Oklahoma Panhandle Research & Extension Center

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http://oprec.okstate.edu

★ OPREC, Goodwell

- Biofuels
- Canola
- Corn
- Corn Planting Technology
- Crop Rotation
- Drip Irrigation
- Irrigation & Water Management
- Soil Fertility
- Sorghum
- Soybeans
- Sunflowers
- Weed Management
- Wheat

2013 Current Reports

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

15 Years

DASNR's Super Bohl

Born and raised in the small town of Walsh, Colo., managing farmland while dealing with dry conditions is nothing new to Lawrence Bohl.

A bachelor's degree from Oklahoma Panhandle State University (OPSU), followed by a master's degree from OSU, was just the beginning of a long-lasting relationship Bohl had with both institutions.

"Being from this part of the country, I already had a great appreciation for the work being done at both schools," Bohl said. "Then, going to work for the research center was just a perfect match."

After years of managing farms for Hitch Enterprises and OPSU, Bohl was hired to be the station superintendent by OPREC in 1994. Nearly 20 years and many, many research experiments later, Bohl retired in the spring of 2013.

"I decided when I got to be 65, it'd be a good birthday present," he said. "However, I'm busier now than when I was working."

Bohl is nothing if not proud of the work being done at the research center.

"Our research station is very important," Bohl said. "Texas County is the largest ag money-maker in the state when you add cattle, irrigation crops and swine. I'm glad I got to be a part of it for so many years."

– SH

OKLAHOMA PANHANDLE RESEARCH AND EXTENSION CENTER

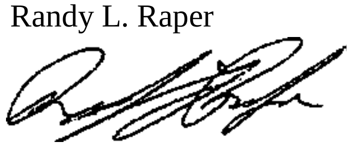
The Division of Agricultural Sciences and Natural Resources (DASNR) including the Oklahoma Agricultural Experiment Station (OAES) and the Oklahoma Cooperative Extension Service (OCES) at Oklahoma State University (OSU) have a long history of working cooperatively with Oklahoma Panhandle State University (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 region. The Oklahoma Panhandle Research and Extension Center (OPREC) is operated within OAES by the Field and Research Services Unit (FRSU). Our unit consists of 19 research stations (including the OPREC) with almost 13,500 acres, numerous growth chambers, and greenhouses. We in OAES generate research information which is then disseminated by OCES 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 OPREC. Together as a team we have been able to solve many significant problems related to high plains agriculture.

OPREC is committed to serving the people of the Panhandle region. One problem we are facing in this area is a shortage of water, whether it comes from rainfall or from groundwater. Developing best management practices for irrigation systems that provide maximum benefit for the least cost will be one of the critical issues facing us in the future. An investment is being made at the OPREC to install a drip irrigation system that should maximize irrigation efficiency and provide valuable information about production practices for farmers and ranchers in the region. Please watch for results from studies conducted with this new irrigation system at our future events!

Many staff continue to serve our clientele and include; Rick Kochenower - Area Agronomy Research and Extension Specialist, Britt Hicks - Area Livestock Extension Specialist, and Cameron Murley - Interim Senior Station Superintendent of OPREC. Other essential OPREC personnel include Donna George- Senior Secretary, Skeate Beck - Equipment Specialist, Camron Nisly - Agriculturalist, and several wage payroll and part-time OPSU student laborers.

We at OSU truly appreciate the support that our clientele, farmers, ranchers, commodity groups, industry, and other agricultural groups have given us over the years. 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.

Randy L. Raper



Senior Director
Field and Research Service Unit
Oklahoma Agricultural Experiment Station
Division of Agricultural Sciences and Natural Resources
Oklahoma State University

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
Crop Production Service
Dow Agro Sciences (Jodie Stockett)
DuPont (Jack Lyons and Robert Rupp)
Farm Credit of Western Oklahoma
Five Star Equipment
Green Country Equipment
Hitch Enterprises
Kincaid Equipment
Liquid Control Systems (Tim Nelson)
Monsanto (Ben Mathews, T. K. Baker, Mike Lenz)
National Sorghum Producers
Oklahoma Genetics, Inc.
Oklahoma Grain Sorghum Commission
Oklahoma Wheat Commission
Oklahoma Wheat Growers
OPSU
Pioneer Seed (Ramey Seed)
Sorghum Partners
Hopkins Ag/AIM Agency (J. B. Stewart & Jarrod Stewart)
Syngenta
Texhoma Wheat Growers
Triumph Seed Company
United Sorghum Checkoff Program
Joe Webb

Oklahoma Panhandle Research and Extension Center

~ Advisory Board ~

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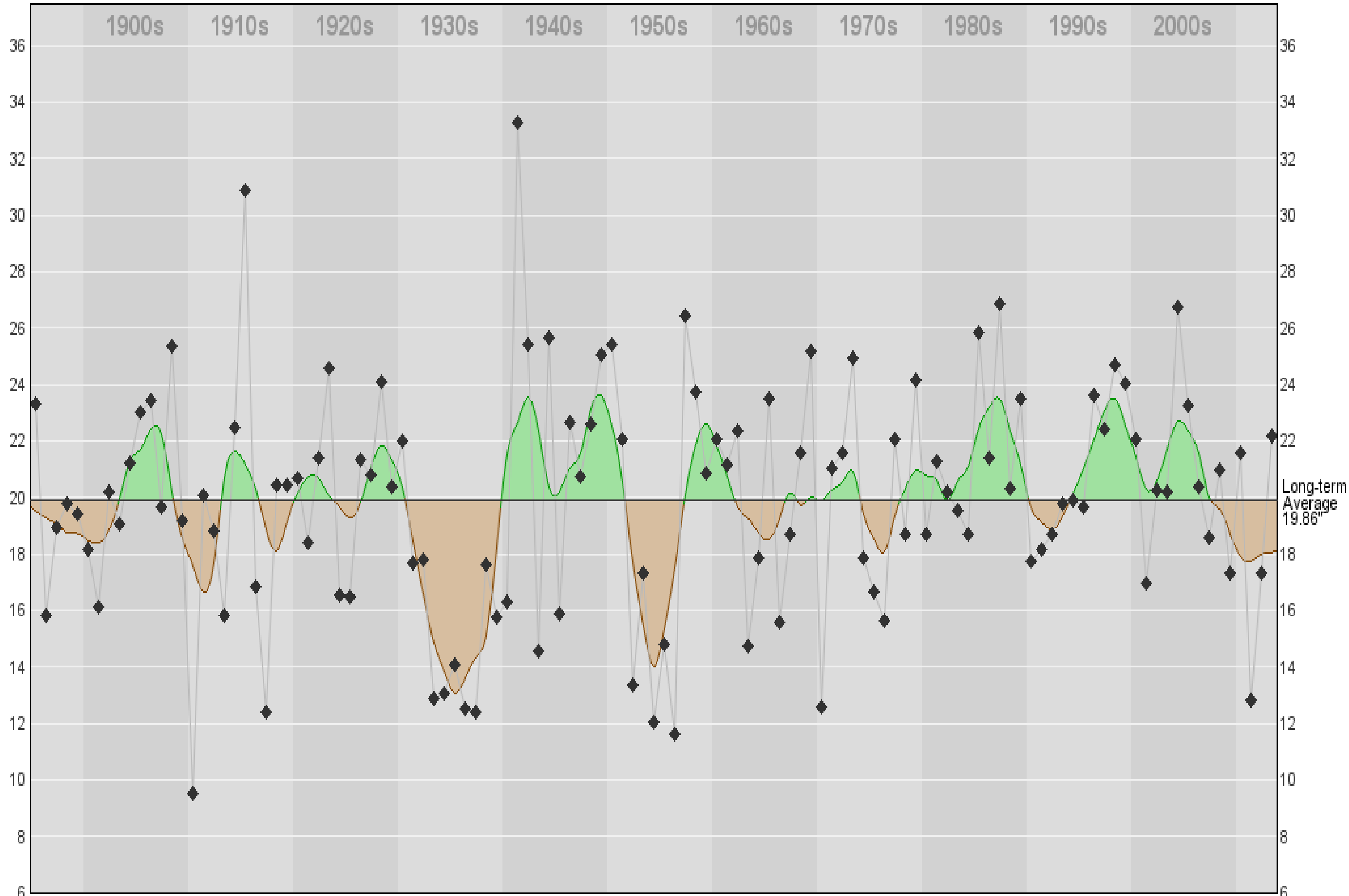
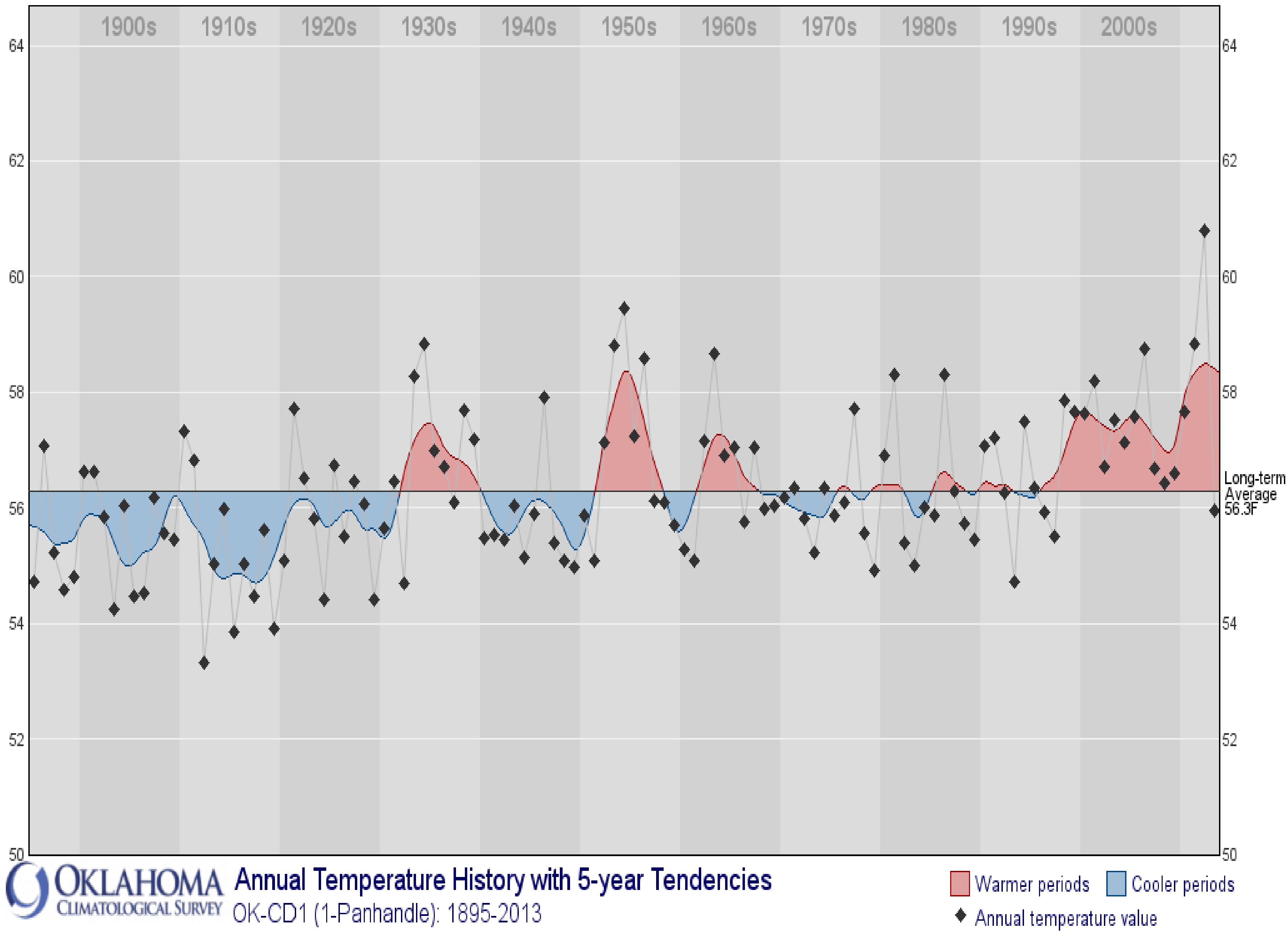


OKLAHOMA CLIMATOLOGICAL SURVEY

Annual Precipitation History with 5-year Tendencies

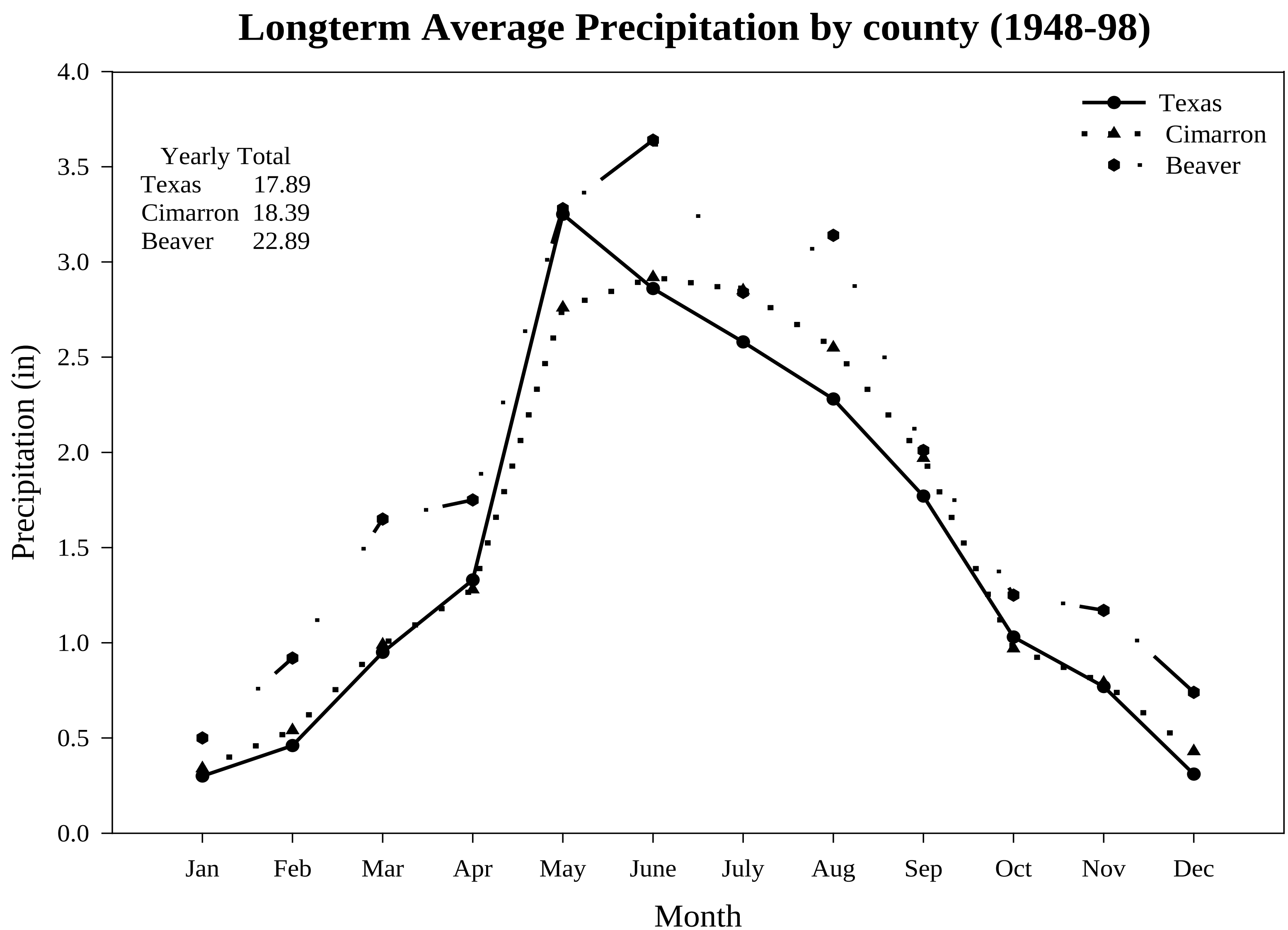
OK-CD1 (1-Panhandle): 1895-2013


1900s
1910s
1920s
1930s
1940s
1950s
1960s
1970s
1980s
1990s
2000s
64
62
60
58
56
54
52
50
Long-term Average 56.3F
OKLAHOMA CLIMATOLOGICAL SURVEY
Annual Temperature History with 5-year Tendencies
OK-CD1 (1-Panhandle): 1895-2013
Warmer periods
Cooler periods
Annual temperature value

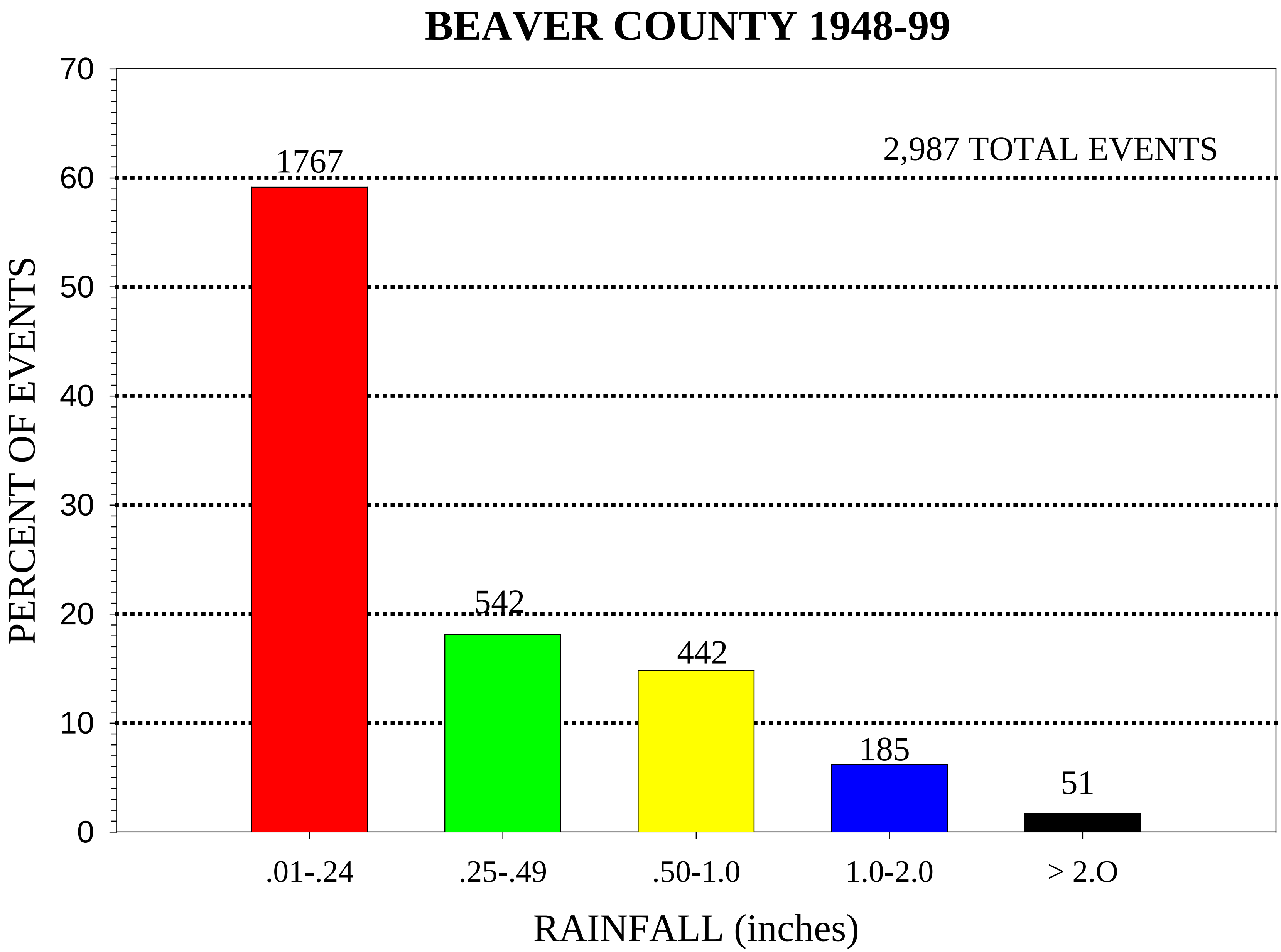
Climatological data for Oklahoma Panhandle Research and Extension Center, 2013.

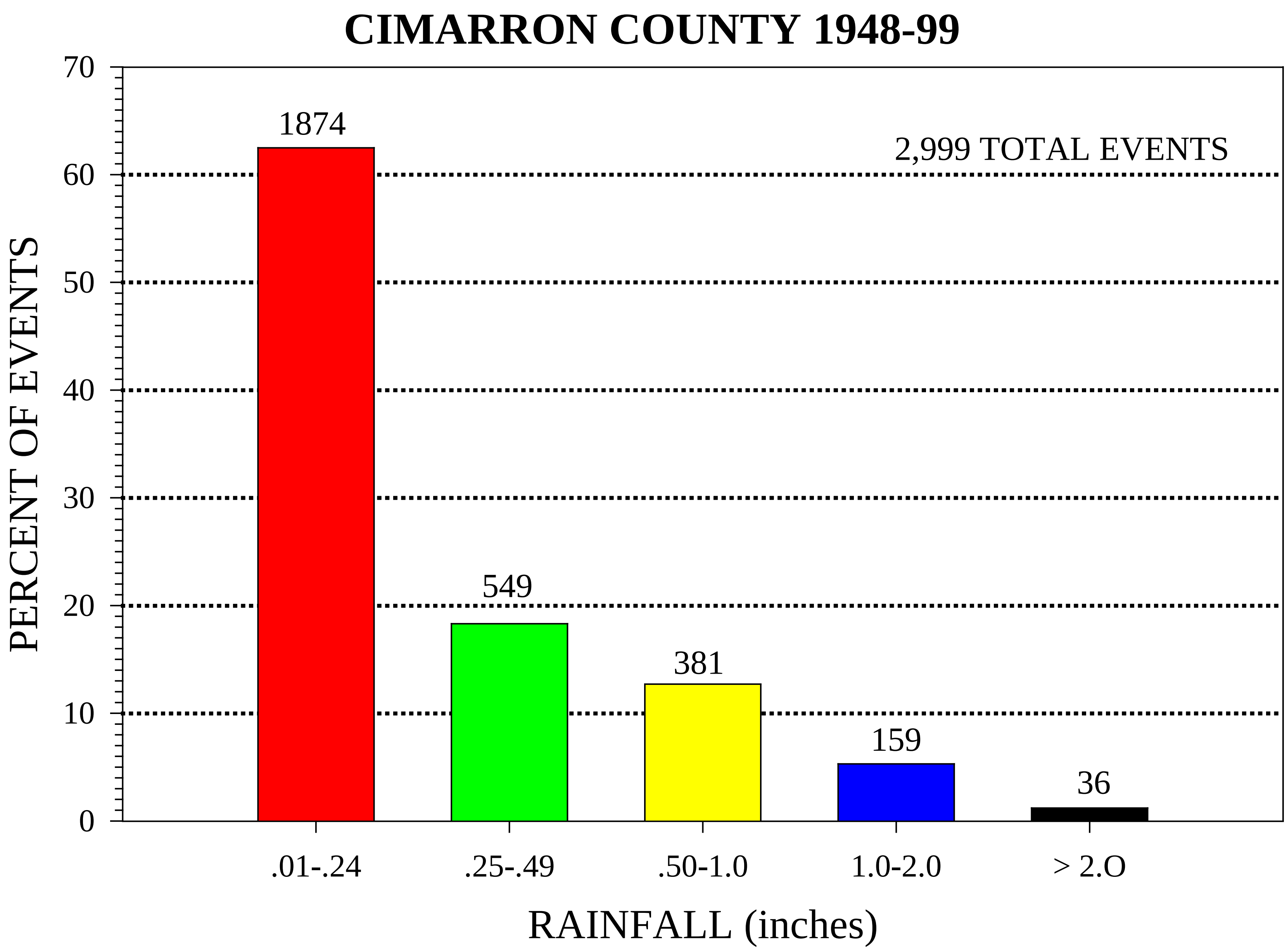
	Temperature								Precipitation				Wind	
Month	Max		Min		Max. mean		Min. mean		Inches		Long term mean	Largest one day total	AVG mph	Max mph
	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012				
Jan	73	72	9	13	48	55	22	24	0.53	0.05	0.30	0.35	11.9	62.7
Feb	70	75	-1	13	49	50	22	24	1.16	0.27	0.46	0.32	12.9	59.7
March	84	87	16	19	61	70	29	38	0.28	1.69	0.95	0.11	12.7	59.8
April	94	95	17	34	66	74	34	45	0.30	2.28	1.33	0.12	14.6	52.6
May	98	101	24	43	83	84	48	52	0.24	0.88	3.25	0.09	14.5	57.6
June	107	107	44	51	93	93	63	63	1.92	2.33	2.86	0.88	15.3	53.7
July	103	103	51	67	92	97	65	67	1.02	1.95	2.58	0.88	13.3	49.0
Aug	102	105	58	54	91	93	65	62	4.04	0.85	2.28	1.36	11.4	67.9
Sept	98	102	42	41	86	85	59	53	1.95	2.66	1.77	0.58	12.3	46.8
Oct	91	90	29	22	72	70	40	40	0.68	0.27	1.03	0.39	12.4	71.7
Nov	77	81	15	18	56	66	29	33	0.55	0.00	0.77	0.18	12.5	51.2
Dec	72	72	3	3	46	51	20	22	0.23	0.23	0.31	0.16	11.0	47.1
	Annual total				70.3	74.1	41.3	43.5	12.90	13.62	17.9	NA	NA	NA

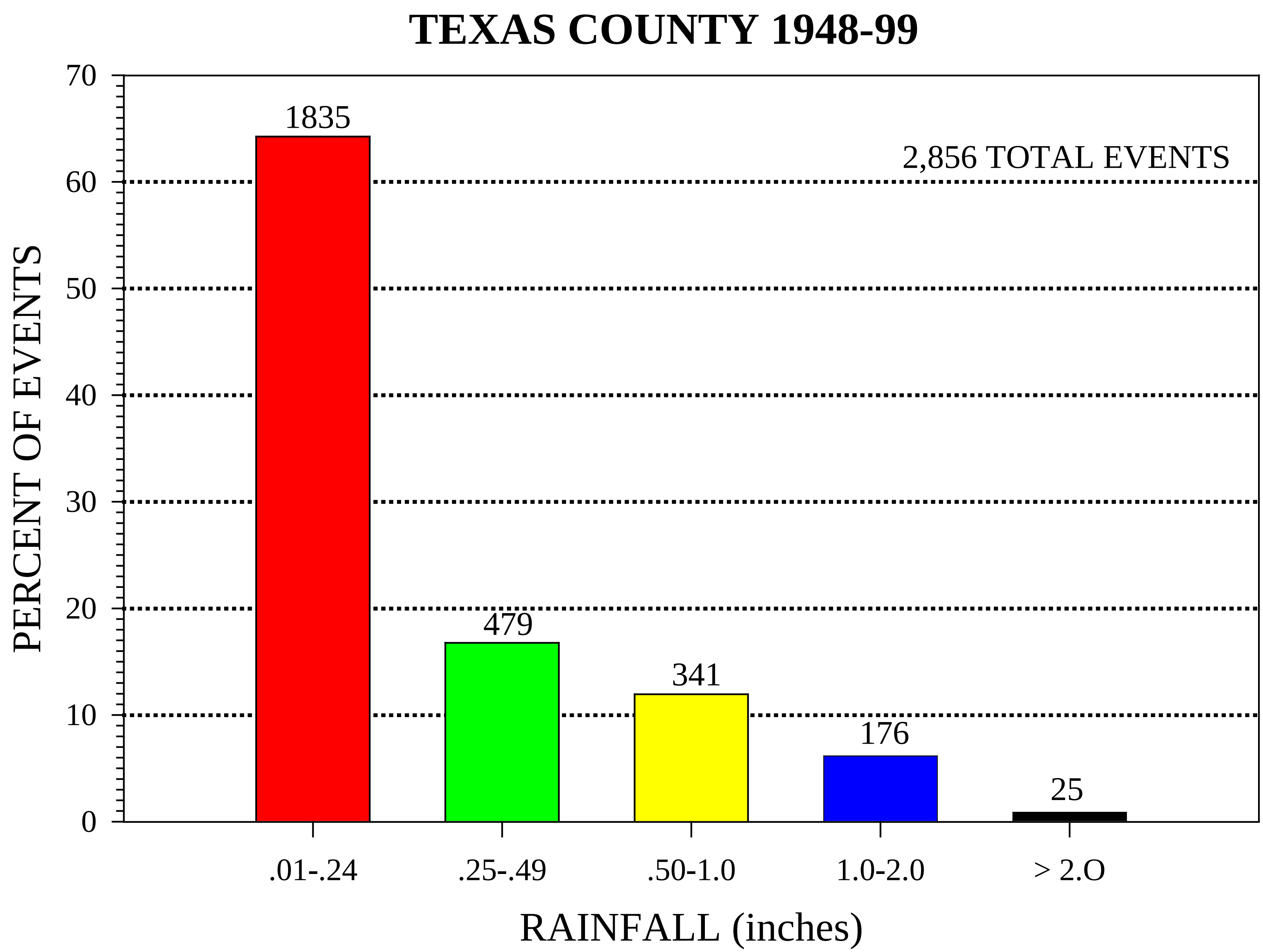
Data from Mesonet Station at OPREC



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
70
60
50
40
30
20
10
0
1767
542
442
185
51
.01-.24
.25-.49
.50-1.0
1.0-2.0
> 2.O
RAINFALL (inches)


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

Oklahoma Panhandle Research & Extension Center
2013 Research Highlights

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CR-2163 Oklahoma Corn Performance Trial, 2013
CR-2162 Grain Sorghum Performance Trials in Oklahoma, 2013
CR-2143 Oklahoma Wheat Variety Trails 2012-13
CR-2135 Protein Content of Winter in Wheat Variety Trials 2012-13

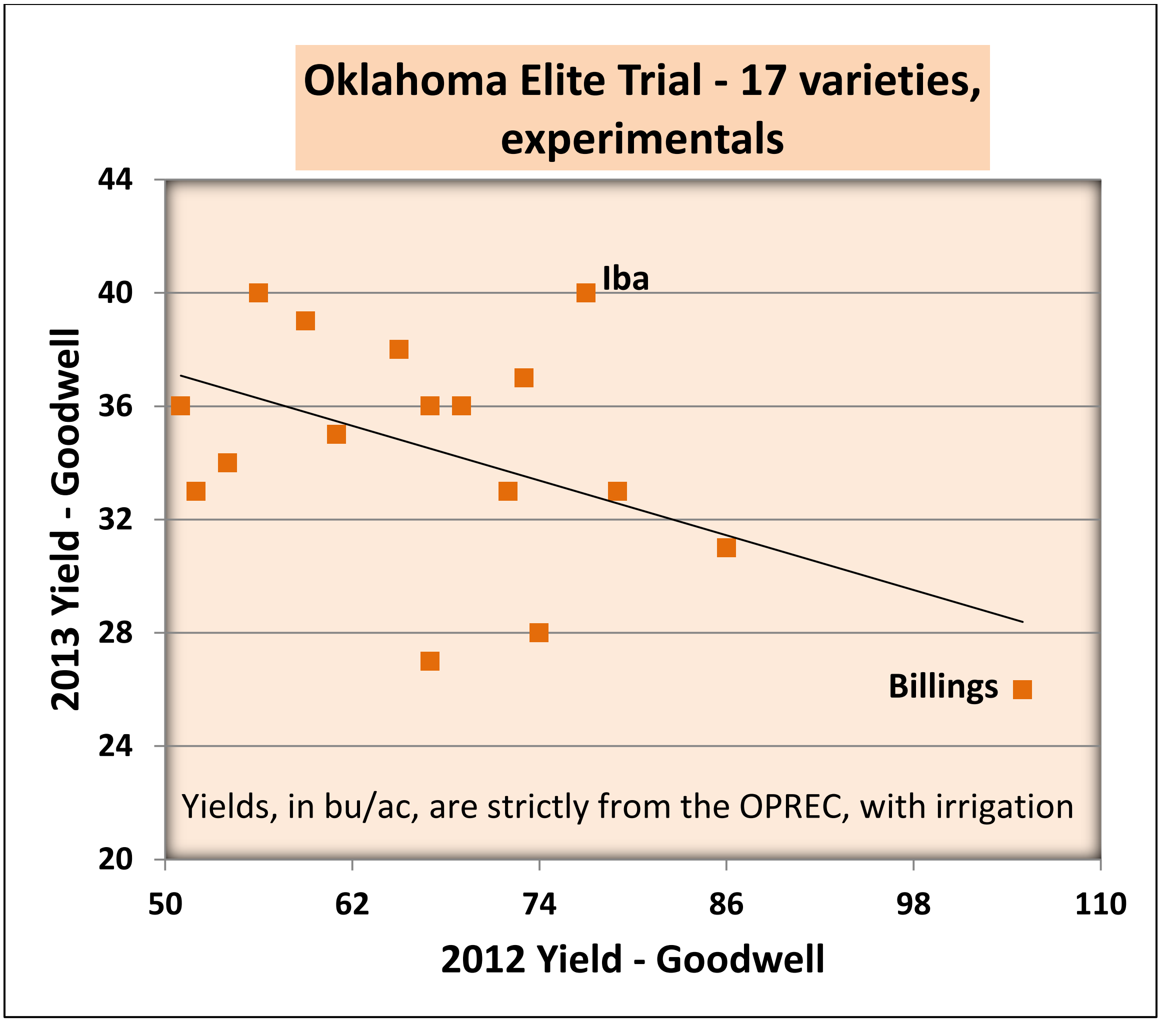
Oklahoma Panhandle Research and Extension Center
Wheat Improvement Program
Annual Report, 2014

Testing of Elite Materials from the OSU Wheat Improvement Program

The OPREC has always served as one of three cornerstone testing sites for replicated yield and quality trials in the OSU wheat improvement program. The other two sites include a farmer-cooperator site near Granite in southwest Oklahoma and the North Central Research Station at Lahoma. 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, called the Oklahoma Elite Trial (OET), contains the most advanced breeding lines each year, along with a panel of several varieties representing the best available commercial genetics for Oklahoma in the HRW market class. This panel changes each year slightly to reflect new improved genetics. Data from the irrigated trial at the Center are shown in Table 1 alongside the statewide means for each entry.

In most years, the yield data from the OPREC are highly regarded as an indication of yield potential in the absence of several diseases which occur with greater intensity and longer duration downstate. We don’t expect a high degree of consistency between the panhandle and downstate sites, but we certainly look for exceptions to this trend when advancing lines in the variety development pipeline. The multiple spring freeze events in the panhandle in 2013 caused an even larger degree of inconsistency in variety performance between the panhandle region and other locations where this trial is conducted.

The spring freezes also caused wide inconsistency between 2013 yields and prior years. If we only consider the advanced lines and varieties in the OET that were tested in both 2012 and 2013, we can chart the yields from both years as shown in Figure 1. From one year to another, typically the relationship is positive; that is, varieties higher yielding in one year tend to be higher yielding in another year. The relationship may not be strong and may even approach zero. However, the relationship between grain yields at the OPREC, under supplemental irrigation, was negative between 2012 and 2013! Hence varieties which excelled in 2012 tended to be the poorer performers in 2013 (note Iba as one exception).



The OSU release, Billings, epitomized the inconsistency between 2012 and 2013, after yielding at the top of the chart in 2012 with 105 bu/ac but only producing one-fourth that amount in 2013. It simply did not recover as well following freeze-induced canopy removal. In fact, it was quite evident among experimental lines and varieties that those which typically do not tolerate canopy removal from grazing also did not fare well from spring canopy removal caused by the freeze. The 2011 OSU release, Ruby Lee, which is positioned to serve as a replacement for Billings, responds very well from grazing and also recovered well after the freeze in 2013. The difference in recovery between Billings and Ruby Lee was captured in this pair of photographs taken at the OPREC on 31 May 2013, in which Billings is on the left and Ruby Lee (in the same trial) is on the right.


Returning to the yield results in Table 1, the experimental line OK05511-RHf2 performed well at the OPREC. Though it has greenbug and Hessian fly resistance, a rare combination indeed, the OSU WIT has not deemed it worthy of release in the past. However, we have used OK05511-RHf2 as a parent in doubled-haploid production to rapidly move the dual insect resistance into other favorable agronomic backgrounds such as Gallagher. Other lines performing consistently well last year, and in previous years, were Iba, Doublestop CL Plus, and OK09125. The latter one remains under consideration for possible release, but not without further evaluation of the data in hand. OK09125 features exceptional grazeability and high grain yielding ability in a moderately late background. Its other noteworthy characteristic is very good leaf hygiene in the presence of several leaf spotting diseases. Test weight will not be its claim to fame.

It's Time for a Change in Breeding Strategy

Producers in the panhandle are well familiar with the challenges of raising a wheat crop under dryland conditions. We in the research arena are equally challenged. Producers can ill-afford to lose a wheat crop to dry weather, and researchers are in the same boat, for different reasons. The OPREC has done everything in their power to ensure a successful dryland crop in the past, but nevertheless, we still lack the critical data to make crucial selection decisions for dryland adaptation in the High Plains.

Hence, we will change our strategy, and use the *irrigated option* that the OPREC provides to establish our *dryland* nursery, if not save it from years with severe drought. Irrigation will only be used to ensure crop establishment and a minimal yield potential of about 30 bu/ac.

More importantly, this opens up other doors that we will walk through. Beginning in fall 2013, we will now plant a portion of our early-generation materials – those populations which give the greatest likelihood of success in the High Plains – under these so-called dryland conditions at the OPREC. This step will allow us to develop experimental lines which are specifically targeted for and adapted to the panhandle region, rather than relying on the "luck of the draw" from experimental lines selected downstate. The bottom line is that we will attempt to conduct a smaller breeding program, one tailored for the panhandle, within the larger one that we normally conduct.

The Wheat Improvement Team will continue to address concerns specific to the High Plains and pertinent to research capabilities at the OPREC. We appreciate the research opportunity afforded by the OPREC and the unique position it places OSU's Wheat Improvement Team in addressing concerns of wheat producers in the northwest region.

Contributed by Brett F. Carver, OSU Wheat Breeder, on behalf of the Wheat Improvement Team

Table 1. Grain yield results from the 2013 Oklahoma Elite Trial (OET) conducted at the OPREC with supplemental irrigation. Entry mean yields (bu/ac) and ranks are shown for the OPREC alone and across all seven sites in Oklahoma. Entries are ordered from highest to lowest yield at the OPREC. This trial contained 30 entries, with 9 common varieties, but one entry (Chisholm) was removed due to incorrect planting.

Entry	Pedigree or check name	Goodwell		Statewide	
OK05511-RHf2	TAM 110/2174	*43*	*1*	40	*5*
Garrison		*40*	*2*	36	*26*
Iba		*40*	*3*	40	*3*
Doublestop CL Plus	N91D2308-13/OK03908C//OK03928C	*39*	*4*	40	*2*
OK0986044	KS99WGRC42/OK93P656H3299-84	*38*	*5*	39	*7*
OK109143CF	N91D2308-13/OK03926C	*38*	*6*	39	*6*
Duster		*38*	*7*	37	*22*
OK09125	Overley/TX98D1170	*37*	*8*	43	*1*
Ruby Lee		*36*	*9*	37	*16*
Endurance		*36*	*10*	38	*10*
OK09634	OK95616-98-6756/Overley	*36*	*11*	38	*13*
OK1059060	OK01307/KS00F5-14-7	*35*	*12*	40	*4*
OK1080031	U3556-3-1-1/Deliver	*34*	*13*	37	*18*
OK0986050	KS99WGRC42/OK93P656H3299-84	*34*	*14*	36	*27*
OCW00S063S-1B	(KAUZ/STAR)//U1254-1-5-1-1/TX89V4213	*34*	*15*	39	*9*
WB-Cedar		*34*	*16*	37	*21*
OK09528	TX98D1170/Ok102	*33*	*17*	39	*8*
OK08328	GK Keve/Ok101//OK93P656-RMH3299	*33*	*18*	38	*14*
OK08229	TX98D1170/OK98697	*33*	*19*	37	*19*
OK09208	OK93P656-RMH3299/Intrada//KS940786-6-7	*32*	*20*	36	*23*
OK1059016	OK93P656H3299-99/OK03522	*32*	*21*	34	*29*
OK1080029	U3556-3-1-1/Deliver	*31*	*23*	38	*11*
Gallagher		*31*	*24*	37	*20*
OK09316	TX98VR8426/Ok102	*30*	*25*	36	*24*
OK09729	OK98697/(BATERA//BUC/TOL73)//OK00614	*28*	*26*	37	*17*
OK09935C	N91D2308-13/OK03928C//OK03928C	*27*	*27*	36	*25*
Billings		*26*	*28*	33	*30*
OK09520	TX98D1170/2*OK96717-99-6756	*25*	*29*	38	*15*
OK10728W	OK02522W/OK98G508W-2-49	*24*	*30*	38	*12*
MEAN		**34**		**38**	
LSD		**9**		**4**	

Starter Fertilizer Effect on Wheat Grain Yields Following Strip-till Corn

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

When producers in the high plains began adapting strip-till for planting corn and then followed with no-till wheat, many producers questioned why they could see the strip till rows in the wheat. Some attributed the increased growth to better seed to soil contact by removal of heavy residue, but others suspected phosphorous (P) fertilizer may have been the cause. With strip-till, P is applied at a depth of six to eight inches concentrating the P in a narrow band at 30 inch intervals. The idea is that when planted following strip-tilled corn, the wheat directly over the band will most easily access the P and reap the greatest benefit. To test this hypothesis a study was initiated at the Oklahoma Panhandle Research and Extension Center (OPREC) in the fall of 2011 to determine the benefit of banding P in wheat following strip-till corn. Treatments included no P applied, 5 or 10 gal/ac 10-34-0 in the row with seed, 5 or 10 gal/ac 10-34-0 applied before planting, and 5 or 10 gal/ac 10-34-0 after planting. The before and after planting treatments were applied with the same drill used for planting and the same mechanism used for the in-row treatment. Soil pH was 7.3 and Mehlich 3 soil test value for P was below 15 ppm for soil collected before the previous corn crop. The wheat variety utilized was Billings and in the fall of 2012 an additional study utilizing Endurance with only the 10 gal/ac rates and treatments was established.

Results

Grain yields were similar in 2012 and 2013, but unlike 2012, none of the treatments affected wheat grain yield or test weight (Table 1). The difference in response between the two years may have been due to freeze events that occurred from March through early May. In 2012, the no P treatment headed out 10 days to two weeks behind all treatments receiving P fertilizer, but the freeze events of 2013 eliminated the possibility of measuring treatment effects on maturity. Endurance (a later maturity variety) section of the study had greater yields than did the Billings section of the study (Table 2). The two-year results show that, with the exception of 5 gal/ac before planting, adding P fertilizer will increase grain yields significantly when compared to no fertilizer added. Adding P fertilizer increased test weight regardless of treatment. Therefore producers utilizing strip-till in corn and plan on following with wheat should consider a P application by either broadcast or starter fertilizer to increase wheat grain yields and test weights.

These results also validate the use of soil test taken for the corn to determine the P need of the following wheat crop.

Table 1. Grain yields and test weight for Billings wheat as affected by starter fertilizer applied following strip-till irrigated corn at the Oklahoma Panhandle Research and Extension Center, Goodwell , OK in 2012 and 2013.

Treatment	Grain Yield (bu/ac)			Test weight (lb/bu)		
	2012	2013	2-year	2012	2013	2-year
10 gal/ac in row	78	70	74	61	57	59
10 gal/ac before planting	71	74	73	61	57	59
5 gal/ac in row	72	73	72	61	57	59
5 gal/ac after planting	68	75	72	61	56	58
10 gal/ac after planting	70	72	71	61	57	59
5 gal/ac before planting	68	70	69	61	57	59
Check no P	58	72	65	59	57	58
L.S.D	7	NS	6	1	NS	0.5

Table 2. Grain yields and test weight for Endurance wheat as affected by starter fertilizer applied following strip-till irrigated corn at the Oklahoma Panhandle Research and Extension Center, Goodwell , OK in 2013.

Treatment	Grain Yield (bu/ac)	Test weight (lb/bu)
10 gal/ac in row	79	57
10 gal/ac after planting	79	57
10 gal/ac before planting	79	57
Check no P	77	57
L.S.D	NS	NS

Corn Planting Date

Rick Kochenower, Oklahoma Panhandle Research and Extension Center, Goodwell

Previous research at OPREC indicated that the optimal planting date for a 114 day maturity corn is near or on April 10th for the central Oklahoma panhandle (Table 1). Data for a 107 day maturity corn was the same (data not shown). Recent research from Texas has suggested that a June planting date may produce higher yields due to lower temperatures during pollination. Therefore in 2012, a planting date study was again established at OPREC with selected planting dates of April 10, May 10, and June 10. The maturity was a 113 day corn. Corn was planted following wheat and double crop sunflowers in 2011 and in 2013 corn following corn. Plots were planted in four 30-inch rows by 30 feet long with a target plant population of 32,000 plants per acre. The two center rows were harvested for grain yield with a Kincaid 8XP plot combine.

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

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

†Yields with same letter not significantly different
Data was not collected in 2002 or 2005 due to irrigation well problems.

Results

As with previous research, April 10th appears to be the optimum date for corn planting with the highest grain yield and test weight observed on that planting date (Table 2). Although no statistical difference was found for grain yield or test weight between April 10th and May 10th in 2012, a difference was observed in 2013, and for the two year average. The May 10th planting date grain yield was 77.8% and 82.6% of the April 10th planting date in 2013 and two-year average respectively. A difference in yield was observed between May 10th and June 10th in 2012, although no difference was observed in 2013 or in the two-year grain yields. Difference in test weight has been observed and is always the lowest for the June 10th planted corn. It appears as if planting date may affect yields more when following corn than when rotated with other crops, as a difference was not observed in 2012 when following sunflower. In 2014, planting date studies will evaluate grain yield following a wheat-double crop sunflower and corn following corn to determine if yields are affected the same.

Table 2. Mean grain yields and test weights for corn planting dates at OPREC in 2012.

Planting date	---- Grain yield (bu/ac) ----			----- Test weight (lb/bu) -----		
	2012	2013	2-year	2012	2013	2-year
April 10	225	212	219	58.9	60.0	59.4
May 10	197	165	181	56.4	59.4	57.9
June 10	157	175	166	53.9	57.6	55.7
CV %	8.1	6.7	10.4	1.0	2.9	1.4
L.S.D.	32	21.3	21.1	0.9	0.4	0.9

Corn Seed Orientation Research

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Toler et al. (1999) found a 5-10 percent yield increase to across the row leaves versus random. This research in South Carolina was conducted with plant populations of 22,000 and 33,000 plants per acre. The benefit of across the row leaves was greater at 33,000 plants per acre. Nine site years of Oklahoma State research indicates an average yield increase of 8 percent to across the row leaf orientation relative to random (Torres, 2012). To date, all trials have been planted by hand. The OSU research team developed a planter to orient corn seeds and place them in the soil. Planter performance results have been mixed, but continued effort is warranted to allow widespread trial to better determine potential agronomic benefits to oriented corn seed placement. These benefits could include but are likely not limited to improved water use efficiency, weed suppression, and yield.

Methods

Corn was planted at Goodwell on April 22, 2013 into strip tilled conditions. Production practices (fertility and weed control) were typical for irrigated corn in the panhandle. Corn was planted at two seeding rates (Table 1). The higher seeding rate is the typical recommended rate for irrigated corn in each area. The lower seeding rate is 20 percent less than the typical rate. Flat and round seed (Pioneer 1395) were planted at all locations with the expectation that the flat seed would be oriented and the round would not. Treatments were replicated four times. The planter developed at OSU (Figure 1) was used to plant trials and a planter provided by AGCO was used with two different closing systems. One closing system was the standard system (STD) and the second was a new alternative closing system (ACS).

Table 1. Treatment structure showing the planter, closing system, seeding rates and seed shape.

Trt	Planter	Closing	Seeding Rate	Seed
1	OSU	STD	25,600	Round
2	OSU	STD	25,600	Flat
3	OSU	STD	32,000	Round
4	OSU	STD	32,000	Flat
5	AGCO	ACS	25,600	Round
6	AGCO	STD	25,600	Round
7	AGCO	ACS	25,600	Flat
8	AGCO	STD	25,600	Flat
9	AGCO	ACS	32,000	Flat
10	AGCO	STD	32,000	Flat

Each plot was 10 feet wide (4-30 inch rows) and 30 feet long. The AGCO planter was used to plant the outside two rows for treatments 1-4. The meter drive was disengaged for the center two rows but they were still leaving a furrow. The OSU planter then planted each of the center two rows by following the path created by the AGCO furrow opener. Only 2 rows of the AGCO alternative closing system were available, so they were mounted in the center (Figure 2). Again the outer rows were planted with the standard AGCO row units. All four rows for treatments, 6, 8, and 10 were planted with the standard AGCO planter.

Figure 1. One row planter developed at OSU to orient and place corn seed.

Figure 2. Closing systems on the AGCO planter. The left row shows the standard system while the two center rows have the alternative closing system.

Stand counts were taken on regular intervals. Photographs were taken of 30 plants in each plot at about V3 for treatments 1-4 and all treatments at V6-V8 to assess leaf orientation. The photos taken at V8 were deemed unusable do to wind and overlapping leaves. The center two rows of each plot were harvested with a plot combine to determine moisture content and yield. The combines varied at locations.

Results

Final stand and emergence percentages were significantly different among the treatments however, neither impacted grain yield. Furthermore, there were no apparent trends in the emergence data. Yield ranged from 198 to 224 bu ac^{-1} with an average of 210 bu ac^{-1}. Treatments 5 and 10 yielded significantly more than treatments 1 and 4 (Figure 3). There were no other significant differences in yield. In general, the AGCO planter resulted in greater yield than the OSU planter; however both seeding rates resulted in similar yields when averaged across other treatments.

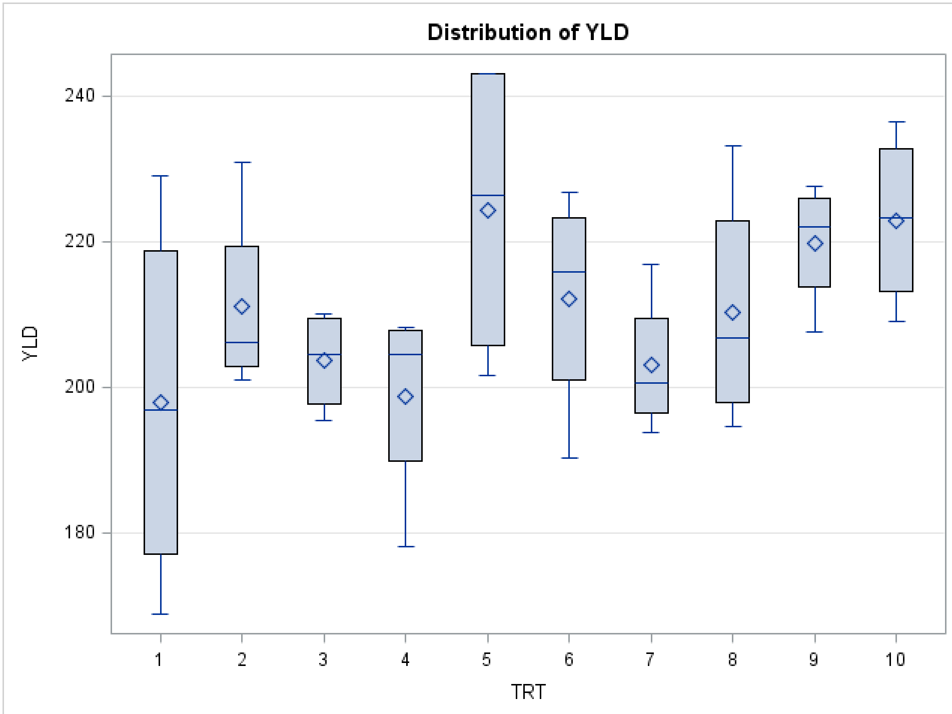

Figure 3. Yield by treatment at Goodwell.

GreenSeeker™ Sensor in Irrigated Corn Production

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The Green Seeker™ sensor plots were established to demonstrate the use of the sensor and N-Rich strip in the high yield production system of the Oklahoma Panhandle. The trials consisted of five nitrogen (N) rates replicated four times. The N treatments were 0, 50, 100, 150 and 200 lbs. N ac^{-1} applied at planting. No side-dress fertilizer was applied because the plots needed to go to final grain yield without additional N to evaluate the ability of the sensor to predict yield. Green Seeker™ Sensor normalized difference vegetative index (NDVI) readings were collected from the plots at the eight leaf stage. The purpose of using the sensor is to collect the data needed for the Sensor Based Nitrogen Rate Calculator (SBNRC) that is located on the www.NUE.okstate.edu website.

Pre-plant soil samples were collected from each treatment of the first rep to a depth of 4ft and analyzed in 1ft segments, results in Table 1. Due to a miscalculation fertilizer was over applied on the 150, 200, and 250 lb treatments. This can be seen in the total N values of table 1. This does not have an impact on the use of the trial for developing a Sensor Based Nitrogen Rate Calculator. The GreenSeeker sensor was used to collect NDVI reading at the V8 growth stage, this data is presented in Table 1 along with grain yield. The 2013 crop is the first crop in which a significant response to N fertilizer was found. This would be due to the reduced level of pre-plant residual N which has been mined for the past 4 seasons.

Figure 1 illustrates the strong relationship between NDVI collected at V8 and final grain yield for the 2010 and 2013 crop years. The 2011 and 2012 data is not presented due to the drought experienced in those years. The strong collection between NDVI and final grain yield indicates that the sensor can at least distinguish differences in yield potential mid-season. Unfortunately Figure 2 documents that the current yield prediction equation consistently underestimate yield. This is likely due to the fact that this algorithm was built with data collected from central Oklahoma, a much lower yield potential region due to annual environmental stresses. This data confirms that a separate algorithm and yield prediction model will be needed for the irrigated high plains. However the strong relationship between NDVI and yield indicates this should be possible.

Table 2 documents Nitrogen removal by crop, nitrogen balance (total nitrogen available minus nitrogen removed by crop), and the pre-plant soil test results for the 2014 crop. This table shows that in the first two treatments (0, 50) more N was removed via harvest than originally estimated available. Some refer to this as N mining. This does give us an estimate of mineralized N, approximately 50-60 lbs N ac^{-1}. The other treatments show a net positive value and this can be seen in the 2014 soil test results on highest N treatments of 200 and 250 lb N ac^{-1}.

Table 1. Pre-plant Soil test NO3, N applied, Total N, Normalized Difference Vegetative Index (NDVI) values, grain yield, from the 2013 Sensor Based N study trial, Goodwell OK. Treatment yield with same letter not significantly different.

N rate lb ac^{-1}	Pre-plant N	N applied	Total N	NDVI	Yield Bu ac^{-1}
0	70	0	70	0.80	191[a]
50	92	0	92	0.82	207[ab]
100	240	0	240	0.82	226[bc]
150	110	95	205	0.84	236[c]
200	176	112	288	0.84	245[c]
250	230	135	365	0.84	244[c]

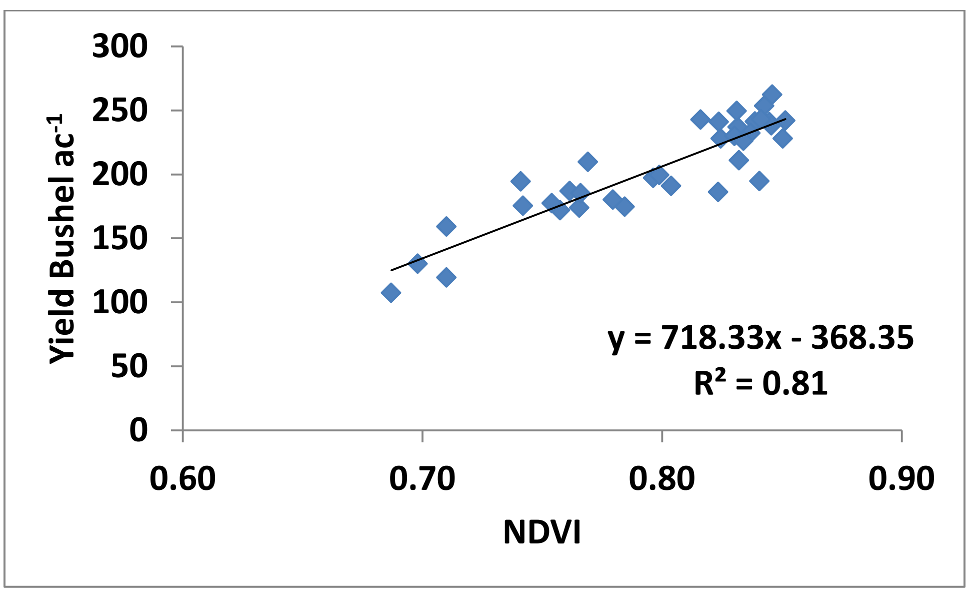

Figure 1. Correlation of NDVI and grain yield from the 2010 and 2013 Sensor Based N study trial, Goodwell OK.

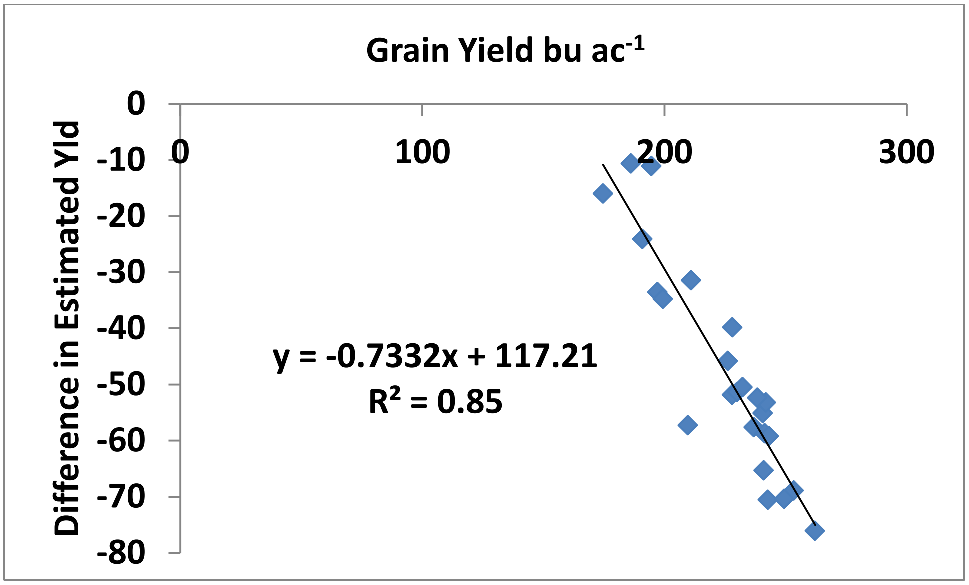

Figure 2. Relationship between actual grain yield and the difference in actual grain yield and estimated yield, 2013 Sensor Based N study trial, Goodwell OK

Table 2. Nitrogen removed by grain (Nupt), Nitrogen balance (total N – Nupt), Pre-plant Soil Test NO3 collected post-harvest, from the 2013 Sensor Based N study trial, Goodwell OK.

N rate lb ac^{-1}	Nupt lb ac^{-1}	N- Balance lb ac^{-1}	2014 Preplant N lb ac^{-1}
0	134	-64	30
50	145	-53	44
100	158	82	40
150	165	40	54
200	172	117	120
250	171	194	140

Comparison of Grain Sorghum and Corn Productivity under Limited Irrigation with Subsurface Drip

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This project focused on comparing the yield potential of corn and sorghum under a range of limited irrigation capacities. As well capacities decline it may be prudent to switch to alternative crops such as sorghum which require less in-season irrigation. It is well known that maximum sorghum yields can be achieved with less water than maximum corn yields. However, there is very little data available to determine the irrigation capacity at which it is economically advantageous to switch from growing corn to growing sorghum. The project was conducted at the Oklahoma State University Panhandle Research and Extension Center in Goodwell, OK. It utilized irrigation capacities from 6.4 GPM/acre to 0.8 GPM/acre. Corn yields were maximized with the 6.4 GPM/acre and as expected the profit was also maximized at this level of irrigation. Sorghum yields and profits were maximized at 4.8 GPM/acre. Data from this first year demonstrated that sorghum would become more profitable per acre at an irrigation capacity of 1.6 GPM/acre.

Methods, Procedures, and Facilities:

This research utilized the subsurface drip irrigation system located at the Oklahoma Panhandle Research and Extension center. This system provides individually plumbed experimental units that can be irrigated independently. These plots are 50 ft long and 15 ft wide. The drip tape is placed at 14 inches below the soil surface at 60 inch spacing such that one tape irrigates 2 rows which are space 30 inches apart. The emitters on the tape are placed 12 inches apart and will emit 0.63 inches/hour.

The experimental design consisted of 6 sorghum treatments and 6 corn treatments. Four of the sorghum treatments and 4 of the corn treatments simulated application rates achievable with well pumping capacities shown in table 1 when applied to 125 acre center pivot. The sorghum treatments will include all pumping capacities included in the table except for the 800 gallon/minute because it is well known that this rate is in excess of water requirements for sorghum. The corn treatments included all pumping capacities listed except for the 100 gal/min rate because this is well below the require water for irrigated corn. One of the remaining treatments for each crop served to optimize water use efficiency by applying applications of water at a rate sufficient to replace water losses due to evapotranspiration as estimated by the Aquaplanner software. The application rate and frequency for this treatment was determined by Aquaplanner to maximize yield potential and water use efficiency without restriction on irrigation capacity. The final treatment was meant to receive irrigation based on recommendations provided by the Aquaspy soil moisture probes. However, technical difficulties leading to uncertainty of moisture data cause this effort to be terminated. This treatment was irrigated at the same rate and frequency as the Aquaplanner treatment describe above.

Table 1: Pumping capacities, application intervals, and resulting application rates for basic irrigation treatments.

Well Capacity	Application /Interval	Minimum Irrigation Interval	Application Rate	
Gallons/min.	Inches	Days	GPM/acre	inches/day
800	1.5	4.4	6.4	0.34
600	1.5	5.9	4.8	0.26
400	1.5	8.8	3.2	0.17
200	1.5	17.7	1.6	0.09
100	1.5	35.4	0.8	0.04
Treatments are meant to simulate a center pivot system irrigating a 125 acre circle with specific well pumping capacities. GPM, Gallons/minute.				

Prior to planting corn and sorghum, plots were fertilized using a strip-till fertilizer applicator. Corn plots will receive 240 lbs N acre^{-1} as liquid UAN (32-0-0) and sorghum plots received 180 lbs N acre^{-1} as Liquid UAN (32-0-0). At planting 5 gallons of 10-34-0 liquid fertilizer was applied as starter fertilizer. Corn was planted on April 15th, however inaccurate row placement relative to the drip tape cause unacceptable distribution of water to the corn rows, therefore this crop was terminated and corn was replanted on June 4th. Sorghum was planted June 17th. Each crop was planted in rows 30 inches apart. Corn was harvested on October 16th and sorghum was harvested on October 24th with a small plot combine. Two rows from each plot were harvested to determine plot weight, test weight and moisture with a harvest master weighing system. Yields presented where corrected to 15.5% moisture for corn and 14% moisture for grain sorghum and 56 lbs/bushel test weight.

On June 11th one soil core was collected from each plot to a target depth of 7ft. However restrictive layers below 4 ft prevented extraction of soil from below this depth in 29 of the 48 plots. Therefore the water balance presented includes soil moisture analysis on the surface 4 ft. Soil cores were again collected to a minimum depth of 4ft on October 29th. Soil cores (1.75 inch diameter) were cut into 1 ft sections before they are weighed, dried (100°C) and then weighed again to determine gravimetric water content. This along with rainfall data from the nearby Mesonet station and flow meter data from each plot were used to calculate water balances for each treatment.

An enterprise budget was developed using cost estimates from the USDA Economics Research Service webpage (http://www.ers.usda.gov/data-products/commodity-costs-and-returns.aspx#.UsWjr_RDtQR) . The costs were adjusted for differences in seeding rate and N fertilizer applications among the treatments. The cost include the investment cost for a center pivot irrigation system but do not include land costs or crop insurance costs.

Analysis of variance for yield and water use efficiency data was analyzed using the SAS, PROC GLM method. Means were separated using Fishers protected LSD.

Results and Discussion:

Table 1 shows a maximum corn yield of 182 bu/acre was achieved with 11.3 inches of irrigation applied in the Aquaplanner treatment. This treatment applied a similar amount of water to the limited irrigation capacity treatment of 4.8 GPM/acre which supplied 11.4 inches resulting in a yield of 167 bu/acre. There was no significant difference in corn yields at irrigation capacities of 3.2 GPM or greater. This lack of difference is due to the large LSD of 25.8 bu/acre. Sorghum yields were maximized at 151 bu/acre from the limited irrigation capacity treatment of 4.8 GPM/acre, but this yield was not significantly greater than the 137 bu/acre yield achieved with the 1.6 GPM/acre treatment which received 5.8 inches of irrigation water. It is noteworthy that no significant differences between corn and sorghum yields were observed within the 4.8, 3.2, and 1.6 GPM/acre limited irrigation capacity treatments. Assessment of treatment differences in irrigation WUE provide a more clear evaluation because it accounts for the lower water application to the sorghum crop under each of the common irrigation treatments (Table 1). For both crops the irrigation WUE increases with decreasing amounts of applied irrigation water and is maximized at 29.8 bu/inch for the sorghum irrigate with a limited supply of 0.8 GPM/acre. At 4.8 and 3.2 GPM/acre no significant difference in irrigation WUE was observed between the two crops. However, at 1.6 GPM/acre the irrigation WUE was significantly higher for the sorghum compared to corn. It is not worthy that the sorghum yield was not significantly lower in this treatment than in the highest yielding treatment which received 4.4 inches more water.

Table 1: the irrigation capacity and resulting irrigation water applied to corn and sorghum; and the resulting grain yield and irrigation water use efficiency (WUE).

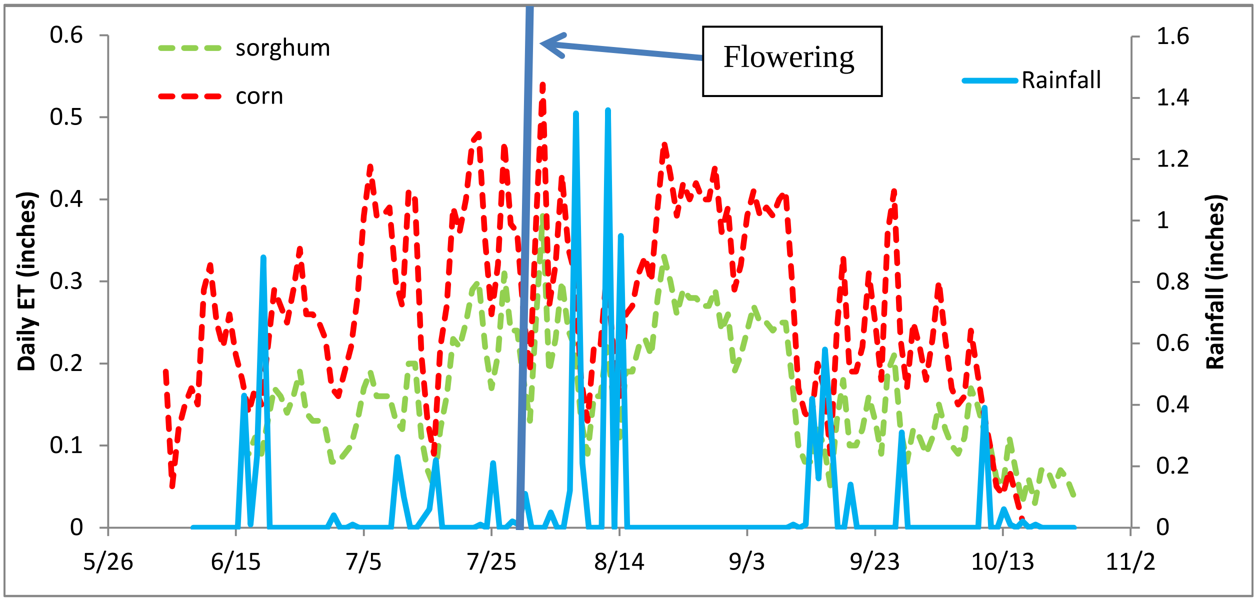
Irrigation Capacity		-----Irrigation------		-----Yield-------		Irrigation WUE	
		Corn	**Sorghum**	**Corn**	**Sorghum**	**Corn**	**Sorghum**
GPM/pivot	GPM/acre	-----Inches/acre----		---Bu/acre---		-----Bu/inch----	
800	6.40	12.9		178a		13.8e	
600	4.80	11.4	10.2	167ab	151bc	14.6e	14.8e
400	3.20	8.6	7.7	159abc	140cd	18.4cd	18.3cd
200	1.60	6.1	5.8	120d	137cd	19.7c	23.6b
100	0.80		3.9		115d		29.8a
Aquaspy	Unlimited	12.4	7.7	172ab	136cd	13.9e	17.7cd
Aquaplanner	Unlimited	11.3	7.8	182a	133cd	16.1de	17.1cd

Table 2 shows that gross returns for corn were consistently higher than for sorghum at irrigation capacities at or above 3.2 GPM/acre. However, production costs for corn were higher at all irrigation rates (production costs are itemized in table 3). Therefore, net returns were not consistently higher for corn. Specifically, net returns per acre were maximized with corn irrigated with aquaplanner treatment because it produced the highest gross return. However, production costs were the same as those required for the limited irrigation treatment receiving 4.8 GPM/acre which produced 15 bu/acre less yield. At this irrigation capacity of 4.8 PGM/acre sorghum generated slightly higher net returns per acre and per inch of water. This is due to the lower production cost of sorghum. Corn was planted at a lower population and received less fertilizer in the 3.2 and 1.6 GPM/acre treatments, therefore production costs were lower. This allowed net returns per inch of water to be maximized at $23/inch in the 3.2 GPM/acre treatment. In contrast the 1.6 GPM/acre treatment maximized net returns for the sorghum. Also, the net returns per acre for sorghum at 1.6 GPM/acre was superior compared to net returns for corn at this irrigation level. This demonstrates the utility of sorghum when water is limited.

Table 2: The irrigation capacity and resulting gross return based on corn and sorghum cash price of $4.32 and $4.03 respectively; production costs and net returns.

Irrigation Capacity		--Gross Return--		Production Costs		---------------Net Returns--------------			
		corn	sorghum	corn	sorghum	corn	sorghum	corn	sorghum
GPM/pivot	GPM/acre	-----$/acre----		-----$/acre-----		------$/acre-----		----$/inch----	
800	6.4	769		548		221		17	
600	4.8	721	609	541	422	180	187	16	18
400	3.2	687	564	487	411	200	153	23	20
200	1.6	518	552	476	395	42	157	7	27
100	0.8		463		387		76		20
Aquaspy	Unlimited	743	548	545	411	198	137	16	18
Aquaplanner	Unlimited	786	536	541	411	245	125	22	16

The 2013 crop year provided ideal conditions for June planted sorghum and corn under limited irrigation. Specifically, timely midseason rains in excess of 1 inch occurred in August directly after flowering (Figure 1). These rains offset the lack of irrigation capacity in the lower capacity treatments, which delayed the onset of severe water stress during the critical grain fill period despite the lack of rainfall that occurred between Aug 16 and Sept. 12. This along with the large treatment variability explains the lack of significant increase in yield as irrigation capacity increased from 3.2 GPM/acre and 1.6 GPM/acre for the corn and sorghum crops. Optimum corn grain yields were suppressed to below expected levels in the 6.4 GPM/acre treatment. Some of this yield drag could have resulted from moderate water stress, however, the primary cause of this generally low yield is likely the late planting date. The shorter season for this corn crop reduces early season vegetative growth, which reduces water requirement but also decreases potential yield.



sorghum
corn
Flowering
Rainfall
Daily ET (inches)
Rainfall (inches)
0.6
0.5
0.4
0.3
0.2
0.1
0
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
5/26
6/15
7/5
7/25
8/14
9/3
9/23
10/13
11/2

Table 3: Enterprise budget for irrigation corn and sorghum treatments, excluding land and crop insurance costs.

	Corn						Sorghum					
Irrigation Capacity (GPM/pivot)	800	600	400	200	Aquaspy	Aquaplanner	600	400	200	100	Aquaspy	Aquaplanner
Irrigation Capacity (GPM/acre)	6.4	4.8	3.2	1.6	Unlimited	Unlimited	4.8	3.2	1.6	0.8	Unlimited	Unlimited
Seeding Cost ($/acre)	95	95	72	72	95	95	14	14	7	7	14	14
Chemical ($/acre)	26	26	26	26	26	26	23	23	23	23	23	23
N Fertilizer ($/acre)	106	106	88	88	106	106	79	79	79	79	79	79
Phosphorus Fertilizer ($/acre)	40	40	40	40	40	40	40	40	40	40	40	40
Crop Consultation ($/acre)	7	7	7	7	7	7	7	7	7	7	7	7
Custom Machinery ($/acre)	175	175	175	175	175	175	175	175	175	175	175	175
Irrigation Labor ($/acre)	7	7	7	7	7	7	7	7	7	7	7	7
irrigation pumping costs ($/acre)	53	47	35	25	51	46	42	32	24	16	32	32
1/2 years of interest on variable costs ($/acre)	17	16	14	14	16	16	13	12	12	11	12	12
Total Variable Costs ($/acre)	**525**	**518**	**464**	**453**	**522**	**518**	**399**	**388**	**372**	**364**	**388**	**388**
Irrigation system investment /yr ($/acre)	23	23	23	23	23	23	23	23	23	23	23	23
Total Production costs ($/acre)	**548**	**541**	**487**	**476**	**545**	**541**	**422**	**411**	**395**	**387**	**411**	**411**

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. Starting in 2010, the study was changed again and only sorghum was grown. 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

The latest drought started at OPREC in September of 2010. In August of 2010 the station received 5.42 inches of rainfall. In the period from September 1, 2010 through August 31, 2011 the station received only 6.11 inches of precipitation with 2.05 inches of that coming in August of 2011 which was too late for any summer crop production. From September 1, 2011 to August 31, 2012 the station received 14.54 inches of precipitation which is also below the average of 17.89 inches. This two year drought has reduced grain yields on both summer and winter crops below what has been raised in the past at OPREC. This is shown in results for both wheat and grain sorghum (Figures 1 and 2)

Eight of the last thirteen summers have been below average rainfall for the months of June – August (Table 1). The two driest periods were 2001 and 2011 with 16.5% and 35.6% of normal. The two years with the highest grain sorghum yields were 2009 and 2010 which is surprising since 2009 was below average rainfall and 2010 was above average.

Table 1. Summer growing season precipitation at OPREC

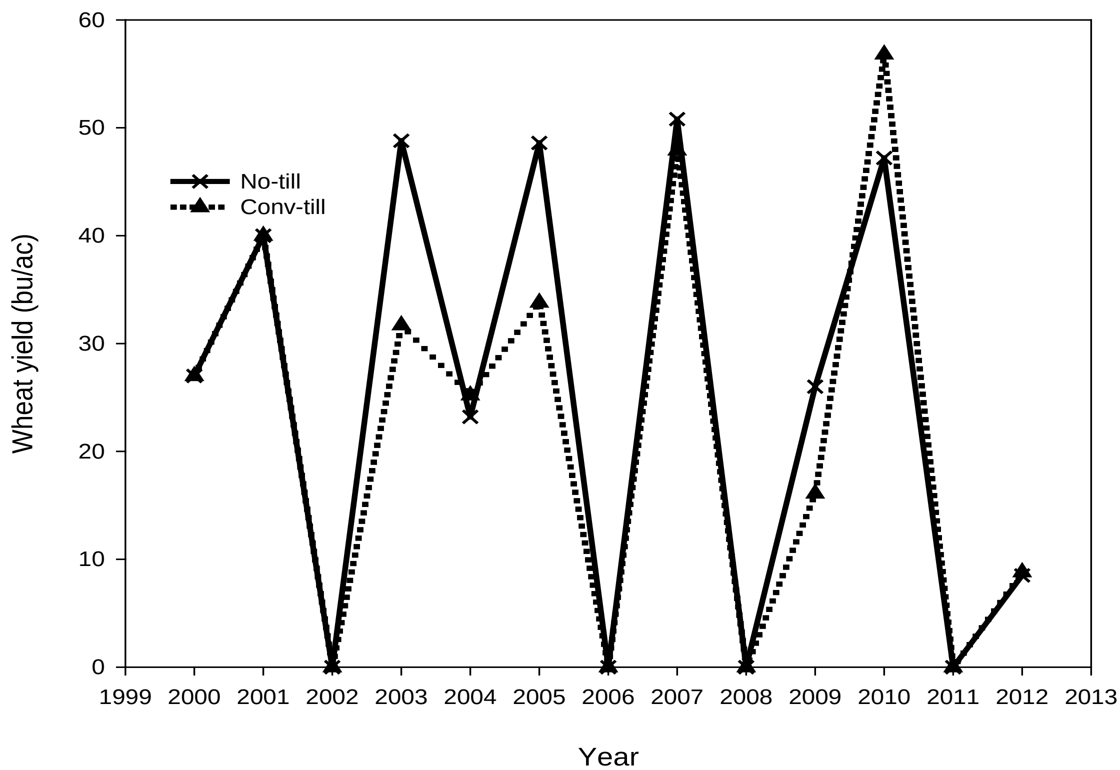
Month	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Long-term mean
June	2.29	0.61	1.32	5.26	3.82	2.01	2.34	1.62	1.51	1.74	3.16	0.53	2.33	2.86
July	0.76	0.00	2.52	1.87	2.43	1.40	2.05	2.00	3.77	2.58	1.22	0.17	1.95	2.58
Aug	1.09	0.66	0.27	1.19	2.87	3.21	4.06	0.26	5.64	1.36	5.42	2.05	0.85	2.28
Total	4.14	1.27	4.11	8.32	9.12	6.62	8.45	3.88	10.7	5.68	9.80	2.75	5.13	7.72

Wheat

No wheat was harvested in 2002, 2008, and 2011 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.

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

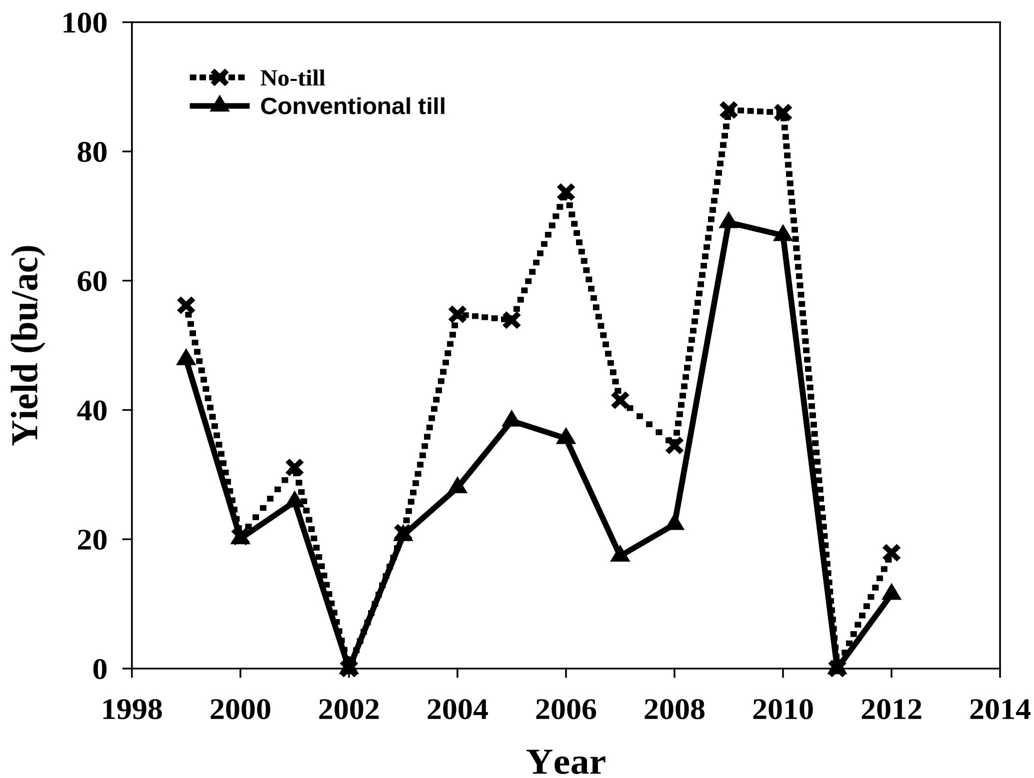


Neither tillage system produced, or will produce grain when drought occurs and no crops are harvested as in 2002, 2008, and 2011 (Figure 1). In three of the seven years that wheat was harvested, grain yields were significantly higher for no-till (Fig. 1) with an average increase of 14 bu/ac. In 2010, yields for conventional tillage were significantly higher than for no-till. Research conducted by Kansas State University at Tribune, 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 the tillage system makes no difference since no sorghum was harvested (see 2002 and 2001 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. 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 those for minimum tillage.

Evaluation of Pre and Post Emergent Herbicides for Kochia Control in a Wheat-Grain Sorghum –Fallow Rotation

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In 2013, a study was initiated to evaluate control of kochia utilizing pre and post emergent herbicides when wheat would be planted in the fall. Controlling kochia with glyphosate products has become more difficult due to resistance. This study was established to determine if control of kochia is easier before or after emergence. Treatment numbers, product and rates are listed in (Table 1). Treatment 1 is untreated check, while treatments 2 – 7 are pre-emergent treatments, and treatments 8 – 14 are post emergent treatments. The pre-emergent treatments were applied on March 5, 2013 and post emergent treatments were applied on June 13, 2013 with a tractor mounted plot sprayer. Rainfall for the 30 days after the application of pre-emergent herbicides totaled 0.41 inches (March 24; 0.11, March 31; 0.14, April 2; 0.10, and April 3; 0.07). Although rainfall total was less than a half an inch it was enough to activate the pre-emergent herbicides.

Table 1. Treatment numbers and product rates for dry-land kochia control study at OPREC in 2013.

1	PRODUCT	UNTREATED		
2	PRODUCT	CORVUS	3	OZ/A
	PRODUCT	SENCOR	8	OZ/A
	PRODUCT	ROUNDUP POWER MAX	22	OZ/A
	PROD_ADJ	DESTINY HC	1	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
3	PRODUCT	CORVUS	3	OZ/A
	PRODUCT	ATRAZINE	1	PT/A
	PRODUCT	ROUNDUP POWER MAX	22	OZ/A
	PROD_ADJ	DESTINY HC	1	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
4	PRODUCT	CORVUS	4	OZ/A
	PRODUCT	ATRAZINE	1	PT/A
	PRODUCT	ROUNDUP POWER MAX	22	OZ/A
	PROD_ADJ	DESTINY HC	1	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
5	PRODUCT	CORVUS	3	OZ/A
	PRODUCT	SENCOR	8	OZ/A
	PRODUCT	BANVEL	16	OZ/A
	PRODUCT	ROUNDUP POWER MAX	22	OZ/A
	PROD_ADJ	DESTINY HC	1	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
6	PRODUCT	CORVUS	4	OZ/A
	PRODUCT	SENCOR	8	OZ/A
	PRODUCT	ROUNDUP POWER MAX	22	OZ/A
	PROD_ADJ	DESTINY HC	1	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
7	PRODUCT	CORVUS	4	OZ/A
	PRODUCT	SENCOR	8	OZ/A
	PRODUCT	BANVEL	16	OZ/A
	PRODUCT	ROUNDUP POWER MAX	22	OZ/A
	PROD_ADJ	DESTINY HC	1	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
8	PRODUCT	LAUDIS	3	OZ/A
	PRODUCT	ATRAZINE	1	PT/A
	PROD_ADJ	MSO	1	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
9	PRODUCT	LAUDIS	3	OZ/A
	PRODUCT	ATRAZINE	1	PT/A
	PRODUCT	BANVEL	8	OZ/A
	PROD_ADJ	MSO	1	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
10	PRODUCT	HUSKIE	16	OZ/A
	PRODUCT	ATRAZINE	1	PT/A
	PRODUCT	BANVEL	8	OZ/A
	PROD_ADJ	NIS	0.25	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
11	PRODUCT	LAUDIS	3	OZ/A
	PRODUCT	STARANE NXT	14	OZ/A
	PROD_ADJ	MSO	1	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
12	PRODUCT	HUSKIE	16	OZ/A
	PRODUCT	ATRAZINE	1	PT/A
	PROD_ADJ	NIS	0.25	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
13	PRODUCT	HUSKIE	16	OZ/A
	PRODUCT	SENCOR	8	OZ/A
	PROD_ADJ	NIS	0.25	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL
14	PRODUCT	HUSKIE	16	OZ/A
	PRODUCT	STARANE ULTRA	4	OZ/A
	PROD_ADJ	NIS	0.25	% V/V
	FERTIL	AMMONIUM SULFATE	18.22	LB/100 GAL

Results

With the minimal rainfall, it was enough to germinate kochia and activate herbicides to provide control of kochia as seen in (Table 2). Results show that controlling kochia before emergence is the best option, with all pre-emergent treatments providing at least 99% control three months after application. The first control rating (June 27) for the post emergent herbicides showed injury to kochia. However, it did not kill plants as can be seen by lower ratings two weeks later. If another rating had been taken in early August for the post emergent herbicides only treatment 14 would have been over 50% control. The pre-emergent treatments were still kochia free in August at the crop tour. All plots were sprayed with glyphosate in early August for control of johnsongrass which had no effect on the kochia in the post emergent treatment plots. These pre-emergent treatments can only be applied on farms that will be planted to wheat in the fall. Therefore producers in a wheat-grain sorghum-fallow rotation would apply these herbicides in late February or early March following grain sorghum harvest. As always check label for any restrictions due to pH or soil types.

Table 2. Treatment number and percent control of kochia for selected dates for dry-land kochia control study at OPREC in 2013.

	-------------- Date ---------------		
Treatment number	June 13	June 27	July 10
1	0	0	0
2	100	100	100
3	100	99	98
4	100	100	100
5	100	99	100
6	99	100	100
7	100	100	100
8	Application	98	28
9	Application	100	71
10	Application	98	76
11	Application	100	99
12	Application	99	43
13	Application	98	54
14	Application	91	96

Evaluation of DuPont™ Herbicides on Corn

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In 2013, a study was established to evaluate herbicides from DuPont™ herbicides for corn. Treatment numbers, product utilized, rate, and timing of application are listed in (Table 1). Pre-emergent treatments were applied the day after planting and the post emergent treatments were applied 32 days after planting. All plots were sprayed with glyphosate prior to planting to begin with clean plots. Crop injury ratings were taken 14 and 28 days after planting (DAP) to evaluate crop response pre-emergent herbicides. Residual weed control (grass and broadleaf) ratings were also taken on June 7th prior to application of post emergent herbicides. Weed control ratings were taken after post emergent application (June 21st and July 8th). The July 8th rating was rated on individual species for both grass and broadleaf. Plots were 30 feet long and 4 rows wide, with the two middle rows harvested for grain yield and test weight with a Kincaid 8 XP plot combine.

Results

Weed pressure was not extremely high at the location selected for the study, and the late burndown treatment (May 1st) may have altered the results. There was no injury observed with any of the pre-emergent herbicides. All of the pre-emergent herbicides provided above 90% control for grass species at the June 7th rating. This excellent control may have been due to the burndown treatment and before the emergence of crabgrass. Treatments, (1, 3, 7, and 10) provide above 90% control for broadleaf species for the June 7th rating, with all other treatments below 85% (Table 2). All post emergent treatments provided excellent control for both rating times June 21st (Table 3) and July 8th (Table 4). The control ratings for July 8th are given as individual species rather than grass and broadleaf, because of emergence of crabgrass and velvetleaf. No difference in grain yield or test weight was observed between herbicide treatments (Table 5). However, grain yield for the untreated check (treatment 13) was significantly lower than any herbicide treatment.

Table 1. Treatment numbers, product rates, and timing of application for evaluation of DuPont™ herbicides for corn at OPREC in 2013.

TRT	Product	RATE	TIMING
1	RIMSULFURON (25% SG)	0.25	PRE
	MESOTRIONE (WG 50 PC)	2.50	PRE
	RIMSULFURON (25% SG)	0.30	POST
	MESOTRIONE (WG 50 PC)	1.25	POST
	ISOXADIFEN-ETHYL (WG 50 PC)	0.15	POST
	ATRAZINE (SL 4.00 LG)	1.50	POST
	ABUNDIT EXTRA (SL 3.0 LG)	32.00	POST
	AMSUL (GR 100 PC)	2.00	POST
2	RIMSULFURON (25% SG)	0.25	PRE
	MESOTRIONE (WG 50 PC)	2.50	PRE
	ATRAZINE (SL 4.00 LG)	1.00	PRE
	RIMSULFURON (25% SG)	0.30	POST
	MESOTRIONE (WG 50 PC)	1.25	POST
	ISOXADIFEN-ETHYL (WG 50 PC)	0.15	POST
	ATRAZINE (SL 4.00 LG)	1.50	POST
	ABUNDIT EXTRA (SL 3.0 LG)	32.0	POST
	AMSUL (GR 100 PC)	2.00	POST
3	RIMSULFURON (25% SG)	0.25	PRE
	MESOTRIONE (WG 50 PC)	2.50	PRE
	CINCH ATZ (5.5 EC)	1.50	PRE
	RIMSULFURON (25% SG)	0.30	POST
	MESOTRIONE (WG 50 PC)	1.25	POST
	ISOXADIFEN-ETHYL (WG 50 PC)	0.15	POST
	ATRAZINE (SL 4.00 LG)	1.50	POST
	ABUNDIT EXTRA (SL 3.0 LG)	32.0	POST
	AMSUL (GR 100 PC)	2.00	POST
4	RIMSULFURON (25% SG)	0.25	PRE
	MESOTRIONE (WG 50 PC)	2.50	PRE
	ATRAZINE (SL 4.00 LG)	1.50	POST
	RIMSULFURON (25% SG)	0.23	POST
	THIFENSULFURON (SG 50 PC)	0.05	POST
	ISOXADIFEN-ETHYL (WG 50 PC)	0.115	POST
	ABUNDIT EXTRA (SL 3.0 LG)	32.0	POST
	AMSUL (GR 100 PC)	2.00	POST
5	RIMSULFURON (25% SG)	0.25	PRE
	MESOTRIONE (WG 50 PC)	2.50	PRE
	ATRAZINE (SL 4.00 LG)	1.00	PRE
	RIMSULFURON (25% SG)	0.23	POST
	THIFENSULFURON (SG 50 PC)	0.05	POST
	ISOXADIFEN-ETHYL (WG 50 PC)	0.115	POST
	ATRAZINE (SL 4.00 LG)	1.50	POST
	ABUNDIT EXTRA (SL 3.0 LG)	32.0	POST
	AMSUL (GR 100 PC)	2.00	POST

TRT	Product	RATE	TIMING
6	RIMSULFURON (25% SG)	0.25	PRE
	MESOTRIONE (WG 50 PC)	2.50	PRE
	CINCH ATZ (5.5 EC)	1.50	PRE
	RIMSULFURON (25% SG)	0.23	POST
	THIFENSULFURON (SG 50 PC)	0.05	POST
	ISOXADIFEN-ETHYL (WG 50 PC)	0.115	POST
	ATRAZINE (SL 4.00 LG)	1.50	POST
	ABUNDIT EXTRA (SL 3.0 LG)	32.00	POST
	AMSUL (GR 100 PC)	2.00	POST
7	RIMSULFURON (25% SG)	0.25	PRE
	MESOTRIONE (WG 50 PC)	2.50	PRE
	ABUNDIT EXTRA (SL 3.0 LG)	32.0	POST
	AMSUL (GR 100 PC)	2.00	POST
8	RIMSULFURON (25% SG)	0.30	POST
	MESOTRIONE (WG 50 PC)	1.25	POST
	ISOXADIFEN-ETHYL (WG 50 PC)	0.15	POST
	ATRAZINE (SL 4.00 LG)	1.50	POST
	ABUNDIT EXTRA (SL 3.0 LG)	32.0	POST
	AMSUL (GR 100 PC)	2.00	POST
9	RIMSULFURON (25% SG)	0.23	POST
	THIFENSULFURON (SG 50 PC)	0.05	POST
	ISOXADIFEN-ETHYL (WG 50 PC)	0.115	POST
	ATRAZINE (SL 4.00 LG)	1.50	POST
	ABUNDIT EXTRA (SL 3.0 LG)	32.00	POST
	AMSUL (GR 100 PC)	2.00	POST
10	LUMAX	3.00	PRE
	ABUNDIT EXTRA (SL 3.0 LG)	32.00	POST
	AMSUL (GR 100 PC)	2.00	POST
11	HALEX GT (EC 4.39 LG)	4.00	POST
	ATRAZINE (SL 4.00 LG)	1.50	POST
	NONIONIC SURFACTANT	0.25	POST
	AMSUL (GR 100 PC)	2.00	POST
12	CAPRENO (SC 3.45 LG)	3.00	POST
	ATRAZINE (SL 4.00 LG)	1.50	POST
	ABUNDIT EXTRA (SL 3.0 LG)	32.0	POST
	AMSUL (GR 100 PC)	2.00	POST
13	Untreated Check		

Table 2. Grass and broadleaf control rating for DuPont™ herbicides for June 7th, 2013 at OPREC.

Treatment number	Grass control %	Broadleaf control %
1	98	93
2	100	73
3	100	99
4	100	62
5	95	72
6	100	85
7	100	90
10	95	94

Table 3. Grass and broadleaf control rating for DuPont™ herbicides for June 21st, 2013 at OPREC.

Treatment number	Grass control %	Broadleaf control %
1	100	100
2	100	100
3	100	100
4	100	99
5	100	100
6	100	94
7	100	100
8	100	100
9	100	99
10	100	98
11	100	100
12	100	100
13	0	0

Table 4. Grass and broadleaf control rating for DuPont™ herbicides for July 8th, 2013 at OPREC.

Treatment Number	Control %					
	Johnson grass	Crab grass	Kochia	Russian thistle	Amaranths Species	Velvet leaf
1	98	100	100	100	100	100
2	100	100	100	100	100	100
3	100	100	100	100	100	100
4	100	100	100	100	100	98
5	98	100	98	98	100	100
6	100	100	100	100	100	88
7	99	88	95	100	100	100
8	100	100	99	98	100	100
9	100	100	98	100	100	99
10	98	100	97	100	100	100
11	99	100	100	100	100	100
12	100	100	99	100	100	100
13	0	0	0	0	0	0

Table 5. Grain yield ant test weight from DuPont™ herbicide evaluation plots at OPREC in 2013.

Treatment number	Grain yield bu/ac	Test weight lb/bu
5	272	57.6
10	272	57.4
12	270	57.6
3	267	58.3
9	267	57.5
7	261	57.3
11	261	57.7
2	260	57.7
1	259	57.6
4	257	57.3
8	256	57.5
6	255	57.6
13	220	57.2
Mean	260	57.6
CV %	6.7	1.7
L.S.D.	25	NS

Evaluation of DuPont™ Commercial Herbicides on Corn

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Table 1. Treatment numbers, product rates, and timing of application for evaluation of DuPont™ herbicides for corn at OPREC in 2013.

Treatment	Product	Rate	Timing
1	Prequel	1.66 oz/ac	Pre-mergence
	Atrazine	1 lb/ac	
	Resolve Q	1.25 oz/ac	Post emergent
	Roundup Weathermax	22 oz/ac	Post emergent
	COC	0.5% v/v	Post emergent
	AMS	2 lbs/ac	Post emergent
2	Realm Q	4 oz/ac	2 leaf
	Atrazine	1 lb/ac	
	Roundup Weathermax	22 oz/ac	
	COC	0.5% v/v	
	AMS	2 lb/ac	
3	Roundup Weathermax	22 o/ac	Weeds at 3-4” inches tall
	AMS	17lbs/100 gal H_2O	
4	Untreated check		

Table 2. Grass and broadleaf control rating for DuPont™ herbicides for (June 7 and 21) and July 8th, 2013 at OPREC.

Treatment	------- Grass Control % -------			------ Broadleaf control % ------		
	June 7	June 21	July 8	June 7	June 21	July 8
1	100	100	100	97	100	100
2	NA	100	100	NA	100	100
3	NA	100	99	NA	97	96
4	0	0	0	0	0	0

Table 3. Grain yield ant test weight from DuPont™ herbicide evaluation plots at OPREC in 2013.

Treatment	Grain yield bu/ac	Test weight lb/bu
1	262	57.4
2	274	57.3
3	265	57.0
4	178	57.2
Mean	245	57.2
L.S.D.	39	NS

BASF™ Yield Advantage Evaluation on Irrigated Grain Sorghum

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Table 1. Treatment numbers, product rates, and timing for BASF™ Yield Advantage Study at OPREC in 2013.

Trt	Product Name	Rate	Unit	Timing
1	ATRAZINE 4L	32.0	fl oz/a	PRE
2	GUARDSMAN MAX	48.0	fl oz/a	PRE
3	GUARDSMAN MAX	48.0	fl oz/a	PRE
	SHARPEN	2.0	fl oz/a	PRE
4	GUARDSMAN MAX	48.0	fl oz/a	PRE
	SHARPEN	2.0	fl oz/a	PRE
	PRIAXOR	4.0	fl oz/a	50% headed
5	GUARDSMAN MAX	48.0	fl oz/a	PRE
	SHARPEN	2.0	fl oz/a	PRE
	PRIAXOR	4.0	fl oz/a	50% headed
	FASTAC 100 SC	3.8	fl oz/a	50% headed
6	STAMINA	0.8	fl oz/cwt	Seed treatment
	GUARDSMAN MAX	48.0	fl oz/a	PRE
	SHARPEN	2.0	fl oz/a	PRE
	PRIAXOR	4.0	fl oz/a	50% headed
	FASTAC 100 SC	3.8	fl oz/a	50% headed

Table 2. Grain yield and grain characteristics from BASF™ Yield Advantage evaluation plots at OPREC in 2013.

Treatment	Grain Yield (bu/ac)	Test weight (lbu/bu)	Lodging %
4	126	54.8	8
6	117	53.9	10
3	115	54.1	7
5	114	53.7	25
2	108	53.2	7
1	101	53.2	0
Mean	113	53.8	-----
CV%	10.1	3.0	-----
L.S.D.	14	1.9	-----

BASF™ Evaluate Facet injury on Irrigated Grain Sorghum

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A study to evaluated injury of the Liquid formulation (Facet) compared to the dry formulation (Paramount) of Quinclorac. Only injury was a cosmetic spotting of the leaves, very similar to what is observed with COC and did not affect grain yield or test weight.

Table 1. Treatment numbers and product rates for BASF™ Facet Injury Study at OPREC in 2013.

Trt	Product	Rate	Unit
1	Untreated Weed-Free Check		
2	FACET	32	FL OZ/A
	ATRAZINE 4L	1	QT/A
	MSO	1	QT/A
	Ammonium Sulfate	2.5	LB/A
3	FACET	32	FL OZ/A
	ATRAZINE 4L	1	QT/A
	COC	1	QT/A
	Ammonium Sulfate	2.5	LB/A
4	FACET	64	FL OZ/A
	ATRAZINE 4L	1	QT/A
	MSO	1	QT/A
	Ammonium Sulfate	2.5	LB/A
5	PARAMOUNT	16	OZ WT/A
	ATRAZINE 4L	1	QT/A
	MSO	1	QT/A
	Ammonium Sulfate	2.5	LB/A

Table 2. Grain yield and test weight from BASF™ Yield Advantage evaluation plots at OPREC in 2013.

Treatment	Grain Yield (bu/ac)	Test weight (lbu/bu)
5	144	56.2
1	139	56.3
2	138	56.0
4	138	55.9
3	137	55.4
Mean	139	56.0
CV%	5.2	1.1
L.S.D.	NS	NS

Evaluation of Syngenta™ Fungicide on Irrigated Grain Sorghum Yields

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This study was to evaluate disease control on grain sorghum, as can been seen by the yields no disease was present in 2013 on grain sorghum.

Table 1. Treatment numbers, product rates, and timing for evaluation of Syngenta™ fungicides on irrigated grain sorghum yields at OPREC in 2013.

Trt	Product Name	Rate	Rate Unit	Timing
1	UNTREATED CHECK			
2	Quilt Xcel 2.2 SE	10.5	fl oz/ac	Boot
	COC	1.0	%v/v	Boot
3	Quilt Xcel 2.2 SE	10.5	fl oz/ac	Bloom
	COC	1.0	%v/v	Bloom

Table 2. Grain yield and test weight from evaluation of Syngenta™ fungicides on irrigated grain sorghum at OPREC in 2013.

Treatment	Grain Yield (bu/ac)	Test Weight (lb/bu)
Quilt and coc at bloom	137	55.3
Quilt and coc at boot	134	55.6
Check	132	55.2
Mean	134.4	55.4
CV%	4.7	1.8
L.S.D	NS	NS

Evaluation of Selected Fungicides on Irrigated Grain Sorghum Yields

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This study was to evaluated an in furrow insecticide against existing fungicides on disease control and grain yield. No disease was present in 2013 at OPREC.

Table 1. Treatment numbers, product rates, and timing for evaluation of selected fungicides on irrigated grain sorghum yields at OPREC in 2013.

Trt	Product Name	Rate	Rate Unit	Timing
1	CHECK			In furrow
2	PRIAXOR	4.0	fl oz/a	50% headed
3	HEADLINE SC	6.0	fl oz/a	50% headed
	SURFACTANT-NONIONIC	0.25	% v/v	
4	PRIAXOR	4.0	fl oz/a	50% headed
	SURFACTANT-NONIONIC	0.25	% v/v	
5	QUADRIS	6.0	fl oz/a	50% headed
	SURFACTANT-NONIONIC	0.25	% v/v	
6	QUILT XCEL	10.5	fl oz/a	50% headed
	SURFACTANT-NONIONIC	0.25	% v/v	

Table 2. Grain yield and test weight from evaluation of selected fungicides on irrigated grain sorghum at OPREC in 2013.

Treatment	Grain Yield (bu/ac)	Test weight (lbu/bu)
5	144	56.2
1	139	56.3
4	138	55.9
2	138	56.0
3	137	55.4
Mean	139	56.0
CV%	5.2	1.1
L.S.D.	NS	NS

Other Project with no Reports

1. Bio-mass production for ethanol with grasses and forage sorghum
2. Kochia control in corn, didn’t go to yield with Syngenta
3. Soybean strip trial with Pioneer
4. Sunflower strip trial with Pioneer and Triumph
5. Three corn strip trials with Pioneer
6. Corn strip trial with Monsanto
7. Carryover of the Post Emergent grass control herbicides in grain sorghum and the effect on Cotton the next year
8. Intensifying dryland rotations has been discontinued due to drought and will utilized as a cover crop study starting in 2014