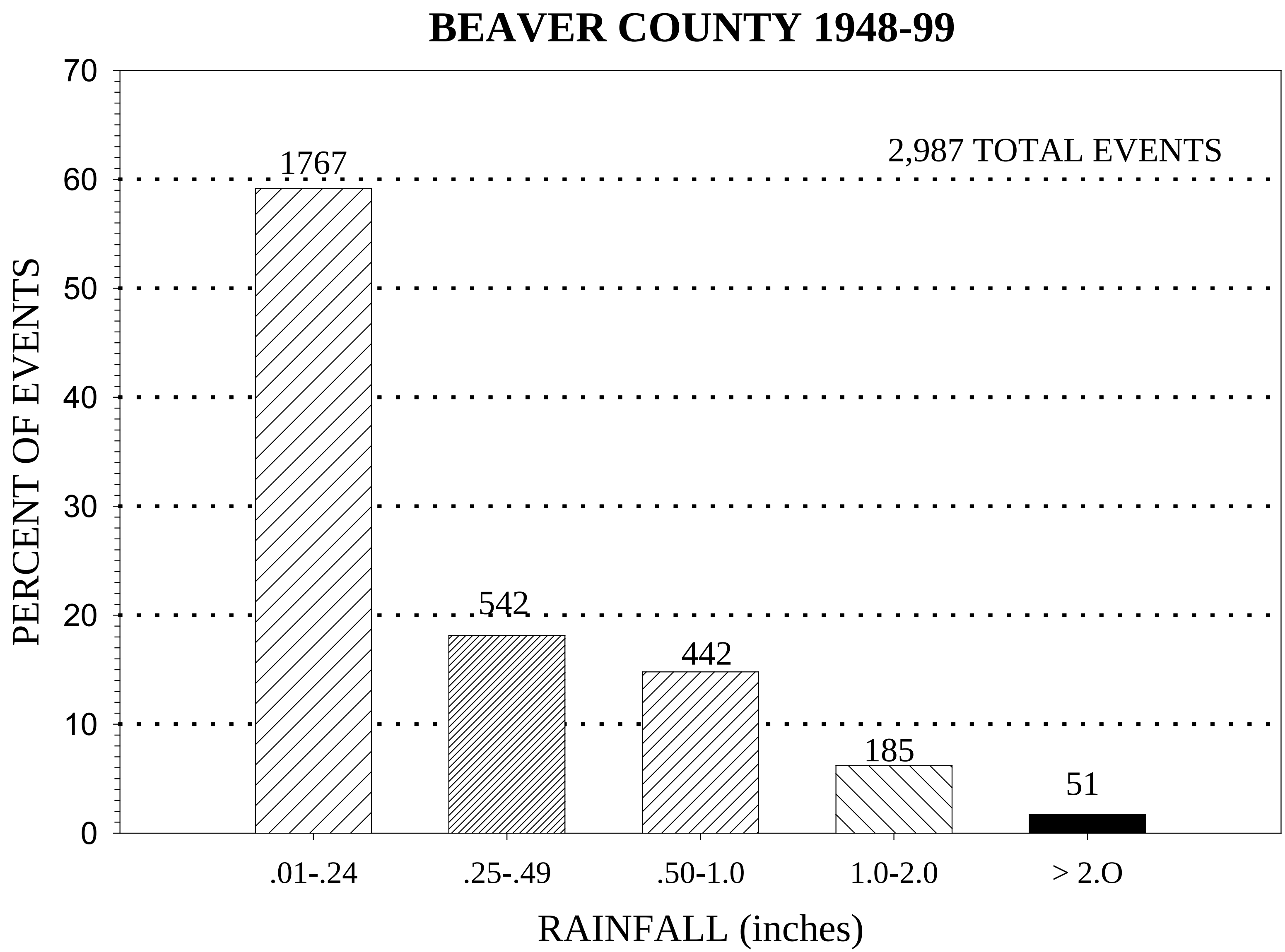
OK-CD1 (Panhandle): 1895-2009

Climatological data for Oklahoma Panhandle Research and Extension Center, 2009.

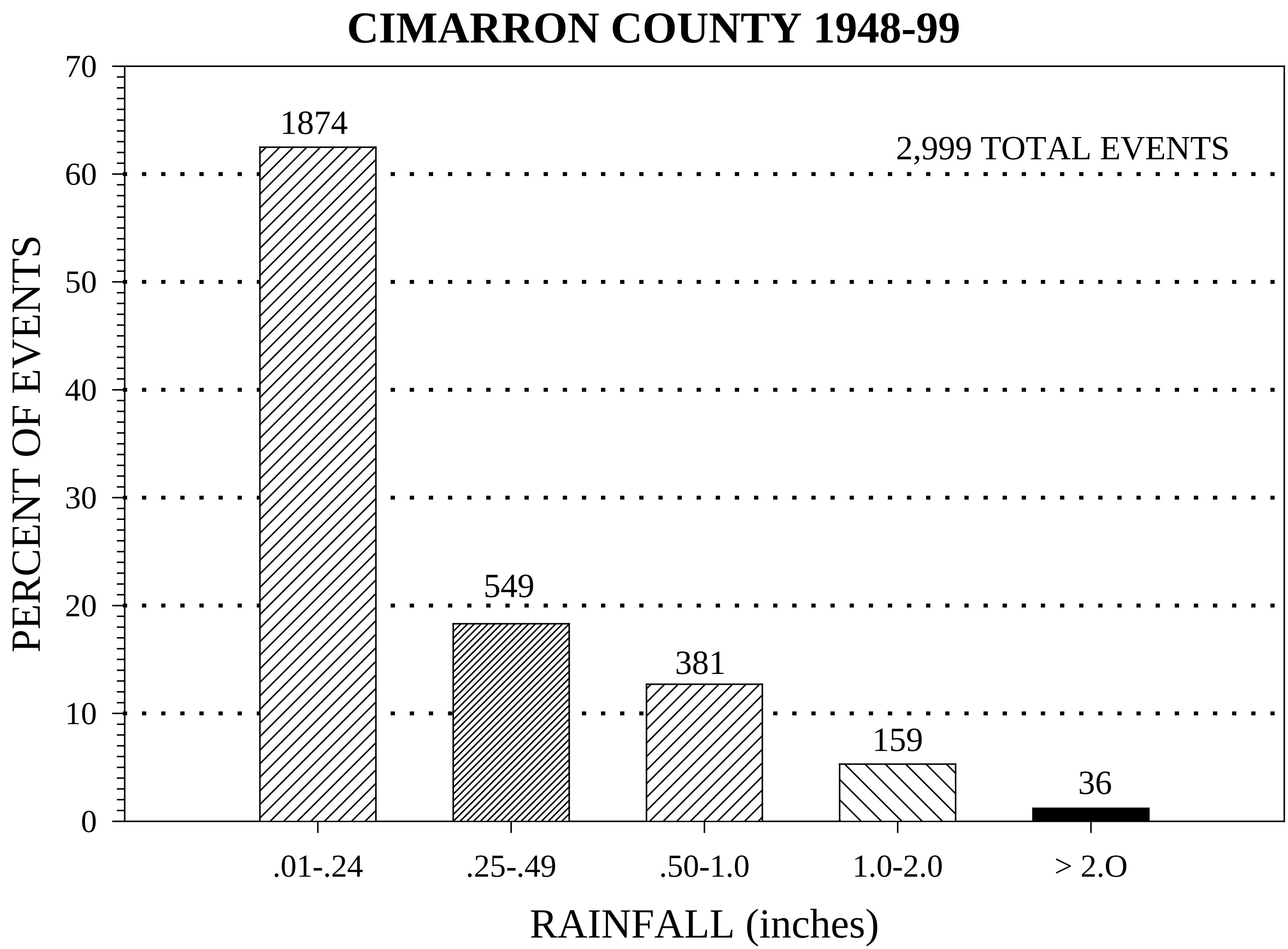
	Temperature				Precipitation			Wind	
Month	Max	Min	Max. mean	Min. mean	Inches	Long term mean	One day total	AVG mph	Max mph
Jan	72	6	53	20	0.00	0.30	0.00	12.2	48.2
Feb	77	13	58	25	0.32	0.46	0.26	12.7	55.5
March	82	13	63	30	0.38	0.95	0.26	14.2	53.6
April	86	18	67	39	2.06	1.33	0.61	15.3	56.6
May	93	40	76	49	0.55	3.25	0.24	12.4	48.0
June	99	45	90	59	1.74	2.86	1.56	12.9	55.5
July	107	56	94	64	2.58	2.58	1.08	11.1	55.1
Aug	100	54	90	61	1.36	2.28	0.65	11.5	56.1
Sept	96	38	81	53	0.45	1.77	0.39	10.6	46.0
Oct	91	27	63	38	3.10	1.03	0.56	12.6	43.3
Nov	87	20	62	32	0.37	0.77	0.15	11.8	53.2
Dec	64	-2	43	16	0.12	0.31	0.10	12.4	52.8
Annual total			70.0	40.5	13.03	17.9	NA	NA	NA

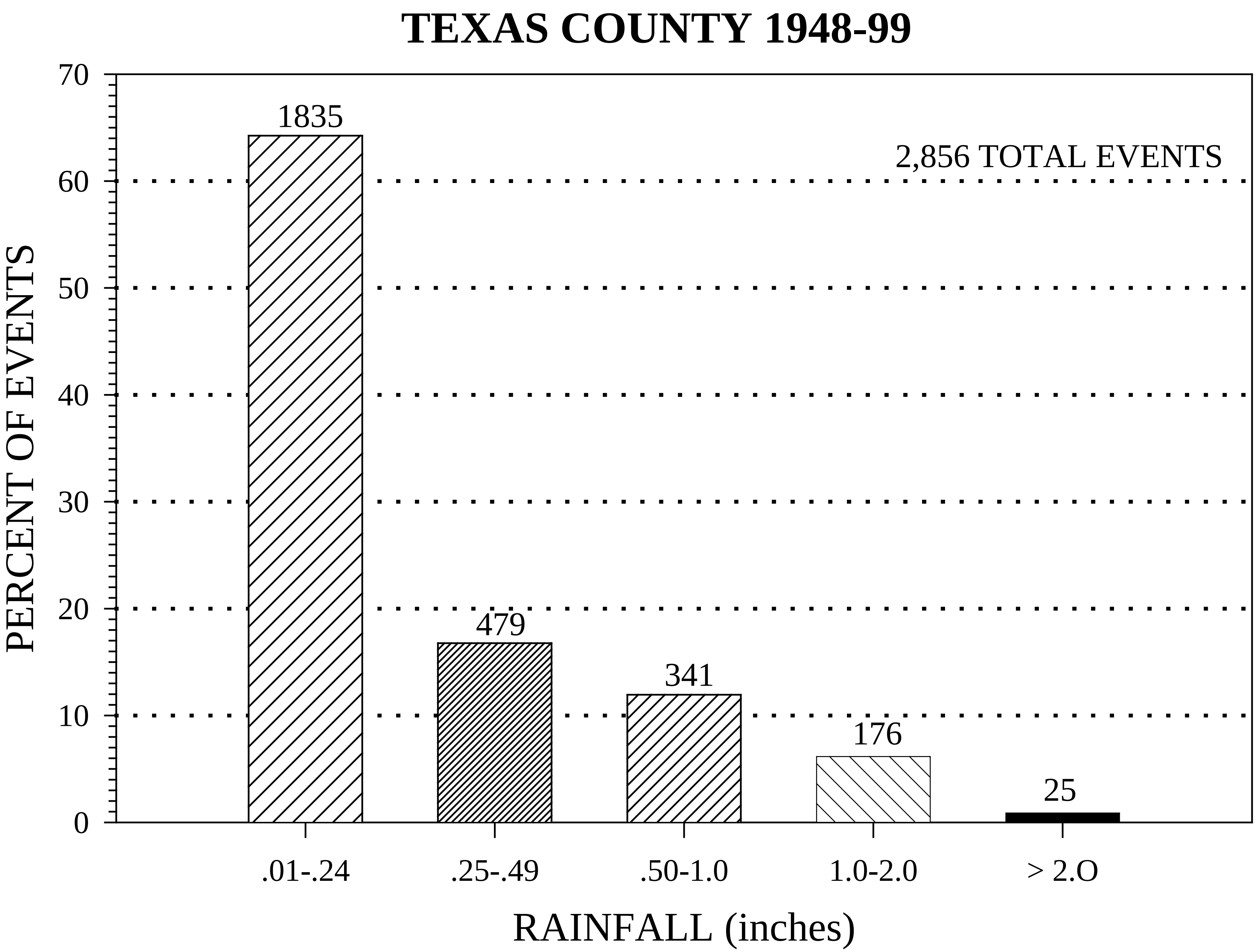
Data from Mesonet Station at OPREC


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

Oklahoma Panhandle Research & Extension Center
2008 Research Highlights

Crops

Animal Science

Extension Publications

Evaluation of Combine Performance with Conventional and Stripper Headers

Randy Taylor, Dept. of Biosystems and Ag Engineering, Oklahoma State University
Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell

With conventional headers, approximately half of the wheat plant passes through the combine during harvest. While this excess material may help during threshing, it increases power requirement and reduces combine capacity. Stripper headers greatly reduce material flow through the combine since very little straw enters the threshing mechanism. The lower material flow means a combine with a stripper header can harvest more bushels per hour than the same combine equipped with a conventional grain platform.

Our objective was to determine performance of a conventional combine operating with a conventional platform or a stripper header. Performance was quantified by material capacity (bu hr^{-1}) and fuel use (gal bu^{-1} and gal hr^{-1}).

Methods

A John Deere 3300 combine was used to harvest irrigated wheat at the Oklahoma Panhandle Research and Extension Center (OPREC). The combine was equipped with either a John Deere 213 conventional platform header or a Shelbourne Reynolds stripper header (Figure 1). The platform header harvested a 13 foot wide swath while the stripper header was harvesting 11.5 feet.

Figure 1. John Deere 3300 combine with a Shelbourne Reynolds stripper header.

The combine was equipped with an auxiliary fuel tank and selector valve to switch between it and the main fuel tank (Figure 2). The auxiliary tank was filled with fuel and weighed. Then it was installed on the combine via a standard marine coupler. Before the combine entered the wheat crop the selector valve was switched to the auxiliary tank. Four passes were made with each header to complete one observation. Each pass was 620 feet long. All passes were made with a full header width by leaving strips of crop between each pass to minimize error. As the combine left the crop after the 4th pass the selector valve was switched back to the main fuel tank after grain flow into the grain bin reduced to a trickle. The auxiliary fuel tank was removed from the combine and weighed to determine total fuel use for the four passes. Fuel weight was converted to gallons with a standard fuel density for gasoline of 6.07 lbs gal^{-1}. Three observations were completed for each header alternating across the field. The time required to harvest the four passes was recorded with a stop watch and the grain was weighed with a weigh wagon. Area was calculated from header width, the number of passes, and plot length. Yield was determined using a standard test weight of 60 lbs bu^{-1}.

Figure 2. Auxiliary fuel tank with selector valve to enable fuel use measurement.

Results

Yield was calculated for each plot based on the mass of grain harvested, header width, and plot length. The mean yield for the three observations with each header are shown in table 1. There was no significant yield difference for the two headers. Though some header loss due to shattering was evident for both headers, it was not considered excessive for the harvest conditions. Grain moisture content was 9.8%. No attempt was made to quantify loss.

Table 1. Performance criteria for the two headers (means within a row followed by different letters are significantly different at $p<0.01$).

	Conventional	*Stripper*
Yield, bu ac^{-1}	51.8	51.1
Fuel Use, gal hr^{-1}	6.1	6.3
Fuel Use, gal bu^{-1}	0.031^{a}	0.021^{b}
Capacity, bu hr^{-1}	199.0^{a}	291.9^{b}
Capacity, ac hr^{-1}	3.8^{a}	5.7^{b}

Fuel use in gal hr^{-1} was not significantly different for the two headers (Table 1). Since the engine was operating at full throttle, fuel consumption was controlled by the engine's governor. Fuel use per bushel harvested was significantly lower for the stripper header (Table 1). This was due to the significantly greater material capacity (bu hr^{-1}) for the stripper header (Table 1). Since there was no difference in yield, the stripper header increased the capacity for the combine in bushels or acres per hour by about 50%. This increase was due to the increased ground speed with the stripper header.

Conclusions

Though the John Deere 3300 is an extremely small combine for the Oklahoma Panhandle, this research reinforces previous work that demonstrated an increase in combine capacity when harvesting wheat with a stripper header. While we might expect fuel consumption per hour to be lower for a combine using a stripper header due to less material passing through the machine, this research does not support that hypothesis. This may be due to the fact that the combine is smaller and the energy required for the stripper header becomes a larger portion of the total energy use. However we did not measure header power requirements so it is simply speculation.

Oklahoma Panhandle Research and Extension Center
Annual Report, 2010
Wheat Improvement Program
Contributed by Brett F. Carver, OSU Wheat Breeder, on behalf of the Wheat Improvement Team

Virus attack, once again, in 2009

The Oklahoma Panhandle Research and Extension Center plays a central role in the final stages of OSU wheat variety development. The Center is used as one of the three cornerstone testing sites for replicated yield and quality trials. The other two sites include Hobart in SW Oklahoma and Lahoma in north central Oklahoma. Breeding lines in their first year of replicated yield trials, all the way up to those in their fifth year of replicated trials, typically appear at the Center in both dryland and irrigated plots. One such trial contains the most advanced (i.e., elite) breeding lines each year, called the Oklahoma Elite Trial (OET).

Ten of the 30 slots in the 2009 trial were occupied by contemporary check varieties, plus the long-term check variety Chisholm (Table 1). We include varieties which represent the best available commercial genetics for Oklahoma in two market classes of wheat, HRW and HW. Thus each year the panel of checks changes slightly to reflect new improved genetics. Thus you will find test results for the newest check varieties in the OET, such as Billings, Pete, Jackpot, and Fuller. The 2009 trial featured 10 HRW and 1 HW check varieties, plus four candidate varieties that remain under the careful watch of the OSU Wheat Improvement Team. A release recommendation for any one (or more) of those candidates is forthcoming following the completion of statewide testing in spring 2010.

Grain yield results for the 2009 OET are shown in Table 1 for 30 entries tested at the OPREC (with or without irrigation). Bear in mind that the yield results under irrigation were highly influenced by the presence of multiple viruses, the most notable of which was *Barley yellow dwarf virus* (BYDV). Also present were *Wheat streak mosaic virus* and *Triticum mosaic virus*, based on tissue samples collected by our wheat pathologist on the team, Dr. Bob Hunger. Disease symptoms were not evident in nearby plots under dryland production. Thus, the correlation between yields with or without irrigation was only intermediate as expected (r=0.62).

Once again, this scenario presented a unique opportunity to evaluate OSU breeding materials in the presence of a disease often difficult to track down. Endurance was one of the better performing check varieties (in both trials) and has a history of performing well in early-planted production systems limited by BYDV. A few experimental lines looked very impressive at Goodwell, and elsewhere in the state, including OK05212, OK05511, OK05312, and OK05526. The high-yielding *Clearfield* experimental line, OK05903C, has historically performed well throughout the state but will likely not be released due to high susceptibility to leaf rust, low test weight potential, and poor end-use quality.

Candidates under review, with a view on the Panhandle

To give our stakeholders in the panhandle region an idea of emerging genetics from the OSU wheat improvement program, the information in Table 2 was extracted from the report, "Wheat Research at OSU 2009" (P-1024) for the convenience of this report. All four experimental lines described in Table 2 have adaptation that stretches easily into the panhandle. Each line was placed under foundation seed increase by Oklahoma Foundation Seed Stocks, Inc in fall 2009. The experimental line, OK05526, received 50% of its genetic makeup from Endurance. It possibly has the highest yielding ability, though that ability is not always realized given the frequency of early spring freeze events of the last three years, coupled with its early maturity (similar to Jagger and Overley). This line also provides the best overall milling quality and gluten strength of all candidates. OK05526 represents a significant improvement over Endurance in yield potential, test weight, kernel size, baking quality, consistency in plant height, and adaptation range, but it provides no improvement in stripe rust resistance and has less acid-soil tolerance.

Two other experimental lines, OK05212 and OK05511, are considered more resilient types, with a slight edge to OK05212 in adaptation range and yield potential. OK05212 extends very well both geographically and edaphically. It has consistently performed well above average in dry soils, acidic soils, and water-logged soils, and its grazing tolerance is on par with Duster and Endurance. On the other hand, OK05511 provides much needed insect resistance currently not offered in OSU releases--specifically greenbug and Hessian fly--though the frequency of resistance is not 100% for either trait. Oddly, the adaptation range of OK05511 is an exact mirror image of that of Billings; it performs relatively best in southwestern Oklahoma and in the panhandle in dryland production systems.

Lastly, we are giving final consideration to the experimental line OK03825-5403-6, which could be touted as an improved version of Custer, fortified with two genes for resistance to the two major biotypes of Russian wheat aphid. We are currently assessing the stability or consistency of the resistance. OK03825-5403-6 would be positioned specifically for northwest Oklahoma and the High Plains of northern Texas and southern Colorado.

Table 1

Oklahoma Elite Trial, 2009		Grain yield, bu/ac[1]	
Entry	**Pedigree**	**Goodwell irrigated**	**Goodwell dryland**
OK05903C	TXGH12588-120*4/FS4//2174/3/Jagger	93	41
OK05312	TX93V5919/WGRC40//OK94P549/WGRC34	88	44
Endurance		**87**	**43**
OK05128	KS94U275/OK94P549	86	36
OK05212	OK95616-1/Hickok//Betty	86	44
OK05511	TAM 110/2174	84	40
OK05711W	G1878/OK98G508W	83	39
Billings	**N566/OK94P597**	**82**	**32**
OK05526	KS94U275/OK94P549	82	30
OK04111	2174*2/Jagger	81	37
OK05204	SWM866442/OK95548	80	35
OK03825-5403-6	Custer*3/94M81	79	31
Pete	**N40/OK94P455**	**79**	**43**
OK Bullet		**78**	**31**
OK06114	complex pedigree	77	37
Duster		**76**	**42**
OK04315	N563/OK94P597	76	36
OK06617	FAWWON 06/2137//OK95G703-98-61421	75	38
OK06729	P2540/OK95548//OK96717	72	41
OK01420W	KS93U206/Jagger	72	33
OK06029C	TXGH12588-120*4/FS4//2*2174	72	33
OK04525	FFR525W/Hickok//Coronado	71	32
Centerfield		**71**	**40**
OK Rising		**69**	**25**
Fuller		**69**	**30**
Deliver		**69**	**33**
OK06618	SWM866442/OK94P549//2174	69	36
Chisholm		**67**	**34**
OK05742W	KS93U206/Jagger	61	27
Jackpot		**59**	**29**
Nursery mean		76	36
LSD (0.05)		8	5
C.V. (%)		8	11

[1] Entries arranged in decreasing order of grain yield in the irrigated trial; check varieties appear in bold font.

Table 2

Experimental number *Pedigree*	**Yield Rank (*n*=30–40)** 2005	2006	2007	2008	2009	**Unique strengths**	**Weaknesses**
OK05526 *KS94U275/Endurance*	1	7	28	1	3	Yielding ability with early maturity Baking quality Test weight + kernel size	Stripe rust reaction no better than Endurance
OK05212 *OK95616/Hickok//Betty*	1	16	4	4	1	Very broad adaptation; resilient Highly tolerant to acid soils Drought tolerant Flood tolerant! Avoided two spring freezes - '07, '09	Small kernel size Test weight
OK05511 *TAM 110/2174*	3	4	15	4	4	Greenbug and Hf resistance (partial) Highly drought tolerant Resistant to stripe rust, powdery mildew Opposite to Billings for adaptation Similar to Billings for quality	Leaf rust and WSBMV reactions
OK03825-5403-6 *Custer*3/94M81*	--	--	1	10	29	Stacked RWA resistance Broader adaptation than Custer	Sensitive to early spring freeze WSSMV reaction

EFFECT OF PLANTING DATE ON YIELD AND TEST WEIGHT OF DRY-LAND WHEAT IN THE OKLAHOMA PANHANDLE

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

Dryland wheat producers in the panhandle region often plant wheat when soil moisture is adequate regardless of calendar date. In the fall of 2004 a study was initiated at OPREC to determine the effect of planting date and variety on dryland wheat grain yield and test weight. Hard red winter wheat (HRW) and hard white winter wheat (HWW) were sown the first and fifteenth of September, October, and November 2006. Seeding rates were 45 lb/ac for September dates, 60 lbs/ac for October 1, and 90 lb/ac for the last three dates, which were consistent with standard practices of most producers in the high plains. Varieties used in this study (HRW and HWW) were chosen because of consistent high yield and test weight in the Panhandle wheat variety trials. Plot size was 5 feet wide by 35 feet long and all plots were planted with a Great Plain no-till plot drill.

Results

No data was collected in 2006 due to hail storm and 2008 due to drought.

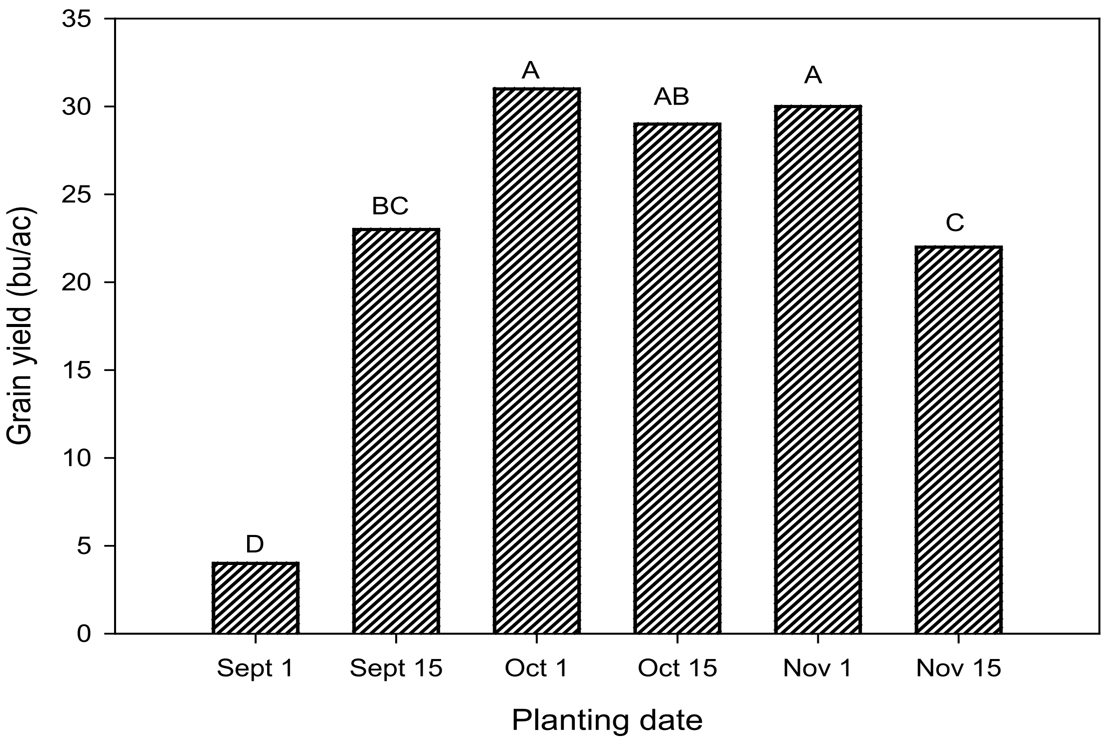
Grain yields in 2009 were the lowest for the three years data has been collected with a range for selected planting dates from 4 - 31 bu/ac (Fig. 1). This is contrast to a range of 44 - 71 bu/ac in 2007, which was one of the highest yielding years for OPREC since 1998. Low grain yields for 2009 were probably the result of lack of precipitation during the winter and early spring (Table 1). For the 2009 wheat crop, precipitation for the winter and early spring was 46% of the long-term mean, as compared to 336% for the 2007 wheat crop. In both of these environments, though, October-sown wheat out yielded September-sown wheat. In 2009 the yield loss from drought for the September 1 planting date was the most dramatic of any year with only 4 bu/ac harvested for that date. October 1 had the highest yield at 31 bu/ac, but there was not a statistical difference between the either October date or the November 1 planting date. The September 15th

Table 1. Long-term (51 years) mean and 2004-05, 2006-07, and 2008-09 rainfall (inches/month) for December through March at OPREC.

Year	Dec	Jan	Feb	March	Total
Mean	0.31	0.30	0.46	0.95	2.02
04-05	0.16	0.73	1.04	1.14	3.07
06-07	3.70	0.84	0.12	2.12	6.78
08-09	0.11	0.12	0.32	0.38	0.93

and the November 15th dates had grain yields of 74 and 69%, of the October 1 planting date respectively. These yields are similar to the three year averages. The November 1st date yielding as well as both October planted dates was not observed in previous years. The lack of winter precipitation probably influenced this result, as, the late planting allowed for moisture to be available during the critical periods of plant growth for this crop year. In 2009 the highest yields were obtained for wheat planted between October 1 and November 1.

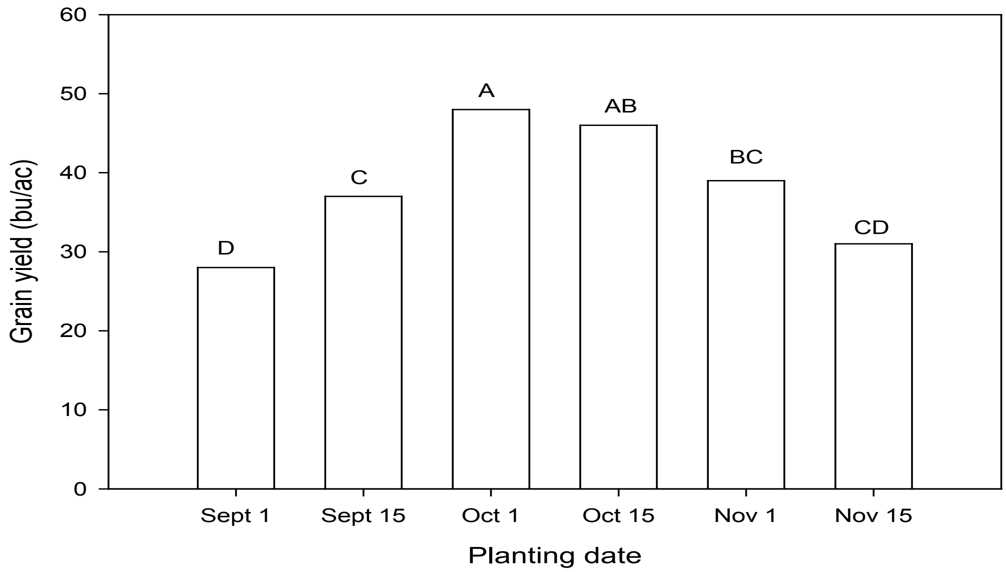
Figure 1. Grain yields for dry-land wheat planted on selected dates at OPREC in 2009.



Yields with same letter are not significantly different

While the November planting date yielding as well as the October planting dates was an abnormality, the October planting dates have produced the highest yields throughout the duration of the study (Fig. 2). When comparing grain yields for the September 1 planting date to the October 1 date, yield is 59% of the October 1 planting date. The September 15th and the November 1st dates have yielded 77 and 82% of the October 1 date respectively. After three years no difference was found between the HRW and HWW in grain yields so all data reported is the average of both.

Figure 2. Grain yields for dry-land wheat on selected planting dates at ORPEC in 2005, 2007, and 2009.

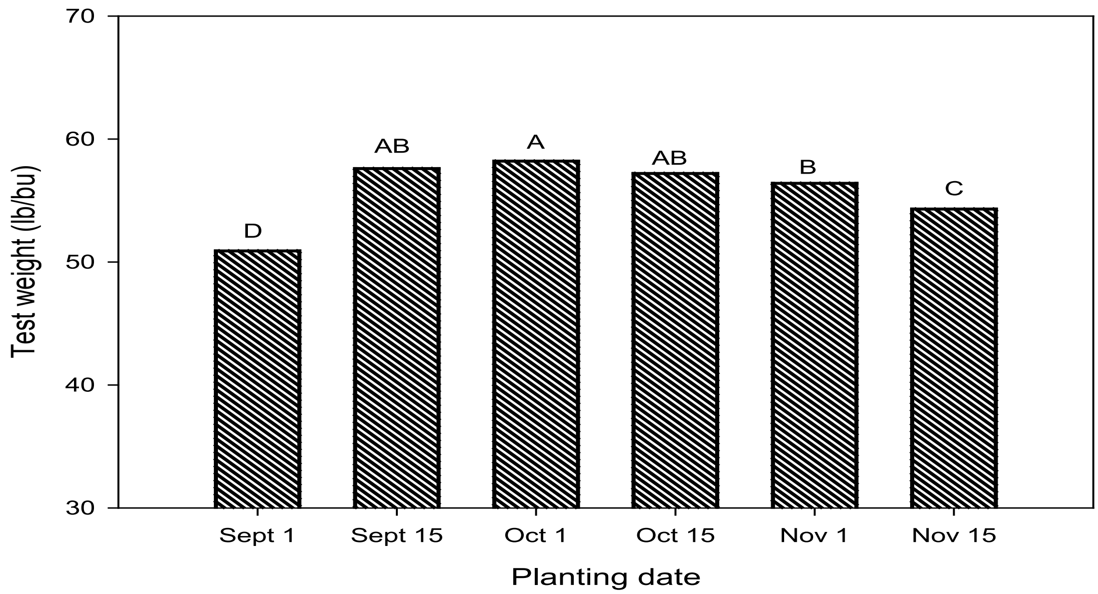


Yields with same letter are not significantly different

Planting date has an effect on test weight with a 7.0 lb/bu difference observed between the September 1 planting date and the October 1 date in 2009 (Fig. 3). Planting September 1 negatively affects test weights of both varieties but no difference was found between varieties. Looking at the three-year data it is apparent that planting September 1 negatively affects test weights (Fig. 4). Also, even though there was no difference in test weight between varieties tested in this experiment, it is well documented that variety selection plays an important role in test weight. Examples of this are reported in other sections of this report.

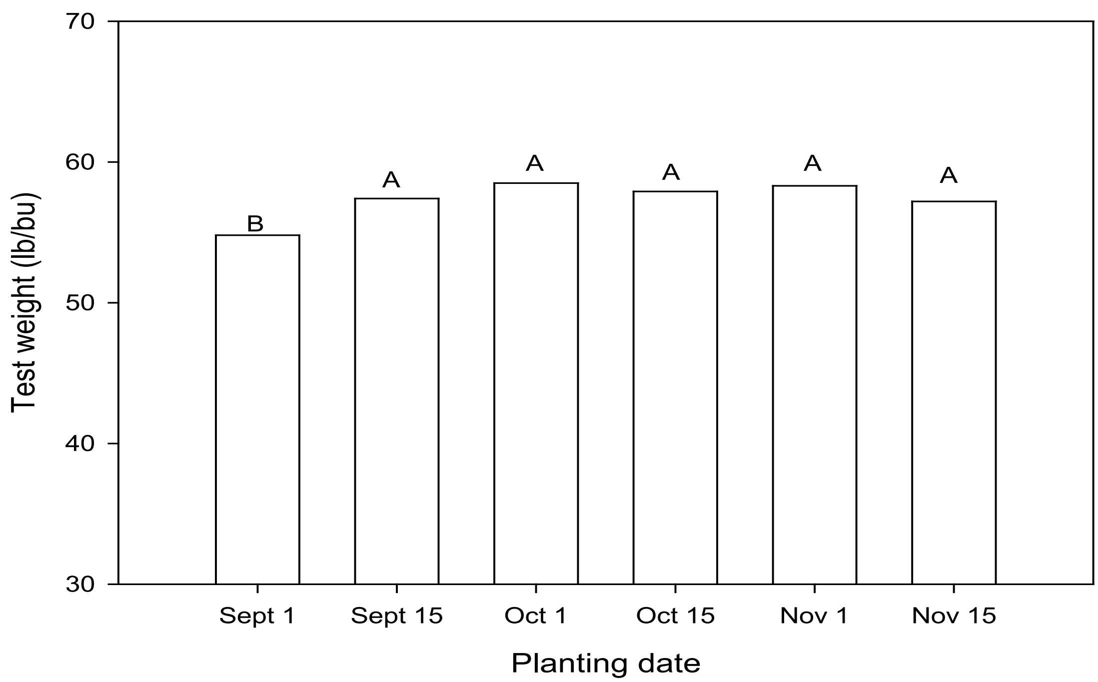
More years of data are needed before final conclusions can be reached, but it appears that October 1 is the optimum planting date for dryland wheat in this region. A good suggestion may be to start dusting in wheat on September 20th if precipitation is not received. In the fall of 2009 a new study was initiated utilizing one variety Duster and two seeding rates 45 and 90 lbs/ac to determine if a seeding rate for selected dates will affect grain yield.

Figure 3. Test weight for dry-land wheat planted on selected dates at OPREC in 2009.



Yields with same letter are not significantly different

Figure 4. Grain yields for dry-land wheat on selected planting dates at ORPEC in 2005, 2007, and 2009.



Yields with same letter are not significantly different

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.

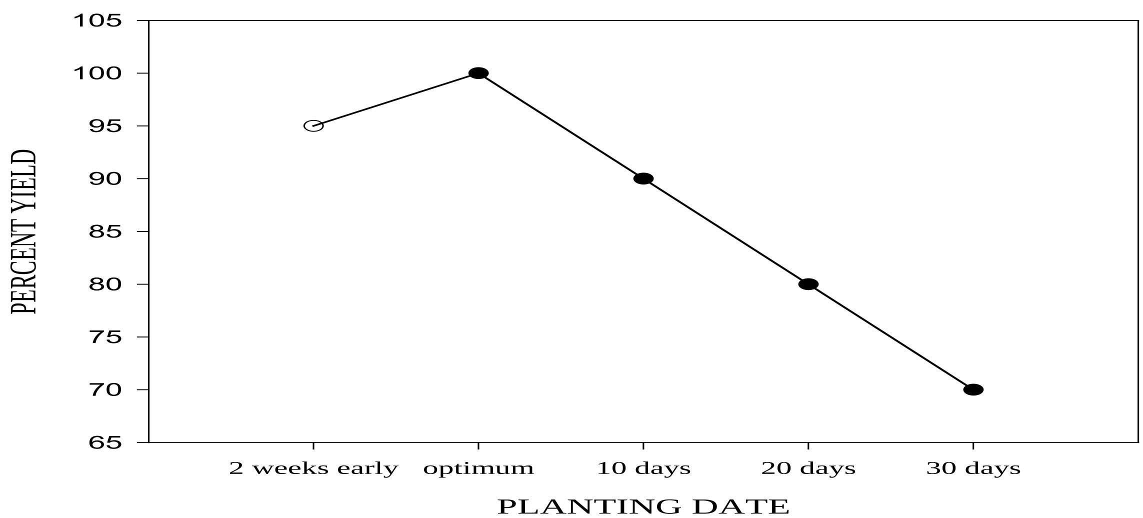


Figure 1. Ten years of grain yields at Lansing, Michigan. Source modern corn production

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

Results

Data was not collected in 2002 and 2009 due to irrigation well problems or in 2006 due to windstorm.

In 2005 with the cool wet spring some dates were unable to be planted therefore, data was not collected. In 2006, two hail storms in early June severely affected the yield of the second planting date for both hybrids. The yield for the second planting date in 2006 was 42 bu/ac less than the long-term mean for the 114-day hybrid (fig. 2). This is the only time in the duration of the study that April 10 date did not have the highest grain yield for both hybrids (likely due to damage from hailstorm). Therefore data from 2006 will not be used in the long-term averages.

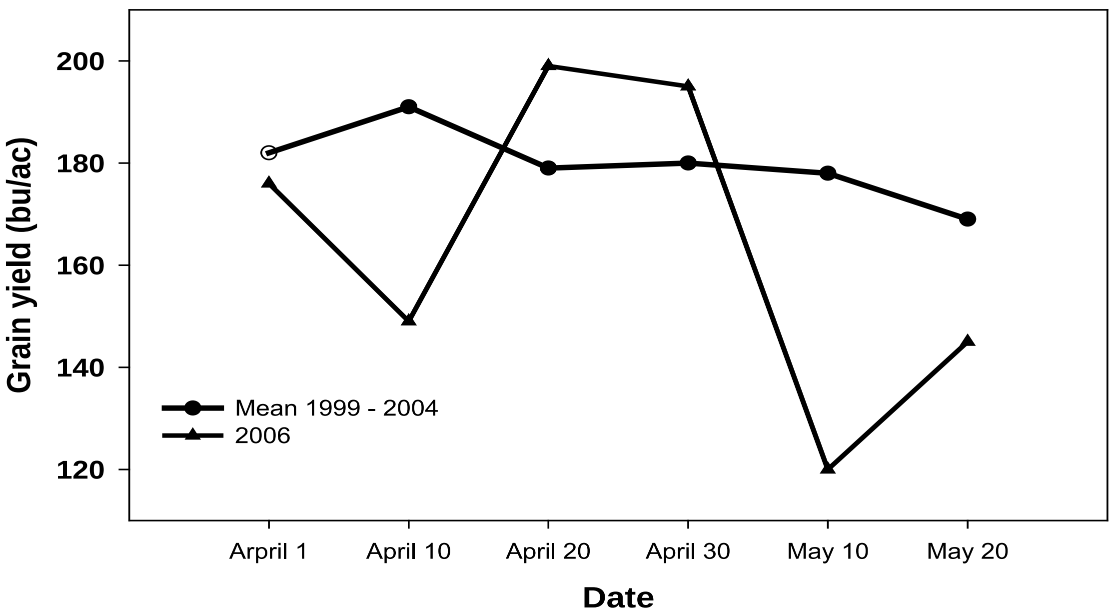


Figure 2. Mean corn grain yields bu/ac from 1999 through 2004 compared to 2006, which demonstrates the yield loss due to hail storms in early June 2006.

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 to 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

GRAIN YIELDS FROM SWINE EFFLUENT APPLICATIONS IN 2009

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OBJECTIVES

1. To evaluate grain yields of continuous corn production under conventional tillage practices utilizing beef manure, swine effluent and anhydrous ammonia in the southern Great Plains region as part of an animal waste management system.
2. To evaluate the grain yields of a multi-year no-till corn–wheat–sunflower–fallow crop rotation production system in the southern Great Plains regions as part of a swine effluent management system.
3. Evaluate the effects of long-term land application of animal wastes on biological, chemical and physical properties of the soil.

INTRODUCTION

Swine and cattle production are important components to agriculture production in the Oklahoma panhandle. Therefore an effort to evaluate integration of swine and cattle production systems through the use of swine effluent and beef manure applications to crop production systems is important. Current production practices were evaluated, in addition to a crop production practice aimed at maximizing the utilization of available water resources in a no-till rotational cropping scheme.

PROCEDURE

Research plots were established in 1995 for the continuously cropped, conventionally tilled corn (*Zea mays* L.) production system (E701); with soil samples which were collected prior to establishment and each annual fertilizer application. During the 2009 growing season N was applied at rates of 50, 150, and 450 lb N ac^{-1} as swine effluent (SE), beef manure (BM) or urea (UN). In 1999 research plots were established to evaluate a no-till corn–wheat–sunflower–fallow (E703) and a no-till sorghum-wheat-sunflower-fallow (E704) crop rotation production system; with which soil samples were collected prior to establishment and each annual fertilizer application. During the 2009 growing season N was applied to both E703 and E704 at rates of 100, 200, and 400 lb N ac^{-1} as swine effluent (SE) or urea (UN); a tillage control plot was also included. Research plots consisted of a 15x30 ft (450 ft^2) area each of which had three replicates; plots had borders separating the replications to minimize effluent movement between the plots and to control for wind effects.

RESULTS

E701

Corn grain yields responded to N treatments when compared to the control in 2009 for an experiment that has been in a continuously cropped, conventional cultivation production (E701) system for fourteen years. The median yield was 149.8±7.8 bu ac^{-1}, with lower and upper (95% confidence) levels at 130.2 and 160.2, respectfully (Table 1). Beef manure applied at all N rates increased grain yields above the control (Table 1, Figure 1); although when BM was applied at 450 lb N ac^{-1} rates there seemed to be no additional benefit above the 50 and 150 lb N rate (Figure 1) and was lower than the low N loading rate. Swine effluent (SE) had a linear response to N applications. The high SE N loading application resulted in a yield increase above the control;

however, yields of the low SE N loading rate were not significantly increased above the control (Table 1) and it appears that ammonia volatilization reduces the amount of plant available N utilized by the growing crop at all N loading applications. Urea at the medium N loading rate produced the greatest yields (221 bu), followed by SE at the high and N loading rate (189 bu) as seen in Table 1.

E703

In 2009 corn harvested under no-till (E703) management practices did not yield greater quantities than the conventional tillage study (E701); overall yields averaged 160.4±6.1 bu ac^{-1}, with lower and upper (95% confidence) levels at 148.0 and 172.7, respectfully (Table 2). Increased corn yields were seen for the sprinkler and surface applied SE applications (Figure 2). Table 3 demonstrates no differences between each treatment when compared to the control (0 N rate); the control has been subtracted from the treatment means, showing the increase or decrease of each treatment from the control.

Results of wheat (*Triticum aestivum* L.) grain (E703) yields in 2009 were not obtained due to the later than normal planting date. Planting occurred around mid October after the corn was harvested. Seasonal temperatures did not allow for adequate tillering to take place prior to winter dormancy, and required much of the spring growing period to recover.

Sunflower (*Helianthus annuus*) yields from the no-till study (E703) in 2009 had no significant treatment effects (Table 2); overall yields averaged 1321±75 lb ac^{-1} (Figure 2), with lower and upper (95% confidence) levels at 1169 and 1474, respectfully (Table 2). Sunflower yields in 2009 were 700 lb ac^{-1} below yields in 2008. It should be noted that N applications are applied to the corn crop, and a flat UN rate to the wheat, and sunflower yields are obtained from any residual N from previous applications; the sunflower crop receives no N applications.

E704

Grain sorghum results for the sorghum-wheat-sunflower-fallow (E704) study did not yield any significant differences; overall yields averaged 124.1±4.3 bu ac^{-1}, with lower and upper (95% confidence) levels at 116.8 and 131.5, respectfully (Table 4). When compared to the control (Table 5) no significant differences were seen; yields were almost uniform across all N loading rates. Additionally, in 2007 and 2008 no significant differences in sorghum yields were observed.

Results of wheat grain (E704) yields in 2009 were not obtained due to the later than normal planting date. Planting occurred around the end of October after the sorghum was harvested. Seasonal temperatures did not allow for adequate tillering to take place prior to winter dormancy, and required much of the spring growing period to recover.

Sunflower yields from the no-till study (E704) again in 2009 had no significant treatment effects (Table 2); overall yields averaged 1233±76 lb ac^{-1} (Figure 3), with lower and upper (95% confidence) levels at 1079 and 1387, respectfully (Table 4); these yields are approximately 780 lb ac^{-1} less than those observed in 2008, but similar to yields in 2007. It should be noted that N applications are applied to the sorghum crop, and a flat UN rate to the wheat, and sunflower yields are obtained from any residual N from previous applications; the sunflower crop receives no N applications.

FUTURE WORK

Grain yield evaluation will continue on a yearly basis. In addition, soil samples will be collected to measure soil properties, biological changes in soil environment due to additions of moisture, organic C, and readily available nutrients. Other soil properties of interest are inorganic N, phosphorus loading, soil organic C, micronutrients, and salt levels. Of particular importance in these soils will be movement of salts at various depths within the soil profile. With high rates of evapotranspiration in this semiarid environment there is a potential for increased levels of salt accumulation in the upper portion of the soil profile. Long term high rates of salt accumulation in the profile will limit agronomic production and be a major concern in this agroecosystem. Physical properties examined include bulk density, soil structure, and water infiltration.

Table 1 Corn grain yields in 2009 for a continuously cropped corn system under conventional tillage (E701) using applications of Urea (UN), beef manure (BM), and swine effluent (SE) at N loading rates of 0, 50, 150, and 450 lb N ac^{-1}. Study is located at OPREC, Goodwell, OK.

Year	N Source†	N Rate‡	Yield	Std Err§	DF	T Value	Pr > |t|
			——Bu ac^{-1}——				
		lb N ac^{-1}					
2009	CONTROL	0	122.17	11.47	26	10.65	<.0001
	BM	50	154.87	19.87	26	7.79	<.0001
		150	167.41	19.87	26	8.42	<.0001
		450	140.07	19.87	26	7.05	<.0001
	SE	50	100.54	19.87	26	5.06	<.0001
		150	130.50	19.87	26	6.57	<.0001
		450	188.52	19.87	26	9.49	<.0001
	UN	50	120.97	19.87	26	6.09	<.0001
		150	221.88	19.87	26	11.16	<.0001
		450	151.10	19.87	26	7.60	<.0001

† Nitrogen source (BM=beef manure, SE=swine effluent, UN=urea).
‡ Annual N additions using N source.
§ Standard error = standard deviation of the samples adjusted by the number of samples.

Table 2 Grain yields in 2009 from a No-Till Corn-Wheat-Sunflower-Fallow rotation (E703) evaluating surface and sprinkler applications of SE. Study is located at OPREC, Goodwell, OK.

YEAR	TRT§	N App†	N Rate‡	Corn		Sunflower	
				——Bu ac^{-1}	±Std Err——	—lb ac^{-1}	±Std Err—
2009	1	SPR	0.5	168.22	25.30	1103.60	277.79
	2		1	156.15	25.30	1915.41	277.79
	3		2	188.77	25.30	1596.41	277.79
	4	SUR	0.5	162.89	25.30	1507.28	277.79
	5		1	175.02	25.30	1593.11	277.79
	6		2	175.40	25.30	1246.50	277.79
	12	UN	1	115.94	25.30	1279.72	277.79
	13		2	143.41	25.30	1080.50	277.79
	10	CHK	0	160.51	11.31	1157.29	124.23
	14	TCHK	0	153.03	25.30	1391.17	277.79

§ Treatment number. † Method of N application (SPR= sprinkler; SUR=surface; INJ=injection; UN=urea; CHK=check; TCHK=tillage check). ‡ Rate of N applied annually (0.5X, 1X, and 2X, where X=200 lb N ac^{-1}).

Table 3 The Standard Error of Differences (SED) in a corn-wheat-sunflower-fallow study (E703) in 2009. Where the control has been subtracted from the mean of each treatment, then statistically computed to determine the effect of each treatment. Yields are ± the control.

TRT‡	Corn Bu ac^{-1}			Sunflower lb ac^{-1}		
1	7.71	27.71	NS†	-53.69	304.30	NS
2	-4.36	27.71	NS	758.12	304.30	NS
3	28.26	27.71	NS	439.12	304.30	NS
4	2.38	27.71	NS	349.99	304.30	NS
5	14.51	27.71	NS	435.82	304.30	NS
6	14.89	27.71	NS	89.21	304.30	NS
12	-44.57	27.71	NS	122.43	304.30	NS
13	-17.10	27.71	NS	-76.79	304.30	NS
14	-7.49	27.71	NS	233.88	304.30	NS

† not significant.
‡ Treatment number, refer to Table 2 for a more complete explanation.

Table 4 Grain yields in 2009 from a No-Till Sorghum-Wheat-Sunflower-Fallow rotation (E704) evaluating surface and sprinkler applications of SE. Study is located at OPREC, Goodwell, OK.

YEAR	TRT§	N App†	N Rate‡	Sorghum Bu ac^{-1}	±Std Err	Sunflower lb ac^{-1}	±Std Err
2009	1	SPR	0.5	113.09	13.99	942.62	321.35
	2		1	135.89	13.99	1423.47	321.35
	3		2	136.86	13.99	1481.76	321.35
	4	SUR	0.5	119.21	13.99	1360.57	321.35
	5		1	128.42	13.99	1264.51	321.35
	6		2	120.37	13.99	986.29	321.35
	12	AA	1	111.82	13.99	1397.48	321.35
	13		2	128.54	13.99	1247.05	321.35
	10	CHK	0	118.16	9.89	1195.27	227.23
	14	TCHK	0	116.32	13.99	810.54	321.35

§ Treatment number. † Method of N application (SPR= sprinkler; SUR=surface; INJ=injection; AA=anhydrous ammonia; CHK=check; TCHK=tillage check). ‡ Rate of N applied annually (0.5X, 1X, and 2X, where X=200 lb N ac^{-1}).

Table 5 The Standard Error of Differences (SED) in a sorghum-wheat-sunflower-fallow study (E704) in 2009. Where the control has been subtracted from the mean of each treatment, then statistically computed to determine the effect of each treatment. Yields are ± the control.

TRT‡	Sorghum Bu ac^{-1}			Sunflower lb ac^{-1}		
1	-5.07	17.13	NS†	-252.64	393.57	NS
2	17.73	17.13	NS	228.20	393.57	NS
3	18.70	17.13	NS	286.49	393.57	NS
4	1.05	17.13	NS	165.30	393.57	NS
5	10.26	17.13	NS	69.24	393.57	NS
6	2.21	17.13	NS	-208.97	393.57	NS
12	-6.34	17.13	NS	202.22	393.57	NS
13	10.38	17.13	NS	51.78	393.57	NS
14	-1.84	17.13	NS	-384.73	393.57	NS

† not significant.

‡ Treatment number, refer to Table 4 for a more complete explanation

Table 6 Grain yields in 2009 from a Sub-Surface No-Till Corn-Wheat-Soybean-Fallow rotation (ESDI) evaluating subsurface irrigation using several N rates under full and limited water applications. The standard error of differences (SED) were included where the control has been subtracted from the mean of each treatment, and then statistically computed to determine the effect of each treatment. SED yields are ± the control. Study is located at OPREC, Goodwell, OK.

YEAR	TRT§	H_2O†	N Rate‡	Corn			Soybean		
				Bu ac^{-1} ±Std Err					
2009	1	Full	High	124.81	13.01		31.31	2.11	
	2	Full	Low	116.22	13.01		31.21	2.11	
	3	Full	None	131.63	13.01		33.17	2.11	
	4	Limited	High	126.12	13.01		36.59	2.11	
	5	Limited	Low	113.34	13.01		30.86	2.11	
	6	Limited	None	130.89	13.01		29.97	2.11	
				Standard Error of Differences (SED) Bu ac^{-1} ±Std Err					
	1	Full	High	-6.07	18.41	NS	1.34	2.99	NS
	2	Full	Low	-14.67	18.41	NS	1.24	2.99	NS
	3	Full	None	0.74	18.41	NS	3.20	2.99	NS
	4	Limited	High	-4.77	18.41	NS	6.62	2.99	NS
	5	Limited	Low	-17.55	18.41	NS	0.88	2.99	NS

§ Treatment number. † Water applied (Full or Limited). ‡ Rate of N applied annually (None=0, Low=100, and High=200 lb N ac^{-1}).

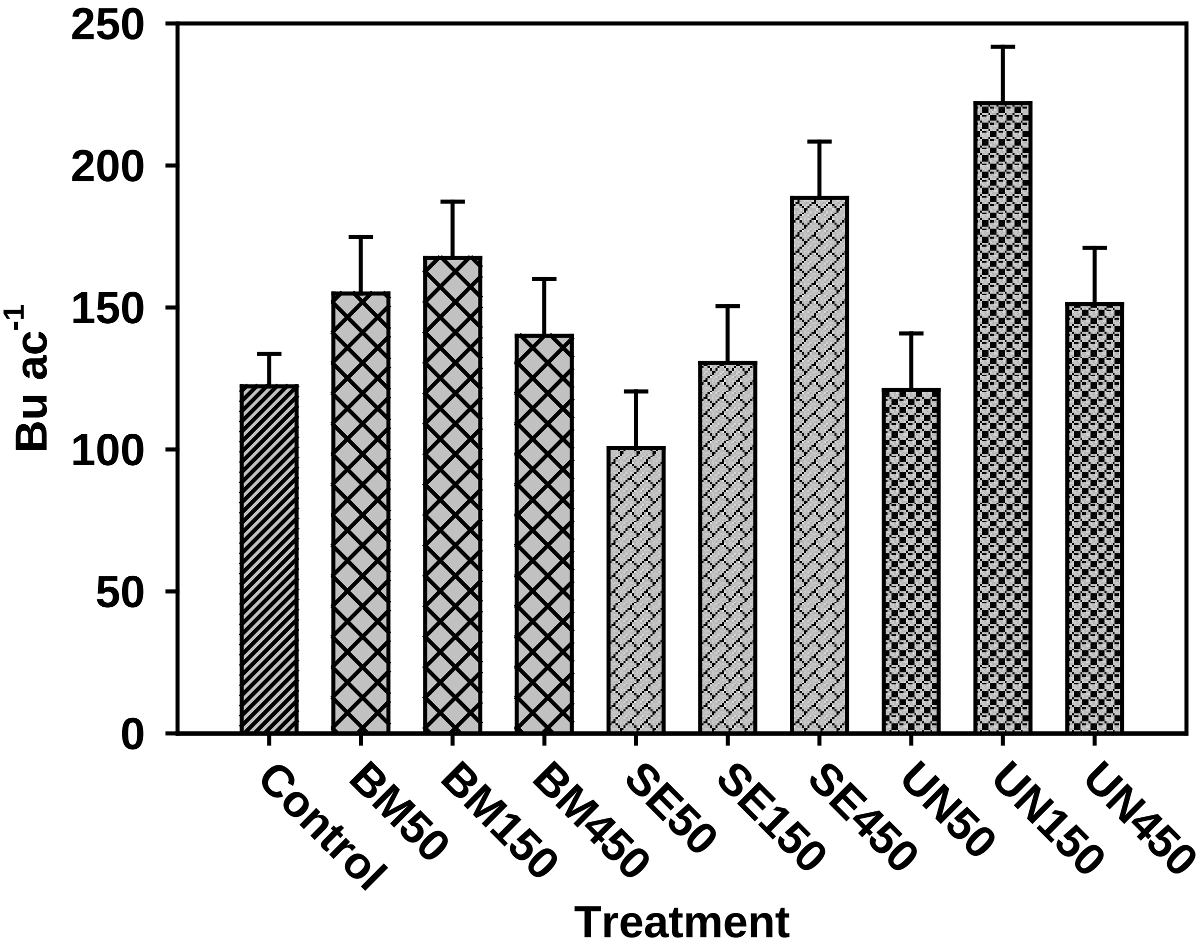

Figure 1 Corn grain yields in 2009 for a continuously cropped corn system under conventional tillage (E701) using applications of urea (UN), beef manure (BM), and swine effluent (SE) at N loading rates of 0, 50, 150, and 450 lb N ac^{-1}. Study is located at OPREC, Goodwell, OK. Control has 0 N applied.

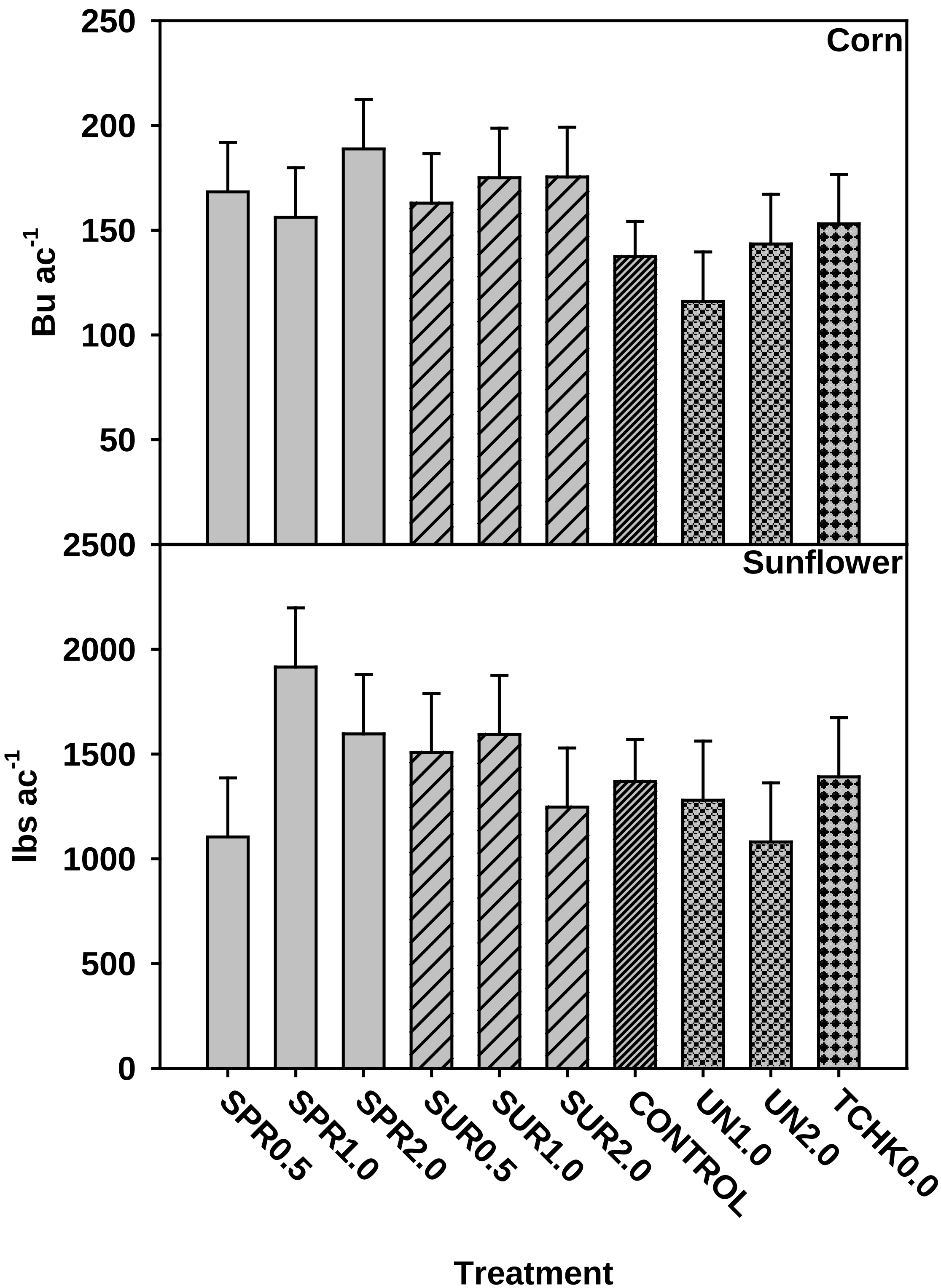

Figure 2 Grain yields in 2009 from a No-Till Corn-Wheat-Sunflower-Fallow rotation (E703) evaluating surface (SUR), sprinkler (SPR), and injection (INJ) applications of SE; these are compared to urea (UN), a control (0 N rate), and tillage control (TCHK, with 0 N applied). N rates are 0.5X, 1X, and 2X, where X=200 lb N ac^{-1}. Study is located at OPREC, Goodwell, OK.

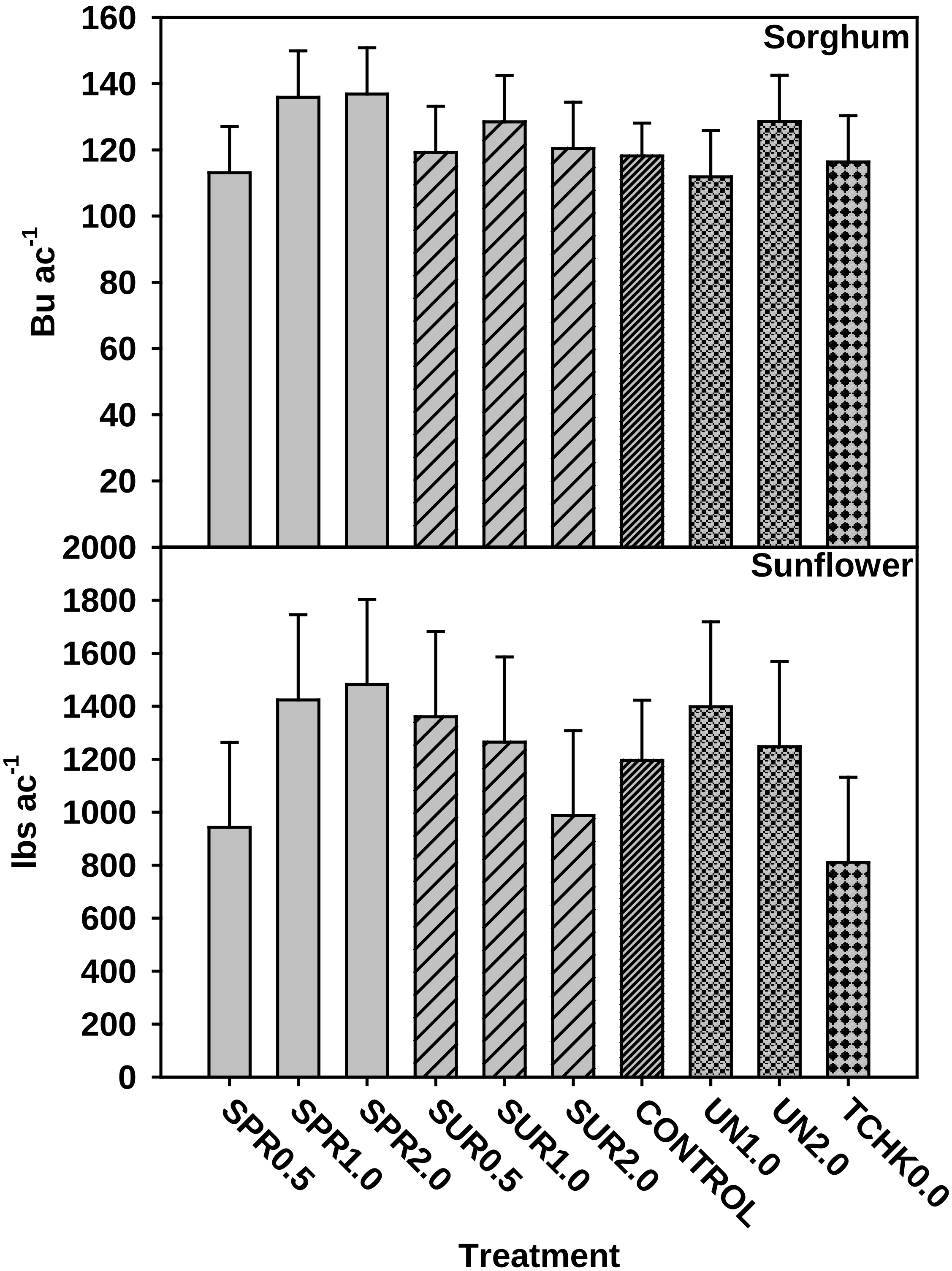

Figure 3 E704 Grain yields in 2009 from a No-Till Sorghum-Wheat-Sunflower-Fallow rotation (E704) evaluating surface (SUR), sprinkler (SPR), and injection (INJ) applications of SE; these are compared to urea (UN), a control (0 N rate), and tillage control (TCHK, with 0 N applied). N rates are 0.5X, 1X, and 2X, where X=200 lb N ac^{-1}. Study is located at OPREC, Goodwell, OK.

PHOSPHORUS DISTRIBUTION IN CALCAREOUS SOILS FOLLOWING REPEATED APPLICATIONS OF BEEF MANURE AND SWINE EFFLUENT AT THE OKLAHOMA PANHANDLE RESEARCH AND EXTENSION CENTER

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Rick Kochenower–Oklahoma Panhandle Research and Extension Center, Goodwell

INTRODUCTION

Livestock production, both cattle and swine, are important components to agriculture production in the Oklahoma panhandle and contribute to the overall economic status of the region. Therefore an effort to evaluate integration of swine and cattle production systems through the use of swine effluent and beef manure applications to crop production systems is important. However, current environmental concerns merit alternative management considerations when compared to traditional production practices. Cogent information that is unbiased and environmentally well-founded is required to make best management practice decisions. Phosphorus (P) derived from animal manures has been a concern in many national and state discussions for some time now. A significant concern about manure application is the increase of soil P as well as P transport to surface waters. Manure is usually applied based on plant N requirements; which often results in a buildup of soil P. Soil P results from several experiments that have received animal manure applications are discussed herein. These experiments are located at the Oklahoma Panhandle Research and Extension Center (OPREC). In an effort to bridge the gap between agricultural production and dependable environmental practices we hope to provide additionally information which can help make best management practice decisions easier.

PROCEDURE

Research plots were established in 1995 for a continuously cropped, conventionally tilled corn (*Zea mays* L.) production system (E701); soil samples were collected prior to establishment and each annual fertilizer application. Since inception, animal excrements have been applied at rates of 50, 150, and 450 lb N ac^{-1} as swine effluent (SE), beef manure (BM) or urea (UN).

Forage plots (E702) were established during the 1998-growing season with soil samples collected prior to establishment of the plots. Cool-season and warm-season perennial grasses were selected. Warm-season grasses were bermudagrass (Midland *Cynodon dactylon* (L.) Pers.), and buffalograss (Bison, *Buchloe dactyloides* (Nutt.) Engelm.). Perennial cool-season grasses selected were pubescent wheatgrass (Luna, *Thinopyrum intermedium* (Host) Barkworth and Dewey), and orchardgrass (Paiute, *Dactylis glomerata* L.). During the 1999 growing season, N was applied at 0, 50, 150 and 450 lb. N ac^{-1} as SE or UN. Forages were harvested as needed during the growing season to determine yields.

In 1999 research plots were established to evaluate a no-till corn–wheat–sunflower–fallow (E703) and a no-till sorghum-wheat-sunflower-fallow (E704) crop rotation production system; with which soil samples were collected prior to establishment and each annual fertilizer application. During the 2008 growing season N was applied to both E703 and E704 at rates of 100, 200, and 400 lb N ac^{-1} as SE or UN; a tillage control plot was also included.

RESULTS

E701–Maize

Because these experiments received manure applications based on crop N recommendations, the quantity of P supplied by manure is considerably greater than the amount removed by biomass removal (Zhang *et al*.). Nutrient concentrations of animal manure applications are shown in Table 1.

Phosphorus applied was calculated from the volume applied and the nutrient composition of the animal manures. A N|P ratio was obtained from the nutrient composition of the animal manures. The manure N|P ratios for BM and SE were 3.38 and 16.57, respectfully (Table 1).

Addition of animal manures has resulted in an increase of MIII soil P (MIII-P) levels (Table 1) and a corresponding increase of water soluble P (WSP) fractions. Water soluble P in soil solutions, can be subsequently transported to waterways via erosion or runoff.

Soil WSP levels have increased from the repeated application of animal manures (Table 1, and Figures 1 and 2). In Figure 1, BM increased WSP at all N loading applications for 0-15cm depth. However, in the 15-30cm depth, WSP levels increased only at the high N loading application. This corresponds to the level of P being applied in the animal manures. Total P applied for thirteen years (Table 1) increases 3-fold with each loading rate increase. Water soluble P levels in the soil have increased similarly; with each N loading increase WSP increased 3-fold. However, WSP increases have been approximately 2.0–2.8 percent of the total P applied (Table 1).

Water soluble P levels increased from SE applications at 0-15cm depth for the high N loading rate, but at no other depths or loading rates. These results are indicative of two main ideas: one, the P loading is much less than the BM applications (Table 1), and two, the form of P in its decreased quantities are moving downward in the soil profile along with the effluent moisture when applied. Beef manure P remains at the surface where it is mineralized, however much of the SE-P is mineralized below the surface.

The remaining P fraction is mineralized forming ortho-P and other complex P minerals, and then it is adsorbed to the soil surface or is taken up by the plant. In the research site, there is an abundance of calcium in the soil; as a result soluble P reverts to hydroxyapatite, or other low-solubility calcium phosphates. Under alkaline conditions calcium phosphates have low solubility. Phosphorus may also be removed from the soil water solution by adsorption onto positively charged sites in clay minerals but on a lower rate than the calcium phosphate minerals.

Table 7. Water soluble P (WSP) and its relationship to N applied and ΔMIII-P in calcareous soils from a continuously cropped, conventionally tilled experiment that received annual applications of animal manures from 1995-2008.

NS†	NR	TN	TP	ΔMIII-P	WSP	ΔWSP/TP
	——————kg ha^{-1}——————					
	0	0	0			
BM	56	728	215	133	78	0.020
	168	2184	646	698	204	0.021
	504	6552	1939	2038	753	0.028
	N|P ratio		3.38			
SE	56	728	43	-7	19	0.000
	168	2184	128	0	14	-0.003
	504	6552	385	81	67	0.009
	N|P ratio		16.57			

†NS=nitrogen source; NR=nitrogen rate; TN=total nitrogen applied (13yrs); TP=total phosphorus applied (13yrs); ΔMIII-P=MIII extractable soil P treatment minus control, WSP=water soluble P, ΔWSP=WSP_{xx}-WSP_{0N}

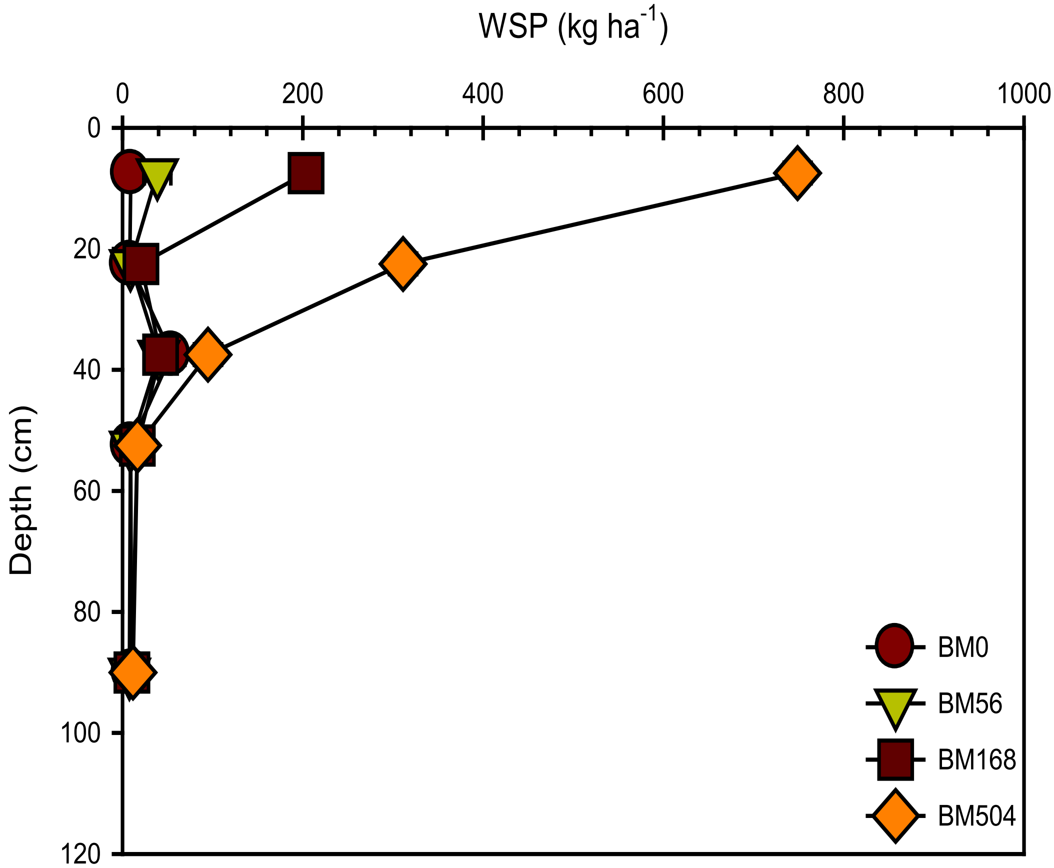


Figure 4. Water soluble P (WSP) from beef manure (BM) applications of N loading rates of 0, 56, 168, and 504 kg ha^{-1}. Mass transport of WSP into the lower depths is likely facilitated by two mechanisms: water transport from irrigations events and possible from tillage affecting more than the surface 15cm. Cumulative results of 13 annual animal manure applications. The control level (BM0) has been included to demonstrate the treatment differences; the control has not been subtracted from the treatment means. Experiment was conducted at the Oklahoma Panhandle Research and Extension Center (OPREC), Goodwell, OK.

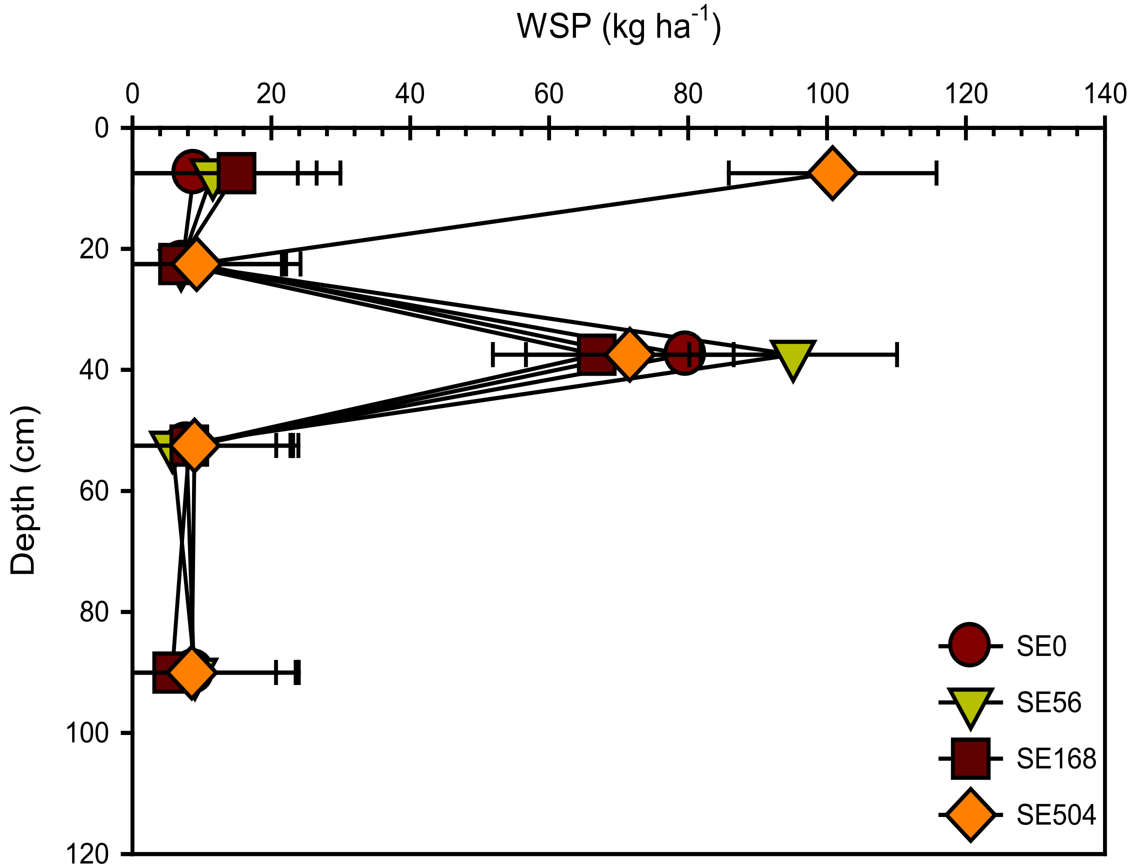


Figure 5. Water soluble P (WSP) from swine effluent (SE) applications of N loading rates of 0, 56, 168, and 504 kg ha^{-1}. Cumulative results of 13 annual animal manure applications. The control level (SE0) has been included to demonstrate the treatment differences; the control has not been subtracted from the treatment means. Experiment was conducted at the Oklahoma Panhandle Research and Extension Center (OPREC), Goodwell, OK.

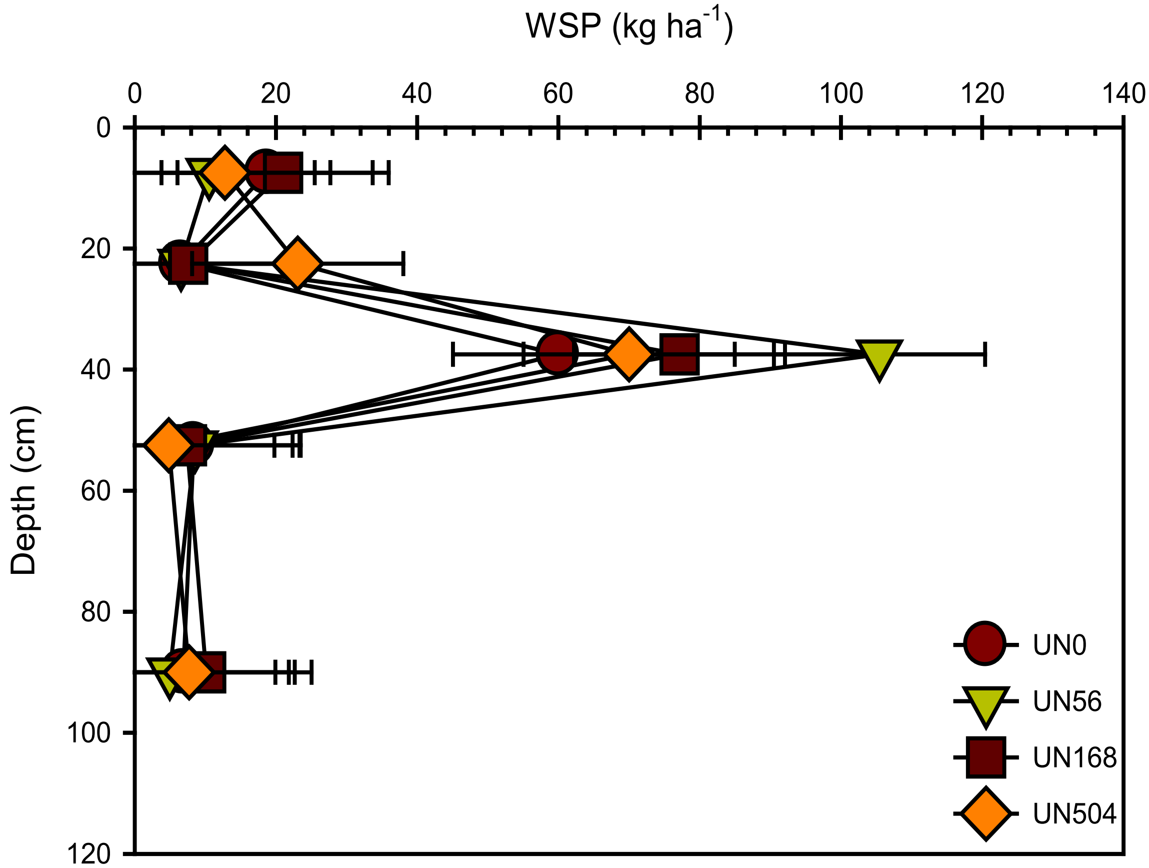


Figure 6 Water soluble P (WSP) from urea N (UN) applications of N loading rates of 0, 56, 168, and 504 kg ha^{-1}. Urea was adopted in 2005, previously anhydrous ammonia was utilized as the source of N. Cumulative results of 13 annual animal manure applications. The control level (UN0) has been included to demonstrate the treatment differences; the control has not been subtracted from the treatment means. Experiment was conducted at the Oklahoma Panhandle Research and Extension Center (OPREC), Goodwell, OK.

E702–Forages

While in the maize production system soil P levels increased along with WSP, conversely in the forage production system soil P levels were reduced by biomass removal (Figure 4). These decreases to soil MIII-P were observed at the 0-15 cm depth. Overall, at this soil depth MIII-P decreased 9.3 kg ha^{-1} yr^{-1} (r^2=0.9416, Figure 4). Bermudagrass, buffalograss, orchardgrass, and wheatgrass biomass removal facilitated the decreases in soil MIII-P at levels of 9.78, 9.58, 9.22, and 8.60 kg P ha^{-1} yr^{-1}, respectfully (r^2=0.9992, 0.9248, 0.9674, 0.9704); however, no significant differences were observed among the grass treatments. While significant annual decreases are observed, it should be noted that soil MIII-P levels initially were greater than crop requirements. Soil MIII-P levels have remained above the recommended soil test-P 100% sufficiency level of 65, even after seven years of biomass removal.

The control plot was subtracted from the treatment LSMEANS to determine the standard error of differences (SED). When SED's were evaluated, SE responded much differently than the UN source (Figure 5). While MIII-P from the UN treatments were not significantly different from each other, SE treatments have a linear response to MIII-P levels and the high N loading rate was significantly different than the low N loading rate (Figure 5). Although NS showed no significant statistically differences, it is evident that P additions from the high loading SE applications are continuing to keep MIII-P levels elevated. Also, when SED's are evaluated, N rate responses indicate that the two N sources responded much differently. Optimal SE loading, where static MIII-P levels are maintained, is near the 168 kg ha^{-1} N loading rate. At this N loading level, P additions appear to equal biomass P removal from harvesting (Figure 6). In Figure 6, biomass P removal is proportional to biomass removed.

In Figure 6, approximately 3, 10, 30 kg P ha^{-1} was applied on an annual basis for the low, medium, and high N loading rates, respectfully. However, at these P loading levels biomass P removal averaged 25, 30, and 35 kg P ha^{-1} annually for the low, medium, and high loading rates, respectfully. While greater quantities of biomass P was removed than was applied, it is evident that at the high loading rates that biomass removal is not as effective when compared to the low loading rate (Figure 6).

However, only the 0-15cm depth has been evaluated for P removal. While biomass P has removed more P than was added (Figure 6) and soil MIII-P levels have decreased (Figure 4) in the 0-15cm depth, this does not indicate that effluent P did not move downward in the soil profile with the wetting front. Phosphorus at depths lower than the 0-15cm depth may be demonstrating transport gains at the higher loading rates due to the volume of SE added. Some of the effluent P may have been transported downward in the soil profile as suspected in the E701 (maize) experiment. Although, it is the surface soil horizon that is of most concern, due to its exposure to surface runoff. Leaching of soil P needs to be evaluated. In this semi-arid agronomic environment, P lost to runoff and leaching many times has been assumed to be negligible; this position needs to be validated. Further research is being conducted to help validate these assumptions.

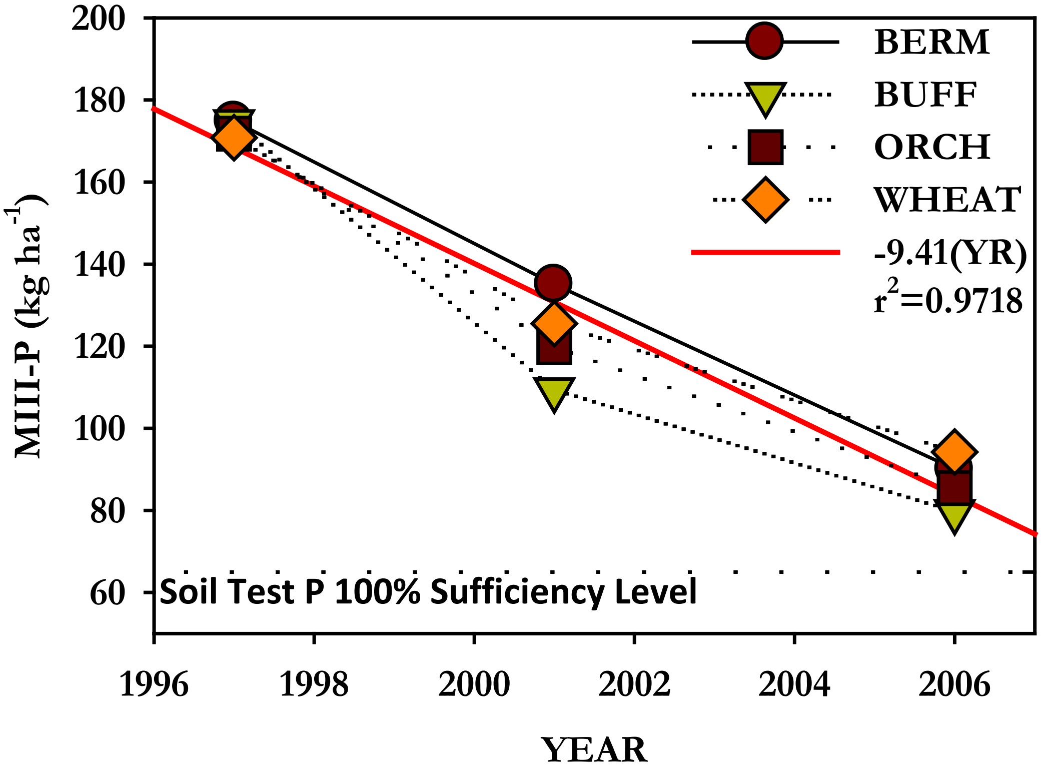


Figure 7 Decreases to soil MIII-P at 0-15 cm. Overall, MIII-P decreased 9.41 kg ha^{-1} yr^{-1} soil (r^2=0.9416). Experiment was conducted at the Oklahoma Panhandle Research and Extension Center (OPREC), Goodwell, OK.

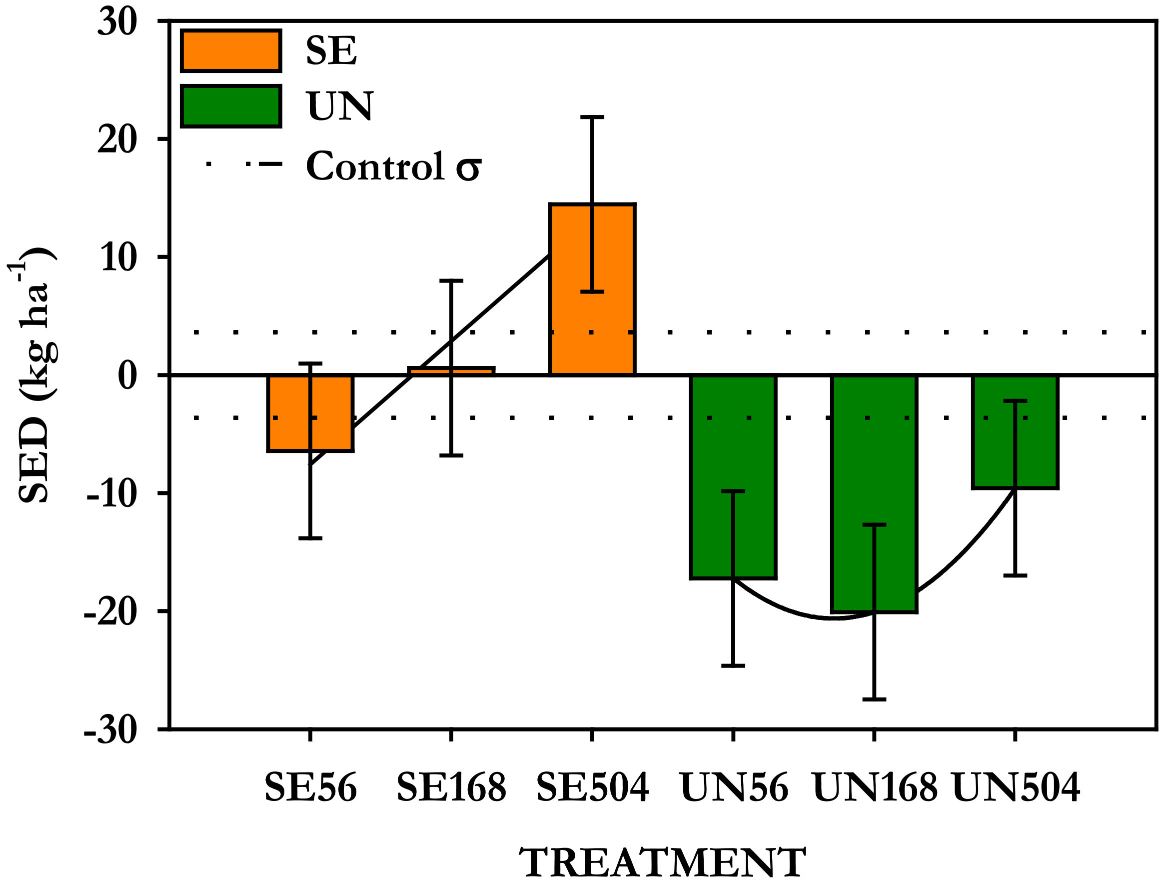


Figure 8 Nitrogen source (NS) affects MIII-P levels when standard error of differences (SED) are evaluated. Additionally, N rate affects treatment responses. The standard error of differences are when then control plot (0N) is subtracted from the treatment plot of interest. SE=swine effluent; UN=urea nitrogen. Experiment was conducted at the Oklahoma Panhandle Research and Extension Center (OPREC), Goodwell, OK.

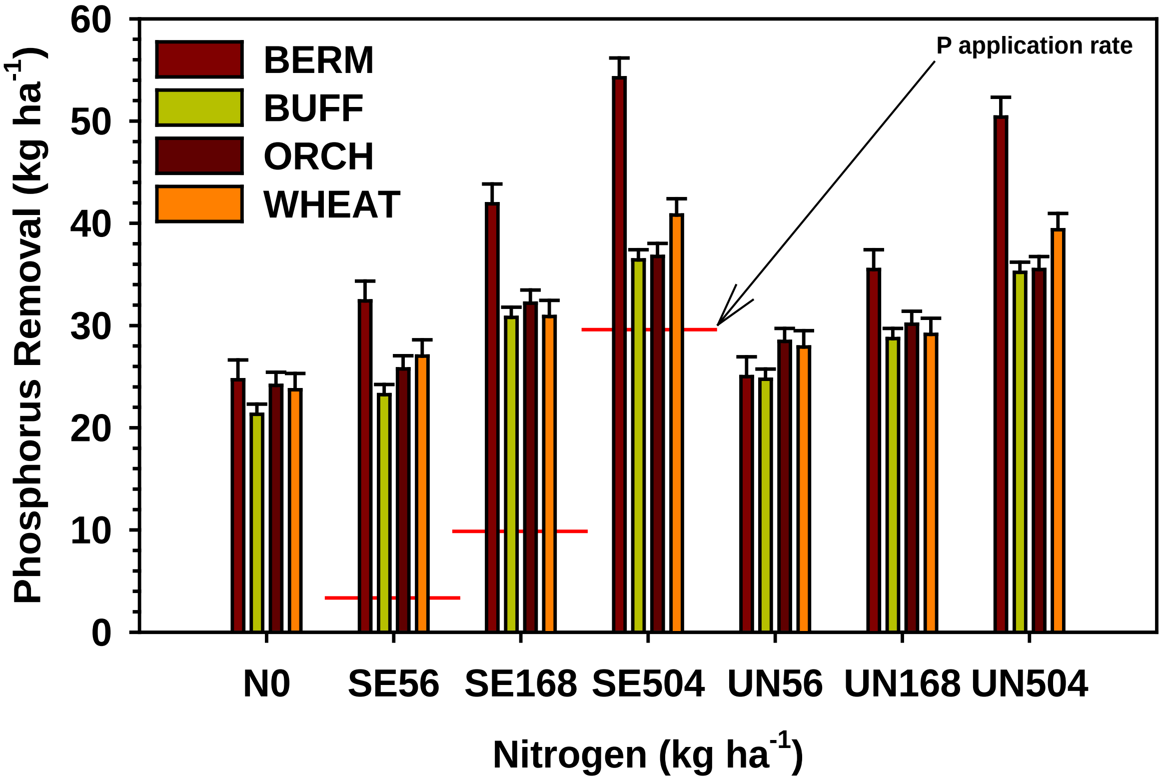


Figure 9 Biomass P removal when SE and UN are used as N sources. While yields are not shown, the amount of biomass P removed is a function of yield. Experiment was conducted at the Oklahoma Panhandle Research and Extension Center (OPREC), Goodwell, OK.

CONCLUSIONS

In the maize experiment, the addition of animal manures has resulted in an increase of MIII soil P (MIII-P) levels along with a corresponding increase of water soluble P (WSP) fractions. Beef manure increased WSP at a higher level than did the SE. Water soluble P levels increases are correlated to the volume of animal manure being applied. Additionally, WSP increases from BM applications have been approximately 2.0–2.8 percent of the total P applied.

Water soluble P levels increased from SE applications at 0-15cm depth for the high N loading rate, but at no other depths or loading rates. These results are indicative of two main ideas: one, the P loading is much less than the BM applications (Table 1), and two, the form of P in its decreased quantities are moving downward in the soil profile along with the effluent moisture when applied and/or tillage maybe affecting the downward movement.

Forage biomass P removal resulted in significant reductions of MIII-P levels in the 0-15cm depth. Biomass P removal exceeded the additions of P from SE, indicating an effective practice for animal manure management and utilization.

In this semi-arid agronomic environment, P lost to runoff and leaching many times has been assumed to be negligible; this position needs to be validated. Further research is being conducted to help validate these assumptions.

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

Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell

A study was initiated in 1999 to evaluate four different dry-land cropping rotations and two tillage systems for their long-term productivity 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 were not successful in the first five years of the study; therefore in 2004 cotton replaced soybean and sunflower replaced corn in the rotation, also continuous sorghum was replaced with a grain sorghum-sunflower (SF) rotation. Tillage systems include no-till and minimum tillage. 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 or varieties. 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

Climate

Due to climate condition and other factors obtaining results from the rotations other than the WSF has been difficult, therefore only the WSF will be reported.

Precipitation since 1999 has been erratic for the panhandle region with yearly totals ranging from a low of 12.0 inches in 2007 to a high of 20.31 in 2004. Even in 2008 the yearly total of 18.27 inches was above the long-term mean of 17.89 inches, although most of the rainfall 14.81 inches was received after July 1. The mean rainfall for the last nine summer growing seasons (June, July, and August) of 6.28 is 1.5 inches below the long term mean (Table 1). Four of the nine years have been 3 inches or more below the long term mean therefore grain sorghum yields have been affected. Between drought and hail storms three wheat crops have failed in the duration of the study. In 2002 rainfall was not received in time to activate the preemergent herbicide and no sorghum was harvested, this was the only time it has happened.

Table 1. Summer growing season precipitation at OPREC

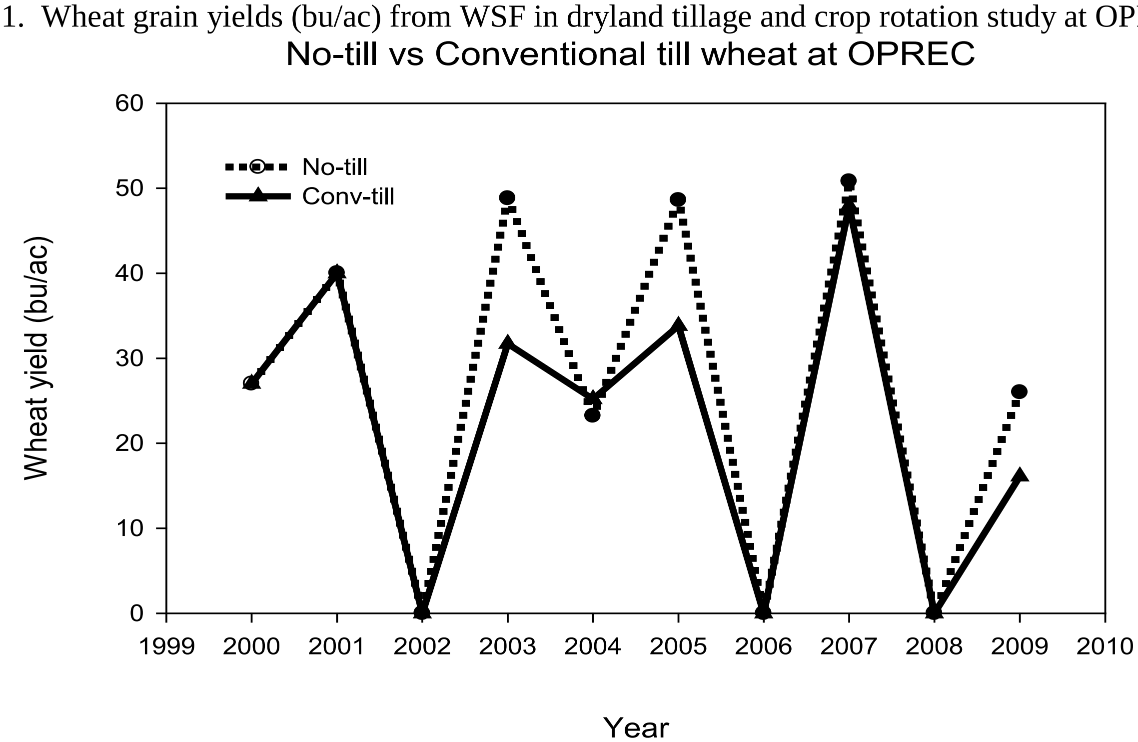
Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Long-term mean
June	2.29	0.61	1.32	5.26	3.82	2.01	2.34	1.62	1.51	1.74	2.86
July	0.76	0.00	2.52	1.87	2.43	1.40	2.05	2.00	3.77	2.58	2.58
August	1.09	0.66	0.27	1.19	2.87	3.21	4.06	0.26	5.64	1.36	2.28
Total	4.14	1.27	4.11	8.32	9.12	6.62	8.45	3.88	10.64	5.68	7.72

Wheat

No wheat was harvested in 2002 and 2008 due to drought, and 2006 due to a hail storm.

This report will focus on wheat yields following grain sorghum, because in some years other crops never emerged or were lost to other factors. Wheat yields following other crops used in this experiment were essentially the same as wheat-fallow-wheat because preceding crops didn't emerge or were lost due to other factors.

Fig. 1. Wheat grain yields (bu/ac) from WSF in dryland tillage and crop rotation study at OPREC.



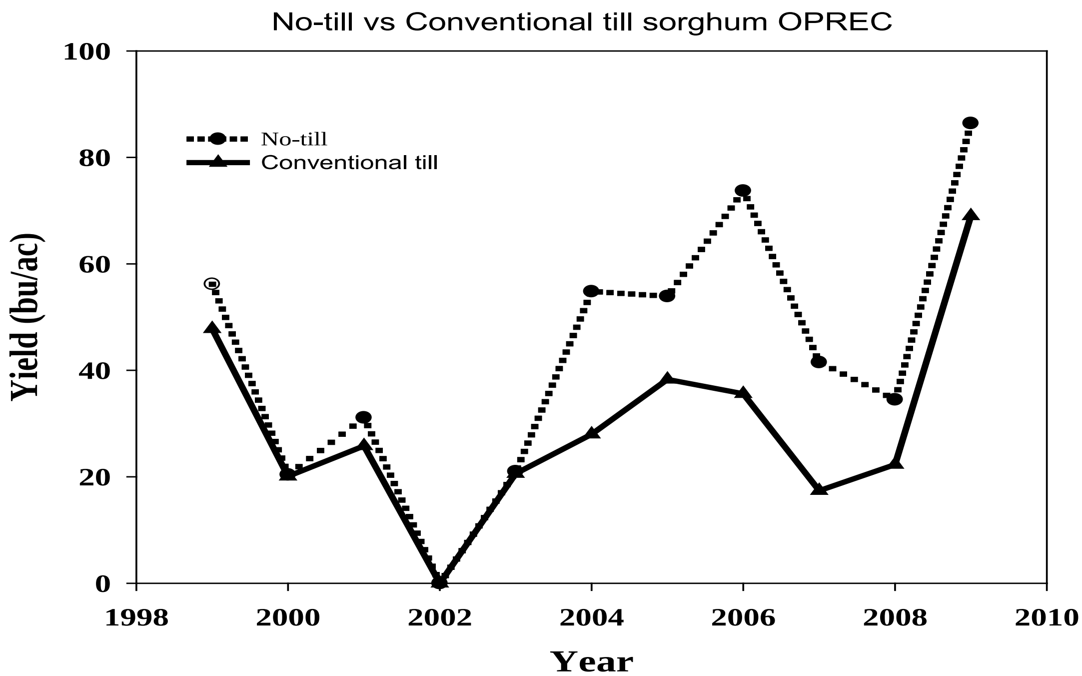
Neither tillage system produced, or will produce grain when drought occurs and no crops are harvested as in 2002 and 2008 (Figure 1). In three of the seven years that wheat was harvested grain yields were significantly higher for no-till (Fig. 1) with an average increase of 14 bu/ac.   In years that no difference was observed yields have been the same. In research conducted by Kansas

State University, they have shown a consistent increase in grain yield for no-till that hasn't yet been observed in this study.

Grain Sorghum

As with wheat when no precipitation is received one tillage system makes no difference as in 2002 when no sorghum was harvested (Fig. 2).

Figure 2. Grain yields of grain sorghum (bu/ac) for dry-land tillage and crop rotation study at OPREC.



Since 2004, grain sorghum yields have been significantly higher for no-till than conventional tillage (Table 3). This increase in sorghum grain yields was in year 6 or the third time through the rotation. This yield difference was also observed and reported by researchers at Kansas State University at the Tribune location. In 2004, 2006, and 2007 no-till grain yields were double of those for minimum tillage. Part of the higher grain yield in 2006 can be attributed to higher test weights for no-till (Table 4). The delayed maturity of minimum till grain sorghum adversely affected the test weights. In 2008 with delayed planting, maturity selection was too long for the year with the cooler conditions that existed. The mean high temperatures in 2008 for July and August were 3 and 9 F^o cooler than in 2007 at 90 and 87 F^o respectively. These cooler temperatures didn't allow for maturity of the grain sorghum and reduced yields. In hybrid performance trial near this study the highest yields 75bu/ac were obtained with shorter season hybrids than was planted in this study.

Again in 2009 planting was delayed until late June due to lack of soil moisture, and with the lower than normal rainfall test weights were affected although not significantly. In all other years no difference in test weight was observed between tillage treatments, although yields for no-till were higher than minimum till. 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. Although test weights are not significantly different for each year, when all years are considered no-till is has a significantly higher test weight than doe's minimum tillage.

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

Tillage	2004	2005	2006	2007	2008	2009	Six-year
No-till	54.8	53.9	73.7	41.5	34.5	86.4	57.5
Minimum till	28.0	38.3	35.6	17.4	22.3	69.0	36.5
Mean	42.3	46.2	53.5	29.5	28.4	77.7	47.0
CV %	6.4	13.6	19.0	8.0	55.3	1.2	21.0
L.S.D.	6.1	NS	24.2	8.3	NS	10.9	6.9

Table 4. Test weight of grain sorghum (lb/bu) for dry-land tillage and crop rotation study at OPREC.

Tillage	2004	2005	2006	2007	2008	2009	Five-year
No-till	56.5	57.8	56.8	57.9	50.9	57.4	56.2
Minimum till	55.8	56.9	49.6	57.9	49.5	55.4	54.2
Mean	56.3	57.2	53.1	57.9	50.2	56.4	55.2
CV %	0.8	1.6	4.2	0.4	2.3	3.0	3.8
L.S.D.	NS	NS	5.0	NS	NS	NS	1.5

Planting Rate Considerations for Sunflowers

Chad Godsey, Rick Kochenower, Randy Taylor
Oklahoma State University

Objectives

A. Determine the optimum plant population for the 2 possible production scenarios, early-season production and double-crop sunflower production.

Methods

Plots were established at the Oklahoma Panhandle Research and Extension Center near Goodwell, OK. Treatments consisted of 5 seeding rates and two hybrids (R859HOCL and s672). Seeding rates were 12K, 15K, 18K, 21K, and 24K. Treatments were arranged in a randomized complete block with 4 replications. Plots were 10 ft wide and 25 ft in length. Plots were kept weed-free and sprayed for grassy weeds and insects as needed.

Results

Sunflower seed yield was lower than normal in 2009. Above normal precipitation and cooler fall temperatures were not conducive to a high yielding environment. Plant population had no consistent effect on yield (Figure 1). Hybrid s672 did have a significantly higher yield compared to R859HOCL.

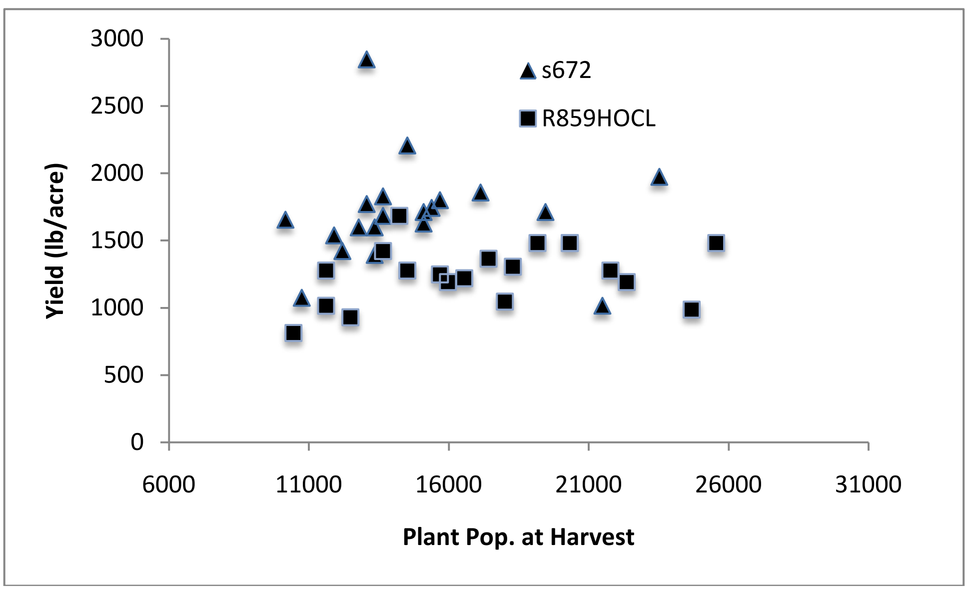


Figure 10. Sunflower seed yield at Goodwell in 2009.

This study needs to be conducted again in 2010 but yield seems relatively unaffected by sunflower plant population indicating that we may be able to reduce populations. A population of 15,000 plants/ac at harvest seems to be sufficient based on the data to date.

Double Crop Sunflower Seeding

Randy Taylor, Biosystems and Ag Engineering, Oklahoma State University, Stillwater
Chad Godsey, Plant and Soil Sciences, Oklahoma State University, Stillwater
Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell

Uniform stand establishment is critical to sunflower production. Poor emergence and non-uniform plant spacing leads to variability in head size. This variability will cause harvesting challenges due to moisture differences between head sizes. Furthermore, no-till seeding requires more focus on seed-soil contact and planter performance than conventional seeding. Since most sunflowers planted as a double crop will be no-tilled into wheat stubble an experiment was designed to evaluate the effect of planter attachments on seeding performance.

Methods

Sunflower was no-till seeded into wheat stubble as a double crop at two locations: a rainfed site near Covington, OK and an irrigated site at Goodwell, OK. All plots were planted with a 4-row John Deere 7300 row crop planter with a vacuum metering system (Deere & Co., Moline, IL) on 30 inch row spacing. Various planter attachments were used to assess their ability in providing faster and more uniform sunflower emergence. Factors included residue clearing (with and without row cleaner), seed firmer (with and without Keeton), closing wheel type (standard John Deere rubber and one standard Deere with one Martin spike), and speed (5 and 7 mph). The study was conducted as a full factorial experiment with 16 treatments and four replications at each site. The rainfed site was planted on July 10, 2009 at a seeding rate of 20500 seeds/ac and the irrigated site was planted July 22, 2009 at a seeding rate of 32500 seeds/ac. Plots at Goodwell were not irrigated until emergence was complete. Triumph 671 was planted at both locations.

Twenty feet of the two center rows of all plots were staked for stand counts. The spacing between plants was also measured in this area. Planter performance evaluation was based on percent emergence, emergence rate index (ERI), mean plant spacing, standard deviation in plant spacing, percent doubles, percent skips, and grain yield.

Results

Treatment yields for the irrigated site are shown in figure 1. Though the difference was not significant, the trend favors using a seed firmer. Using a seed firmer had no effect on evaluation parameters at either location, though the trends at both locations favored the use of a seed firmer.

Residue clearing wheels resulted in significantly slower emergence as measured by the ERI at the rainfed site. The plots where residue was removed from the seed row came up slower than the plots where it wasn't removed. At the irrigated site, residue cleaners resulted in greater emergence (6 points), closer plant spacing (0.5 in), lower standard deviation in plant spacing (0.7 in), fewer skips, but no difference in yield. Though there was no effect on yield the residue clearing wheels significantly improved down the row plant spacing uniformity.

Using one spiked closing wheel resulted in significantly faster emergence, as measured by the ERI, and higher yield (128 lbs/ac) at the rainfed site. It is possible that the hot temperatures following planting caused rapid soil drying and the spiked wheel helped avoid crusting. Though the spiked closing wheel had no significant effects at the irrigated site, the trends in yield (figure 1) and other performance criteria favored its use.

Operating at a slower speed (5 mph versus 7) had no significant effect on performance criteria at the rainfed site. The slower speed resulted in greater emergence percentage (6 points), closer plant spacing (0.3 in), and fewer skips at the irrigated site.

Though some treatments impacted stand establishment, none of the criteria were correlated with yield at either site.

Aside from the statistical significant findings, the trends at the rainfed site favor the use of a seed firmer and single spiked closing wheel, operating without residue cleaners and a faster planting speed. The trends at the irrigated site favor the use of a seed firmer, a residue cleaner and single spike closing wheel and a slower planting speed.

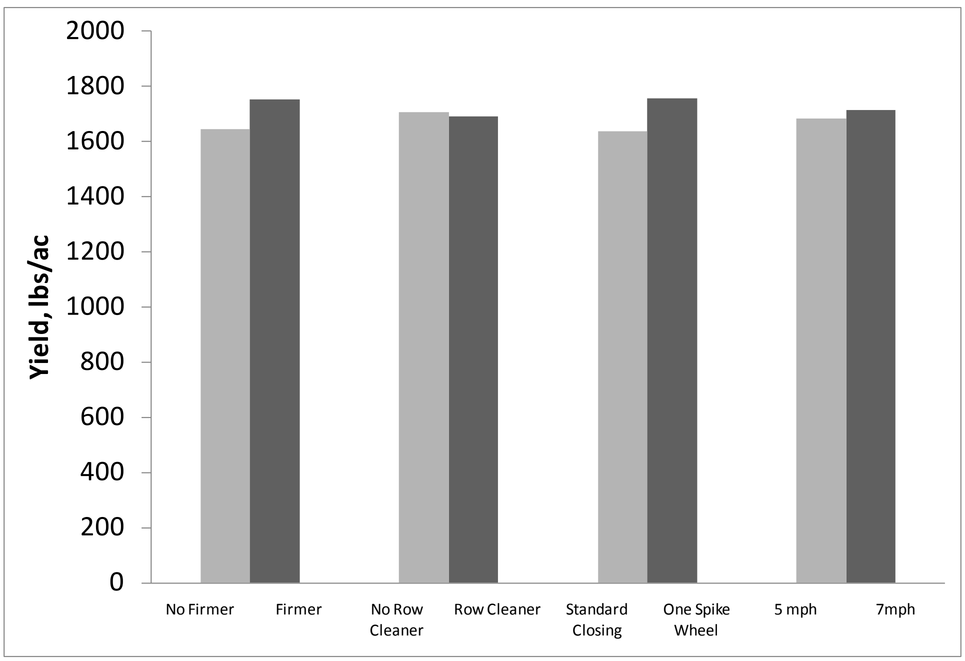


Figure 1. Treatment yields for the Goodwell site.

The mixed results among treatments at the two sites could be due to weather conditions following planting. Figure 2 shows the daily high temperature for the ten days after planting for the two locations. The average daily high temperature at the rainfed site for the ten days after planting was 99 degrees F while it was 87 degrees F at the irrigated site. Thus moving the residue with a row cleaner at the rainfed site exposed the seed trench to extreme heat. Though no measurements were made, these conditions could have ‘baked’ the soil in the row area and caused emergence problems.

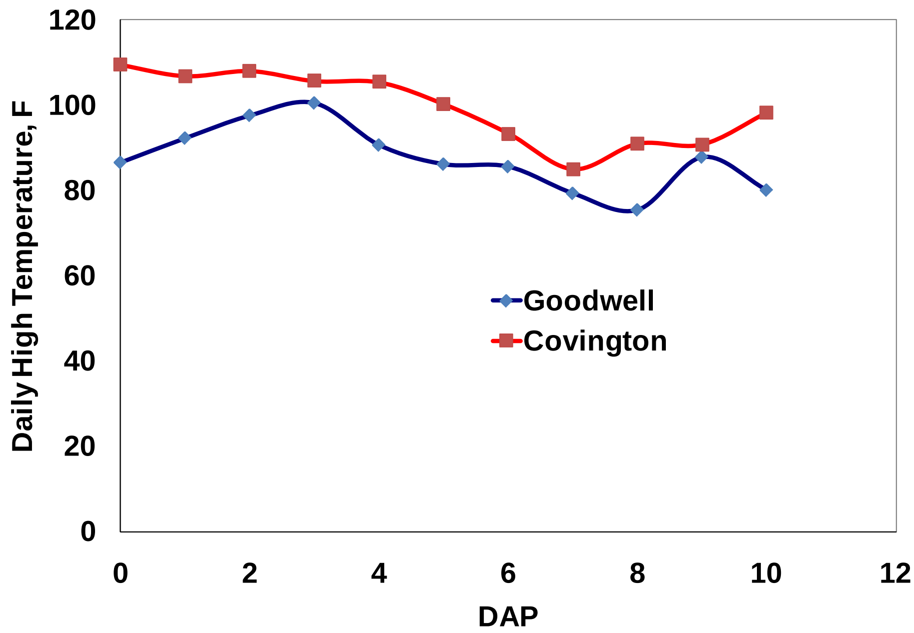


Figure 2. Daily high temperatures from Mesonet sites near each trial for the ten days after planting.

Conclusions

These results indicate that using a seed firmer and single spiked closing wheel improved planter performance. The trends at both sites (rainfed and irrigated) favored these items. However, residue clearing and operating speed had mixed results between the two sites. The inconsistency of residue clearing could have been caused by the difference in weather conditions following planting at the two sites. There was no plausible explanation for the different results for operating speed.

Acknowledgements

The authors would like to thank the National Sunflower Association for funding this research.

Comparing BTN to Fertilizer in Irrigated Grain Sorghum Production

Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell

In 2008 Bio Tech Nutrients (BTN) + Carbon Burst + Fungicide treatment was evaluated and compared to the standard fertilizer rate, and no fertilizer addition in irrigated grain sorghum. The BTN treatment was 2 gal/ac in furrow + 2 gal/ac broadcast at planting. Then one week after emergence another 2 gal/ac was applied. This was followed by a fungicide + carbon burst application 25 days after emergence and at flag leaf. The fertilizer rate was 150 lbs N/ac – soil test N + 20 lbs P_2O_5/acre. The last treatment was no fertilizer applied. These treatments were then harvested for grain yield, test weight, and grain moisture. Plots were 6 rows by 25 ft long, which were trimmed to 20 ft prior to harvest and the middle two rows harvested.

BTN is a product that has an analysis of 5-4-4-3, therefore total nutrients applied were N 2.7 lbs, P 2.2 lbs, K 2.2 lbs, and S 1.6 lbs. The fungicide and carbon burst (help with fungicide activity) are suppose to help by giving a healthier plant. Soil test results for each treatment are in (Table 1).

Table 1. Soil test results for the BTN study for 2009.

Treatment	N (lbs/ac)	P_2O_5 (lbs/ac)	K (lb/ac)	pH
Check no fertilizer	33	127	1,417	7.9
Fertilized plots	53	146	1,527	7.9
BTN	33	155	1,560	7.9

Results

After two years of testing the unfertilized plots have yielded as well as both the BTN and the fertilized plots (Table 2). There are two possible explanations for this, soil test are not determining the total N available, or being under irrigated condition N is being mineralized from the soil. When determining soil test N, it can be available deeper than is being sampled. BTN possibly may show a benefit under different condition that occurred at this site.

Table 2. Grain yield and harvest characteristics from BTN study at OPREC in 2008 and 2009.

Treatment	Grain yield (bu/ac)	Test weight (lb/bu)
BTN	100	56.0
Check	96	56.8
Fertilizer	92	55.8
Mean	96	56.2
CV %	10.5	2.5
L.S.D.	NS	NS

TIMING OF DRY-LAND STRIP-TILLAGE FOR GRAIN SORHUM PRODUCTION IN THE HIGH PLAINS

Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell

With the growing interest in strip-till throughout the high plains, a study was initiated in the fall of 2003 to determine if timing of strip-till would affect yield of dry-land grain sorghum. After three years it appeared that strip-till reduced grain yields when compared to no-till. But one question was not answered in the previous study was would strip-tilling just before planting reduced yields. Therefore in the summer of 2007 a new study with four dates of strip-tilling was initiated. The dates were immediately after wheat harvest, fall, spring, and on the same day as planting. The immediately after harvest date was selected for two reasons, generally a good time when producer have time do tillage and the chance to receive rainfall and replenish the tilled strips with moisture. The fall date was selected due data from the previous study, in 2005 yield for fall strip-till was same as no-till (Table 1). This can be explained by the strip-tillage having been done before a significant rainfall event in November of 2004. With the amount of rainfall received 3.51 inches the tillage strips were replenished with moisture before planting, therefore no reduction in grain yields was observed. The spring date was selected because again it is time when producers can do tillage work. One of the concerns many producers have with no-till is that nitrogen (N) is tied-up in the crop residue when surface applied or volatilized. Nitrogen tie-up and volatilization is greatly reduced with strip-till due to the N being placed below (generally 3 – 8 inches) seeding depth. Many irrigated producers in the region are doing strip-till from late fall to early spring. This original study was designed to determine what the affect of strip-till (no fertilizer applied) at different dates would have on grain sorghum yield. In the new study all fertilizer in the strip-till treatments is applies with the strip-till unit, and only the no-till fertilizer is applied on the surface. Grain sorghum was selected as the crop to be grown, because it is the most widely grown summer row crop in the region. Plots were four rows wide by 50 foot long and strip-tilled with an Orthman four-row one-tripper at a depth of 7 inches.

Table 1. Grain sorghum yield (bu/ac) for selected years from a timing of dry-land strip-till experiment at OPREC.

Timing	2004	2005	2006	Two-year
No-till	62.5 a[†]	81.7 a	80.1 a	74.8 a
March (spring)	47.6 b	77.6 a	54.1 b	59.1 b
September (fall)	45.5 b	66.9 a	56.6 b	57.9 b
January	42.1 b			
November	37.9 b			

[†]Yields with same letter not significantly different

Results

No data was collected in 2009 due to late planting.

Due to climate condition 2008 was not a great year to start a new study looking at strip-till. The planting date was delayed due to dry conditions until 1.29 inches of rainfall was received on June 20th. With the delay in planting grain sorghum yields were affected. Due to variation no statistical difference between any of the treatments was observed although the spring yield was lower numerically (Table 2). It appears that possibly doing strip-till immediately after harvest or at planting will have yields as high as no-till.

Table 2. Grain sorghum yield (bu/ac) for 2008 timing of dry-land strip-till experiment at OPREC.

Strip-till Timing	2008
At planting	50.7
After harvest	48.1
Fall	45.4
No-till	44.2
Spring	31.8

Expanding Production Area and Alternative Energy Crop Market of Proso Millet for Water Deficient Lands

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Proso millet is a low water-use, low input crop. It is an ideal crop for water deficient lands, such as contract-expired CRP lands. Expanding the production area of proso millet will require development of a new end-use market. Currently, proso millet is used almost exclusively for birdseed. The birdseed market is limited and expansion is improbable. The feed grain market with recent exponential growth is ethanol. Most ethanol production in the United States is from corn. If proso millet replaces some of the corn as an ethanol feedstock, expansion of proso millet production would occur. The purpose of this study is two-fold: 1) to determine if proso millet is viable crop outside of its traditional production area and 2) to determine if proso millet is a viable ethanol crop. If our objectives for proso millet are successful, production area expansion (into new dryland areas) and market expansion (as a new ethanol feedstock) will be realized.

Material and Methods

We planted proso millet at two sites, the Plainsman Research Center at Walsh, Colorado and the Oklahoma Panhandle Research and Extension Center at Goodwell, Oklahoma. We planted four proso millet cultivars at four incremental planting dates throughout July, 2009. Three of the cultivars were standard starch cultivars: Huntsman, Sunrise, and Horizon. The fourth cultivar was a waxy starch cultivar, Plateau. The four planting dates at Walsh were: PD1, July 1; PD2, July 10; PD3, July 20; and PD4, July 31, 2009. The four planting dates at Goodwell were: PD1, July 7; PD2, July 14; PD3, July 21; and PD4, July 28, 2009. The experimental designs were split-plots with planting dates as the main plot and cultivars as the subplots with four replications. The plot size at Walsh was 10 ft. by 50 ft. (harvested 10 ft. by 44 ft.). The plot size at Goodwell was 5 ft. by 35 ft. (harvested 5 ft. by 30 ft.). Both sites were irrigated to assure seed germination. All cultivars and planting dates were seeded at 15 lb/a. Nitrogen was the only fertilizer applied, 50 lb/a at Walsh and 100 lb/a at Goodwell. For weed control at Walsh, the entire site had a preplant application of glyphosate 24 oz/a and 2,4-D ester 0.5 lb/a, and a post emergence application of dicamba 4 oz/a and 2,4-D amine 0.38 lb/a. For weed control at Goodwell, the entire site had a preplant application of atrazine 1.0 lb/a, and no post emergence herbicides were applied. Both sites were harvested with a self-propelled combines equipped with conventional grain heads. Grain yields, test weights, and seed moistures were recorded. The harvest dates at Walsh were: PD1, September 29; PD2, October 16; PD3 and PD4, October 17. The harvest dates at Goodwell were: PD1, September 14 and PD3 October 19. At Goodwell, the July 14 planting date (PD2) did not establish an adequate stand and was eliminated from the study, and the July 28 planting date (PD4) was not harvested because of excessive rainfall.

Results

The first planting dates at both sites produced the highest average grain yield, 1645 lb/a at Walsh and 1450 lb/a at Goodwell (Tables 1 and 2). The planting date ranking for grain yield at Walsh was: PD1>>PD2>PD3=PD4 (Table 3). The planting date ranking at Goodwell was PD1>PD3 (Table 4). Huntsman produced the highest yield at all harvested planting dates at both sites, although Huntsman was not significantly different than Sunrise at Walsh, and Huntsman only significantly out yielded Plateau at Goodwell. Grain yield ranking of the four cultivars was consistent for all four planting dates at Walsh: Huntsman=Sunrise>Horizon>Plateau (Table 3 and Figure 1). The relative ranking of the four cultivars for the two harvested planting dates at Goodwell was: Huntsman>Sunrise=Horizon>Plateau, although the only significant difference was between Huntsman and Plateau (Table 4 and Figure 3).

Test weights significantly decreased with later planting dates at Walsh (Table 3 and Figure 2), but increased, although not significantly, between the two harvested planting dates (PD1 and PD3) at Goodwell (Table 4 and Figure 3). Huntsman had the highest overall test weight at both sites, 56.9 lb/bu at Goodwell and 54.6 lb/bu at Walsh.

The first two planting dates and the last two planting dates at Walsh had similar lodging percentages, PD1, 9.1%; PD2, 9.2%; PD3, 4.4%; and PD4, 5.3% (Table 1). Of the four cultivars, Plateau had the highest plant lodging at all planting dates and was the only cultivar that had double-digit lodging.

Plant height consistently decreased with later planting dates at Walsh (Table 1). The plant height ranking from tallest to shortest was: Huntsman, Sunrise, Horizon, and Plateau.

At Walsh, date to 50% heading averaged 33 days after planting (DAP) for all planting dates and cultivars (Table 1). With later planting dates, date of 50% heading became increasingly earlier for all cultivars, except Plateau. Plateau was the earliest maturing cultivar tested and its date to 50% heading remained at 30 to 31 DAP for the first three planting dates then dropped to 29 DAP at the last planting date. Date to 80% maturity, when the crop was ready for swathing, averaged 61 DAP for all planting dates and cultivars. Like heading, date to 80% maturity was earlier with later planting dates for all cultivars, except Plateau. Date of maturity of Plateau remained 58 to 59 DAP for all four planting dates.

Discussion

For the first year of this study, we evaluated only July planting dates for proso millet production. The first planting dates (July 1 for Walsh and July 7 for Goodwell) produced the highest yield. There was a significant yield decrease between PD1 and PD2 at Walsh (990 lb/a yield drop), and the yield difference between the two harvested planting dates (PD1 and PD3) at Goodwell of 267 lb/a was also significant. This suggests that early July planting is critical for high yields at Walsh and Goodwell, but with the small yield decrease, the planting window maybe longer at Goodwell. Test weights decreased significantly with later planting dates at Walsh, but they actually increased at Goodwell, although the test weight increase was not significant. Delayed planting, past early July, does not appear to have the severe yield and test weight penalty at Goodwell as it does at Walsh. Nonetheless, the highest yield averages were from the first planting dates at both sites. From these initial results, we recommend planting proso millet no later than early July. This recommendation may change with the greater range of planting dates planned for next year and with ethanol yield analyses from the various planting dates.

Of the four proso millet cultivars tested, Huntsman had the highest average yield at both sites. However, Huntsman did not have significantly higher yield than Sunrise at Walsh, and Huntsman was only significantly better than Plateau at Goodwell. The cultivar choice for high yields is not as evident as is the choice for planting date. This year, Huntsman appears to have a marginal yield advantage compared to the other three cultivars. Cultivar choice may change with the results from the expanded planting dates planned for next year. Also, after fermentation and distillation of the harvested grain, the cultivars may more readily be separated by their ethanol production.

Table 1.--Proso Millet: Planting Dates and Cultivars, Walsh, CO, 2009.

Cultivar	Seed Yield	Test Weight	Moisture	Lodging	Plant Height	50% Heading	80% Maturity
	lb/a	lb/bu	%	%	in	DAP	DAP
PD1 - July 1							
Huntsman	2137	56.5	12.9	3.5	27	39	66
Sunrise	1956	56.3	13.1	5.3	26	38	65
Horizon	1411	56.0	13.0	7.5	24	36	64
Plateau	1076	53.5	12.9	20.0	21	30	58
PD1 Average	**1645**	**55.6**	**13.0**	**9.1**	**25**	**36**	**63**
PD2 - July 10							
Huntsman	981	55.8	14.4	4.3	21	36	63
Sunrise	940	54.5	14.3	4.5	20	35	62
Horizon	490	54.4	14.3	0.5	19	34	61
Plateau	208	54.1	14.8	27.5	16	30	58
PD2 Average	**655**	**54.7**	**14.5**	**9.2**	**19**	**34**	**61**
PD3 - July 20							
Huntsman	429	54.1	14.8	0.0	18	34	62
Sunrise	399	53.9	14.7	0.0	16	34	62
Horizon	139	55.0	14.7	0.0	16	33	61
Plateau	151	53.5	14.6	17.5	13	31	59
PD3 Average	**280**	**54.1**	**14.7**	**4.4**	**16**	**33**	**61**
PD4 - July 31							
Huntsman	365	51.9	17.1	0.0	16	32	59
Sunrise	316	51.5	17.3	3.0	14	32	59
Horizon	229	51.3	16.9	3.0	15	30	58
Plateau	201	50.7	16.9	15.0	12	29	58
PD4 Average	**278**	**51.4**	**17.1**	**5.3**	**14**	**31**	**59**
Average	714	53.9	14.8	7	18	33	61
LSD 0.05	272.1	0.94	0.71	8.71			

Harvested: PD1, Sept. 29; PD2, Oct. 16; PD3, Oct. 17; PD3, Oct. 17, 2009.
DAP is days after planting.
Seed yields adjusted to 13% seed moisture content.

Table 2.--Proso Millet Planting Dates and Cultivars Seed Yield Summary at Goodwell, OK, 2009.

Cultivar	--------PD1 - July 7-------			--------PD3 - July 21------		
	Seed Yield	Test Weight	Moisture	Seed Yield	Test Weight	Moisture
	lb/a	lb/bu	%	lb/a	lb/bu	%
Huntsman	1686	56.4	14.4	1558	57.3	13.3
Sunrise	1498	54.8	14.0	1065	57.6	12.9
Horizon	1450	55.4	13.6	1234	55.5	13.0
Plateau	1168	52.4	13.2	873	54.7	12.4
Mean	1450	54.8	13.7	1183	56.3	12.9
LSD 0.05	NS	NS	0.4	NS	NS	NS
CV %	23	3	2	27	3	16

Seed Yield is adjusted to 13.0% seed moisture content.

Table 3.--Proso Millet Planting Dates and Cultivar Summary at Walsh, 2009.

	Seed Yield		Test Weight		Seed Moisture	
	lb/a		lb/bu		%	
Planting Date						
PD1 - July 1	1645	a	55.6	a	13.0	a
PD2 - July 10	655	b	54.7	b	14.4	b
PD3 - July 20	280	c	53.9	c	14.7	b
PD4 - July 31	278	c	51.3	d	17.0	c
PD LSD 0.05	160.8		0.44		0.35	
Cultivar						
Huntsman	978	a	54.6	a	14.8	a
Sunrise	903	a	54.0	b	14.8	a
Horizon	567	b	53.9	b	14.7	a
Plateau	409	c	53.0	c	14.8	a
Cultivar LSD 0.05	135.2		0.49		0.37	
Average	715		53.9		14.8	

Seed Yield is adjusted to 13% seed moisture content.

Table 4.--Proso Millet Planting Dates and Cultivar Summary at Goodwell, 2009.

	Seed Yield		Test Weight		Seed Moisture	
	lb/a		lb/bu		%	
Planting Date						
PD1 - July 7	1450	a	54.7	b	13.8	a
PD3 - July 21	1183	b	56.3	a	12.9	a
PD LSD 0.05	91.2		2.31		2.33	
Cultivar						
Huntsman	1622	a	56.9	a	13.8	a
Sunrise	1282	ab	56.3	a	13.5	a
Horizon	1342	ab	55.4	ab	13.3	a
Plateau	1021	b	53.5	b	12.8	a
Cultivar LSD 0.05	354.0		1.97		1.88	
Average	1317		55.5		13.4	

Seed Yield is adjusted to 13% seed moisture content.

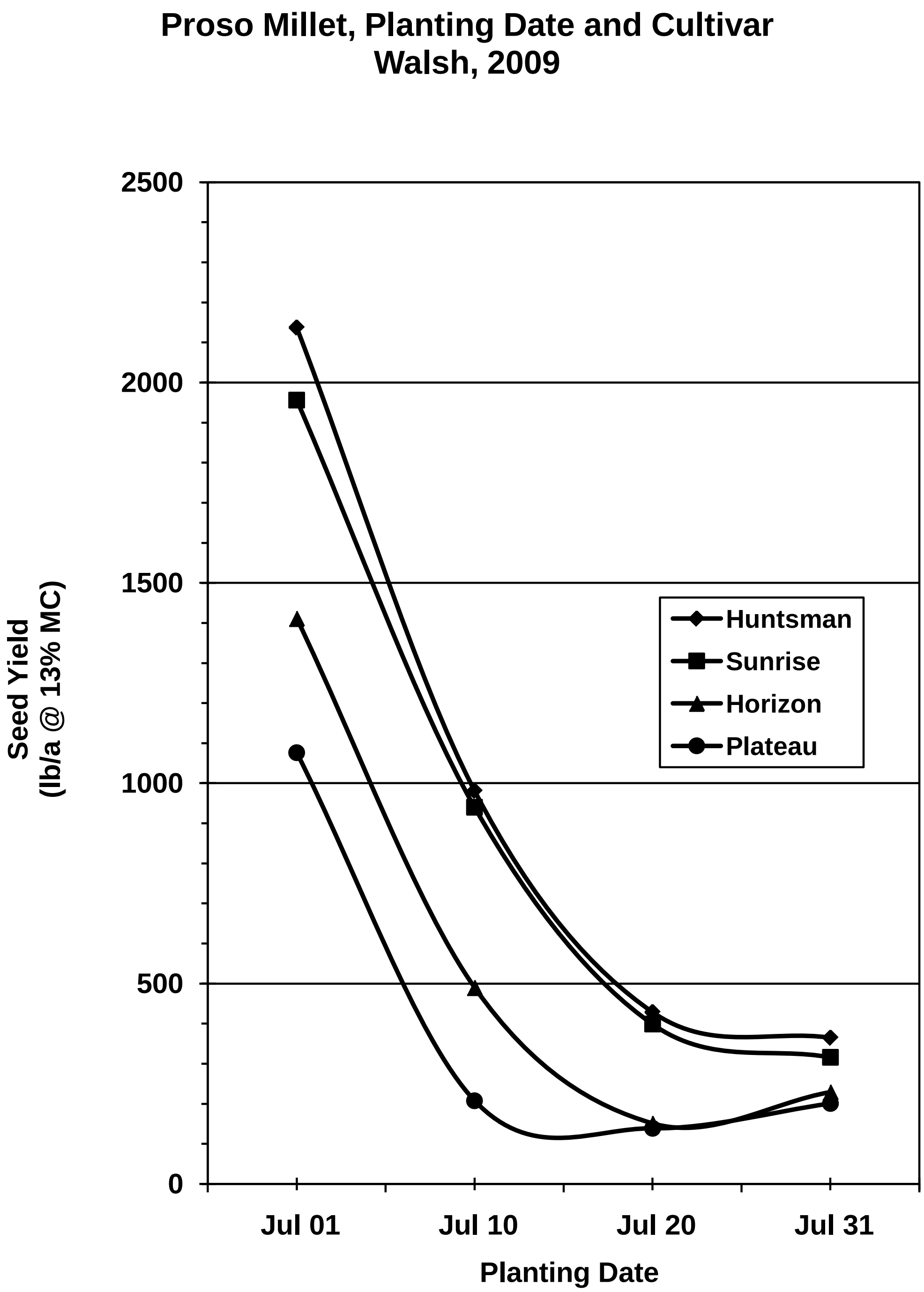

Fig. 1. Seed yield of proso millet planting dates and cultivars for ethanol production study at Walsh, CO, 2009. The planting dates were: PD1, July 1; PD2, July 10; PD3, July 20; and PD4, July 31. The cultivars were: Huntsman, Sunrise, Horizon, and Plateau. All planting dates and cultivars were seeded at 15 lb/a. Harvest dates were: PD1, September 29; PD2, October 16; PD3 and PD4, October 17.

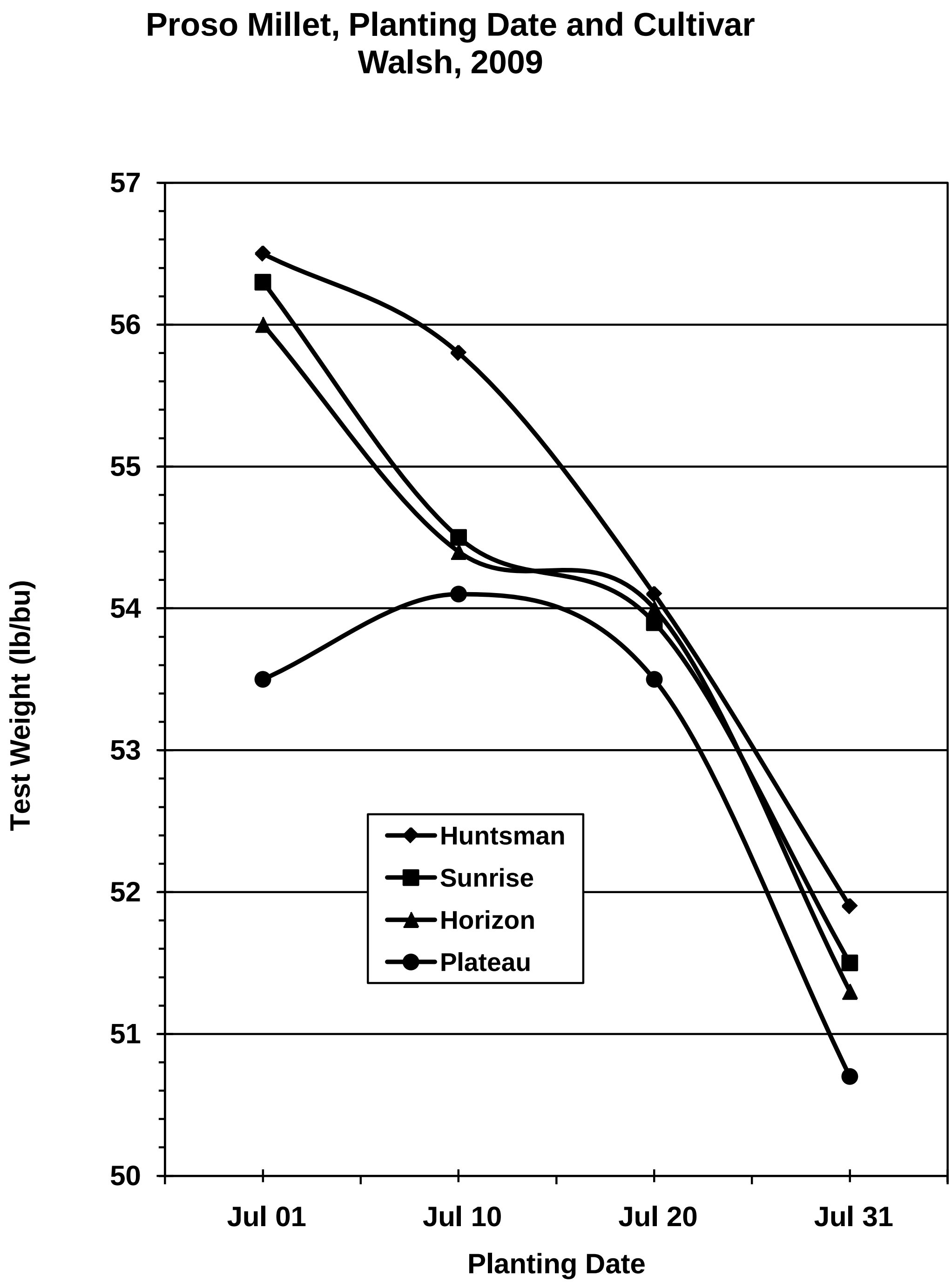

Fig. 2. Test weight of proso millet planting dates and cultivars for ethanol production study at Walsh, CO, 2009. The planting dates were: PD1, July 1; PD2, July 10; PD3, July 20; and PD4, July 31. The cultivars were: Huntsman, Sunrise, Horizon, and Plateau. All planting dates and cultivars were seeded at 15 lb/a. Harvest dates were: PD1, September 29; PD2, October 16; PD3 and PD4, October 17.

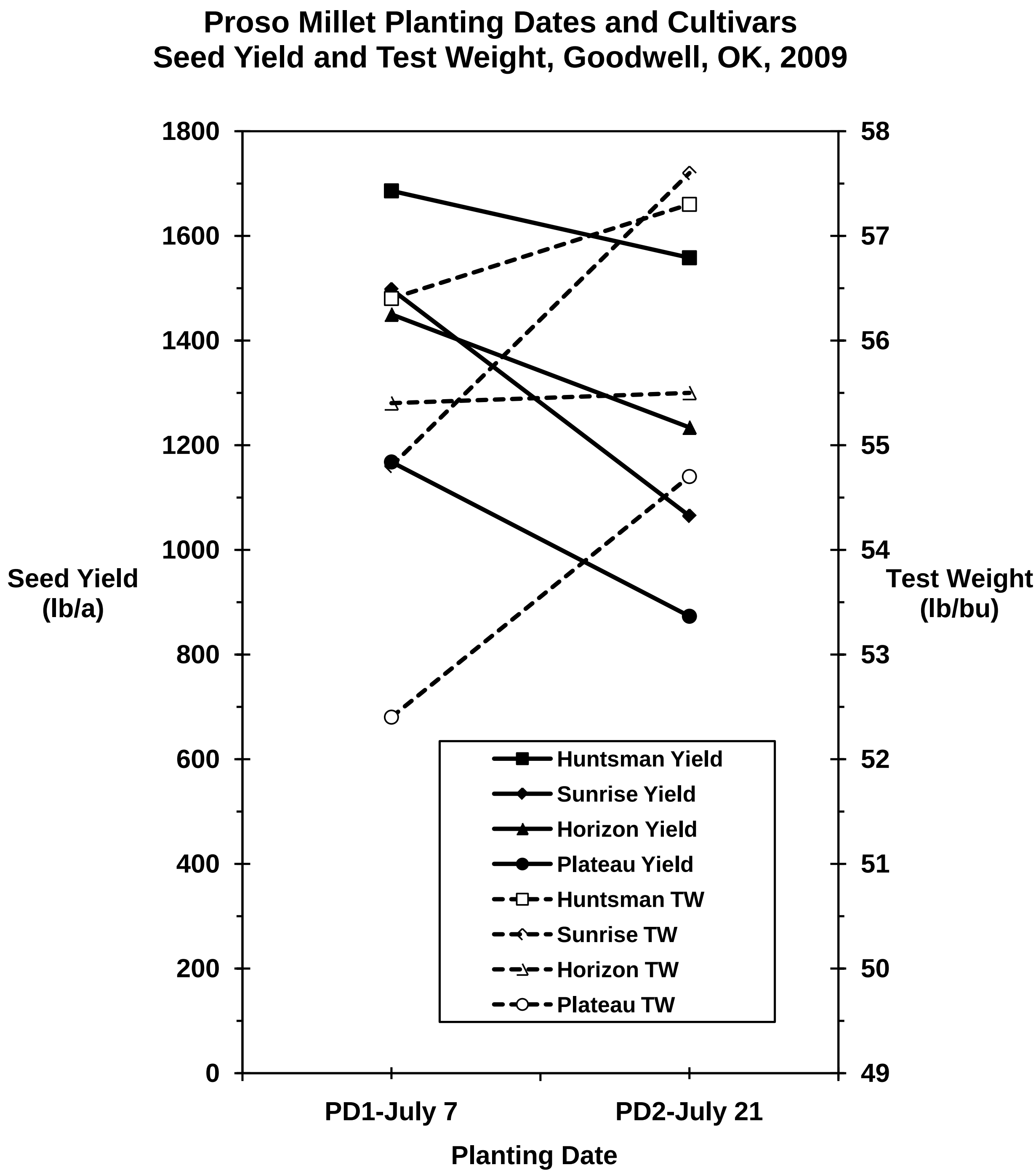

Fig. 3. Seed yield and test weight of proso millet planting dates and cultivars for ethanol production study at Goodwell, OK, 2009. The harvested planting dates were: PD1, July 7; and PD3, July 21, 2009. The cultivars were: Huntsman, Sunrise, Horizon, and Plateau. All planting dates and cultivars were seeded at 15 lb/a. Harvest dates were: PD1, September 14; and PD3, October 19. Seed yield is adjusted to 13.0% seed moisture content.

Timing of Irrigation for Limited Irrigated Grain Sorghum

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With dwindling water supplies and the increased focus on grain sorghum as a bio-fuels crop, utilizing limited irrigation will become more important in the coming years. Grain sorghum is a drought tolerant crop that responds well to irrigation. Most recommendations for limited irrigation have focused on applying irrigation for adequate soil moisture at early boot to heading stage of development (approx. 55 days after emergence). This recommendation misses the critical stage of development when the plant goes from vegetative to reproductive (approx. 30 days after emergence). This stage is when head size and number of seeds per head is determined. Therefore inadequate soil moisture could reduce yield in one of two ways, smaller heads or reduced number of seeds per head. In 2009 a study was established at the Oklahoma Panhandle Research and Extension Center (OPREC) to determine the effectiveness of irrigation timing with limited irrigation (9 total inches for treatment receiving all irrigation). Treatments were no irrigation at 30 or 55 days (6.5 inches), no irrigation at 30 days + irrigation at 55 days (7.75 inches), irrigation at 30 days + none at 55 days (7.75 inches), and irrigation at both 30 and 55 days (9.0 inches). Plots were 600 ft long by 8 rows wide, with the middle four rows harvested for grain yield, test weight, and grain moisture. Plots were planted below a lateral move irrigation system and valves were turned on and off to achieve selected irrigation timings.

Results

From the first year of the study it appears that irrigation at either period is important. The only difference observed in grain yield was the treatment with no irrigation at either 30 or 55 days when compared to irrigation at 55 days and for both dates (Table 1). This yield difference may also be attributed to the decreased amount of irrigation received 6.5 inches compared to 9.0 inches for all irrigation timings. When comparing treatments based on bushels of grain produced per inch of irrigation, irrigation at 55 days and no irrigation at either date were comparable at 17.8 bu/inch and 17.5 bu/inch respectively. The least efficient use of water was actually when irrigation was applied at both 30 and 55 days, with a yield of 15.3 bu/inch of irrigation. When irrigation was applied at 30 days and none at 55 the yield was 16.4 bu/inch. These yields may have been a one year phenomenon, because the soil profile was full at planting. The amount of rainfall received was below the long-term mean, for May through September, 6.68 inches compared to 13.1, although

85% was received during the period of June through August. This rainfall was optimum for use by the sorghum crop. Also in 2009 rainfall and irrigation never occurred at the same time, which allowed for the irrigation at selected dates to be expressed. This study will be continued in 2010.

Table 1. Grain characteristics from timing of limited irrigation study at OPREC in 2009.

Irrigation treatment (days)	Grain yield (bu/ac)	Test weight (lb/bu)	Harvest moisture %
none @ 30 + 55	138	61	14.4
@ 30 + 55	138	61	14.6
@ 30 + none @ 55	127	61	14.4
none @ 30 or 55	114	61	14.2
Mean	130	61	14.4
CV %	6	1	1
L.S.D	16	NS	NS

No difference was found in test weight or harvest moisture.

Supplemental Vitamin E Concentration in Beef Finishing diets Containing Wet Distillers Grains with Solubles: Feedlot Performance and Carcass Characteristics

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Abstract

The objective of this study was to evaluate feedlot performance and carcass characteristics of finishing beef steers fed diets containing wet distiller's grains with solubles (WDGS) and supplemented with vitamin E to target improvements in meat quality. One hundred ninety-nine steers (BW = 800 ± 68.5 lb) of mixed *Bos indicus*, *Bos taurus,* and *Bos indicus x Bos taurus* breeding were blocked by body weight and randomly assigned to 1 of 4 supplemental vitamin E levels (0, 125, 250, and 500 IU/hd/day) fed for the last 97 days of the feeding period. Two blocks were fed for a total of 129 d and 3 blocks were fed for a total of 150 d. Steers were fed a rolled corn-based finishing diet with 35% WDGS and 7% ground alfalfa (DM basis). Individual body weights were measured initially on two consecutive days, the initial day of vitamin E supplementation, and the day of harvest. Carcass data were collected at harvest. There were no differences in ADG, G:F, and DMI for the pre-vitamin E supplementation period, the vitamin E supplementation period, or over the entire feeding period ($P \geq 0.11$). Final BW, HCW, and carcass-adjusted final BW did not differ among treatments ($P \geq 0.06$). Carcass characteristics (LM area, fat thickness, calculated YG, and KPH) were not affected by treatment ($P \geq 0.13$). Percentage of cattle grading upper 2/3 choice, low choice, and select did not differ ($P \geq 0.57$), nor did percentage calculated yield grades 2, 3, and 4 ($P \geq 0.07$). Data from this study illustrate that vitamin E can be supplemented in WDGS diets during the last 97 days of the feeding period to target improvements in meat quality with no adverse effects on animal performance or carcass characteristics.

Key Words: beef cattle, feedlot, distiller's grain, vitamin E, performance, carcass merit

Introduction

As the ethanol production industry continues to expand, the availability and cost effectiveness of ethanol co-products continues to push cattle producers to include the co-products in finishing diets across the U.S. Current industry trends are supported by Oklahoma State University research in that, at least with flaked corn based finishing diets, addition of wet distiller's grains increases anti-quality characteristics in meat. Our research and a recent Nebraska research (de Mello et al., 2008) suggest that cattle fed higher levels (20 to 40%) of wet distillers grains increases the oxidation of meat which results in faster color deterioration in meat products. More rapid deterioration of color results in shorter periods of time in which retailers have to market the products as consumers use color as an important factor in purchasing decisions. While it is difficult to get a hold of the actual dollars lost in the industry due to color instability and, as such, discards or discounts from the meat case, retails are quick to state that the addition of 6 h of shelf life for steaks and 2 h of shelf life for ground beef makes a major economic contribution to their bottom line.

Given the increasing availability and use of distiller's grains across the country and particularly in the Southern Plains region, it is critical to evaluate the impact of potential pre and post-harvest

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interventions on maintaining color stability, and subsequently, the palatability of steaks processed using these interventions. Previous research has shown that supplemental dietary vitamin E consistently improves color retention and shelf life of steaks in cattle fed diets (Roeber et al., 2001; Sanders et al., 1997), but limited data exists for the impact of vitamin E in combination with distiller's grains.

As such, the objective of this study was to evaluate feedlot performance and carcass characteristics of finishing beef steers fed diets containing wet distiller's grains with solubles (WDGS) and supplemented with vitamin E to target improvements in meat quality.

Material and Methods

One hundred ninety nine steers (721 lb initial weight) of mixed Bos indicus, Bos taurus, and Bos indicus x Bos taurus breeding arrived at the Oklahoma Panhandle Research and Extension Center feedlot from wheat pasture in the Texas panhandle on February 10, 2009. Approximately eighteen hours after arrival, steers were individually identified with an uniquely numbered ear tag, weighed, vaccinated with Vista 5 SQ (Intervet/Schering Plough Animal Health, Roseland, NJ), dewormed with Ivomec Plus (Merial, Deluth, GA), and implanted with Revalor-XS (200 mg trenbolone acetate and 40 mg estradiol; Intervet/Schering Plough Animal Health). After processing, steers were housed in 20 open lot pens and limit fed a mixed ration containing 62% cracked corn, 30% alfalfa, and 8% supplement (DM basis) and was fed at 2% of BW for 38 days before initiation of the trial. The supplement was formulated to supply 22 g/ton of monensin and 7.9 g/ton of tylosin in the diet.

At the end of the pre-trial period, the steers were weighed on two successive days (March 19 and 20 (800 ± 68.5 lb), sorted into five weight blocks based on the first days BW, and randomly assigned to pens (4 pens/block, 9 or 10 steers/pen). Within block, pens were randomly assigned to one of four dietary vitamin E treatments: 0, 125, 250, or 500 IU/steer/day. The trial was initiated on March 20. The steers were adapted to a 93% concentrate finishing diet (Table 1) using 3 transition diets; with the first diet containing 68% concentrate (12 d), the second diet containing 76% concentrate (5.5 d), and the third diet containing 84% concentrate (5 d). The final finishing diet was formulated to meet or exceed NRC (2000) requirements and contained monensin and tylosin (Elanco Animal Health, Greenfield, IN; 33.5 and 10.6 g/ton, respectively, on a 90% DM basis).

During the trial, the cattle were fed twice daily (0730 and 1300) in quantities sufficient to ensure ad libitum consumption. Feed bunks were evaluated visually each day of the experiment at 0700 to determine the quantity of feed to offer each pen. The bunk management strategy was designed to allow for 0 to 2 lb of feed remaining at the time of evaluation. Diets were mixed using a Roto-Mix 184-8 mixer wagon (Roto-Mix, Dodge City, KS). All pharmaceuticals and supplemental vitamins and minerals were contained in fine ground corn based supplements mixed at the Oklahoma State University Feed Mill.

Blocks 1 and 2 and 3, 4 and 5, were started on the various vitamin E treatments on days 32 and 53 of the trial, respectively. All pens were subject to their respective vitamin E treatment feedings during the last 97 days prior to harvest. Rations were top dressed in the bunk with 0.45 lb/hd/feeding of their respective treatment vitamin E supplement, which was fine ground corn with the appropriate amount of vitamin E premix. The top dressed supplement was immediately mixed with the ration by hand.

Dry matter determination (105°C for 5 h) was conducted weekly on wet distiller's grains samples and used to adjust as fed rations. Feed bunks were cleaned, and orts weighed before feeding on each weigh day and as needed to ensure feed quality. Samples of orts were dried and unconsumed feed weight collected was corrected for moisture content. Dry orts were subtracted from DM delivery for determination of pen DMI. Animals had ad libitum access to water via an automatic water basin located along the fence line and shared between 2 adjacent pens.

Blocks 1 and 2 were on feed for a total of 129 days. Blocks 3, 4, and 5 were fed for a total of 150 days. The morning of the day of slaughter, cattle were individually weighed. All performance calculations were determined using the average of the trial initiation BW with a 2% pencil shrink and the interim and final BW with a 4% pencil shrink. All cattle were transported to an Excel Beef slaughter facility in Dodge City, KS.

Results and Discussions

The effects of feeding supplemental vitamin E on steer performance are presented in Table 2. There were no differences in ADG, G:F, and DMI for the pre-vitamin E supplementation period, the vitamin E supplementation period, or over the entire feeding period ($P \geq 0.11$). Final body weight averaged 1379 lb and did not differ among treatments. ADG, G:F, and DMI over the entire feeding period averaged 4.10 lb/day, 0.165, and 24.89 lb/day, respectively.

The effects of feeding supplemental vitamin E on carcass characteristics are presented in Table 3. Hot carcass weight averaged 887 lb and did not differ among treatments ($P \geq 0.06$). The average dressing percentage was 64.32%. Carcass characteristics (LM area, fat thickness, calculated YG, and KPH) were not affected by treatment ($P \geq 0.13$). Percentage of cattle grading upper 2/3 choice, low choice, and select did not differ ($P \geq 0.57$), nor did percentage calculated yield grades 2, 3, and 4 ($P \geq 0.07$). The percentage of cattle grading low choice or better in this trial was 64.1%.

In summary, data from this study illustrate that vitamin E can be supplemented in WDGS diets during the last 97 days of the feeding period to target improvements in meat quality with no adverse effects on animal performance or carcass characteristics.

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Table 1. Composition and formulated nutrient content of diets (DM basis).

	Ration			
Item	Step-up #1	Step-up #2	Step-up #3	Final
Ingredient				
Rolled corn	30.00	38.00	46.00	55.00
Alfalfa	32.00	24.00	16.00	7.00
WDGS	35.00	35.00	35.00	35.00
Supplement	3.00	3.00	3.00	3.00
Nutrient Composition				
DM, %	57.34	57.27	57.20	57.12
CP, %	19.55	18.76	17.98	17.10
Ca, %	1.23	1.08	0.93	0.76
P, %	0.46	0.46	0.46	0.46
K, %	1.13	1.01	0.89	0.75
S, %	0.40	0.38	0.37	0.35
Fat, %	6.14	6.27	6.40	6.54
Supplement Composition, % of DM				
Ground Corn		34.308		
Urea		3.333		
Limestone		50.133		
Potassium chloride		1.967		
Salt		8.333		
Rumensin 80		0.633		
Tylan 40		0.400		
Thiamine 10		0.020		
Vitamin A 30,000		0.123		
Copper sulfate		0.119		
Manganous oxide		0.208		
Zinc oxide		0.231		
Magnesium oxide		0.008		
Selenium 600		0.183		

Table 2. Effects of supplemental vitamin E level on performance of feedlot steers.

	Supplemental vitamin E, IU/hd/day					
	0	125	250	500	SE	p-value
Body Weights, lb[1]						
Initial	800.1	799.3	801.1	798.8	33.1	0.9312
day 32 or 53[2]	1010.3	1003.9	1023.3	1007.0	28.5	0.4937
Final[3]	1370.5	1381.5	1375.0	1347.5	39.8	0.3420
Adj. Final[4]	1372.4	1349.4	1401.0	1391.6	41.5	0.0571
ADG, lb						
d 0 to vitamin E start	4.82	4.73	5.00	4.85	0.333	0.7704
Vitamin E to end	3.80	3.68	3.79	3.89	0.140	0.3742
d 0 to end	4.10	3.98	4.17	4.15	0.166	0.3449
Adj. d 0 to end[4]	4.06	3.91	4.25	4.22	0.185	0.0299
DMI, lb/d						
d 0 to vitamin E start	25.21	24.93	26.09	25.07	1.205	0.2389
Vitamin E to end	24.07	24.27	24.43	24.31	1.053	0.6027
d 0 to end	24.60	24.60	25.38	24.99	0.977	0.1018
G:F						
d 0 to vitamin E start	0.191	0.189	0.192	0.192	0.007	0.9799
Vitamin E to end	0.158	0.152	0.155	0.160	0.004	0.2915
d 0 to end	0.167	0.162	0.165	0.166	0.003	0.5530
Adj. d 0 to end[4]	0.165	0.159	0.168	0.168	0.003	0.0648

[1]Initial weight is presented with a 2% pencil shrink. All body weights after initial are presented with a 4% pencil shrink.
[2]Day 32 for blocks 1 and 2 and day 53 for blocks 3, 4, and 5. Vitamin E supplementation began on this weigh day.
[3]Cattle in block 1 and 2 were on feed 129 days and cattle in blocks 3, 4, and 5 were on feed 150 days.
[4]Adjusted final weight was calculated from hot carcass weight divided by the average dressing percent (64.32%) of all the cattle after which ADG and F:G values were recalculated using the adjusted final weight.

Table 3. Carcass characteristics of steers fed supplemental vitamin E.

	Supplemental vitamin E, IU/hd/day					
	0	125	250	500	SE	p-value
Hot carcass weight, lb	882.7	867.9	901.1	895.1	26.7	0.0571
Dressing percent	64.0	63.8	64.8	64.6	0.43	0.1543
Fat thickness, in	0.52	0.51	0.58	0.53	0.025	0.1844
% KPH	2.28	2.32	2.26	2.48	0.085	0.1264
LM area, in^2	14.63	14.57	14.62	15.12	0.383	0.6058
Yield grade	3.41	3.34	3.48	3.45	0.065	0.3690
Marbling score*	439	426	423	442	12.3	0.6249
USDA upper 2/3 choice, %	24.5	12.2	12.8	21.3	6.14	0.5687
USDA low choice, %	42.9	42.9	53.2	46.8	7.28	0.7654
USAD Select, %	32.7	44.9	34.0	31.9	7.11	0.6619
USDA Yield Grade 2, %	6.3	24.5	10.6	6.4	6.14	0.3937
USDA Yield Grade 3, %	81.4	61.3	70.6	83.3	7.88	0.068
USDA Yield Grade 4, %	12.4	14.1	18.8	6.2	6.26	0.3299

*Marbling score: 300 = slight; 400 = small.

Extension Reports

EXTENSION

Oklahoma Small Grains Variety Performance Tests 2008-2009

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Great Plains Technology Center, Frederick

Bryan Vail, Apache

CONTENTS

Protein data will be reported in a separate publication in August of 2009

This and other wheat-related publications can be found at:

www.wheat.okstate.edu

2009 WHEAT CROP OVERVIEW

The 2008-2009 Oklahoma wheat crop will go down as one of the smallest crops on record. Oklahoma weather can be tough, and it is not uncommon for Oklahoma wheat producers to face drought, flood, disease, hail, cool weather, heat, and late-spring freezes. It is uncommon, however, for them to face all of these events during the same wheat production season. This perfect storm of adverse weather conditions devastated the 2008-2009 wheat crop.

A few timely rainfalls in September and October meant that conditions for sowing were generally favorable in areas north of Highway 51. South of highway 51 the rainfall events were less frequent, so good timing and a lot of luck were required to obtain adequate stands of wheat. Once wheat emerged, growth was slowed by dry soil conditions, inadequate rainfall, and limited soil nitrogen. Combined, these made for a lackluster fall forage production season in most of the state. Rainfall data are presented in Figure 1, and more information on fall forage production by winter wheat varieties in 2008 can be found in OSU Current Report # 2141.

Nitrogen fertilizer prices were still relatively high during sowing in 2008, and many producers opted to forgo pre-plant nitrogen fertilizer. This choice resulted in nitrogen-hungry wheat fields and was compounded by poor root growth and inadequate soil moisture limiting availability of soil nitrogen. Nitrogen prices moderated somewhat by topdress time and most producers chose to apply some topdress nitrogen during winter. Reports from sensor-based nitrogen trials in growers' fields around the state, however, indicate that the nitrogen requirement for wheat this year was greater than normal, and most producers under fertilized.

Several insect pests were present during the 2008-2009 production year. Moderate to severe drought prevented wheat from outgrowing damage caused by winter grain mites and brown wheat mites in some areas of the state. Aphids were present across most of the state, and fields infected with barley yellow dwarf were easy to find after greenup in the spring of 2009. While wheat streak mosaic virus, high plains virus, and Triticum mosaic virus were present in the Panhandle, some fields infected with barley yellow dwarf virus were misdiagnosed as having one of the other three viruses. Tissue samples revealed that other fields were affected by a complex of two or more of these viral diseases.

Hessian fly was barely a blip on the radar screen of Oklahoma wheat producers five years ago. Increased adoption of conservation and no-tillage production practices, however, has made Hessian fly a force to be reckoned with in Oklahoma. In fact, there were several reports of fields being “zeroed out” in southwest Oklahoma due to Hessian fly damage. Growers impacted by Hessian fly in 2009 are now strongly encouraged to plant a variety with some level of resistance to Hessian fly, such as Duster, Centerfield, or Shocker.

It was a relatively quiet year for foliar diseases of wheat, with a few reports of powdery mildew and leaf rust. Fungal disease of wheat came back with a vengeance at flowering, however. Fusarium head blight (a.k.a. head scab) was a major factor in north-central and eastern Oklahoma. Corn and/or wheat residue provided the inoculant and Mother Nature provided the persistent cool, damp conditions during flowering that are required for infection. Properly-timed foliar fungicides likely reduced the level of infection in some fields but did not eliminate the problem. The end result was low test weight wheat with marketing losses issues due to vomitoxin.

Weather was the biggest story of the 2008-2009 wheat crop. While the freeze events in March and April of 2009 received the most attention, drought had already severely limited the potential of much of the Oklahoma wheat crop prior to the freeze events. It was common to see wheat heading at a total plant height of only 8 – 10 inches, and in areas south of I-40 the freeze finished off what the drought had started.

The first spring freeze injury to wheat occurred over the four-day period from 26 March to 30 March 2009. Temperatures dipped below freezing over most of the state and the cold snap resulted in various levels of injury, from cosmetic damage in northern Oklahoma to total sterility in some fields in southern Oklahoma. Most years Oklahoma wheat would not be far enough along by the end of March for such an event to be of great concern; however, the warm temperatures during February and the extreme drought stress sped the wheat crop along in 2009. As a result, much of the crop in southwest OK was starting to head when the freeze occurred.

The entire state of Oklahoma dipped below freezing once again on the nights of April 6 & 7. In fact, many areas fell into the lower 20's or upper teens for several hours. These types of temperatures placed the entire wheat crop in jeopardy. We stopped at several of the variety trial locations and split stems of the earliest wheat varieties. If significant freeze injury was present, random tiller samples (primary and secondary) were collected from Overley, OK Bullet, Jagger, Duster, Doans and Endurance. Twenty-five random tillers from each variety were split and checked for injury.

Moderate freeze injury was found at the Cherokee location, but only minor damage was found at Alva, Kildare, and Afton. Rick Kochenower reported similar findings in the Panhandle, with early-sown fields showing injury and later-sown fields showing little to no injury. Outside of this northern tier of counties, however, the freeze injury increased dramatically. There were 40 to 88% non-viable (i.e. dead) tillers in our Lahoma samples. Marshall plots had 52 to 92% non-viable heads, and it appears that grazing had little effect on survival. Our Kingfisher plots were severely injured and our plots at Apache were a complete loss.

Most agronomists agree that cool, moist conditions are beneficial after freeze events, as they promote survival of secondary tillers. The problem in 2009, though, was that the cool, wet conditions persisted for a 14 – 20 day period and many fields remained waterlogged. Waterlogged conditions were not restricted to terrace channels and low-lying areas. As a result, large areas of fields turned white, and yield potential was reduced or eliminated.

Harvest began just before Memorial Day, but proceeded at a crawl due to rain and green "sucker" heads low in the canopy. By mid June the rains subsided and 100 F temperatures quickly ripened the green heads that remained. Harvest then proceeded rapidly and was nearly complete by July 1. Harvested acreage was 3.6 million acres or 80% of the 2008 harvested acreage. This reduction in harvested acres was in spite of a 5% increase in planted acres. Statewide average yield was not finalized at the time of this report, but it is a certainty that total production will be only a fraction of that produced in 2008.

Methods

Cultural Practices. Conventional plots were eight rows wide with six-inch row spacing. No-till plots were seven rows wide with 7.5-inch row spacing. Plots were 20 feet long. Conventional till plots received 50 lb/ac of 18-46-0 in-furrow at planting. No-till plots received 5 gal/ac of 10-34-0 at planting. The El Reno and Marshall dual-purpose (DP) were sown at 120 lb/ac. All other locations were sown at 60 lb /ac. Grazing pressure, nitrogen fertilization, and insect and weed control decisions were made on a location-by-location basis and reflect standard management practices for the area.

Additional information on the Web

A copy of this publication as well as additional variety information and more information on wheat management can be found at

www.wheat.okstate.edu

Marketing rights

Breeding programs responsible for varietal release are indicated as the "source" in results tables. In many cases, however, a separate entity has the marketing rights for these varieties. For this reason, a list of wheat seed companies and the varieties they market is provided below.

AgriPro
Doans
Fannin
Jackpot
Jagalene
TAM 111
TAM 203
OK Rising (W)

Husker Genetics
Mace

Kansas Wheat Alliance
Fuller
Jagger
Overley

Oklahoma Genetics, Inc.
Billings
Centerfield
Duster
Guymon (W)
OK Bullet
Pete

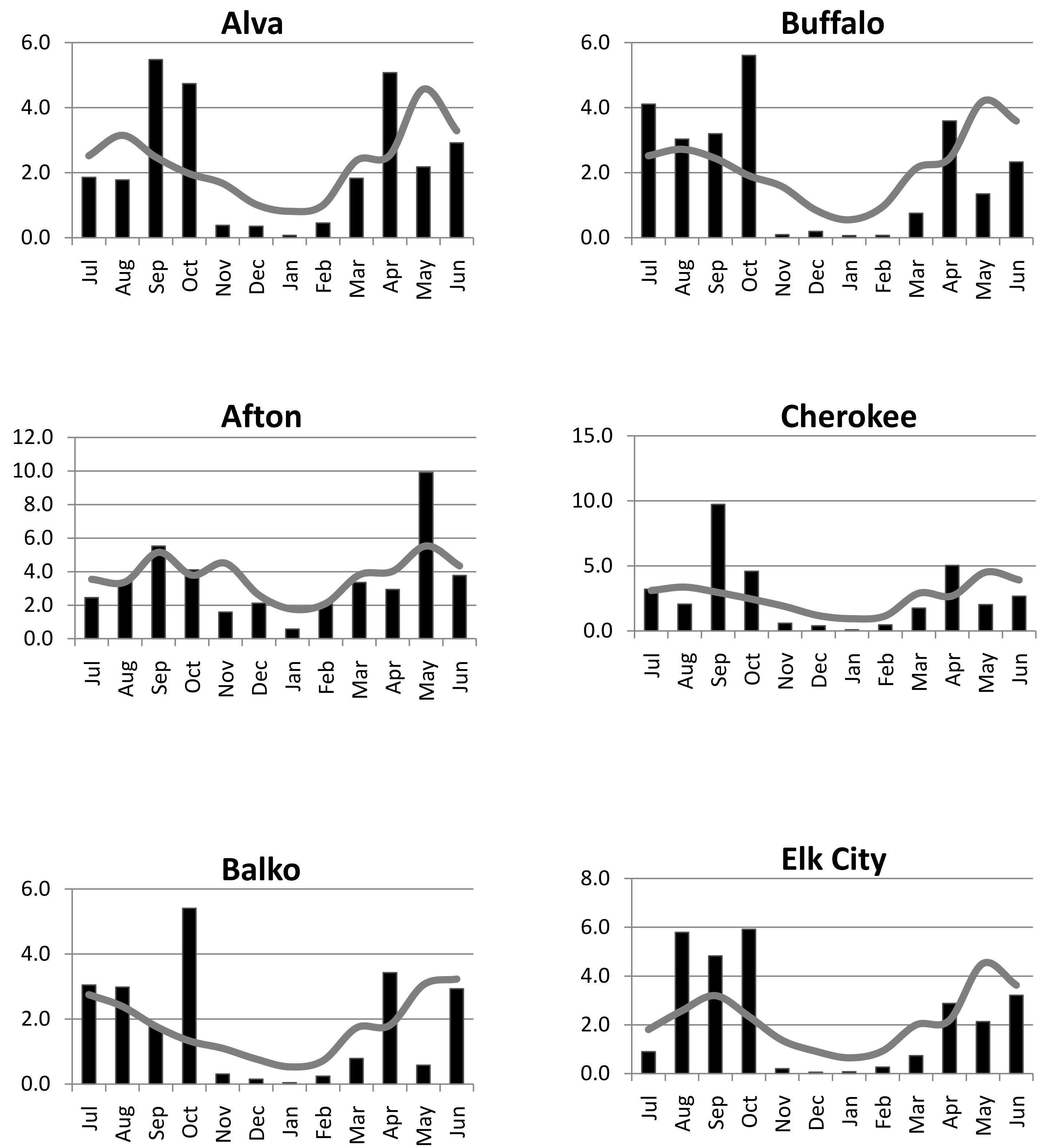
OK Foundation Seed
Deliver
Endurance

Scott Seed
TAM 304

WestBred
Armour
Aspen (W)
Keota
Santa Fe
Shocker
Winterhawk

Whatley Seed
TAM 112

Figure 1. Rainfall (inches) during the 2008-09 wheat production season (bars) and 30-year average rainfall (smoothed lines) for wheat variety test sites



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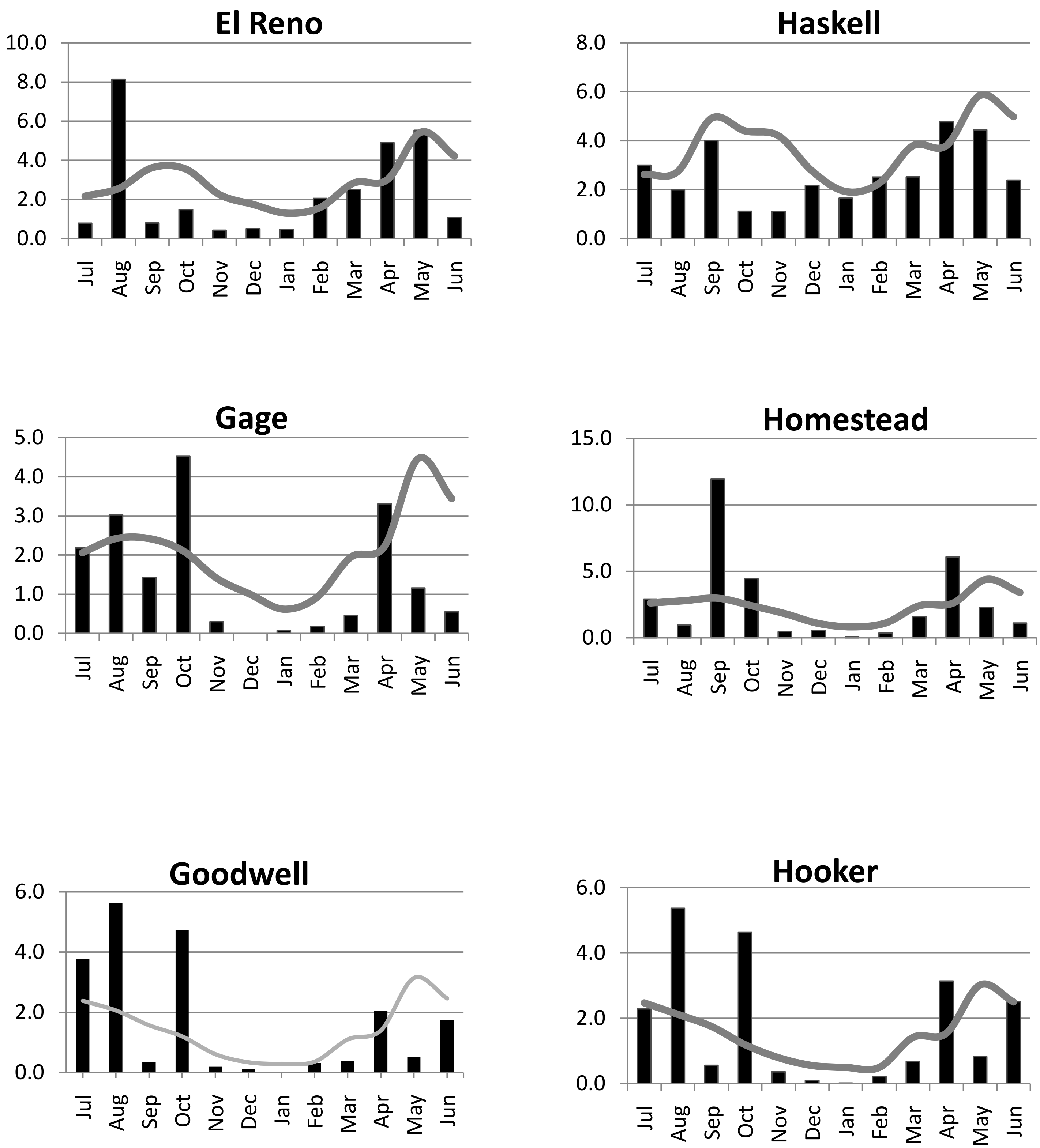

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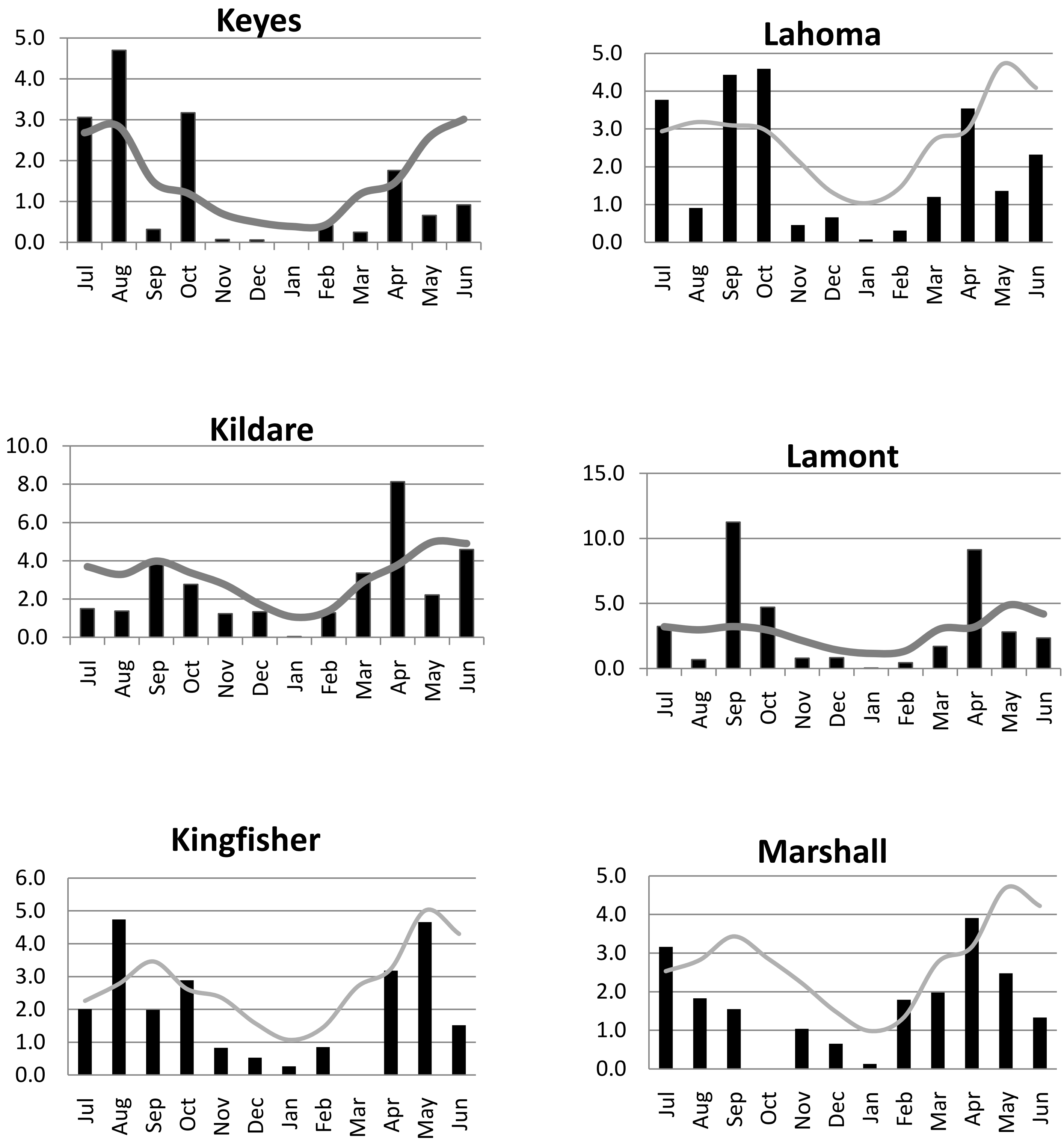

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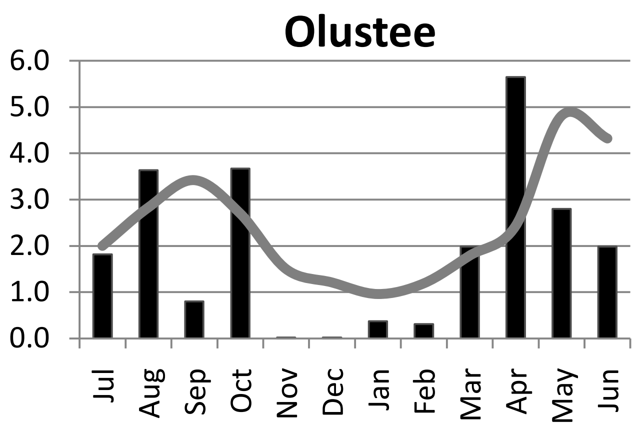

2009 Oklahoma Wheat Variety Trial Summary

Variety	Afton	Alva	Balko	Buffalo	Cherokee	Elk City	El Reno Conv Till DP	El Reno Conv Till GO	El Reno No Till DP	El Reno No Till GO	Gage	Goodwell NI
							bu/ac					
Armour	36	41	53	57	40	24	35	24	27	28	20	39
Aspen (W)	-	-	59	-	-	-	-	-	-	-	-	36
Billings	20	45	-	-	-	-	23	-	-	-	-	
Centerfield	22	44	46	61	38	24	30	36	25	28	26	33
Deliver	24	46	46	64	37	21	35	31	23	24	23	34
Doans	24	42	51	61	41	25	37	26	34	32	25	30
Duster	23	47	49	70	44	22	36	44	26	31	27	41
Endurance	31	51	59	74	48	26	43	36	31	31	29	44
Fannin	-	-	-	-	-	-	22	16	21	22	-	
Fuller	28	42	46	55	39	24	26	28	29	25	24	29
Guymon (W)	-	-	56	-	-	-	-	-	-	-	-	36
Jackpot	17	47	47	58	34	17	27	23	18	21	26	25
Jagalene	19	46	59	69	48	22	21	26	21	17	27	41
Jagger	24	45	54	54	36	22	19	15	20	16	27	29
Keota	-	41	49	69	41	21	-	-	-	-	29	41
Mace	-	-	55	-	-	-	-	-	-	-	-	29
OK Bullet	18	40	49	59	41	26	26	24	23	21	23	27
OK Rising (W)	16	40	47	53	33	21	22	26	19	19	19	24
Overley	14	44	52	61	36	21	22	19	19	14	25	39
Pete	12	45	50	-	37	16	15	-	-	-	23	33
Santa Fe	26	47	51	55	40	27	35	36	33	29	25	32
Shocker	23	42	49	49	31	22	26	13	28	25	21	25
TAM 111	-	41	55	65	39	27	-	-	-	-	26	38
TAM 112	-	45	58	63	40	27	-	-	-	-	30	44
TAM 203	29	48	54	63	44	27	33	38	27	29	26	34
TAM 304	16	-	-	-	-	-	-	-	-	-	-	40
Winterhawk	-	45	50	66	47	25	-	-	-	-	25	35
OK04315	-	-	-	-	-	26	29	-	-	-	-	
OK05312	-	-	60	-	-	-	-	-	-	-	-	38
OK05526	25	51	50	-	45	24	35	-	-	-	-	
OK05742W	-	-	-	-	-	24	-	-	-	-	-	
OK06114	-	-	-	-	-	-	-	-	-	-	-	
OK06729	-	-	-	-	-	-	-	-	-	-	-	
OK04525	-	49	-	-	-	25	-	-	-	-	-	
STARS 0601W	-	51	50	-	-	-	-	-	-	-	-	35
Mean	**22**	**45**	**52**	**61**	**40**	**23**	**28**	**27**	**25**	**24**	**25**	**34**
LSD $_{(0.05)}$	**6**	**5**	**8**	**6**	**5**	**4**	**7**	**9**	**9**	**9**	**3**	6

Partial financial support provided by the Oklahoma Wheat Commission

2009 Oklahoma Wheat Variety Trial Summary

Variety	Haskell	Homestead Conv Till	Homestead No Till	Hooker	Keyes	Kildare	Kingfisher	Lamont	Lahoma	Lahoma fungicide	Marshall Dual Purpos	Marshall Grain Only	Olustee
	bu/ac												
Armour	24	35	35	10	36	31	34	37	62	69	6	25	24
Aspen (W)	-	-	-	16	48	-	-	-	-	-	-	-	-
Billings	15	-	-	-	-	31	29	36	49	52	4	16	-
Centerfield	19	36	38	17	38	30	36	46	54	58	7	22	23
Deliver	14	33	39	14	36	33	37	43	51	58	5	20	20
Doans	10	35	37	14	35	22	40	43	53	58	13	27	23
Duster	18	38	43	11	43	44	50	37	59	68	13	30	28
Endurance	20	39	40	18	50	32	44	46	62	67	8	31	23
Fannin	-	-	-	-	-	-	-	-	-	-	-	-	17
Fuller	18	35	37	10	36	34	32	38	50	56	10	21	25
Guymon (W)	-	-	-	16	37	-	-	-	-	-	-	-	-
Jackpot	12	34	32	11	32	32	34	37	50	51	7	17	23
Jagalene	17	32	36	11	44	30	41	43	51	65	5	13	27
Jagger	15	29	32	14	35	30	29	43	51	55	4	11	25
Keota	-	-	-	12	38	-	-	-	47	57	-	-	-
Mace	-	-	-	27	47	-	-	-	-	-	-	-	-
OK Bullet	18	36	33	14	33	30	40	38	48	57	10	17	29
OK Rising (W)	17	31	25	8	35	34	37	35	49	55	4	13	24
Overley	7	35	32	14	39	27	30	42	47	53	4	12	26
Pete	14	-	-	-	-	-	27	-	43	50	3	13	23
Santa Fe	18	38	37	9	34	39	40	48	67	61	10	25	27
Shocker	12	37	33	7	34	32	23	49	48	53	14	20	24
TAM 111	-	-	-	16	48	-	-	-	49	60	-	-	-
TAM 112	-	-	-	22	45	-	-	-	47	63	-	-	-
TAM 203	19	37	38	12	39	35	41	46	56	63	12	29	27
TAM 304	17	-	-	-	-	36	28	40	53	60	-	-	-
Winterhawk	-	-	-	19	37	-	-	-	59	57	-	-	-
OK04315	-	-	-	15	-	-	-	-	-	-	12	29	-
OK05312	-	-	-	-	43	-	-	-	-	-	-	-	-
OK05526	-	-	-	12	-	43	27	39	56	61	12	23	-
OK05742W	-	-	-	-	-	-	36	-	-	-	-	-	27
OK06114	-	-	-	-	-	32	-	42	53	61	-	-	-
OK06729	-	-	-	-	-	-	-	-	-	-	-	-	24
OK04525	-	-	-	-	-	36	-	-	-	-	-	-	23
STARS 0601W	-	-	-	-	-	-	-	-	-	-	-	-	17
Mean	**16**	**35**	**35**	**14**	**39**	**33**	**35**	**41**	**53**	**59**	**8**	**21**	**24**
LSD $_{(0.05)}$	**5**	**5**	**5**	**4**	**9**	**7**	**6**	**8**	**4**	**6**	**4**	**5**	**3**

Partial financial support provided by the Oklahoma Wheat Commission

Afton Variety Trial

Cooperator: Greg Leonard	**Tillage: Conventional till**
Soil type: Parsons silt loam	**Management: Grain only**
Planting date: 10-14-08	**Previous crop: Corn**
Harvest date: 6-26-09	**Soil test information: pH = 6.9 , P = 104, K = 236**

		Grain Yield	Test Weight
Source	Variety	2008-09	2008-09
		-----bu/ac----	-----lb/bu-----
WestBred	Armour	36	-
OSU	Endurance	31	-
TAMU	TAM 203	29	-
KSU	Fuller	28	-
WestBred	Santa Fe	26	-
OSU	Deliver	24	-
AgriPro	Doans	24	-
KSU	Jagger	24	-
WestBred	Shocker	23	-
OSU	Duster	23	-
OSU	Centerfield	22	-
OSU	Billings	20	-
AgriPro	Jagalene	19	-
OSU	OK Bullet	18	-
AgriPro	Jackpot	17	-
TAMU	TAM 304	16	-
OSU	OK Rising (W)	16	-
KSU	Overley	14	-
OSU	Pete	12	
Experimentals			
	OK05526	25	-
	Mean	22	-
	LSD $_{(0.05)}$	6	

(W) = Hard white wheat variety

Notes: Grain yield of all varieties was greatly reduced by waterlogged soil conditions and Fusarium head blight (scab). Grain yield was not sufficient to measure test weight.

Alva Variety Trial

Cooperator: Wes Mallory | **Tillage: Conventional till**
Soil type: Grant silt loam | **Management: Grain only**
Planting date: 10-29-08 | **Previous crop: Wheat**
Harvest date: 6-23-09 | **Soil test information: pH = 6.4, P = 71, K = 680**

		Grain Yield			Test Weight
Source	Variety	2008-09	2-Year	3-Year	2008-09
			-----bu/ac----		---lb/bu---
OSU	Endurance	51	56	48	53
TAMU	TAM 203	48	-	-	52
WestBred	Santa Fe	47	54	47	51
OSU	Duster	47	56	49	52
AgriPro	Jackpot	47	56	-	53
AgriPro	Jagalene	46	52	41	53
OSU	Deliver	46	53	47	55
OSU	Billings	45	53	-	52
KSU	Jagger	45	52	42	51
TAMU	TAM 112	45	-	-	53
OSU	Pete	45	52	-	56
WestBred	Winterhawk	45	-	-	53
KSU	Overley	44	50	45	53
OSU	Centerfield	44	52	46	53
WestBred	Shocker	42	50	44	52
KSU	Fuller	42	55	48	52
AgriPro	Doans	42	52	46	56
WestBred	Keota	41	-	-	52
WestBred	Armour	41	-	-	50
TAMU	TAM 111	41	51	43	53
OSU	OK Bullet	40	50	45	54
OSU	OK Rising (W)	40	51	45	53
Experimentals					
	STARS 0601W	51	-	-	56
	OK05526	51	-	-	54
	OK04525	49	-	-	55
	Mean	45	53	45	53
	LSD $_{(0.05)}$	5	4	3	1

(W) = Hard white wheat variety

Partial financial support provided by the Oklahoma Wheat Commission

Balko Variety Trial

Cooperator: Kenton Patzkowsky
Soil type: Ulysses-Richfield complex
Planting date: 9-24-08
Harvest date: 6-25-09

Tillage: No-till
Management: Grain only
Previous crop: Wheat/fallow

		Grain Yield			Test Weight
Source	Variety	2008-09	2-Year	3-Year	2008-09
		-----bu/ac----			---lb/bu---
OSU	Endurance	59	76	55	59
AgriPro	Jagalene	59	73	55	61
WestBred	Aspen (W)	59	-	-	61
TAMU	TAM 112	58	77	-	62
OSU	Guymon (W)	56	72	54	62
TAMU	TAM 111	55	76	57	60
UNL	Mace	55	-	-	60
TAMU	TAM 203	54	-	-	58
KSU	Jagger	54	69	51	59
WestBred	Armour	53	-	-	57
KSU	Overley	52	72	53	59
WestBred	Santa Fe	51	72	53	58
AgriPro	Doans	51	67	-	62
OSU	Pete	50	-	-	61
WestBred	Winterhawk	50	-	-	60
OSU	OK Bullet	49	70	54	61
WestBred	Shocker	49	65	-	58
WestBred	Keota	49	-	-	61
OSU	Duster	49	71	53	60
OSU	OK Rising (W)	47	-	-	60
AgriPro	Jackpot	47	-	-	60
KSU	Fuller	46	67	-	59
OSU	Centerfield	46	67	-	61
OSU	Deliver	46	65	47	61
Experimentals					
	OK05312	60	-	-	62
	OK05526	50	-	-	61
	STARS 0601W	50	-	-	62
	Mean	52	71	25	60
	LSD $_{(0.05)}$	8	6	4	1

(W) = Hard white wheat variety

Partial financial support provided by the Oklahoma Wheat Commission

Buffalo Variety Trial

Cooperator: NRCS	**Tillage: Conventional till**
Soil type: St. Paul silt loam	**Management: Grain only**
Planting date: 9-29-08	**Previous crop: Wheat**
Harvest date: 6-22-09	**Soil test information: pH = 7.3, P = 61, K = 592**

		Grain Yield			Test Weight
Source	Variety	2008-09	2-Year	3-Year	2008-09
			-----bu/ac----		---lb/bu---
OSU	Endurance	74	69	58	57
OSU	Duster	70	67	57	57
WestBred	Keota	69	-	-	59
AgriPro	Jagalene	69	59	51	59
WestBred	Winterhawk	66	-	-	59
TAMU	TAM 111	65	62	52	56
OSU	Deliver	64	64	54	58
TAMU	TAM 112	63	-	-	57
TAMU	TAM 203	63	-	-	55
OSU	Centerfield	61	58	-	56
KSU	Overley	61	61	53	57
AgriPro	Doans	61	62	-	59
OSU	OK Bullet	59	61	52	58
AgriPro	Jackpot	58	-	-	56
WestBred	Armour	57	-	-	54
KSU	Fuller	55	60	-	56
WestBred	Santa Fe	55	60	-	54
KSU	Jagger	54	52	43	55
OSU	OK Rising (W)	53	58	-	57
WestBred	Shocker	49	54	-	54
	Mean	61	61	52	57
	LSD $_{(0.05)}$	6	3	3	1

(W) = Hard white wheat variety

Notes: Location not harvested in 2008 so 2 and 3-year averages use 2007 and 2006 data

Partial financial support provided by the Oklahoma Wheat Commission

Cherokee Variety Trial

Cooperator: Kenneth Failes | **Tillage: Conventional till**
Soil type: Dale silt loam | **Management: Grain Only**
Planting date: 10-1-08 | **Previous crop: Wheat**
Harvest date: 6-23-09 | **Soil test information: pH = 6.2, P = 66, K = 643**

Source	Variety	Grain Yield 2008-09	Grain Yield 2-Year	Grain Yield 3-Year	Test Weight 2008-09
		-----bu/ac----			-----lb/bu-----
OSU	Endurance	48	51	47	55
AgriPro	Jagalene	48	50	38	57
WestBred	Winterhawk	47	-	-	56
OSU	Duster	44	50	42	55
TAMU	TAM 203	44	-	-	54
WestBred	Keota	41	-	-	55
AgriPro	Doans	41	46	40	57
OSU	OK Bullet	41	45	40	57
WestBred	Armour	40	-	-	53
WestBred	Santa Fe	40	45	41	55
TAMU	TAM 112	40	-	-	56
TAMU	TAM 111	39	-	-	55
KSU	Fuller	39	43	40	55
OSU	Centerfield	38	43	40	55
OSU	Pete	37	-	-	56
OSU	Deliver	37	42	40	55
KSU	Overley	36	38	36	55
KSU	Jagger	36	43	36	55
AgriPro	Jackpot	34	41	-	54
OSU	OK Rising (W)	33	-	-	54
WestBred	Shocker	31	40	38	54
Experimentals					
	OK05526	45	-	-	56
	Mean	40	44	40	55
	LSD $_{(0.05)}$	5	5	4	1

(W) = Hard white wheat variety

Notes: Moderate freeze injury. Management was dual purpose in 2007-2008

Elk City Variety Trial

Cooperator: Carl Simon | **Tillage: Conventional till**
Soil type: Grandfield sandy loam | **Management: Grain Only**
Planting date: 9-30-08 | **Previous crop: Wheat**
Harvest date: 6-15-09 | **Soil test information: pH = 5.9, P = 38, K = 289**

		Grain Yield			Test Weight
Source	Variety	2008-09	2-Year	3-Year	2008-09
		-----bu/ac----			-----lb/bu-----
TAMU	TAM 112	27	-	-	58
TAMU	TAM 203	27	-	-	56
TAMU	TAM 111	27	27	32	58
WestBred	Santa Fe	27	26	34	57
OSU	OK Bullet	26	28	38	59
OSU	Endurance	26	28	36	57
AgriPro	Doans	25	26	37	60
WestBred	Winterhawk	25	-	-	58
KSU	Fuller	24	27	36	58
OSU	Centerfield	24	25	32	57
WestBred	Armour	24	-	-	55
OSU	Duster	22	25	30	57
AgriPro	Jagalene	22	23	27	59
KSU	Jagger	22	23	29	57
WestBred	Shocker	22	21	33	56
KSU	Overley	21	20	29	58
OSU	Deliver	21	21	35	58
WestBred	Keota	21	-	-	58
OSU	OK Rising (W)	21	22	36	57
AgriPro	Jackpot	17	21	-	56
OSU	Pete	16	21	33	57
Experimentals					
	OK04315	26	-	-	58
	OK04525	25	-	-	59
	OK05526	24	-	-	57
	OK05742W (W)	24	-	-	58
	Mean	23	24	33	58
	LSD $_{(0.05)}$	4	2	1	1

(W) = Hard white wheat variety

Notes: Grain yield impacted by drought, freeze injury, and two hail storms after heading

Partial financial support provided by the Oklahoma Wheat Commission

El Reno Conventional Till Variety Trial

Cooperator: Bornemann Farms | **Soil type: Pond creek silt loam** | **Tillage:Conventional till**
Planting date: 9-25-08 | **Management: Dual Purpose** | **Previous crop: Canola**
Harvest date: 6-16-09 | **Soil test information: pH = 5.6, P = 108, K = 362**

		Grain Yield									Test Weight		
		2008-09			2-year			3-year					
Source	Variety	Grazed	Non-grazed	*Diff.*	Grazed	Non-grazed	*Diff.*	Grazed	Non-grazed	*Diff.*	Grazed	Non-grazed	*Diff.*
		bu/ac									lb/bu		
OSU	Endurance	43	36	*-7*	58	55	*-3*	45	45	*0*	54	53	*-2*
AgriPro	Doans	37	26	*-11*	51	39	*-12*	41	33	*-8*	58	57	*-2*
OSU	Duster	36	44	*8*	62	64	*3*	47	52	*5*	53	55	*2*
WestBred	Santa Fe	35	36	*0*	50	52	*2*	38	42	*4*	54	57	*3*
OSU	Deliver	35	31	*-4*	51	42	*-9*	40	35	*-5*	55	57	*1*
WestBred	Armour	35	24	*-10*	-	-	-	-	-	-	52	53	*2*
TAMU	TAM 203	33	38	*4*	-	-	-	-	-	-	50	53	*3*
OSU	Centerfield	30	36	*5*	43	44	*0*	34	33	*-1*	52	56	*4*
AgriPro	Jackpot	27	23	*-4*	45	39	*-6*	-	-	-	51	54	*3*
WestBred	Shocker	26	13	*-13*	42	34	*-8*	33	30	*-3*	51	53	*1*
KSU	Fuller	26	28	*2*	48	49	*1*	37	41	*4*	53	58	*5*
OSU	OK Bullet	26	24	*-1*	42	45	*2*	34	37	*3*	53	53	*0*
OSU	Billings	23	-	-	-	-	-	-	-	-	51	-	-
KSU	Overley	22	19	*-3*	36	32	*-4*	29	32	*3*	51	56	*5*
AgriPro	Fannin	22	16	*-6*	34	36	*3*	25	31	*6*	53	56	*3*
OSU	OK Rising (W)	22	26	*4*	-	-	-	-	-	-	49	52	*3*
AgriPro	Jagalene	21	26	*5*	39	42	*3*	29	34	*5*	51	56	*5*
KSU	Jagger	19	15	*-4*	40	37	*-3*	29	31	*2*	49	52	*3*
OSU	Pete	15	-	-	-	-	-	-	-	-	50	-	-
Experimentals													
	OK05526	35	-	-	-	-	-	-	-	-	55	-	-
	OK04315	29	-	-	-	-	-	-	-	-	53	-	-
	Mean	28	27	*-1*	46	43	*-3*	35	37	*2*	52	55	*3*
	LSD $_{(0.05)}$	7	9		7	7		5	5		2	4	

(W) = Hard white wheat variety

Notes: Non-grazed plots were sown earlier than recommended for grain-only production and do not represent full yield potential of varieties in a true grain-only system. Dual-purpose plots were grazed for 69 days. Stocking rate was 0.28 head per acre and average daily gain was 2.5 lb/hd/day.

Partial financial support provided by the Oklahoma Wheat Commission

El Reno No-Till Variety Trial

Cooperator: Bornemann Farms | **Soil type: Pond creek silt loam** | **Tillage: No-till**
Planting date: 9-25-08 | **Management: Dual Purpose** | **Previous crop: Canola**
Harvest date: 6-16-09 | **Soil test information: pH = 5.1, P = 102, K = 279**

		Grain Yield									Test Weight		
		2008-09			**2-year**			**3-year**					
Source	Variety	Grazed	Non-grazed	***Diff.***	Grazed	Non-grazed	***Diff.***	Grazed	Non-grazed	***Diff.***	Grazed	Non-grazed	***Diff.***
		----------bu/ac----------									----lb/bu----		
AgriPro	Doans	34	32	*-2*	52	49	*-4*	45	42	*-3*	56	57	*2*
WestBred	Santa Fe	33	29	*-4*	59	56	*-3*	44	47	*3*	53	55	*2*
OSU	Endurance	31	31	*0*	56	54	*-2*	44	45	*1*	51	54	*3*
KSU	Fuller	29	25	*-4*	62	51	*-11*	48	44	*-4*	53	56	*4*
WestBred	Shocker	28	25	*-3*	53	47	*-6*	40	39	*-1*	51	55	*3*
TAMU	TAM 203	27	29	*2*	-	-	-	-	-	-	49	51	*3*
WestBred	Armour	27	28	*1*	-	-	-	-	-	-	49	51	*2*
OSU	Duster	26	31	*5*	60	59	*-1*	46	48	*2*	50	53	*3*
OSU	Centerfield	25	28	*4*	53	47	*-6*	39	35	*-4*	51	54	*3*
OSU	Deliver	23	24	*1*	53	48	*-5*	41	39	*-2*	51	55	*4*
OSU	OK Bullet	23	21	*-2*	52	50	*-2*	41	42	*1*	52	53	*1*
AgriPro	Fannin	21	22	*1*	40	40	*1*	29	34	*5*	53	55	*2*
AgriPro	Jagalene	21	17	*-4*	50	44	*-6*	37	36	*-1*	51	51	*0*
KSU	Jagger	20	16	*-4*	52	41	*-11*	38	34	*-4*	48	51	*3*
OSU	OK Rising (W)	19	19	*-1*	-	-	-	-	-	-	50	50	*-1*
KSU	Overley	19	14	*-5*	37	34	*-4*	31	33	*2*	50	52	*2*
AgriPro	Jackpot	18	21	*3*	52	46	*-7*	-	-	-	48	51	*3*
	Mean	25	24	*-1*	52	47	*-5*	40	40	*0*	51	53	*2*
	LSD $_{(0.05)}$	9	9		6	6		4	4		3	1	

(W) = Hard white wheat variety

Notes: Non-grazed plots were sown earlier than recommended for grain-only production and do not represent full yield potential of varieties in a true grain-only system. Dual-purpose plots were grazed for 69 days. Stocking rate was 0.28 head per acre and average daily gain was 2.5 lb/hd/day.

Partial financial support provided by the Oklahoma Wheat Commission

Gage Variety Trial

Cooperator: Curtis Torrance	**Tillage: Conventional till**
Soil type: St. Paul silt loam	**Management: Dual Purpose**
Planting date: 9-23-08	**Previous crop: Wheat**
Harvest date: 6-24-09	**Soil test information: pH = 7.8, P = 12, K = 464**

		Grain Yield			Test Weight
Source	Variety	2008-09	2-Year	3-Year	2008-09
		-----bu/ac----			-----lb/bu-----
TAMU	TAM 112	30	-	-	59
OSU	Endurance	29	35	41	57
WestBred	Keota	29	-	-	59
AgriPro	Jagalene	27	34	36	59
KSU	Jagger	27	31	33	56
OSU	Duster	27	34	39	57
AgriPro	Jackpot	26	34	-	58
TAMU	TAM 111	26	33	38	58
OSU	Centerfield	26	31	34	57
TAMU	TAM 203	26	-	-	56
WestBred	Santa Fe	25	31	35	56
AgriPro	Doans	25	31	35	60
KSU	Overley	25	30	34	57
WestBred	Winterhawk	25	-	-	58
KSU	Fuller	24	32	40	56
OSU	OK Bullet	23	31	37	58
OSU	Pete	23	-	-	58
OSU	Deliver	23	28	35	57
WestBred	Shocker	21	27	31	56
WestBred	Armour	20	-	-	55
OSU	OK Rising (W)	19	28	34	56
	Mean	25	31	36	57
	LSD $_{(0.05)}$	3	2	2	1

(W) = Hard white wheat variety

Notes: Grain yield impacted by drought during fall and winter months. Plots were not grazed in 2006-07.

Partial financial support provided by the Oklahoma Wheat Commission

Goodwell Nonirrigated Variety Trial

Cooperator: OK Panhandle Research and Extension Center
Soil type: Richfield clay Loam — **Tillage: No-till**
Planting date: 10-3-08 — **Management: Grain only**
Harvest date: 6-19-09 — **Previous crop: Wheat**

Source	Variety	Grain Yield 2008-09	Grain Yield 2-Year	Test Weight 2008-09
		-----bu/ac----		-----lb/bu-----
OSU	Endurance	44	61	60
TAMU	TAM 112	44	-	58
OSU	Duster	41	62	59
WestBred	Keota	41	-	59
AgriPro	Jagalene	41	58	59
TAMU	TAM 304	40	-	57
KSU	Overley	39	58	58
WestBred	Armour	39	-	58
TAMU	TAM 111	38	56	60
WestBred	Aspen (W)	36	-	59
OSU	Guymon (W)	36	52	61
WestBred	Winterhawk	35	-	60
TAMU	TAM 203	34	-	58
OSU	Deliver	34	53	59
OSU	Centerfield	33	46	60
OSU	Pete	33	-	60
WestBred	Santa Fe	32	52	59
AgriPro	Doans	30	47	60
KSU	Jagger	29	48	58
UNL	Mace	29	-	59
KSU	Fuller	29	54	58
OSU	OK Bullet	27	52	59
WestBred	Shocker	25	46	58
AgriPro	Jackpot	25	-	59
OSU	OK Rising (W)	24	49	59
Experimentals				
	OK05312	38	-	61
	STARS 0601W	35	-	59
	Mean	34	53	59
	LSD $_{(0.05)}$	6	8	1

(W) = Hard white wheat variety

Notes: Plots were not harvested in 2007-2008, so 2-year average includes 2006-2007 harvest year

Partial financial support provided by the Oklahoma Wheat Commission

Haskell Variety Trial

Cooperator: Eastern Research Station — **Tillage: Conventional till**
Soil type: Taloka silt loam — **Management: Grain only**
Planting date: 10-13-08 — **Previous crop: Wheat**
Harvest date: 6-26-09 — **Soil test information: pH = 6.4, P = 45, K = 209**

		Grain Yield			Test Weight
Source	Variety	2008-09	2-Year	3-Year	2008-09
		-----bu/ac----			-----lb/bu-----
WestBred	Armour	24	-	-	-
OSU	Endurance	20	43	45	-
TAMU	TAM 203	19	-	-	-
OSU	Centerfield	19	35	38	-
KSU	Fuller	18	39	-	-
OSU	OK Bullet	18	34	38	-
OSU	Duster	18	40	43	-
WestBred	Santa Fe	18	35	38	-
OSU	OK Rising (W)	17	-	-	-
AgriPro	Jagalene	17	30	35	-
TAMU	TAM 304	17	37	-	-
OSU	Billings	15	-	-	-
KSU	Jagger	15	31	35	-
OSU	Deliver	14	35	35	-
OSU	Pete	14	-	-	-
AgriPro	Jackpot	12	32	-	-
WestBred	Shocker	12	29	-	-
AgriPro	Doans	10	31	-	-
KSU	Overley	7	26	32	-
	Mean	16	34	38	-
	LSD $_{(0.05)}$	5	4	2	

(W) = Hard white wheat variety

Notes: All plots had some bird damage and Overley was worst hit with > 60% injury. Grain yield of all varieties was greatly reduced by waterlogged soil conditions and Fusarium head blight (scab). Grain yield was not sufficient to measure test weight.

Homestead Variety Trial

Cooperator: Brook Strader
Soil type: Canadian fine sandy loam
Planting date: 11-3-08
Harvest date: 6-17-09

Management: Grain only
Tillage: Conventional till and No-till
Previous crop: Grain sorghum
Soil test information: pH = 6.0, P = 44, K = 451

		Grain Yield						Test Weight		
		2008-09			2-Year			2008-09		
Source	Variety	Conv. till	No till	***Diff.***	Conv. till	No till	***Diff.***	Conv. till	No till	***Diff.***
OSU	Duster	38	43	*4*	35	44	*9*	59	58	*-1*
OSU	Endurance	39	40	*1*	37	41	*4*	60	58	*-2*
OSU	Deliver	33	39	*6*	32	39	*7*	60	59	*-1*
TAMU	TAM 203	37	38	*1*	-	-	-	59	58	*-1*
OSU	Centerfield	36	38	*2*	35	39	*5*	59	58	*-1*
WestBred	Santa Fe	38	37	*-1*	38	39	*1*	60	59	*-2*
KSU	Fuller	35	37	*2*	36	43	*7*	58	57	*-1*
AgriPro	Doans	35	37	*2*	34	38	*5*	61	61	*0*
AgriPro	Jagalene	32	36	*5*	30	35	*5*	60	59	*-1*
WestBred	Armour	35	35	*0*	-	-	-	57	57	*0*
OSU	OK Bullet	36	33	*-3*	35	36	*1*	60	57	*-3*
WestBred	Shocker	37	33	*-4*	34	35	*2*	59	57	*-1*
KSU	Jagger	29	32	*3*	32	35	*4*	58	57	*-1*
AgriPro	Jackpot	34	32	*-2*	38	39	*1*	59	57	*-2*
KSU	Overley	35	32	*-3*	31	33	*2*	60	58	*-1*
OSU	OK Rising (W)	31	25	*-6*	-	-	-	58	55	*-4*
	Mean	35	35	*0*	34	38	*4*	59	58	*-1*
	LSD $_{(0.05)}$	5	4		5	5		1	2	

(W) = Hard white wheat variety

Partial financial support provided by the Oklahoma Wheat Commission

Hooker Variety Trial

Cooperator: Dan Herald
Soil type: Dalhart fine sandy loam
Planting date: 9-24-08
Harvest date:6-25-09
Tillage: No-till
Management: Grain only
Previous crop: Grain sorghum

		Grain Yield				Test Weight
Source	Variety	2008-09	WSM rating	2-Year	3-Year	2008-09
			-----bu/ac----			-----lb/bu-----
UNL	Mace	27	1.0	25	-	58
TAMU	TAM 112	22	1.3	25	-	58
WestBred	Winterhawk	19	1.8	-	-	56
OSU	Endurance	18	3.3	23	40	55
OSU	Centerfield	17	3.0	-	-	57
TAMU	TAM 111	16	1.5	22	38	55
WestBred	Aspen (W)	16	4.0	-	-	55
OSU	Guymon (W)	16	2.8	21	-	58
KSU	Overley	14	2.3	-	-	55
AgriPro	Doans	14	3.5	-	-	58
OSU	Deliver	14	3.8	20	-	57
OSU	OK Bullet	14	1.5	21	38	56
KSU	Jagger	14	2.3	20	35	54
WestBred	Keota	12	2.0	-	-	55
TAMU	TAM 203	12	2.5	-	-	53
AgriPro	Jackpot	11	1.8	-	-	54
AgriPro	Jagalene	11	2.0	21	34	55
OSU	Duster	11	4.0	18	-	-
KSU	Fuller	10	2.5	20	-	51
WestBred	Armour	10	4.0	-	-	53
WestBred	Santa Fe	9	3.3	-	-	-
OSU	OK Rising (W)	8	2.3	-	-	-
WestBred	Shocker	7	3.8	-	-	-
Experimentals						
	OK04315	15	2.00	-	-	57
	OK05526	12	2.75	-	-	55
	Mean	14		21	37	55
	LSD $_{(0.05)}$	4		3	2	2

(W) = Hard white wheat variety

Wheat Streak Mosaic Virus ratings recorded by Dr. Bob Hunger on 05-14-2009. A 0-5 scale was used where:	
0=no symptoms/healthy	3=Moderate yellow and/or mosaic; some stunting
1=Very slight yellowing	4=Severe yellowiing and/or mosaic; moderate stunting
2=Mild yellow and/or mosaic; some stunting	5=Severe yellowing and/or mosaic; stunted; dead or nearly dead

Keyes Variety Trial

Cooperator: J.B. Stewart
Soil type: Richfield clay loam
Planting date: 9-29-08
Harvest date: 6-26-09

Tillage: Minimum-till
Management: Grain only
Previous crop: Grain sorghum

		Grain Yield			Test Weight
Source	Variety	2008-09	2-Year	3-Year	2008-09
		-----bu/ac----			-----lb/bu-----
OSU	Endurance	50	38	48	59
TAMU	TAM 111	48	39	49	61
WestBred	Aspen (W)	48	-	-	60
UNL	Mace	47	35	-	60
TAMU	TAM 112	45	37	-	60
AgriPro	Jagalene	44	34	44	60
OSU	Duster	43	34	-	59
TAMU	TAM 203	39	-	-	58
KSU	Overley	39	-	-	58
OSU	Centerfield	38	-	-	60
WestBred	Keota	38	-	-	59
WestBred	Winterhawk	37	-	-	60
OSU	Guymon (W)	37	32	-	62
WestBred	Armour	36	-	-	58
OSU	Deliver	36	30	-	59
KSU	Fuller	36	27	-	59
OSU	OK Rising (W)	35	-	-	59
KSU	Jagger	35	24	37	58
AgriPro	Doans	35	-	-	60
WestBred	Shocker	34	-	-	58
WestBred	Santa Fe	34	-	-	58
OSU	OK Bullet	33	28	43	59
AgriPro	Jackpot	32	-	-	59
Experimentals					
	OK05312	43	-	-	60
	Mean	39	33	44	59
	LSD $_{(0.05)}$	9	5	3	2

(W) = Hard white wheat variety

Partial financial support provided by the Oklahoma Wheat Commission

Kildare Variety Trial

Cooperator: Don Schieber
Soil type: Tabler Silt Loam
Planting date: 10-2-08
Harvest date: 6-25-09

Tillage: No-till
Management: Grain only
Previous crop: Soybean
Soil test information: pH = 5.8, P = 122, K = 414

		Grain Yield		Test Weight
Source	Variety	2008-09	2-Year	2008-09
		-----bu/ac----		-----lb/bu-----
OSU	Duster	44	48	54
WestBred	Santa Fe	39	50	55
TAMU	TAM 304	36	46	52
TAMU	TAM 203	35	-	52
OSU	OK Rising (W)	34	36	55
KSU	Fuller	34	47	55
OSU	Deliver	33	41	56
WestBred	Shocker	32	44	55
AgriPro	Jackpot	32	41	53
OSU	Endurance	32	43	54
OSU	Billings	31	38	54
WestBred	Armour	31	-	53
AgriPro	Jagalene	30	38	55
OSU	Centerfield	30	38	55
KSU	Jagger	30	37	57
OSU	OK Bullet	30	35	55
KSU	Overley	27	35	55
AgriPro	Doans	22	35	55
Experimentals				
	OK05526	43	-	57
	OK04525	36	-	57
	OK06114	32	-	55
	Mean	33	41	55
	LSD $_{(0.05)}$	7	5	2

(W) = Hard white wheat variety

Partial financial support provided by the Oklahoma Wheat Commission

Kingfisher Variety Trial

Cooperator: Rodney Mueggenborg
Soil type: Tillman silt loam
Planting date:10-9-08
Harvest date: 6-15-09
Tillage: Conventional till
Management: Grain only
Previous crop: Wheat
Soil test information: pH = 6.7, P = 29, K = 400

		Grain Yield			Test Weight
Source	Variety	2008-09	2-Year	3-Year	2008-09
			-----bu/ac----		-----lb/bu-----
OSU	Duster	50	57	56	59
OSU	Endurance	44	53	50	59
TAMU	TAM 203	41	48	-	57
AgriPro	Jagalene	41	51	46	61
WestBred	Santa Fe	40	48	48	59
AgriPro	Doans	40	49	45	60
OSU	OK Bullet	40	47	49	61
OSU	Deliver	37	43	42	60
OSU	OK Rising (W)	37	46	48	59
OSU	Centerfield	36	47	42	59
WestBred	Armour	34	-	-	57
AgriPro	Jackpot	34	47	-	59
KSU	Fuller	32	49	50	60
KSU	Overley	30	42	45	60
KSU	Jagger	29	42	42	59
OSU	Billings	29	43	45	59
TAMU	TAM 304	28	-	-	57
OSU	Pete	27	42	-	59
WestBred	Shocker	23	38	41	58
Experimentals					
	OK05742W	36	-	-	59
	OK05526	27	-	-	60
	Mean	35	47	46	59
	LSD $_{(0.05)}$	6	4	3	1

(W) = Hard white wheat variety

Lahoma Variety Trial

Cooperator: North Central Research Station
Soil type: Pond Creek Silt Loam
Planting date: 10-10-08
Harvest date: 6-18-09

Management: Grain only
Soil test information: pH = 6.4 , P = 32, K = 378
Previous crop: Wheat
Fungicide = 10 oz/A Stratego on 15 April 2009

		Grain Yield						Test Weight		
		2008-09			2-Year			2008-09		
Source	Variety	No Fungicide	Fungicide	*Diff.*	No Fungicide	Fungicide	*Diff.*	No Fungicide	Fungicide	*Diff.*
		-bu/ac-						-lb/bu-		
WestBred	Santa Fe	67	61	*-6*	70	69	*-1*	59	58	*-1*
OSU	Endurance	62	67	*5*	64	71	*7*	58	58	*0*
WestBred	Armour	62	69	*8*	-	-	-	58	58	*0*
WestBred	Winterhawk	59	57	*-2*	-	-	-	58	58	*0*
OSU	Duster	59	68	*9*	62	73	*11*	58	59	*1*
TAMU	TAM 203	56	63	*7*	67	73	*6*	56	57	*0*
OSU	Centerfield	54	58	*4*	57	63	*6*	57	58	*0*
TAMU	TAM 304	53	60	*7*	-	-	-	55	56	*1*
AgriPro	Doans	53	58	*5*	63	66	*3*	60	61	*1*
AgriPro	Jagalene	51	65	*14*	47	68	*21*	58	59	*1*
OSU	Deliver	51	58	*7*	59	67	*8*	59	59	*0*
KSU	Jagger	51	55	*5*	49	64	*15*	57	58	*0*
KSU	Fuller	50	56	*6*	62	68	*7*	58	59	*1*
AgriPro	Jackpot	50	51	*1*	65	73	*8*	58	58	*0*
OSU	Billings	49	52	*3*	63	65	*2*	57	56	*-1*
TAMU	TAM 111	49	60	*11*	-	-	-	57	59	*2*
OSU	OK Rising (W)	49	55	*7*	54	66	*12*	57	57	*0*
OSU	OK Bullet	48	57	*10*	50	65	*15*	59	60	*1*
WestBred	Shocker	48	53	*5*	64	68	*4*	57	58	*0*
WestBred	Keota	47	57	*10*	-	-	-	59	59	*0*
KSU	Overley	47	53	*6*	56	64	*8*	58	58	*1*
TAMU	TAM 112	47	63	*16*	-	-	-	58	60	*2*
OSU	Pete	43	50	*7*	-	-	-	59	59	*1*
Experimentals										
	OK05526	56	61	*5*	-	-	-	59	59	*0*
	OK06114	53	61	*8*	-	-	-	58	59	*1*
	Mean	53	59	*6*	60	68	*8*	58	58	*0*
	LSD (0.05)	4	6		25	4		1	1	*NS*

Lamont Variety Trial

Cooperator: Kirby Farms
Soil type: Pond creek silt loam
Planting date: 11-4-08
Harvest date: 6-25-09

Tillage: Conventional till
Management: Grain only
Previous crop: Wheat
Soil test information: pH = 6.3 , P = 40, K = 459

		Grain Yield			Test Weight
Source	Variety	2008-09	2-Year	3-Year	2008-09
		-----bu/ac----			-----lb/bu-----
WestBred	Shocker	49	52	-	54
WestBred	Santa Fe	48	55	53	55
TAMU	TAM 203	46	-	-	53
OSU	Centerfield	46	46	44	56
OSU	Endurance	46	48	45	54
AgriPro	Doans	43	54	-	56
AgriPro	Jagalene	43	44	46	54
OSU	Deliver	43	45	42	55
KSU	Jagger	43	44	47	54
KSU	Overley	42	50	48	55
TAMU	TAM 304	40	52	-	52
KSU	Fuller	38	54	-	54
OSU	OK Bullet	38	43	45	56
AgriPro	Jackpot	37	54	-	55
WestBred	Armour	37	-	-	52
OSU	Duster	37	52	52	53
OSU	Billings	36	50	-	54
OSU	OK Rising (W)	35	42	43	55
Experimentals					
	OK06114	42	-	-	55
	OK05526	39	-	-	56
	Mean	41	49	46	55
	LSD $_{(0.05)}$	8	5	3	2

(W) = Hard white wheat variety

Partial financial support provided by the Oklahoma Wheat Commission

Marshall Variety Trial

Cooperator: Henry Fuxa
Soil type: Kirkland silt loam
Soil test information: pH = 5.3, P = 50, K = 386
Planting date: Dual purpose = 9-17-08; Grain only = 10-20-08
Tillage: Conventional till
Previous crop: Wheat
Harvest date: 6-16-09

		Grain Yield								
		2007-08			2-Year			3-Year		
Source	Variety	Grain only	Dual purpose	***Diff.***	Grain only	Dual purpose	***Diff.***	Grain only	Dual purpose	***Diff.***
		------bu/ac------								
WestBred	Shocker	20	14	*-6*	39	34	*-5*	35	30	*-5*
AgriPro	Doans	27	13	*-13*	43	32	*-10*	40	28	*-12*
OSU	Duster	30	13	*-18*	48	36	*-11*	42	31	*-10*
TAMU	TAM 203	29	12	*-17*	47	37	*-10*	-	-	-
KSU	Fuller	21	10	*-11*	44	35	*-9*	42	29	*-13*
OSU	OK Bullet	17	10	*-7*	36	33	*-3*	36	29	*-8*
WestBred	Santa Fe	25	10	*-15*	41	32	*-9*	38	28	*-10*
OSU	Endurance	31	8	*-23*	46	34	*-13*	40	29	*-11*
OSU	Centerfield	22	7	*-15*	40	29	*-11*	34	23	*-12*
AgriPro	Jackpot	17	7	*-10*	42	34	*-8*	-	-	-
WestBred	Armour	25	6	*-19*	-	-	-	-	-	-
OSU	Deliver	20	5	*-15*	38	26	*-12*	36	24	*-12*
AgriPro	Jagalene	13	5	*-8*	25	26	*1*	24	21	*-3*
KSU	Overley	12	4	*-7*	36	32	*-5*	33	27	*-7*
KSU	Jagger	11	4	*-6*	27	31	*3*	25	24	*-2*
OSU	Billings	16	4	*-13*	38	30	*-8*	-	-	-
OSU	OK Rising (W)	13	4	*-9*	34	26	*-8*	41	24	*-17*
OSU	Pete	13	3	*-10*	-	-	-	-	-	-
Experimentals										
	OK04315	29	12	*-17*	-	-	-	-	-	-
	OK05526	23	12	*-10*	-	-	-	-	-	-
	Mean	21	8	*-13*	39	32	*-7*	36	27	*-9*
	LSD $_{(0.05)}$	5	4		2	5		3	3	

Notes: Recovery from grazing impacted by drought. Grain yields were insufficient to obtain test weight measurements. Dual purpose plots were grazed from 4 December 2008 to 6 March 2009 (92 days). Average initial cattle weight was 534 lb and cattle were stocked at 0.446 head per acre. ADG was 2.52 lb/head/day.

Partial financial support provided by the Oklahoma Wheat Commission

Olustee Variety Trial

Cooperator: David Bush | **Tillage: Conventional till**
Soil type: Tillman silt loam | **Management: Grain only**
Planting date: 10-23-08 | **Previous crop: Wheat**
Harvest date: 6-8-09 | **Soil test: pH = 8.0, P = 21, K = 1040**

		Grain Yield			Test Weight
Source	Variety	2008-09	2-Year	3-Year	2008-09
		-----bu/ac----			-----lb/bu-----
OSU	OK Bullet	29	42	50	62
OSU	Duster	28	39	44	61
AgriPro	Jagalene	27	42	47	62
WestBred	Santa Fe	27	42	50	61
TAMU	TAM 203	27	43	-	59
KSU	Overley	26	41	50	61
KSU	Fuller	25	42	51	60
KSU	Jagger	25	41	48	60
WestBred	Armour	24	-	-	59
OSU	OK Rising (W)	24	-	-	60
WestBred	Shocker	24	39	46	59
OSU	Centerfield	23	37	43	60
AgriPro	Doans	23	37	44	61
OSU	Endurance	23	38	45	60
AgriPro	Jackpot	23	40	-	61
OSU	Pete	23	38	47	61
OSU	Deliver	20	39	45	58
AgriPro	Fannin	17	33	41	60
Experimentals					
	OK05742W	27	-	-	60
	OK06729	24	-	-	63
	OK04525	23	-	-	61
	STARS 0601W	17	-	-	60
	Mean	24	40	47	60
	LSD $_{(0.05)}$	3	3	2	1

Partial financial support provided by the Oklahoma Wheat Commission

Hulless Barley Trials

Newkirk Cooperator: Don Merz **Marshall Cooperator: Henry Fuxa**
Buffalo Cooperator: NRCS

	Grain Yield			
Variety	Buffalo	Marshall Dual-Purpose	Marshall Grain Only	Newkirk
	------bu/ac------			
VA 125	33	14	34	25
EVE	29	23	38	24
VA03H-61	-	-	-	40
TAMBAR 501 check	-	-	-	18
Jagger Check	54	5	14	-
Duster Check	70	16	35	-
Mean	47	15	30	27
LSD $_{(0.05)}$	7	5	2	10

Notes: All yields, including barley, calculated using a 60 lb bushel weight

Plant height, lodging score, and heading date for selected variety trials in Oklahoma in 2009

	Plant Height											Lodging		Heading date	
	Balko	Buffalo	Keyes	El Reno Conv Till DP	El Reno Conv Till GO	El Reno No Till DP	El Reno No-till GO	Kingfisher	Lahoma	Lamont	Olustee	Alva	Buffalo	Lahoma	Stillwater early-sown
Variety					-----------------------------------inches-----------------------------------							0 - 10 scale†			
Armour	24	24	24	24	24	23	22	22	28	24	19	3	1	21-Apr	15-Apr
Aspen (W)	26	-	25	-	-	-	-	-	-	-	-	-	-	-	15-Apr
Billings	-	-	-	23	-	-	-	23	26	27	-	2	-	20-Apr	16-Apr
Centerfield	28	24	26	22	23	24	22	26	27	28	20	2	1	22-Apr	18-Apr
Deliver	28	26	28	24	28	26	22	24	31	30	20	3	2	25-Apr	17-Apr
Doans	28	28	36	24	26	25	23	25	30	29	20	2	2	21-Apr	19-Mar
Duster	29	25	28	24	27	24	23	25	29	28	23	4	3	23-Apr	18-Apr
Endurance	28	28	28	25	26	25	24	26	32	30	23	2	2	24-Apr	18-Apr
Fannin	-	-	-	22	24	22	22	-	-	-	20	-	-	-	14-Apr
Fuller	26	22	26	24	26	24	24	25	29	29	21	3	1	19-Apr	16-Apr
Guymon (W)	29	-	26	-	-	-	-	-	-	-	-	-	-	-	19-Apr
Jackpot	27	26	26	25	26	24	22	24	28	28	21	2	2	19-Apr	17-Apr
Jagalene	28	27	29	24	26	25	24	25	30	27	23	2	1	23-Apr	19-Mar
Jagger	26	24	26	22	25	23	21	24	27	28	21	5	3	20-Apr	17-Apr
Keota	31	29	30	-	-	-	-	-	32	-	-	2	2	25-Apr	18-Apr
Mace	30	-	28	-	-	-	-	-	-	-	-	-	-	-	21-Apr
OK Bullet	30	28	29	25	28	25	27	26	29	30	23	1	1	24-Apr	18-Apr
OK Rising (W)	28	27	28	24	26	25	24	26	29	30	22	1	1	23-Apr	17-Apr
Overley	30	24	29	23	24	24	23	24	30	30	22	2	1	22-Apr	15-Apr
Pete	26	-	-	24	-	-	-	21	28	-	19	2	-	16-Apr	14-Apr
Santa Fe	26	24	26	24	24	23	23	26	29	30	21	4	2	22-Apr	16-Apr
Shocker	28	23	27	23	24	23	22	23	29	32	21	3	2	21-Apr	15-Apr
TAM 111	30	26	29	-	-	-	-	-	30	-	-	1	2	24-Apr	20-Apr
TAM 112	26	26	28	-	-	-	-	-	29	-	-	5	4	17-Apr	17-Apr
TAM 203	28	25	26	25	26	25	22	24	29	30	22	2	2	25-Apr	18-Apr
TAM 304	-	-	-	-	-	-	-	23	27	24	-	-	-	19-Apr	15-Apr
Winterhawk	28	26	26	-	-	-	-	-	28	-	-	2	2	21-Apr	16-Apr
OK04315	-	-	-	24	-	-	-	-	-	-	-	-	-	-	-
OK05312	30	-	28	-	-	-	-	-	-	-	-	-	-	-	18-Apr
OK05526	30	-	-	25	-	-	-	27	31	29	-	2	-	19-Apr	15-Apr
OK05742W	-	-	-	-	-	-	-	25	-	-	23	-	-	-	16-Apr
OK06114	-	-	-	-	-	-	-	-	27	28	-	-	-	20-Apr	14-Apr
OK06729	-	-	-	-	-	-	25	-	-	-	20	-	-	-	16-Apr
STARS 0601W	31	-	-	-	-	-	-	-	-	-	21	1	-	-	17-Apr

† Scale of 0 - 10 with 0 representing no lodging and 10 representing severe lodging

OKLAHOMA COOPERATIVE EXTENSION SERVICE CR-2141
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Current Report

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Fall forage production and date of first hollow stem in winter wheat varieties during the 2008-2009 crop year

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Introduction

Fall forage production potential is just one consideration in deciding which wheat variety to plant. Dual-purpose wheat producers, for example, may find varietal characteristics such as grain yield after grazing and disease resistance to be more important selection criteria than slight advantages in forage production potential. Forage-only producers might place more importance on planting an awnless wheat variety or one that germinates readily in hot soil conditions. Ultimately, fall forage production is generally not the most important selection criteria used by Oklahoma wheat growers, but it is one that should be considered.

Fall forage production by winter wheat is determined by genetic potential, management and environmental factors. The purpose of this publication is to quantify some of the genetic differences in forage production potential and grazing duration among the most popular wheat varieties grown in Oklahoma. Management factors such as planting date, seeding rate, and soil fertility are very influential and are frequently more important than variety in determining forage production. Environmental factors such as rainfall and temperature also play a heavy role in dictating how much fall forage is produced. All of these factors along with yield potential after grazing and the individual producer's preferences will determine which wheat variety is best suited for a particular field.

Site Descriptions and Methods

The objective of the fall forage variety trials is to give producers an indication of the fall forage production ability of wheat varieties commonly grown throughout the state of Oklahoma. The forage trials are conducted under the umbrella of the Oklahoma State University winter wheat variety trials at the El Reno, Okla. and Stillwater, Okla. test sites. Weather data for these sites are provided in Figures 1 and 2.

A randomized complete block design with four replications was used at each site. Forage was measured by hand clipping two 1-m by 1-row samples at random sites within each plot. Samples were then placed in a forced-air dryer for approximately 7 days and weighed. All plots were sown at 120 lbs/acre. Conventional till plots received 50 lbs/acre of 18-46-0 in furrow at planting and no-till plots received 5 gal/acre of 10-34-0 at planting. Fertility, planting date and harvest date information are provided in Table 1.

Figure 1. Average daily temperature and rainfall from Sept. 1, 2008 to Dec 31, 2008, Stillwater, Okla.

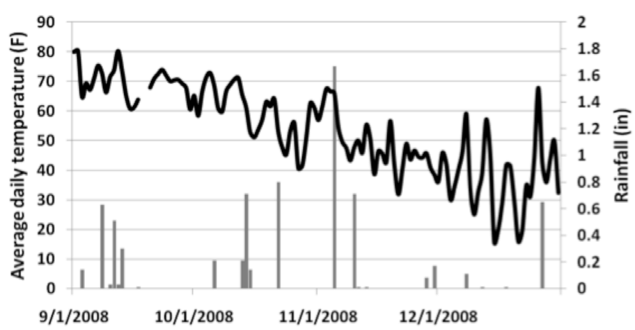

Figure 2. Average daily temperature and rainfall from Sept. 1, 2008 to Dec 31, 2008, El Reno, Okla.

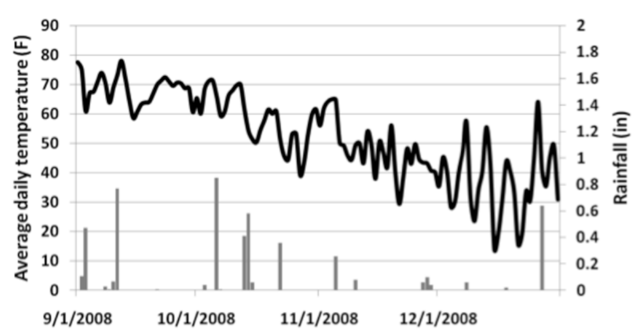

Table 1. Location information.

	Planitng date	Sampling date	pH	P	K
El Reno Conventional till	9/25/2008	12/11/2008	5.6	108	362
El Reno No-till	9/25/2008	12/11/2008	5.1	102	279
Stillwater	9/16/2008	12/02/2008	5.6	39	341

Results

There were no statistically-significant differences in fall forage production among wheat varieties within a location in 2008 (Table 2). Average fall forage production by conventionally-tilled winter wheat plots was 1,690 lbs/acre more at the Stillwater site than the El Reno site in 2008 (Table 2). This was partially due to a nine-day earlier planting date for the Stillwater site but also was attributable to greater plant-available moisture at the Stillwater location.

The lack of differences in forage yield among varieties further illustrates that most commercially-available wheat varieties can produce adequate fall forage when managed properly. While most varieties can produce adequate fall forage, the two and three-year averages (Tables 3 and 4) clearly show that some varieties routinely produce more forage than others when placed under similar management. This does not mean, however, that a high-yielding variety from our test will produce a bumper crop of forage when not managed properly. Similarly, some of the mid-tier and even lower-tier varieties in our test are excellent dual-purpose varieties due to traits such as late first hollow stem and prolific tillering.

Conventionally-tilled wheat plots produced 660 lbs/acre more forage yield than no-tillage plots at the El Reno site

Table 2. Fall forage production by winter wheat varieties sown in 2008 at Stillwater and El Reno. No statistical differences were observed among varieties.

Source	Variety	Stillwater	El Reno Conv. till	El Reno No-till	No-till Difference
		------------------------------lbs dry forage/acre-----------------------------			
WestBred	Armour	3,400	1,660	900	-760
Oklahoma	Centerfield	3,340	1,610	950	-660
Oklahoma	Deliver	3,020	1,550	990	-560
AgriPro	Doans	3,220	1,840	860	-980
Oklahoma	Duster	3,620	1,700	1,160	-540
Oklahoma	Endurance	2,960	1,500	1,120	-380
AgriPro	Fannin	3,540	1,440	900	-540
Kansas	Fuller	3,280	1,800	960	-840
AgriPro	Jackpot	3,370	1,520	690	-830
AgriPro	Jagalene	3,180	1,720	910	-810
Kansas	Jagger	3,270	1,400	940	-460
WestBred	Keota	3,420	-	-	-
USDA-ARS	Mace	3,400	-	-	-
Oklahoma	OK Bullet	3,340	1,690	1,040	-650
Oklahoma	OK Rising	3,410	1,770	1,180	-590
Kansas	Overley	3,390	1,860	1,060	-800
WestBred	Santa Fe	3,160	1,420	680	-740
WestBred	Shocker	3,640	1,490	880	-610
Texas	TAM 111	3,350	-	-	-
Texas	TAM 112	3,280	-	-	-
Texas	TAM 203	2,990	1,420	840	-580
Texas	TAM 304	3,370	-	-	-
WestBred	Winterhawk	2,940	-	-	-
Average		3,300	1,610	950	-670
LSD		NS†	NS	NS	

† NS = differences among varieties within a location were nonsignificant at P = 0.05.

in 2008 (Table 2). Similar trends were observed in the two (710 lbs/acre difference) and three (790 lbs/acre difference) year data. These data were collected as part of a three-year, comprehensive experiment comparing no-till and conventional till wheat production practices, so it is important to reserve judgment on the two systems until final grain yield data are in and economic analyses performed. Nevertheless, our data have consistently shown less forage production in no-till plots than in conventional till plots.

The lesser forage production in no-till was probably due to several factors. Emergence was delayed in no-till plots in two years of the experiment due to drier soil conditions in the top 1.5 inches of the profile. In this situation, the final tillage operation brought enough moisture to the surface to allow for germination and adequate subsoil moisture was present to fuel early-season plant growth. Had adequate subsoil moisture not been present, the results would likely have been reversed. Other probable causes include cooler soil temperatures and shallow soil compaction, which may actually benefit grazing conditions by keeping cattle out of muddy conditions. It also is important to note that grain yields have been greater in no-till plots than conventional till plots some years of the experiment.

As mentioned previously, occurrence of first hollow stem dictates when cattle are removed from wheat pasture; therefore, fall forage numbers provided in this document describe the amount of forage available, but date of first hollow stem dictates how long the forage can be utilized. There was a 17-day difference between the earliest (Fannin) and latest (Centerfield & Mace) first hollow stem varieties at Stillwater in 2008. Unlike previous years, however, we observed no difference in date of first hollow stem between conventional till and no-till plots at El Reno.

Acknowledgments

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Table 3. Two-year average fall forage production by winter wheat varieties sown in 2007 and 2008 at Stillwater and El Reno.

Source	*Variety*	*Stillwater*	*El Reno Conv. till*	*El Reno No-till*	*No-till Difference*
		lbs dry forage/acre			
Oklahoma	Centerfield	**2,890**†	1,740	1,170	-570
Oklahoma	Deliver	2,520	**2,180**	**1,610**	-570
AgriPro	Doans	2,540	**2,320**	**1,290**	-1,030
Oklahoma	Duster	**2,970**	**2,220**	**1,450**	-770
Oklahoma	Endurance	2,390	**2,160**	**1,470**	-690
AgriPro	Fannin	**2,790**	**2,220**	**1,400**	-820
Kansas	Fuller	2,570	**1,970**	1,260	-710
AgriPro	Jackpot	2,670	**2,180**	**1,320**	-860
AgriPro	Jagalene	2,360	1,850	1,050	-800
Kansas	Jagger	2,270	1,690	1,140	-550
Oklahoma	OK Bullet	**2,760**	**2,030**	**1,370**	-660
Kansas	Overley	2,670	1,930	**1,390**	-540
WestBred	Santa Fe	2,370	**2,040**	1,150	-890
WestBred	Shocker	**2,770**	1,850	**1,320**	-530
Texas	TAM 203	2,370	-	-	-
Texas	TAM 304	**2,970**	-	-	-
Average		2,620	2,030	1,310	-710
LSD		290	360	330	

† Bolded numbers are not statistically different from the highest-yielding variety within a column.

Table 4. Three-year average fall forage production by winter wheat varieties sown in 2006, 2007 and 2008 at Stillwater and El Reno.

Source	*Variety*	*Stillwater*	*El Reno Conv. till*	*El Reno No-till*	*No-till Difference*
		---lbs dry forage/acre---			
Oklahoma	Centerfield	**2,650†**	2,190	1,510	-680
Oklahoma	Deliver	2,390	**2,580**	**1,870**	-710
AgriPro	Doans	2,330	**2,650**	1,620	-1,030
Oklahoma	Duster	**2,670**	**2,640**	**1,810**	-830
Oklahoma	Endurance	2,210	**2,580**	**1,740**	-840
AgriPro	Fannin	**2,520**	**2,760**	**1,660**	-1,100
Kansas	Fuller	2,360	2,310	1,520	-790
AgriPro	Jagalene	2,150	2,230	1,340	-890
Kansas	Jagger	2,000	2,040	1,440	-600
Oklahoma	OK Bullet	**2,490**	2,380	**1,680**	-700
Kansas	Overley	2,370	2,210	**1,690**	-520
WestBred	Santa Fe	2,090	**2,530**	1,510	-1,020
WestBred	Shocker	2,410	2,290	**1,700**	-590
Average		2,360	2,410	1,620	-790
LSD		180	240	230	

† Bolded numbers are not statistically different from the highest-yielding variety within a column.

Table 5. Occurrence of first hollow stem (day of year) for winter wheat varieties sown in 2009 at Stillwater and El Reno.

Variety	*Stillwater*	*El Reno Conv. till*	*El Reno No-till*	*Variety*	*Stillwater*	*El Reno Conv. till*	*El Reno No-till*
	---day of year---				---day of year---		
Fannin	52	-	-	OK Rising	63	-	-
Shocker	54	66	64	TAM 304	63	-	-
Billings	56	-	-	Pete	65	-	-
Jackpot	57	68	64	Aspen	66	-	-
Fuller	58	62	62	Deliver	66	68	75
Jagger	58	60	66	Doans	66	66	68
TAM 112	58	-	-	Duster	66	72	68
TAM 203	58	72	68	Keota	66	62	64
Santa Fe	59	62	66	TAM 111	66	-	-
OK Bullet	61	66	66	Winterhawk	66	64	68
Overley	61	64	66	Endurance	67	75	75
STARS 0601W	61	-	-	Centerfield	69	75	75
Armour	63	64	64	Mace	69	-	-
Guymon	63	-	-				
Jagalene	63	68	68	Average	62	67	67

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OSU EXTENSION

2009 Wheat Variety Comparison

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Oklahoma Cooperative Extension Fact Sheets are also available on our website at:
http://osufacts.okstate.edu

Importance of Variety Selection

Variety selection will dictate many of the decisions made in producing a wheat crop. Reactions to foliar diseases or insects, for example, will determine which pesticides are needed and when. Therefore, wheat farmers should carefully review variety characteristics and choose varieties that match their management style. This publication is designed to help wheat farmers make educated decisions about which varieties to grow. Additional information on yield potential of varieties can be found at www.wheat.okstate.edu

Variety Source

The variety source listed in this Fact Sheet indicates the breeding program that released the variety. This may or may not be the same organization marketing the variety. The Oklahoma Crop Improvement Association (www.okcrop.com) can be contacted to obtain a listing of certified seed producers in Oklahoma.

Lodging

Lodging ratings are based on a 1 – 4 scale with 1 indicating good straw strength and 4 indicating a greater propensity for lodging. This rating represents the genetic propensity for lodging and does not account for environmental factors, such as excessive nitrogen fertilization, which can also lead to lodging.

First Hollow Stem

First hollow stem is the stage of growth when cattle should be removed from dual-purpose wheat pasture. A variety with a very late (VL) rating would offer one to two weeks more grazing in most years than a variety with a very early (VE) rating.

Maturity

Maturity ratings are based on observations within the OSU wheat breeding and variety testing programs. Spreading acreage among a range of wheat maturities is a good way to hedge against spring freeze injury, some wheat diseases, and to spread harvest workload.

High Temperature Germination Sensitivity

Some varieties do not germinate well in hot soils and are not good candidates for early sowing. This chart uses a 1 – 4 scale to rate varieties with a 1 indicating a variety that will germinate well in hot soils and a 4 indicating a variety that does not germinate well in hot soils and should not be sown before October 1. For more information on this topic consult OSU Extension Fact Sheet PSS-2256 "Factors Affecting Wheat Germination and Stand Establishment in Hot Soils."

Coleoptile Length

The coleoptile is a rigid, protective structure that covers the emerging shoot to aid it in reaching the soil surface. If the coleoptile does not reach the soil surface, the plant will die. Therefore, coleoptile length should dictate planting depth. Coleoptile length is highly correlated to plant height at maturity and is shortened by hot soil conditions. In this chart, a rating of 1 indicates a relatively long coleoptile and a rating of 4 indicates a relatively short coleoptile. For more information on this topic consult OSU Extension Facts PSS-2256 "Factors Affecting Wheat Germination and Stand Establishment in Hot Soils."

Hessian Fly

Hessian fly is an increasing problem in Oklahoma wheat fields. Hessian fly overwinters and oversummers in wheat residue, so it is most prevalent in, but not restricted to, continuous no-till wheat fields. Therefore growers who no-till wheat after wheat should consider sowing varieties that have a resistant (R) or at least partially resistant (PR) rating. Likewise, growers who sow prior to 1 October might benefit from a variety with an R or PR rating, as early-sowing is a risk factor for Hessian fly. For more information on best management practices for no-till wheat production, refer to OSU Extension Fact Sheet PSS-2132 "No-till Wheat Production in Oklahoma."

Acid Soil Tolerance

When soil pH drops below 5.5, essential plant nutrients can become unavailable while, some elements such as aluminum, can become toxic. This publication uses a 1 – 5 scale, with 1 being most tolerant to low soil pH and 5 being least tolerant. Table 1 shows acceptable acid soil tolerance ratings for a range of pH conditions and production systems. It is also important to note in-furrow application of phosphorus at planting will increase early-season growth in most low-pH settings regardless of acid soil tolerance.

Table 1. Recommended acid soil tolerance ratings for given soil pH and production systems.

soil pH	*Grain only*	*Dual Purpose*
< 5.0	1	1
5.0 - 5.4	1-2	1
5.5 - 5.9	1-4	1-3
≥ 6.0	1-5	1-5

Wheat Streak Mosaic

Wheat streak mosaic virus is transmitted by the wheat curl mite. Mites oversummer on host crops such as corn, volunteer wheat, and many grassy weeds. Wheat curl mites have a life span of about 7 to 10 days, so the best way to combat this virus is to make sure that any host crops are completely dead (not just sprayed) at least two weeks prior to sowing. Tolerance ratings are on a 1 – 4 scale with 1 indicating tolerance and 4 indicating no tolerance. Wheat streak mosaic virus ratings adapted from Kansas State Publication MF-991. For more information on wheat streak mosaic virus, refer to OSU Extension Fact PSS-2136 "Considerations When Rotating Wheat Behind Corn."

Soil-borne Mosaic

Soil-borne mosaic virus is most prevalent in areas east of a line from Altus to Alva. Once a field has been infested with soil-borne mosaic, the only alternative is to plant resistant varieties. Susceptibility ratings are on a 1 – 4 scale with 1 being the most resistant and 4 indicating the least resistant. Fields with a history of soil-borne mosaic virus should only be sown to varieties with a 1 or a 2 rating.

Septoria and Tan Spot

Septoria and tan spot are two foliar diseases of wheat that become more prevalent with adoption of conservation and no-till farming practices. These diseases rarely reach economic threshold levels in tilled Oklahoma wheat fields, but growers employing conservation or no-till farming practices should avoid planting varieties highly susceptible to these diseases. Ratings are on a 1 – 4 scale with 1 indicating the most resistance and 4 indicating the least resistance.

Powdery Mildew

Powdery mildew is a very common foliar disease in Oklahoma, but one that rarely justifies a fungicide application by itself. Powdery mildew is generally most prevalent in early-sown wheat fields with adequate nitrogen fertility and dense plant canopies. Varieties with a 1 or 2 rating are not likely to be significantly impacted by powdery mildew. Varieties with a rating of 3 can have moderate amounts of powdery mildew if conditions are favorable for disease development. Varieties with a rating of 4 are most likely to have severe powdery mildew infestations and may require treatment.

Leaf Rust

Leaf rust probably has more impact on wheat yield in Oklahoma than any other foliar disease. While less aggressive than stripe rust, leaf rust occurs more frequently than stripe rust. For this reason, some producers choose to apply fungicides to control leaf rust if the crop yield potential and price warrant control. Ratings for leaf rust are on a 1 to 4 scale with 1 representing the greatest resistance to current disease races. It is important to note disease races can shift. So planting a variety with a rating of 1 will not eliminate the possibility of leaf rust, but will greatly decrease the likelihood that leaf rust reaches economic threshold levels. For more information on control of foliar diseases in wheat, consult OSU Extension Current Report CR-7668 "Foliar Fungicides and Wheat Production in Oklahoma."

Stripe Rust

Stripe rust is the most aggressive of the foliar diseases listed in this publication. Fortunately, stripe rust is not a widespread problem every year. This makes it difficult, however, to accurately track genetic resistance to stripe rust. Ratings for stripe rust are on a 1 to 4 scale with 1 representing the greatest resistance to current disease races. It is important to note disease races can shift. So planting a variety with a rating of 1 will not eliminate the possibility of stripe rust, but will greatly decrease the likelihood that stripe rust reaches economic threshold levels. For more information on control of foliar diseases in wheat, consult OSU Extension Current Report CR-7668 "Foliar Fungicides and Wheat Production in Oklahoma."

Variety Protection

Varieties listed as having PVP protection can only be sold as a certified class of seed. For more information on PVP protection laws, visit www.farmersyieldinitiative.com

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WestBred

David Worrall
AgriPro

Wheat Variety Comparison Chart

Source	Entry	Lodging	First Hollow Stem	Maturity	High-temp germination sensitivity	Coleoptile Length	Acid Soil Tolerance	Hessian Fly	Wheat Streak Mosaic	Septoria	Soil-borne Mosaic	Leaf Rust	Stripe Rust	Powdery Mildew	Tan Spot	Variety Protection
HARD RED WINTER WHEAT VARIETIES																
AgriPro	AP502 CL	3	VE	VE	2	1	4	S	3	3	3	4	4	1	2	Y
AgriPro	Cutter	4	VE	M	4	3	1	S	3	3	1	4	1	4	4	Y
AgriPro	Doans	2	M	M	2	-	1	S	-	2	2	1	1	2	-	Y
AgriPro	Dumas	1	E	E	2	4	4	S	4	2	4	3	4	3	2	Y
AgriPro	Fannin	2	VE	VE	3	1	2	-	-	-	1	1	1	2	-	Y
AgriPro	Jagalene	2	E	E	3	2	1	S	3	2	1	4	1	4	3	Y
AgriPro	Jackpot	1	VE	E	2	-	1	-	-	-	1	1	-	-	-	Y
AGSECO	7853	3	VE	M	3	4	2	S	3	2	1	3	-	2	3	N
CSU	Above	2	VE	VE	2	2	4	S	3	3	4	4	4	1	2	Y
CSU	Hatcher	3	M	M	-	2	3	PR	4	3	3	3	2	-	3	Y
CSU	Ripper	1	VE	VE	-	2	4	S	3	-	-	4	4	-	-	Y
KSU	Karl 92	3	E	E	2	4	3	-	4	3	1	4	3	1	2	Y
KSU	2137	1	L	L	3	4	1	S	3	2	2	3	4	2	3	Y
KSU	2145	2	E	E	2	2	3	PR	4	2	1	1	2	3	4	Y
KSU	Fuller	2	VE	E	3	-	4	-	3	3	1	1	1	3	3	Y
KSU	Ike	3	VL	L	2	2	4	PR	4	3	4	4	3	2	4	Y
KSU	Jagger	3	VE	VE	1	2	1	S	3	1	1	4	1	4	2	Y
KSU	Overley	1	VE	VE	4	3	1	S	3	2	1	3	1	4	2	Y
UN-L	Scout 66	4	L	L	-	1	4	-	3	3	4	4	-	3	4	N
UN-L	Mace	1	VL	VL	-	-	-	-	-	-	3	-	-	-	-	-
OSU	Triumph 64	4	L	M	4	1	4	-	-	4	4	4	-	3	1	N
OSU	2174	1	VL	L	4	3	2	PR	4	2	1*	2	2	1	4	Y
OSU	Billings	2	E	E	1	3	2	-	4	2	1	1	1	2	3	Y
OSU	Chisholm	2	L	E	3	3	2	PR	-	3	4	4	1	3	4	N
OSU	Centerfield	2	VL	M	4	3	2	R	-	-	2	2	2	1	4	Y
OSU	Custer	2	E	E	1	3	4	-	-	3	4	3	4	1	3	N
OSU	Deliver	3	L	M	2	4	4	-	4	2	1	1	1	1	3	Y
OSU	Duster	3	M	M	1	3	1	R	4	3	1	1	2	2	4	Y
OSU	Endurance	2	VL	M	1	2	1	S	4	3	2*	2	2	2	3	Y
OSU	OK Bullet	1	E	E	1	2	2	S	3	3	2	3	1	3	3	Y
OSU	Ok101	2	E	VE	1	4	1	S	-	3	2	3	3	4	4	N
OSU	Ok102	1	VL	L	4	1	2	PR	-	3	1	2	4	2	4	N
OSU	Okfield	2	M	L	4	1	3	PR	-	3	4	3	3	1	3	Y
OSU	Pete	1	M	M	1	2	2	-	3	2	1	1	3	2	3	Y
TAMU	Lockett	4	E	VL	1	-	2	S	-	-	4	2	3	-	-	Y
TAMU	TAM 107	3	E	M	3	2	4	-	2	3	4	4	-	1	3	P
TAMU	TAM 110	2	VE	VE	2	1	4	S	3	3	4	4	4	1	4	Y
TAMU	TAM 111	3	M	M	3	1	4	S	4	2	3	3	4	4	3	Y
TAMU	TAM 112	4	VE	E	1	1	1	S	3	2	4	3	4	1	3	Y
TAMU	TAM 203	-	VE	E	4	-	4	-	-	-	1	2	2	3	-	Y
TAMU	TAM 304	-	M	M	3	-	2	-	-	-	2	1	2	2	-	Y
WestBred	Armour	1	E	M	-	3	1	S	3	3	1	1	3	1	2	Y
WestBred	Keota	1	L	L	-	2	2	S	4	3	1	4	2	4	4	Y
WestBred	Shocker	2	VE	E	4	3	1	PR	4	2	1	1	2	2	2	Y
WestBred	Santa Fe	2	VE	E	2	2	2	S	3	1	1	1	2	3	2	Y
WestBred	Winterhawk	2	L	L	-	3	3	S	4	3	1	3	2	3	3	Y
HARD WHITE WHEAT VARIETIES																
KSU	Danby	3	VL	M	4	3	3	-	3	4	4	4	1	4	4	Y
KSU	Heyne	3	VE	M	1	-	1	-	2	2	1	1	-	2	3	Y
KSU	Lakin	2	VL	M	1	4	3	-	3	4	2	3	4	4	3	Y
KSU	RonL	3	L	M	-	3	4	S	1	4	1	3	1	3	4	Y
KSU	Trego	4	L	M	2	3	4	S	3	3	2	4	4	3	4	Y
OSU	Guymon	3	VE	L	1	4	4	S	-	2	1	3	4	3	3	Y
OSU	Intrada	4	E	E	1	3	3	S	-	3	2	3	3	4	2	N
OSU	OK Rising	1	E	E	1	2	2	S	3	3	1	2	2	2	2	Y

General
1 = Excellent
4 = Poor

Maturity & FHS
VE = Very Early
E = Early
M = Medium
L = Late
VL = Latest

High-temp germ. sensitivity
1 = less sensitive
4 = very sensitive

Coleoptile
1 = Longest
4 = Shortest

Hessian Fly
S = Susceptible
PR = Partially resistant
R = Resistant

Variety Protection
N = Not protected
Y = PVP-Protected

* Reaction presented is to soilborne mosaic; reaction to spindle streak is a '3.'

OKLAHOMA CORN PERFORMANCE TRIALS, 2009

PRODUCTION TECHNOLOGY CROPS

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

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TRIAL OBJECTIVES AND PROCEDURES

Each year the Oklahoma Cooperative Extension Service conducts corn performance trials in Oklahoma. These trials provide producers, extension educators, industry representatives, and researchers with information on corn hybrids marketed in Oklahoma. Company participation was voluntary, so some hybrids marketed in Oklahoma were not included in the test. Company or brand name, entry designation, plant characteristics, and maturity information, were provided by the companies and were not validated by OSU; therefore, we strongly recommend consulting company representatives for more detailed information regarding these traits and disease resistance ratings (Tables 3 and 4).

Irrigated test plots were established at the Oklahoma Panhandle Research and Extension Center (OPREC) near Goodwell and the Joe Webb farm near Guymon. Additionally in 2009 dry-land trials were conducted in north central Oklahoma at Enid, Jet, and Wakita. Fertility levels, herbicide use, and soil series (when available) are listed with data. Individual plots were two 25-foot rows seeded at a target population of 32,000 plants/ac for irrigated and 23,000 plants/ac for the trials in north central Oklahoma. Plots were trimmed to 20 feet prior to being harvested to determine grain yield. The ensilage trial was seeded the same as grain trial with 10 feet of one row harvested to determine yield. Experimental design for all locations was a randomized complete block with four replications. Grain yield is reported consistent with U.S. No. 1 grade corn (56 lbs/bu and adjusted to moisture content of 15.5%). Corn ensilage was harvested at the early dent stage with average moisture content of 69 % and production is reported as tons/ac adjusted to 65% moisture.

GROWING CONDITIONS

North Central Oklahoma

The early part of the planting season was characterized by dry soil in many areas. The trial in Wakita was planted into dry soil, while the trials at Jet and Enid were planted in adequate soil moisture. The trials were planted on March 26, the day before the blizzard that hit northwest and north central Oklahoma. The snow and cold temperatures (a freeze on April 6 and 7 reduced wheat yields) slowed germination and emergence of corn. After the corn emerged, conditions improved until late June. In June lack of precipitation and high temperatures the last two weeks dramatically affected corn, mainly west of I-35 (Table 1). Conditions east of I-35 were almost ideal throughout the growing season and grain yields were considerably higher than west of I-35 with yields over 120 bu/ac reported. The lack of precipitation and high temperatures (8 of last 14 days in June had high temperatures above 100˚F) caused many acres of corn to not be harvested either due to low yields or levels of aflatoxins being too high for grain to be accepted at elevators. The trials at Wakita and Enid were harvested but the data not reported. Deer found the plots at Wakita and caused the data to be to variable to report. Grain yields were severely reduced at the Enid location with yields ranging from 5 to 18 bu/ac, also the yields were so variable they are not reported. Enough grain was harvest at each location to sample for Aflatoxin of four hybrids each location. Aflatoxin was present at each location and ranged from 100 ppb to over 400 from both sites.

Panhandle

The early planting period was delayed due to the blizzard, but after April 10 any delays were minimal. Conditions for germination and emergence were good. Most corn acres were irrigated prior to planting, due to dry conditions from lack of precipitation from November through March. Total precipitation from the period was 1.00 inches compared to the long-term average of 2.79 inches. The growing conditions during the growing season in the panhandle were not as severe as what was observed in the body of the state. Most of the 100 ˚F temperatures were during the middle of July (10 days), and the total number of days was 11 for June through August, which is normal. Although precipitation was limited (Table 2), producers reported the highest yields they have ever obtained. Yields ranged from 190 bu/ac to over 270 bu/ac in the panhandle area as reported by producers. Many producers had the highest average yields on their total farms ever observed. This is partially due to the widespread adoption of strip-till in the last few years. Trials at OPREC were reduced due to sprinkler and irrigation problems in late June and early July, and therefore are not reported here.

RESULTS

Grain yield, test weight, harvest moisture, and plant populations for OPREC and Webb trials are presented (Tables 3-5). 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 variation (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 also provided in tables producers interested in comparing hybrids for consistency of yield should consult these.

The following people have contributed to this report by assisting in crop production, data collection, and publication; Roger Gribble, Jeff Bedwell, Tommy Puffinbarger, Donna George, Lawrence Bohl, Matt LaMar, Eddie Pickard, Wilson Henry, Cameron Murley, and Craig Chesnut. Their efforts are greatly appreciated.

Table 1. Rainfall for selected locations near dry-land corn performance trial locations in north central Oklahoma.

Location	March	April	May	June	July	Total
Long-term mean in Garfield county	2.50	3.20	4.90	4.40	2.80	17.80
Blackwell	2.59	6.52	2.42	4.13	4.80	20.46
Cherokee	1.75	5.04	2.02	2.66	1.86	13.33
Lahoma	1.20	3.54	1.49	2.32	2.57	11.12

Table 2. Rainfall and irrigation for irrigated corn performance trial locations in Texas County.

Location	April	May	June	July	Aug	Total
Long-term mean	1.33	3.25	2.86	2.58	2.28	12.30
2009	2.06	0.55	1.74	2.58	1.36	8.29
			Irrigation			
Joe Webb	3.0	4.0	6.0	6.0	2.0	21.0

Table 3. Characteristics of Corn Hybrids in Panhandle Corn Performance Trials, 2009

Company Brand Name	Hybrid	Plant Characteristics				Maturity Days
		SV	SS	SG	EP	
Triumph Seed Co. Inc.	1536H	8	7	8	M	115
Triumph Seed Co. Inc.	1706H	8	7	8	MH	117
Triumph Seed Co. Inc.	7514X	7	7	7	M	114
Triumph Seed Co. Inc.	1420V	3	3	3	ML	117
Triumph Seed Co. Inc.	1825V	3	2	2	MH	118
Triumph Seed Co. Inc.	1305V	2	2	3	M	113
Triumph Seed Co. Inc.	2288H	3	2	2	H	122
Mycogen Seeds	F2F 797	7	7	NA	NA	115
Mycogen Seeds	TMF2H918	8	8	NA	NA	123
Mycogen Seeds	TMF 2L844	7	6	NA	NA	119
Mycogen Seeds	TMF2L831	7	6	NA	NA	118
Mycogen Seeds	TMF7Q759	7	7	NA	NA	113
Mycogen Seeds	F2F700	8	8	NA	NA	113
Syngenta Seeds	N78N 3000 GT	2	4	5	MH	115
Syngenta Seeds	82R44 3000 GT	4	3	3	H	117
Syngenta Seeds	N72K GT/CB/LL	NA	NA	NA	NA	115
Syngenta Seeds	N82A CB/LL	4	3	3	M	117
Syngenta Seeds	N83Z	5	5	5	H	118
Syngenta Seeds	N91J	4	5	3	H	124
DEKALB	DKC 64-79	3	5	5	M	114
DEKALB	DKC 61-69 VT3	3	4	3	M	111
Golden Acres	GA 26Y23	1	1	2	M	115
Golden Acres	GA 28V87	2	2	2	M	118
Golden Acres	GA 27Z07	2	3	2	H	117

Table 4. Characteristics of Corn Hybrids in North Central Oklahoma Corn Performance Trials, 2009

Company Brand Name	Hybrid	Plant Characteristics				Maturity Days
		SV	SS	SG	EP	
Dyna Gro Seeds	55V71	NA	NA	NA	NA	105
Dyna Gro Seeds	55B31	NA	NA	NA	NA	105
Dyna Gro Seeds	57V15	NA	NA	NA	NA	110
Dyna Gro Seeds	57V07	NA	NA	NA	NA	112
Dyna Gro Seeds	57V40	NA	NA	NA	NA	111
DEKALB	DKC 52 59 (VT3)	2	4	3	M	111
DEKALB	DKC 61-69 (VT3)	3	3	2	M	109
Syngenta Seeds	N69L GT	NA	NA	NA	NA	111
Syngenta Seeds	N77P 3000 GT	3	2	3	H	114
Syngenta Seeds	84A53 GT/CB/LL	NA	NA	NA	NA	112
Syngenta Seeds	N73V 3000 GT	3	3	2	MH	113
NuTech Seed LLC.	3T-603 VT3	2	3	4	L	103
NuTech Seed LLC.	3T-706 VT3	2	3	4	M	106
G2 Genetics	1H-005 HX/LL	2	1	4	M	105
G2 Genetics	5H-506 RR/HXT	2	1	5	L	106
G2 Genetics	5H-911 RR/HX	2	3	4	H	111

Table 5. Grain Yield and Harvest Parameters Joe Webb location, Oklahoma Corn Performance Trials, 2009.

Company Brand Name	Hybrid	Grain Yield Bu/ac	Test Weight Lb/bu	Harvest Moisture	Plant Population plants/ac
Triumph Seed Co. Inc.	1536H	255	55	19.6	34,300
Triumph Seed Co. Inc.	7514X	252	56	19.1	34,400
Triumph Seed Co. Inc.	1420V	252	55	20.1	35,400
Triumph Seed Co. Inc.	1825V	252	56	19.4	35,800
Mycogen Seeds	TMF2L831	251	55	20.1	37,700
Golden Acres	GA 28V87	242	56	18.1	30,600
Golden Acres	GA 27Z07	239	54	20.1	33,400
Golden Acres	GA 26Y23	238	55	19.5	34,300
Syngenta Seeds	N78N 3000 GT	235	54	21.5	25,900
Triumph Seed Co. Inc.	1706H	235	55	20.1	36,900
DEKALB	DKC 64-79	230	58	18.2	28,400
Syngenta Seeds	82R44 3000 GT	222	54	21.4	25,900
Mycogen Seeds	TMF7Q759	212	54	20.2	37,400
Triumph Seed Co. Inc.	2288H	211	56	22.8	33,400
DEKALB	DKC 61-69 VT3	200	56	17.1	26,400
Syngenta Seeds	N72K GT/CB/LL	195	55	19.0	29,400
Triumph Seed Co. Inc.	1305V	186	56	19.5	26,100
Mycogen Seeds	F2F700	158	58	19.3	33,500
	Mean	226	551	19.7	32,200
	CV%	9.1	2.3	6.5	8.7
	L.S.D.	29	2	1.8	4,000

Cooperator: Joe Webb
Soil Series: Richfield Clay Loam
Strip-Till: Following wheat and sunflowers in 2008
Soil Test: N: NA P: NA K: NA pH: NA
Fertilizer: N: 230 lbs/ac P: 50 lbs P_2O_5/ac K: 0
Herbicide: 1.5qt/ac Harness Extra (Preemergence) + 3/4 oz/ac Balance
Planting Date: April 22, 2009
Harvest Date: September 24, 2009

Table 6. Grain Yield and Harvest Parameters Alfalfa Country rain-fed location, Oklahoma Corn Performance Trials, 2009.

Company Brand Name	Hybrid	Grain Yield Bu/ac	Test Weight Lb/bu	Harvest Moisture	Plant Population plants/ac	Aflatoxin Level ppb
Dyna-Gro Seeds	57V40	81	55	17.7	16,200	0
DEKALB	DKC 52 59 (VT3)	76	56	15.2	18,600	0
Syngenta Seeds	84A53 GT/CB/LL	71	56	17.2	16,400	8
DEKALB	DKC 61-69 (VT3)	71	56	17.8	18,500	67
G2 Genetics	5H-911 RR/HX	69	58	17.6	12,700	10
Syngenta Seeds	N77P 3000 GT	67	56	18.1	18,500	15
Dyna-Gro Seeds	55B31	66	59	15.0	15,800	51
Dyna-Gro Seeds	57V07	63	55	18.6	19,000	140
NuTech Seed LLC.	3T-706 VT3	63	58	15.1	14,900	0
Dyna Grow Seeds	55V71	59	56	15.5	13,800	64
Syngenta Seeds	N69L GT	59	57	16.4	16,600	48
G2 Genetics	1H-005 HX/LL	56	55	17.1	10,200	78
NuTech Seed LLC.	3T-603 VT3	56	59	14.0	15,200	17
G2 Genetics	5H-506 RR/HXT	52	56	13.7	8,000	60
Syngenta Seeds	N73V 3000 GT	51	57	16.7	11,400	5
	Mean	63.9	57	16.4	15,000	38
	CV%	16.1	1.4	3.5	19.1	----
	L.S.D.	14.7	1	0.8	4,100	----

Cooperator: Troy Campbell
Soil Series: Pond Creek Silt Loam
No-Till: Following double crop soybean and wheat in 2008
Soil Test: N: NA P: NA K: NA pH: NA
Fertilizer: N: 120 lbs/ac P: 50 lbs P_2O_5/ac K: 0
Herbicide: 1 lb/ac Atrazine (preplant) + 1 qt/ac Dual (preemergent)
Planting Date: March 24, 2009
Harvest Date: September 2, 2009

GRAIN SORGHUM PERFORMANCE TRIALS IN OKLAHOMA, 2009

PRODUCTION TECHNOLOGY CROPS

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

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TRIAL OBJECTIVES AND PROCEDURES

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

Performance trials are conducted at ten locations in Oklahoma: Altus, Alva, Blackwell, Cherokee, Enid, Goodwell, Homestead, Keyes, Slapout, and Tipton. Dry-land trials are conducted at all locations, with an additional limited irrigation trial at Goodwell. The Cherokee, Homestead, and Slapout locations are uniquely designed trials to evaluate certain hybrids (generally early and medium maturity) for planting in late April. In 2009 trials were established at Enid and Alva to evaluate hybrids for use as a double crop. **All trial locations also have DK-37-07 and KS 585 planted with and without (WO) seed applied insecticide to determine the effect of these treatments on grain yield.**

Highlights

The highlight in 2009 was weather, either too much rain at planting, or lack of rain that delayed maturity and harvest. The normal late April planting for some producers was delayed due to rainfall, and they were unable to plant until late May. What sorghum was planted had delayed maturity in some areas because of the temperatures above 100˚F and lack of rain fall in the last half of June. When rainfall was received in July and August the plants exerted more heads and tended to have a higher yield.

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 were not entered at all locations. Hybrids tested at the Cherokee, Homestead, Enid, Alva, and Slapout 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 two 30-inch rows by 25 feet. Plots were trimmed to 20 feet prior to harvest. Tractor powered cone planters were used to plant all trials with seeding rates adjusted for trial location. Trials were harvested with a Massey-Ferguson model, 8 plot combine.

Target populations, cooperating producers, fertilization, cultural practices, soil series, and herbicide use on all trials are listed individually in the results tables. Rainfall data from the nearest Mesonet site are also listed. Some trials are long distances from the nearest Mesonet site; therefore rainfall could be greater or less than reported. This year we only reported in-season rainfall, as compared to yearly totals, in previous reports.

GROWING CONDITIONS

Soil moisture conditions were excellent for planting at the April planted trials, although soil temperatures were cool and delayed emergence on some fields. The planting period in April was short, and many producers were delayed until late May due to continued precipitation. There 17 days of measurable rainfall from April 16 to May 15 for the Blackwell and Cherokee locations. In the Panhandle dry-land planting was delayed until moisture from rainfall in mid June. Rainfall was sporadic in 2009 with periods of no rainfall in June and periods of high rainfall in late July for the body of the state. In the panhandle rainfall was below the long-term average but was timely, resulting in outstanding yields. Planting was delayed for double crop sorghum due to lack of rainfall. Cool wet weather through much of the fall delayed maturity for most double crop sorghum and delayed harvesting, therefore many acres were not harvested until mid December. With the delay in maturity some double crop did not have enough time to mature and test weights were affected by a freeze.

Insects were not a major concern in 2009, but due to late harvest many producers reported some bird damage

Trials at Blackwell, Altus, and Tipton were not harvest due to bird damage, also trials at Homestead and Slapout were damaged by dear and not harvested. The trial at Keyes is not reported due to damage from blowing soil after emergence, it delayed maturity and resulted in freeze damage and reduced test weights.

RESULTS

Grain yields in 2009 were lower than 2008, and producers report the highest yields obtained were on late May and early June plantings.

Grain yields are reported bushel per acre of threshed grain, adjusted to a moisture content of 14.0% (Tables 2-5). 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 prevent accurate comparison between locations. Also 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.

Least Significant Difference (L.S.D.) is a statistical test of yield differences and is 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 and 3-year means for yield and test weight are provided where trials have been conducted for more than one year with more than three 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, Eddie Pickard, Ryan Sproul, Jeff Bedwell, Jimmy Rhodes, Tommy Puffinbarger, and Wilson Henry. Their efforts are greatly appreciated. Also would like to thank the **Oklahoma Grain Sorghum Commission and The United Sorghum Checkoff Program** for their financial support.*

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Table 1. Seed source and hybrid characteristics of grain sorghum in the Oklahoma Grain Sorghum Performance Trials, 2009. All hybrids are susceptible to birds and are single cross.

Company Brand Name	Hybrid	Seed Color	Endosperm	Days to Mid-bloom	Greenbug Resistance
Less than 60 days to mid-bloom					
Johnston Seed Co.	JS 207	Bz	Hy	58	C
DEKALB	DK 39Y	Y	Y	59	E
DEKALB	DKS 28-05	Bz	HY	58	-----
Frontier Hybrids	F 303C	W	Y	60	E
Frontier Hybrids	F 505E	R	Y	60	E
DEKALB	Pulsar	Bz	HY	60	C,E,I
DEKALB	DKS 37-07	Bz	HY	60	C,E,I
DEKALB	DKS 37-07 (wo)	Bz	HY	60	C,E,I
Frontier Hybrids	F 270E	Bz	Y	55	E
DEKALB	DKS 29-28	Bz	HY	59	E
60 to 69 days to mid-bloom					
DEKALB	DKS 44-20	BZ	HY	67	NA
Syngenta Seeds	5464	Bz	Na	69	C, E
Sorghum Partners Inc	KS 585	Bz	HY	67	C, E
Sorghum Partners Inc	KS 585 (wo)	Bz	HY	67	C, E
Dyna-Gro	771	Bz	Na	65	-----
Dyna-Gro	742C	W	Na	62	-----
Sorghum Partners Inc	NK5418	Bz	HY	67	C,E
Syngenta Seeds	5613	Bz	Na	65	C,D,E
Syngenta Seeds	5556	R	Na	67	C
Syngenta Seeds	H-486	R	Na	68	-----
Dyna-Gro	766B	Bz	HY	65	CE
Dyna-Gro	772B	Bz	HY	68	CE
NC+ Hybrids	5B90	Bz	NA	62	C
Pioneer Hi-Bred Int.	85G03	R	W	69	Na
Pioneer Hi-Bred Int.	86G32	R	W	65	Na
Sorghum Partners Inc	X445	Bz	Hy	67	-----
Johnston Seed Co.	JS 222	Bz	Hy	68	C, E
Johnston Seed Co.	JS 753	Bz	Hy	66	C
Johnston Seed Co.	JS 005	W	Hy	69	C, E
Johnston Seed Co.	JS - 056	R	N	65	C
Johnston Seed Co.	JS - 524	R	N	65	C
DEKALB	DKS 36-06	Bz	Hy	63	-----
Pioneer Hi-Bred Int.	87P06	R	W	63	Na
NC+ Hybrids	6B10	Bz	Hy	61	Na
NC+ Hybrids	7B11	Bz	Hy	67	E,I
Triumph Seed	TR 452	R	HY	65	C,E
Triumph Seed	TRX 95003	R	HY	69	Na

Table 1. continued.

Company Brand Name	Hybrid	Seed Color	Endosperm	Days to Mid-bloom	Greenbug Resistance
70 day and greater to mid-bloom					
Sorghum Partners Inc	SP6680	Bz	Hy	70	E
Sorghum Partners Inc	X 698	Bz	Hy	70	E
DEKALB	DKS 53-67	Bz	HY	71	C,E,I
DEKALB	DKS 54-00	Bz	HY	72	C,E,I
DEKALB	DKS 54-03	Bz	HY	74	NA
Pioneer Hi-Bred Int.	84G62	Bz	Y	72	NA
Sorghum Partners Inc	NK6638	Bz	HY	70	C
Pioneer Hi-Bred Int.	84P74	R	W	70	NA
Frontier Hybrids	F 700E	R	Y	70	E

Table 2. Results from Cherokee grain sorghum performance trial, 2009.

Company Brand Name	Hybrid	Days to Mid-bloom	Grain Yield bu/ac		Test weight lb/bu		Harvest Moisture	Plant Population plants/ac	Head Population heads/plant
			2009	Two-year	2009	Two-year			
Sorghum Partners Inc	KS 585	67	78	99.0	59.0	59.2	14.6	27,400	2.10
DEKALB	DKS 44-20	67	75	98	58.7	59.2	14.7	29,200	1.54
Dyna-Gro	766B	65	72	94	57.2	57.5	14.3	22,300	1.97
DEKALB	DKS 37-07	60	76	91	58.1	58.5	14.6	33,400	1.52
Sorghum Partners Inc	KS 585 (wo)		70	86	59.2	59.2	14.5	24,600	2.02
Sorghum Partners Inc	NK6638	70	.4	84	57.1	57.5	15.6	23,600	1.83
DEKALB	DKS 37-07 (wo)		66	80	59.0	58.7	14.6	34,000	1.45
Pioneer Hi-Bred Int.	85G03	69	95	----	57.8	----	15.2	30,400	2.06
NC+ Hybrids	5B90	62	85	----	59.0	----	14.2	38,000	1.71
Syngenta Seeds	H-486	68	77	----	56.2	----	15.5	31,800	1.43
Frontier Hybrids	F 505E	60	76	----	55.4	----	17.1	25,800	1.55
Johnston Seed Co.	JS - 056	65	73	----	57.9	----	15.0	31,800	1.50
DEKALB	DKS 36-06	63	73	----	57.6	----	15.3	30,500	1.48
Triumph Seed	TR 452	65	72	----	57.9	----	14.6	23,700	1.78
Johnston Seed Co.	JS 222	68	72	----	56.4	----	15.9	27,900	1.48
Dyna-Gro	742C	62	71	----	56.0	----	14.6	31,400	1.44
Syngenta Seeds	5613	65	67	----	57.3	----	14.4	30,100	1.51
DEKALB	DKS 28-05	58	62	----	57.1	----	13.6	36,000	1.79
Pioneer Hi-Bred Int.	87P06	63	61	----	56.4	----	14.0	28,400	2.06
Sorghum Partners Inc	X445	65	52	----	55.3	----	15.4	29,100	1.37
Johnston Seed Co.	JS 207	58	41	----	55.9	----	13.6	30,800	1.62
		Mean	70	90	57.3	58.5	14.8	29,500	1.67
		C.V.%	12.4	13.2	1.9	1.3	6.7	19.4	13.0
		L.S.D.	12	13	1.6	0.8	1.4	8,100	0.31

Cooperator: Doug McMurtrey Soil Series: Pond Creek Silt Loam No-till Practices: fallowed after soybean in 2008 Soil Test: N: 19 P: 72 K: 271 pH: 6.6
Fertilizer: N: 116 lbs N/ac + 5 gal/ac 10-34-0 with planter Planting Date: April 24, 2009 Target Population: 45,000 plants/ac
Herbicide 2 qt/ac Atrazine pre-plant Harvest Date: September 9, 2009

Monthly Rainfall (in.)

	Apr.	May	June	July	Aug.	**Total**
2009:	5.04	2.02	2.66	1.86	4.75	**16.33**
Long term mean:	3.28	5.83	4.05	2.68	3.19	**19.03**

Table 3. Results from Enid double crop grain sorghum performance trial, 2009.

Company Brand Name	Hybrid	Grain Yield bu/ac		Test weight lb/bu		Harvest Moisture	Plant Population plants/ac	Lodging %
		2009	Two-year	2009	Two-year			
Sorghum Partners Inc	NK6638	53	81	55.5	57.3	15.1	33,700	55
DEKALB	DKS 44-20	53	80	56.7	58.7	15.1	35,300	45
NC+ Hybrids	5B90	39	74	54.9	57.2	15.4	33,100	60
DEKALB	DKS 37-07	43	65	55.5	57.7	14.9	43,700	65
Johnston Seed Co.	JS - 056	56	----	55.6	----	15.9	38,200	45
Syngenta Seeds	H-486	55	----	54.5	----	15.4	27,200	15
Dyna-Gro	772B	54	----	55.1	----	15.6	31,200	55
NC+ Hybrids	6B10	54	----	53.0	----	14.8	38,900	20
Sorghum Partners Inc	NK5418	53	----	54.5	----	15.4	32,500	20
Syngenta Seeds	5464	49	----	54.7	----	14.9	29,500	65
Frontier Hybrids	F 505E	48	----	58.2	----	14.5	29,500	15
Johnston Seed Co.	JS 222	47	----	56.1	----	15.2	40,700	35
Pioneer Hi-Bred Int.	87P06	46	----	55.5	----	15.2	33,500	35
Triumph Seed	TR 452	46	----	56.3	----	14.7	32,200	45
Triumph Seed	TRX 95003	44	----	55.0	----	15.4	38,900	75
Pioneer Hi-Bred Int.	86G32	44	----	54.6	----	16.5	28,500	80
Dyna-Gro	742C	38	----	56.0	----	14.5	28,200	10
Frontier Hybrids	F 303C	36	----	55.4	----	14.6	30,500	25
	Mean	48	75	55.4	57.7	15.2	33,600	40
	C.V.%	18.4	17.7	3.3	1.9	6.0	19.8	----
	L.S.D.	15	15	NS	1.3	NS	11,000	----

Cooperator: Richard and James Wuerflein
No-till Practices: Corn-Wheat-Double crop sorghum
Fertilizer: N: 105 lbs N/ac P: 20 lb P_2O_5 K: 0
Planting Date: June 24, 2009 Target Population: 45,000 plants/ac

Soil Series: Grant Silt Loam
Soil Test: N: NA P: NA K: NA pH: NA
Herbicide: 2 qt/ac Cinch ATZ Lite Preemergence
Harvest Date: December 14, 2009

Monthly Rainfall (in.)

	June	July	Aug	Sept	Oct	**Total**
2009:	2.32	2.57	7.57	0.51	4.98	**17.95**
Long term mean:	4.26	2.89	3.35	3.39	3.17	**17.06**

Table 4. Results from OPREC dry-land grain sorghum performance trial, 2009.

Company Brand Name	Hybrid	Grain Yield bu/ac		Test weight lb/bu		Harvest Moisture	Plant Population plants/ac	Head Population heads/plant
		2009	Two-year	2009	Two-year			
Less than 60 days to mid-bloom								
DEKALB	DKS 37-07	92	83	58.3	56.2	15.0	22,700	2.07
DEKALB	DKS 37-07 (wo)	85	80	57.9	55.8	15.1	19,200	2.28
DEKALB	Pulsar	77	74	56.7	56.2	15.5	15,500	2.52
DEKALB	DKS 29-28	79	70	56.4	56.7	15.4	20,300	2.34
DEKALB	DKS 28-05	89	----	57.4	----	14.8	17,700	2.94
Frontier Hybrids	F 270E	79	----	56.7	----	15.0	21,600	1.64
Frontier Hybrids	F 303C	72	----	56.2	----	16.1	19,100	1.92
Johnston Seed Co.	JS 207	67	----	56.9	----	14.7	19,100	1.89
DEKALB	DK 39Y	67	----	57.9	----	15.1	15,700	2.21
Frontier Hybrids	F 505E	67	----	50.0	----	16.5	18,400	1.79
	Mean	77	79	56.4	56.2	15.3	18,900	2.16
	C.V.%	8.6	9.2	4.1	4.2	6.1	11.8	11.5
	L.S.D.	10	7	3.4	NS	NS	3,200	0.36

Company Brand Name	Hybrid	Grain Yield bu/ac 2009	Test weight lb/bu 2009	Harvest Moisture	Plant Population plants/ac	Head Population heads/plant
70 days and greater to mid-bloom						
Sorghum Partners Inc	X 698	67	58.8	14.5	20,100	2.04
Frontier Hybrids	F 700E	65	54.9	15.5	20,300	1.74
Sorghum Partners Inc	NK6638	62	53.5	14.0	18,800	2.09
Sorghum Partners Inc	SP6680	42	46.7	18.4	19,700	1.78
	Mean	59	53.5	15.6	19,700	1.91
	C.V.%	5.0	4.4	4.4	7.4	9.2
	L.S.D.	6	4.7	1.4	NS	NS

Table 4. Continued.

Company Brand Name	Hybrid	Grain Yield bu/ac		Test weight lb/bu		Harvest Moisture	Plant Population plants/ac	Head Population heads/plant
		2009	Two-year	2009	Two-year			
60 to 69 days to mid-bloom								
Sorghum Partners Inc	NK5418	87	82	57.4	56.2	15.1	17,400	2.84
Pioneer Hi-bred Int.	86G32	81	81	57.2	55.0	15.0	18,500	2.50
Sorghum Partners Inc	KS 585	79	81	58.0	56.3	14.8	17,900	2.53
NC+ Hybrids	5B90	84	79	59.4	55.8	15.1	21,400	2.35
Sorghum Partners Inc	KS 585 (wo)	79	76	57.8	54.6	15.0	21,300	2.04
DEKALB	DKS 44-20	82	74	58.3	54.9	15.2	19,700	2.06
Pioneer Hi-bred Int.	85G03	79	73	54.6	53.5	15.5	18,200	2.69
Dyna-Gro	766B	80	70	57.4	55.0	15.3	17,500	2.27
Dyna-Gro	772B	78	65	56.6	54.2	15.3	16,700	2.35
NC+ Hybrids	6B10	86	----	56.6	----	15.6	21,100	2.08
DEKALB	DKS 36-06	84	----	56.3	----	15.1	21,900	1.97
Pioneer Hi-bred Int.	87P06	83	----	56.7	----	14.1	16,700	3.31
NC+ Hybrids	7B11	82	----	57.4	----	15.4	19,400	2.11
Johnston Seed Co.	JS - 056	78	----	57.3	----	15.2	20,600	2.05
Triumph Seed	TR 452	77	----	57.3	----	14.7	19,200	1.94
Syngenta Seeds	5613	77	----	58.5	----	14.6	18,400	2.07
Johnston Seed Co.	JS - 524	76	----	56.0	----	14.7	20,600	2.08
Johnston Seed Co.	JS 222	76	----	56.7	----	15.2	18,000	1.99
Syngenta Seeds	5556	75	----	57.8	----	14.7	15,200	2.30
Sorghum Partners Inc	X445	73	----	55.2	----	14.2	16,200	2.45
Dyna-Gro	742C	73	----	56.5	----	15.2	17,300	2.06
Syngenta Seeds	5464	72	----	56.3	----	15.3	18,200	2.00
Johnston Seed Co.	JS 753	71	----	55.0	----	15.0	17,500	2.28
Syngenta Seeds	H-486	64	----	53.0	----	15.6	20,000	1.64
Johnston Seed Co.	JS 005	62	----	56.6	----	14.1	16,300	2.28
Triumph Seed	TRX 95003	60	----	54.3	----	15.5	18,200	1.82
	Mean	77	75.6	56.7	55.0	15.0	18,700	2.23
	C.V.%	9.3	12.6	2.7	3.2	3.7	14.1	14.0
	L.S.D.	10	10	2.2	1.8	0.8	NS	0.44

Cooperator: OPREC
Herbicide: Cinch ATZ Lite 2 qts/ac (Preemergence)
Soil Test: N: 60 P: 105 K: 1,391 pH: 7.9
Planting Date: June 23, 2009
Harvest Date: November 3, 2009

Soil Series: Richfield Clay Loam
No-till following wheat in 2008
Fertilizer: N: 50 lbs N + 5 gal/ac 10-34-0 with planter
Target Population: 22,000 plants/ac

Monthly Rainfall (in.)

	May	June	July	Aug.	Sep.	**Total**
2009:	0.55	1.74	2.58	1.36	0.45	**6.68**
Long term mean:	2.76	2.92	2.85	2.55	1.97	**13.05**

Table 5. Results from OPREC limited irrigation grain sorghum performance trial, 2009.

Company Brand Name	Hybrid	Grain Yield bu/ac		Test weight lb/bu		Harvest Moisture	Plant Population plants/ac	Head Population heads/plant
		2009	Two-year	2009	Two-year			
Less than 60 days to mid-bloom								
DEKALB	DKS 37-07 (wo)	164	152	60.0	58.9	12.6	42,900	1.41
DEKALB	DKS 37-07	159	149	59.6	59.1	12.5	51,200	1.17
DEKALB	Pulsar	149	141	57.8	57.7	12.5	45,200	1.37
DEKALB	DK 39Y	137	122	58.8	57.9	11.9	35,000	1.57
DEKALB	DKS 29-28	125	116	57.2	56.7	11.4	47,700	1.31
Frontier Hybrids	F 303C	159	----	59.2	----	11.8	46,500	1.21
Frontier Hybrids	F 505E	152	----	56.6	----	12.3	44,500	1.18
Johnston Seed Co.	JS 207	145	----	56.6	----	11.5	43,500	1.43
Frontier Hybrids	F 270E	144	----	58.4	----	12.1	47,200	1.17
DEKALB	DKS 28-05	144	----	57.5	----	11.4	45,700	1.64
	Mean	148	136	58.2	58.1	12.0	44,900	1.34
	C.V.%	6.7	5.5	1.9	2.3	3.5	9.1	11.9
	L.S.D.	14	8	1.6	1.4	0.6	5,900	0.23

Company Brand Name	Hybrid	Grain Yield bu/ac 2009		Test weight lb/bu 2009		Harvest Moisture	Plant Population plants/ac	Head Population heads/plant
70 days and greater to mid-bloom								
DEKALB	DKS 53-67	153	138	60.1	58.3	12.9	49,300	1.23
DEKALB	DKS 54-03	148	135	57.2	56.7	12.2	45,300	1.23
DEKALB	DKS 54-00	144	126	58.7	57.2	12.1	46,400	1.20
Sorghum Partners Inc	NK6638	139	124	58.6	58.0	11.3	47,300	1.22
Sorghum Partners Inc	SP6680	169	----	58.9	----	13.0	45,800	1.27
Pioneer Hi-Bred Int.	84G62	154	----	58.8	----	12.1	41,100	1.25
Frontier Hybrids	F 700E	153	----	58.3	----	12.3	42,400	1.26
Pioneer Hi-Bred Int.	84P74	142	----	57.7	----	13.0	41,700	1.32
Sorghum Partners Inc	X 698	139	----	58.5	----	12.2	47,900	1.20
	Mean	149	131	58.5	57.5	12.3	45,200	1.24
	C.V.%	7.5	7.6	2.6	3.2	2.8	8.7	7.2
	L.S.D.	16	10	NS	NS	0.5	5,700	0.13

Table 5. Continued.

Company Brand Name	Hybrid	Grain Yield bu/ac 2009	Grain Yield bu/ac Two-year	Test weight lb/bu 2009	Test weight lb/bu Two-year	Harvest Moisture	Plant Population plants/ac	Head Population heads/plant
60 to 69 days to mid-bloom								
Sorghum Partners Inc	KS 585	172	153	58.6	58.6	12.4	45,100	1.33
NC+ Hybrids	5B90	151	141	58.7	58.3	12.0	39,600	1.54
Sorghum Partners Inc	KS 585 (wo)	151	141	59.3	58.8	12.5	47,500	1.18
Dyna-Gro	772B	153	140	59.3	57.7	12.7	44,100	1.23
Sorghum Partners Inc	NK5418	147	139	56.9	57.5	11.6	42,800	1.36
DEKALB	DKS 44-20	155	135	58.5	58.9	12.4	41,600	1.39
Dyna-Gro	766B	149	128	57.7	57.2	12.1	39,000	1.39
Pioneer Hi-bred Int.	86G32	162	----	57.9	----	11.8	44,300	1.35
Johnston Seed Co.	JS - 056	162	----	58.8	----	12.4	44,400	1.41
Syngenta Seeds	5556	161	----	57.9	----	12.3	44,900	1.25
Sorghum Partners Inc	X445	159	----	58.0	----	11.9	47,200	1.42
Johnston Seed Co.	JS - 524	159	----	56.3	----	12.5	43,000	1.33
Johnston Seed Co.	JS 222	156	----	58.2	----	12.2	45,100	1.16
Syngenta Seeds	5613	156	----	58.7	----	12.5	42,400	1.35
NC+ Hybrids	6B10	155	----	58.3	----	12.3	42,600	1.24
Pioneer Hi-bred Int.	85G03	154	----	57.9	----	12.1	40,100	1.37
Dyna-Gro	742C	154	----	56.5	----	11.8	43,000	1.29
Syngenta Seeds	5464	152	----	59.5	----	12.4	45,500	1.23
Triumph Seed	TR 452	152	----	58.4	----	11.9	43,900	1.34
NC+ Hybrids	7B11	148	----	59.2	----	12.3	42,400	1.37
DEKALB	DKS 36-06	145	----	58.6	----	12.2	42,500	1.26
Johnston Seed Co.	JS 005	143	----	57.6	----	12.0	41,200	1.35
Pioneer Hi-bred Int.	87P06	139	----	58.7	----	12.0	45,200	1.34
Triumph Seed	TRX 95003	138	----	58.3	----	11.7	45,300	1.22
Johnston Seed Co.	JS 753	136	----	57.8	----	11.8	44,800	1.25
Syngenta Seeds	H-486	135	----	57.4	----	11.9	41,200	1.46
	Mean	152	140	58.2	58.1	12.1	43,400	1.32
	C.V.%	7.0	8.2	2.7	2.9	3.7	9.6	12.3
	L.S.D.	15	12	NS	NS	0.6	NS	NS

Cooperator: OPREC
Herbicide: Cinch ATZ Lite 2 qts/ac (Preemergence)
Soil Test: N: 36 P: 15 K: 833 pH: 7.8
Fertilizer: N: 150 lbs N and 50 lbs P2O5 with strip-till + 5 gal/ac 10-34-0 with planter
Planting Date: May 28, 2009
Harvest Date: November 6, 2009

Soil Series: Richfield Clay Loam
Strip-till following wheat and double crop sunflower in 2008
Target Population: 50,000 plants/ac

Monthly Rainfall (in.)	May	June	July	Aug.	Sep.	**Total**
2009:	0.55	1.74	2.58	1.36	0.45	**6.68**
Long term mean:	2.76	2.92	2.85	2.55	1.97	**13.05**

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

Jun.	Jul.	Aug.	Sept.	Oct
2.2	3.3	3.3	0.0	0.0