2006 Vegetable Trial Report

January 2007

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Department of Horticulture and Landscape Architecture
Division of Agricultural Sciences and Natural Resources
Oklahoma State University

The Department of Horticulture and Landscape Architecture, cooperating departments and experimental farms conducted a series of experiments on field vegetable production. Data were recorded on a majority of aspects of each study, and can include crop culture, crop responses and yield data. This report presents those data, thus providing up-to-date information on field research completed in Oklahoma during 2006.

Small differences should not be overemphasized. Least significant differences (LSD) values are shown at the bottom of columns or are given as Duncan's letter groupings in most tables. Unless two values in a column differ by at least the LSD shown, or by the Duncan's grouping, little confidence can be placed in the superiority of one treatment over another.

When trade names are used, no endorsement of that product or criticism of similar products not named is intended.

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www.sugarcreekseed.com

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- Pure Line Seeds
- Merlin Schantz
- Seedway
- Dean Smith
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- USDA Interregional Research Project #4

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Crop Culture

Organic and Synthetic Fertilizer Comparisons with Cantaloupe Cultivar Evaluations

Lane Agricultural Center - 2006

Warren Roberts, Merritt Taylor, Jim Shrefler, Benny Bruton, Wayne Fish

Twelve cultivars of cantaloupe-type melons were grown in a field that was fertilized with either conventional fertilizer (13-13-13) or poultry litter fertilizer (2-2-2). The rate of both materials was adjusted to provide 100 pounds of N, P_2O_5, and K_2O. Fertilizers were applied in blocks representing main plots, and one row of each cantaloupe cultivar was planted within each larger fertilizer block. There were four replications of each treatment. With four replications, two fertilizer treatments, and 12 cultivars, the total number of plots was 96.

Organic certification practices require that all animal waste manures that are used for fertilizer be applied at least 120 days before harvest, if the edible portion of the crop can come into contact with the soil. Since cantaloupe fruit does have contact with the soil, all fertilizers were applied at least two months before the crop was planted.

2006 was the second year of this study. Treatments applied in 2005 were duplicated in 2006, with the same identical treatment being made to the same identical portion of the field each year. The only exception to this rule is that two cultivars in 2005 were no longer available in 2006, and two new cultivars were substituted in the place of the two older cultivars.

			Yield (tons/ acre)	Avg. fruit weight (lbs)	Number of Mkt fruit per plot	Number of culls per plot	Yield (tons/ acre)	Avg. fruit weight (lbs)	Number of Mkt fruit per plot	Number of culls per plot
Cultivar	**Company**	**type**		***Synthetic**				***Organic**		
XLT 9201 Max	Abbott & Cobb	XLT Melon	5.89	4.70	15	22	3.90	3.78	12	20
ACX 2100ES	Abbott & Cobb	XLT Melon	6.52	4.46	15	17	3.59	3.85	10	25
ACX 3200 ss	Abbott & Cobb	XLT Melon	2.66	2.55	11	37	2.89	2.38	13	36
ACX 1520 ss	Abbott & Cobb	XLT Melon	0.53	2.41	3	45	1.84	2.90	7	44
ACX 30 ES	Abbott & Cobb	XLT Melon	4.28	5.51	10	23	4.13	5.68	8	29
Achapparal	Abbott & Cobb	Cantaloupe	4.72	2.79	20	11	4.19	2.70	20	12
Compadre	Abbott & Cobb	Cantaloupe	3.98	2.99	17	13	4.96	3.22	19	14
Aphrodite	DeWitt	Cantaloupe	4.03	3.19	13	14	5.66	3.65	16	12
Caravelle	DeWitt	Cantaloupe	4.89	2.82	21	9	4.33	2.46	21	17
Magnum 45	DeWitt	Cantaloupe	3.42	1.90	19	18	4.33	1.95	24	15
Tamdew Improved	DeWitt	Honeydew	7.99	4.82	20	38	4.82	4.01	14	12
Dorado	Seminis	Honeydew	5.48	3.98	14	17	3.15	3.27	10	25

XLT and Honey Dew transplants were started May 22 and transplanted June 14
Cantaloupe transplants were started June 5 and transplanted June 27
Plot size was 8 ft by 30ft, 25 plants per plot
*Synthetic was 13-13-13 applied at a rate of 100 lbs of N, P2O5, and K2O per acre (4.24 lbs per plot) applied April 13,2006
*Organic was poultry litter applied at a rate of 100 lbs of N, P2O5, and K2O per acre (17.8 lbs per plot) applied April 13,2006

Organic and Synthetic Fertilizer Comparisons with Cantaloupe Cultivar Evaluations

Lane Agricultural Center - 2005

Warren Roberts, Merritt Taylor, Jim Shrefler, Benny Bruton, Wayne Fish

Twelve cultivars of cantaloupe-type melons were grown in a field that was fertilized with either conventional fertilizer (17-17-17) or poultry litter fertilizer (2-2-2). The rate of both materials was adjusted to provide 100 pounds of N, P_2O_5, and K_2O. Fertilizers were applied in blocks representing main plots, and one row of each cantaloupe cultivar was planted within each larger fertilizer block. There were four replications of each treatment. With four replications, two fertilizer treatments, and 12 cultivars, the total number of plots was 96.

Organic certification practices require that all animal waste manures that are used for fertilizer be applied at least 120 days before harvest, if the edible portion of the crop can come into contact with the soil. Since cantaloupe fruit does have contact with the soil, all fertilizers were applied at least two months before the crop was planted.

2005 was the first year of a study that was to be repeated in 2006. Fertilizer treatment locations applied in 2005 were maintained so that the corresponding treatments could be applied in 2006, with the same identical treatment being made to the same identical portion of the field each year.

			Yield (tons/ acre)	Avg. fruit weight (lbs)	Number of Mkt fruit per plot	Yield (tons/ acre)	Avg. fruit weight (lbs)	Number of Mkt fruit per plot
Cultivar	**Company**	**Type**		***Synthetic**			***Organic**	
XLT 9100 Max	Abbott & Cobb	XLT Melon	12.50	2.95	30	13.62	3.72	32
XLT 9201 Max	Abbott & Cobb	XLT Melon	11.39	3.47	29	10.01	2.92	28
ACX 351	Abbott & Cobb	XLT Melon	10.62	3.87	25	10.22	3.34	27
ACX 2100ES	Abbott & Cobb	XLT Melon	11.32	2.40	30	11.67	2.15	31
ACX 30 ES	Abbott & Cobb	XLT Melon	11.69	4.77	27	13.54	4.70	31
Achapparal	Abbott & Cobb	Cantaloupe	13.93	3.09	43	11.85	2.18	41
Compadre	Abbott & Cobb	Cantaloupe	12.15	3.69	34	10.58	2.82	35
Aphrodite	DeWitt	Cantaloupe	14.63	5.04	30	13.68	4.83	31
Caravelle	DeWitt	Cantaloupe	12.61	2.56	49	11.57	3.16	44
Magnum 45	DeWitt	Cantaloupe	7.33	1.71	41	11.27	2.07	48
Tamdew Improved	DeWitt	Honeydew	11.01	3.79	28	10.28	3.22	26
Dorado	Seminis	Honeydew	9.22	3.30	22	10.19	3.96	24

Cantaloupe transplants were started June 1 and transplanted June 29
Plot size was 8 ft by 30ft, 25 plants per plot
*Synthetic was 17-17-17 applied at a rate of 100 lbs of N, P2O5, and K2O per acre (3.24 lbs per plot) applied April 28,2005
*Organic was poultry litter applied at a rate of 100 lbs of N, P2O5, and K2O per acre (17.8 lbs per plot) applied April 28,2005

Cucurbit Demonstration Trial

Spring 2006
Lynn Brandenberger, Brian Kahn, Sue Gray, Lynda Wells
Robert Havener, and Charlotte Richert
Oklahoma State University

Background and objectives: Cucurbits in all shapes and sizes are grown for market and consumption in Oklahoma. Fresh market producers, particularly those that sell through local farmers markets have indicated that they are interested in being able to see specialty melons in the field and possibly to have replicated trials carried out in the future. The objective of this demonstration was to provide an opportunity for growers to observe several types of less common cucurbits that may hold promise for direct marketing and to observe these for potential for replicated trials in the future.

Methods: The trial was completed in summer 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. It was direct seeded on 6/16/06 using a research plot planter (Kincaid Manufacturing, Haven, KS) with no randomization or replication. Plot length was 20 feet long with between-row spacing of 12 feet. The trial was thinned to an in-row spacing of 2.5 feet between plants. The study area received 45 lb/acre of nitrogen from urea (46-0-0) on 6/23/06 and was drip irrigated throughout the season. Weed control included a tank-mix of curbit at 0.75 lb ai/acre plus Sandea at 0.016 lb ai/acre applied on 6/19/06, followed by cultivation and a layby application between rows of Sandea at 0.024 lb ai/acre on 8/01/06. Plots were harvested multiple times during August.

Results and discussion: Melon qualities were rated on 8/22/06 with results in table 1. The taste of the melons was rated on a 0 to 10 scale with 0 representing poor taste and 10 representing desirable taste. Visa, Vicar, and Galileo all had ratings of 6.5 or above with Visa having the highest rating with a 7.7. Exterior color was rated on a 0 to 10 scale with 0 representing poor color and 10 representing best color. Sensation had the highest exterior color rating at 7.4 followed by Vicar and HiBrix having 7.3 and 7.1, respectively. No differences were recorded for interior color. Overall ratings were also on a 0 to 10 scale and represent a combined rating that gives some indication of a melon's consumer appeal. Visa had the highest overall rating with a 7.4 and was followed by Galileo and Sensation, both with 6.8, indicating that these melons had good consumer appeal. Average fruit weight ranged from 2.8 to 7.3 lb/fruit (Table 2). Three cultivars had fruit weights above 5 lbs., these were HiBrix, Lilly, and Sancho which had fruit weights of 6.3, 7.3, and 6.6 lb, respectively. Smaller fruited types with average fruit weights of less than 4 lbs included Duke, Galia Max, HSR 4028, HSR 4296, Passport, and Vicar. Sweetness was measured at one harvest with a hand-held refractometer. Percent soluble solids ranged from 4.3 to 13.8% for cultivars in the trial.

The objective of this trial was to provide an opportunity to observe several specialty melon cultivars and to determine if further trials would be justified. Based upon the interest of producers at and following the 2006 field day, further testing of Galia type melons will be carried out in the future in replicated trials.

Table 1. 2006 Speciality melon quality measurements including: taste, exterior and interior color, and overall quality ratings Bixby, OK.

Variety	Category	Company	Taste[z]	Exterior color[z]	Interior color[z]	Overall rating[z]
Courier	Galia	Hollar	4.1 ef[y]	5.5 cd	5.4 a	5.0 bc
Duke	Ananas	Hollar	4.1 ef	6.4 abcd	6.3 a	4.9 bc
Galia Max	Galia	Hollar	1.5 g	4.9 d	4.9 a	3.0 d
Galileo	Galia	Syngenta	6.5 ab	6.7 abc	6.6 a	6.8 ab
HiBrix	Canary	Rupp	4.7 cdef	7.1 ab	5.6 a	5.0 bc
HSR 4028	Galia	Hollar	5.9 bcd	6.6 abc	6.4 a	6.3 abc
HSR 4296	Speciality	Hollar	5.2 bcde	6.2 abcd	5.9 a	5.9 abc
Lilly	Crenshaw	Rupp	4.4 def	5.8 bcd	6.1 a	4.6 cd
Passport	Galia	Hollar	3.4 f	6.0 abcd	5.9 a	5.3 bc
Sancho	Piel de Sapo	Syngenta	4.5 def	6.6 abc	5.9 a	5.1 bc
Sensation	Speciality	Hollar & Twilley	6.3 abc	7.4 a	6.5 a	6.8 ab
Vicar	Galia	Syngenta	6.5 ab	7.3 ab	6.6 a	6.5 abc
Visa	Galia	Hollar	7.7 a	6.9 abc	6.5 a	7.4 a

[z] All ratings based on a 0-10 scale, 10 being best.
[y] Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Table 2. 2006 Speciality melon average fruit size, largest harvest date, Soluble solids, Bixby, OK

Variety	Category	Company	Avg. Fruit size (lbs.)	Largest harvest	Soluble solids[z]
Courier	Galia	Hollar	4.2	8/18	4.3
Duke	Ananas	Hollar	3.4	8/18	7.3
Galia Max	Galia	Hollar	3.7	8/18	9.0
Galileo	Galia	Syngenta	4.2	8/14	8.9
HiBrix	Canary	Rupp	6.3	8/23	13.0
HSR 4028	Galia	Hollar	2.8	8/18	10.2
HSR 4296	Speciality	Hollar	3.1	8/14	11.0
Lilly	Crenshaw	Rupp	7.3	8/29	NA
Passport	Galia	Hollar	3.7	8/18, 8/23	8.0
Sancho	Piel de Sapo	Syngenta	6.6	8/23	5.0
Sensation	Speciality	Hollar & Twilley	4.3	8/18	13.8
Vicar	Galia	Syngenta	3.5	8/23	8.2
Visa	Galia	Hollar	4.1	8/23	8.0

[z] Soluble solids=percent soluble solids using a refractometer. One melon sampled on each variety on 8/23/06.

Cowpea Plant Population and Fertility Study

Spring 2006

Lynn Brandenberger, Lynda Wells, Robert Havener
Oklahoma State University

Introduction and objective: Cowpeas are an important crop for vegetable producers in Oklahoma, used primarily for canning in the processing industry. A majority of cowpeas within the state are combined dry (10-12% moisture) with small-grain combines. A variety of production systems are utilized including irrigated-land, dry-land, and numerous crop-row arrangements that vary for both between-row spacing and overall plant population. Crop fertility varies widely between producers and production sites. The objective of this study was to determine if different combinations of cultivar, plant population, and fertility would have an effect on the maturity and yield of cowpea.

Methods: The study was carried out at the Oklahoma State University Vegetable Research Station at Bixby, Oklahoma. Work was initiated on 6/06/06 with plot lay-out and the application of supplemental potassium treatments of either 50 or 100 lb/acre of K_2O from 0-0-60. Following potassium application, finish tillage was completed in all plots prior to planting. All plots were planted on 6/13/06 to the corresponding cultivars (Early Scarlet or Empire) and row spacing (15" or 30" rows) with all plots being planted to a uniform population of 12 seeds/row foot. Following planting the entire study area received a preemergence application of Dual Magnum (S-metolachlor at 0.75 lb ai/acre) tank-mixed with Pursuit (imazethapyr at 0.063 lb ai/acre). Immediately after herbicide application, the study area received 0.5 inches of overhead irrigation to aid in herbicide incorporation. Plant populations were thinned to the appropriate number of plants (4 or 8 seeds/foot) on 7/06/06. All plots received 30 lb/acre of nitrogen from urea (46-0-0) on 7/10/06 and an additional 50 lb/acre on 7/25/06 to treatment plots of 80 lb/acre of nitrogen.

Results and discussion: The percentage of dry pods on 8/09/06 was significantly greater for all Early Scarlet treatments compared to Empire treatments (Table 1). The Early Scarlet treatment that received 30 lbs/acre of Nitrogen and 50 lbs/acre of Potassium in a 15" row and 4 seeds/foot had 74% dry pods compared to 48 to 63% for other Early Scarlet treatments and 0 to 1% for Empire treatments. Yield did not vary significantly, but in general Empire treatments had higher yields than Early Scarlet. Early Scarlet yields ranged from 575 to 1,546 lbs/acre while Empire yields ranged from 1,061 to 1,864 lbs/acre. The authors would also note that the lowest yielding Early Scarlet treatment utilized the high rate of Nitrogen and Potassium and also the highest plant population. Peas from each plot were checked for percent moisture at harvest and moisture readings are given in Table 1. In general, percent moisture was lower for Early Scarlet than Empire. Empire at the high plant population receiving 30 lbs Nitrogen and 50 lbs potassium/acre had the highest moisture level at harvest (14.6%).

Cultivar had the most dramatic effect of all treatment variables in this study. Early Scarlet is known to be an early maturing cultivar, while Empire is known to be more of a full season one. Both cultivars performed much as expected. Early Scarlet matured earlier as evidenced by its higher percentage of dry pods and lower percent moisture at harvest, while Empire was slower to mature and in general yielded higher than Early Scarlet. There was no clear evidence that yield or maturity was affected by the fertility and population treatments in the study. Based upon the results, the authors would conclude that cowpea is very adaptable to different plant populations and fertility programs and that these management decisions should be based upon keeping production costs as low as possible.

Acknowledgements: The authors wish to thank Allen Canning for partial support of this study.

Table 1. Cowpea plant population and fertility study: Percent dry pods on 8/09/06, dry yield, and percent moisture at harvest.

Variety	N lbs.	K lbs.	row space (in.)	No. seeds per ft.	% Dry pods [z]	Yield lbs/acre [x]	Moisture [w]
Early Scarlet	30	50	15	4	74 a [y]	941 a [z]	9.8 c
Early Scarlet	30	50	15	8	63 ab	1063 a	10.7 c
Early Scarlet	80	100	15	4	63 ab	1403 a	10.9 bc
Early Scarlet	80	100	15	8	56 ab	575 a	10.1 c
Early Scarlet	30	50	30	4	48 b	993 a	10.7 c
Early Scarlet	30	50	30	8	58 ab	1477 a	10.4 c
Early Scarlet	80	100	30	4	59 ab	1150 a	10.6 c
Early Scarlet	80	100	30	8	59 ab	1546 a	10.9 bc
Empire	30	50	15	4	1 c	1577 a	12.3 a-c
Empire	30	50	15	8	1 c	1255 a	14.6 a
Empire	80	100	15	4	0 c	1734 a	12.1 a-c
Empire	80	100	15	8	0 c	1864 a	14.1 ab
Empire	30	50	30	4	1 c	1329 a	12.6 a-c
Empire	30	50	30	8	1 c	1542 a	12.7 a-c
Empire	80	100	30	4	1 c	1061 a	12.7 a-c
Empire	80	100	30	8	1 c	1098 a	14.2 a

[z]% dry pods=average of visual ratings for dry pods recorded on 8/09/06.
[y]Numbers followed by the same letter are not significantly different based upon Duncan's multiple range test with P=0.05.
[x]Yield lbs/acre are based upon measured yields of plots when harvested with a plot combine.
[w]Moisture=average moisture of cowpeas measured at harvest with a Dickey-John grain moisture meter.

Southern Cooperative Cowpea Trial

Spring 2006, Bixby, Oklahoma

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Materials and Methods: The Southern Cooperative trials are an ongoing effort by scientists at 5 Land Grant Universities and the U.S.D.A to provide cowpea performance data from a wide variety of production environments. The Bixby trial provides Oklahoma producers with information on crop maturity and yield potential of breeding lines that may possibly become available in the near future. Plots consisted of one row 20 feet long with 36 inches between rows. Seed were spaced 8 to 10 seed per foot and were planted on 6/14/06. Immediately following planting all plots received a preemergence application of Dual Magnum at 0.75 lb ai/acre tank-mixed with Pursuit at 0.063 lb ai/acre followed by an overhead irrigation of 0.5 inches of water. Supplemental water was supplied through overhead irrigation. Plots were fertilized on 6/14/06 with 25lbs N/acre. The trial included 4 replications for the 12 replicated lines and 2 replications for the 16 observational lines (Tables 1, 2). Plots were rated for percent flowering on 8/1/06. The trial was machine harvested on 9/26/06 and dry and imbibed yields were recorded subsequently. Data in the replicated trial were analyzed using Duncan's multiple range test with comparisons made between varieties within a pea type (blackeye, cream, pinkeye types were compared only to other peas within that given type) no comparisons were made in the observational trial due to only 2 replications being utilized.

Results and Discussion: Differences in percent flowering reflect different rates of maturing between breeding lines in the trials. Varieties with the lowest flowering percentages, indicated lower yields, due to later maturity (Table 1). All types of peas had significant differences in the flowering. No standard for comparison is available for the Red Holstein type, AR01-874, which had one of the lowest flowering percents at 13%. The lowest being a cream US-1080 at 10%. The highest in the replicated study, a pinkeye type TX2036-4-1PE at 95% (Table 1). In the observational trial, percent flowering varied between 23 and 95% in the blackeyes, 5 to 73% in the creams, and 70 to 95% in the pinkeyes (Table 2). Percent moisture of the harvested peas is also an indicator of maturity. In the blackeyes no differences were observed. In the cream types US-1080 had 12.2% and Early Acre had 14.6%. Pinkeye no differences were observed while 2 varieties did not yield enough to run a moisture reading, the lowest moisture reading being Coronet. Percent moisture ranged between 12.0 to 14.7% for blackeyes in the observational trial, 13.3 to 14.0% for the creams, and 9.5 to 13.5% for the pinkeyes. Imbibed yields were not analyzed due to lower yields. In the blackeye type AR00-178 had 1181 lbs/acre and ARK Blackeye #1 had 1912 lbs/acre. Cream types US-1080 and Early Acre had imbibed yields of 860 and 1218 lbs/acre, respectively. AR 01-1293 was the highest yielding pinkeyes with a yield of 2048 lbs/acre imbibed yield. AR 01-874 had an imbibed yield of 1564 lbs/acre. In the observational trial, AR 01-1704 and ARK Blackeye # 1 were the highest yielding blackeyes with 1474 and 1285 lbs/acre imbibed yield. AR 01-1781 was the highest yielding cream, with US-1127 having low yields due to a poor plant stand. AR 01-821 was the highest yielding pinkeye at 1659 lbs/acre imbibed yield.

Conclusions: Factors that should be considered when selecting a particular cowpea cultivar include plant growth habit, time to maturity, and of course, yield. The percentage of moisture in the harvested pea is an indicator of maturity with earlier maturing cultivars having a higher percentage dry pods and a lower percentage of moisture at harvest. Several cultivars had 10 to 12% moisture at harvest and should be considered earlier maturing than those above 15%. Growth habit has a direct bearing on the ability to harvest the crop, both by machine and by hand. Cultivars that are more erect, particularly with pods set in the upper portion of the plant are essential for machine harvest, but are also desirable for hand harvesting of fresh market peas. Pinkeye cultivars, LA96-74 and TX2036-4-1PE had erect vine growth. In the observational trial several cultivars exhibited a more erect growth habit included LA96-25, LA96-37, AR01-1704, TX2028-2-1BEgc, and TX2028-2-20BEgc. Yields varied considerably in the trial, but in general were low. Plot combine adjustments will hopefully rectify problems that were experienced during the 2006 season.

Table 1. Spring 2006 Southern Pea Trial, Bixby, OK. Replicated Trial.

Variety	Source	Flowering[z]	% Moisture[y]	Shelled yield lbs./acre Dry[x]	Imbibed[x]
Blackeye types					
AR00-178	U of Arkansas	64 a[w]	11.9 a	491 a	1181
ARK Blackeye #1	Industry Standard	92 a	12.8 a	833 a	1912
Cream types					
US-1080	USDA	10 b	12.2 b	378 a	860
Early Acre	Industry Standard	69 a	14.6 a	565 a	1218
Pinkeye types					
LA95-16	Louisiana State	20 d	n/a	276 c	682
LA96-10	Louisiana State	74 bc	n/a	252 c	605
LA96-74	Louisiana State	94 a	12.9 a	699 ab	1719
AR01-1293	U of Arkansas	76 b	15.0 a	871 a	2048
TX2044-5-1PEgc	Texas A & M	85 ab	12.3 a	457 bc	1094
TX2028-1-3PEgc	Texas A & M	93 a	13.3 a	390 bc	894
TX2036-4-1PE	Texas A & M	95 a	13.5 a	530 a-c	1231
Coronet	Industry Standard	63 c	8.6 a	414 bc	965
Other types *(Red Holstein)*					
AR01-874	U of Arkansas	13	22.2	300	767

[z]Flowering=estimated percent flowers on 8/1/06.
[y]Moisture=percent moisture on 9/26/06.
[x]Dry shelled wt.=mechanically harvested on 9/26/06 yield in lbs./acre.
[x]Imbibed wt.=Imbibed weight in lbs./acre, not analyzed.
[w]Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Table 2. Spring 2006 Southern Pea Trial, Bixby, OK. Observational Trial.

Variety	Source	Flowering[z]	% Moisture[y]	Shelled yield lbs./acre Dry[x]	Imbibed[x]
		Blackeye types			
AR01-1704	U of Arkansas	80	n/a	232	553
AR01-1764	U of Arkansas	23	14.7	269	656
TX2028-2-1BEgc	Texas A & M	95	n/a	94	208
TX2028-2-2-0BEgc	Texas A & M	95	13.3	399	890
ARK Blackeye #1	Industry Standard	88	12.0	828	1938
		Cream types			
LA96-37	Louisiana State	48	13.3	748	1760
US-1127	USDA	5	n/a	22	n/a
AR01-1781	U of Arkansas	18	14.0	762	1762
Early Acre	Industry Standard	73	13.6	900	2012
		Pinkeye types			
LA96-25	Louisiana State	75	11.1	501	1244
LA97-29	Louisiana State	80	12.8	566	1451
LA2-52	Louisiana State	70	13.5	407	1035
AR01-821	U of Arkansas	70	9.5	733	1659
TX2044-5-2-0PEgc	Texas A & M	93	11.5	501	1185
TX2044-4-3-0PEgc	Texas A & M	95	11.4	610	1516
Coronet	Industry Standard	75	n/a	378	914

[z]Flowering=estimated percent flowers on 8/1/06.
[y]Moisture=percent moisture on 9/26/06.
[x]Dry shelled wt.=mechanically harvested on 9/26/06 yield in lbs./acre.
[x]Imbibed wt.=Imbibed weight in lbs./acre

Chemical Profiling of Herbs as Alternative or Rotation Crops with Vegetables

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Since 2000 we have been evaluating annual herbs and expanding plantings of perennial herbs to determine their potential as alternative crops. Herb crops could fit well as a rotational crop with vegetables, particularly as extraction crops, since many of the production steps are similar to those used in vegetable production. In last year's proceedings we published fresh and air dried production potential for a number of herbs. The focus of this report is to provide information as to the chemical content of many herbs under study, to provide a basis for value of the crops for extraction markets.

Herbs vary dramatically in their chemical content and thus potential value as natural producers of chemicals. In the report that follows, in concert with a multitude of previous reports by others, plants within the same genus and species may produce markedly different chemical profiles (Italian pesto basil versus Lemon basil versus Thai basil) and/or markedly different amounts of the same chemicals ('Common' versus 'Aromata' summer savory). Since herb chemical profiles and production potential may be influenced by a multitude of external factors, our results from plants grown at Bixby may not be exactly the same as plants grown at another location or under different production practices, but they do serve as a point of reference for those interested in considering herbs as an alternate or rotational crop.

Crop culture, harvest and pre-extraction processing: Seed sources and varieties will be presented in the crop summaries. Crop results are presented for the 2005 and/or 2006 cropping seasons. In both years soil tests indicated adequate phosphorus, potassium and micronutrients, but very low nitrogen, and crops were fertilized preplant with 40 pounds of nitrogen per acre using urea. A top dress application of an additional 40 pounds of nitrogen per acre using urea was applied about one month after planting. All annual crops were planted in 2005 in late April and in 2006 in early May (following a failed planting in mid-April) using a Monosem vacuum planter. Summer savory was planted in 4 row beds (12 inch between row spacing) and a targeted plant density of 4 to 6 plants per linear foot of row. Basils were planted in 2 row plots with row spacing of 36 inches and a targeted plant spacing of 2 to 3 plants per linear foot of row. Oregano (established in 2002), winter savory and thyme (established in 2005) were established from transplants in two row plots with 36 inch between row spacing and 18 inch within row plant spacing. Plots were watered as needed from overhead sprinklers with approximately ½ inch water per application. Harvest was conducted with a Kincaid self propelled greens/forage harvester and harvested material was conveyed into plastic lugs. Harvester cutting height was set at 10 inches for all basils except 'Sweet Thai', which was cut at 6 inches; summer savories were harvested at 6 inches; winter savory and thyme was harvested at 10 inches and oregano was harvested at 12 inches. Total harvested weight was obtained and a sub-sample of 7 to 10 pounds (2 plastic lugs) from each plot was placed into a cooler at 50 F. The contents of each lug was placed into a plastic bag, overlaid with ice inside a cooler and transported to Stillwater. Samples were held at 50 F overnight, and were then weighed, washed to remove soil and other debris, spin-dried in a greens washer and placed onto cheesecloth. The cheesecloth was then tied to contain the samples and dried for five days at 74 to 80 F in a Proctor-Shwartz forced air drier. Moisture content was determined for all samples and results are presented on a dry weight basis.

Extraction and chemical profile analysis: Dried samples were ground to a fine powder using a Udy cyclone mill and duplicate samples were accurately weighed (500 mg for basils, 200 mg for 'Common' summer savory and thyme, and 50 mg for 'Aromata' summer savory, oregano and winter savory) and extracted with stirring for 20 min with 4 ml of hexane. Just prior to extraction, thujone (a chemical not present in the crops studied) was added to allow for extraction recovery determination. Samples were centrifuged and decanted into a clean pre-weighed vial and the extraction process was repeated two more times for a total of three extractions. Hexane extracts were weighed to determine volume and a predetermined amount was added to 2-heptanol (another chemical not naturally present in the crops studied) just prior to analysis, then injected onto a gas chromatograph. Individual chemical components were identified according to coelution with authentic standards and their quantities were determined in comparison to the authentic standards, relative to 2-heptanol. Although many chemicals were found in samples, only the major chemicals are reported in the tables that follow.

Basil chemical profiles and chemical production potential: Chemical profiles for six basil varieties ('Genovese', 'Italian Large Leaf' and 'Sweet Thai', *Ocimum basilicum;* 'Mrs Burns' Lemon', *Ocimum basilicum citriodora;* 'Lime', *Ocimum americanum* – all from Johnny's Seed Co. and 'Ethiopian', *Ocimum basilicum* – a privately acquired line) are shown in terms of concentration (mg per lb dry weight) in table 1. Classified according to typical use/aroma characteristics these basils fall into 3 broad groupings: a) typical pesto-type basils – 'Genovese' and 'Italian Large Leaf', b) citrus flavored – 'Mrs. Burns' Lemon' and 'Lime', and c) regional specialty basils – 'Sweet Thai' and 'Ethiopian' (very similar to 'Egyptian'). Chemical concentrations in bold type face denote chemicals of notably highest concentration for the variety, and can be used to compare the varieties. The pesto type basils contained higher concentrations of the two impact chemicals eugenol and linalool, with 'Italian Large Leaf' containing slightly less of these chemicals but substantial quantities of methyl chavicol not found in 'Genovese'. The only other basil containing substantial amounts of eugenol was 'Ethiopian', with about 10 times or more eugenol than the pesto type basils. Eugenol imparts a clove-like smell and flavor to basils, has important health-promoting properties and is an effective antimicrobial, and perhaps nematocidal, agent. Methyl chavicol imparts an "anise-clove" flavor, differentiating the two pesto basils, imparting a very unique flavor in combination with the extremely large eugenol content of 'Ethiopian' basil and resulting in the distinctive anise flavor of 'Sweet Thai' basil. The citrus flavored basils both contained substantial quantities of geranial and neral (collectively referred to as citral), and differed most substantially in terms of linalool concentration – 'Mrs Burns' Lemon' basil contained a substantial quantity of linalool whereas 'Lime' basil did not.

We have summarized annual production potential (gm per acre) using data from five basil varieties (all noted above except 'Lime' basil) grown during the 2005 season in table 2. Our 2006 planting was very irregular in terms of stand establishment and herb yield data was considered non-usable. Our 2005 data represents cumulative yield from 6 individual harvests. Although space in this report does not allow presentation of chemical production within all basils at each harvest, we did notice a striking difference. In terms of in-season production potential, the impact chemicals fell into two categories: those that tended to peak in production about mid-season (mid August) and then decline (cineole, linalool, α-terpineol, β-caryophylene and humulene) and those that continued to increase throughout the season (October harvest numbers were higher than early July and mid August; methyl chavicol, geranial, neral and eugenol). Looking at total impact chemical production potential alone, the basil varieties fall into two broad categories: those preferentially accumulating one chemical ('Etiopian' – eugenol, and 'Sweet Thai' – methyl chavicol) and those accumulating multiple chemicals ('Mrs. Burns' Lemon" – geranial, neral and linalool, 'Genovese' – eugenol and linalool, and 'Italian Large Leaf' – linalool, methyl chavicol and eugenol).

Summer savory, winter savory, oregano and thyme chemical profiles and chemical production potential: Chemical profiles for two summer savories ('Common' and 'Aromata', *Satureja hortensis*, Johnny's Seed Co.), one winter savory ('Winter', *Satureja montana,* Johnny's Seed Co.), one oregano ('Turkish', *Origanum vulgare,* Prarie Wind Nursury) and one thyme ('German Winter', *Thymus vulgaris,* Johnny's Seed Co.) is shown in terms of both concentration (mg per pound) and production potential (gm per acre) in table 3. The summer savories are annual crops and data is provided for the 2005 harvest season – our 2006 plots were abandoned due to poor field emergence. Winter savory and thyme were established from transplants as perennial crops in 2005 and first harvested in 2006. The oregano plots were established in 2002. The oregano, winter savory and thyme yields were extremely low because of the hot and dry weather conditions prevailing in 2006 and a severe insect infestation which prevented a third harvest that should have occurred in early September.

The most notable difference between these crops and basils was comparatively fewer impact chemicals, with predominance of carvacrol and, in one case thymol, in these crops. Turkish oregano produced the highest concentration and overall yield of carvacrol. Carvacrol has value as a natural anti-microbial agent, with activity against both fungi and bacteria. Extracts from Turkish oregano have shown good activity against pathogenic E. coli bacteria. The savories produced substantial quantities of carvacrol. Winter savory had the highest savory carvacrol concentration, but due to very low yield in 2006 it produced the least on a per acre basis. 'Aromata' summer savory contained over twice the concentration of carvacrol than 'Common', and even though it yielded only half that of 'Common' it produced more carvacrol on a per acre basis. Thyme was the only crop producing substantial quantities of thymol – the extremely low yield in 2006 resulted in very low production potential. We are hopeful that yields for the perennial crops will increase in seasons to come.

Prospects for the future: All of the basils appear to have good production potential in Oklahoma, with fresh yield potential in excess of 60,000 lbs per acre. If eugenol is desired, 'Ethiopian' basil appears to have promise; if methyl chavicol is desired, "Sweet Thai' basil may be of interest. A basil (or other herb) extract may also have value as a natural flavoring, in which case each basil (or herb) would be judged on its own merits. Turkish oregano produced almost four times more carvacrol than the savories and could have potential as a carvacrol source. Turkish oregano has potential as a carvacrol-rich crop – we plan to expand our planting in 2007 to continue its evaluation as a new crop with potential for production in Oklahoma.

Table 1. Average concentration (mg per pound) for impact chemicals extracted from six air dried basils.

Impact chemical	Genovese	Italian Large Leaf	Mrs. Burns' Lemon	Lime	Ethiopian	Sweet Thai
Cineole	15	9	1	1	58	12
Linalool	**108**	**75**	**154**	14	1	1
α-Terpineol	5	2	1	3	10	7
Methyl Chavicol		**74**		1	**107**	**365**
Geranial			**204**	**293**		
Neral			**192**	**270**		
Eugenol	**102**	**41**			**984**	1
β-Caryophylene	1	1	48	35	26	3
Humulene	3	2	8	5	26	10

Table 2. Annual production potential (g per acre) for impact chemicals from five basil cultivars.

Impact chemical	Genovese	Italian Large Leaf	Mrs. Burns' Lemon	Ethiopian	Sweet Thai
Cineole	102	60	8	392	106
Linalool	**728**	**507**	**1040**	6	6
α-Terpineol	31	10	8	66	58
Methyl Chavicol	2	**501**		**718**	**3126**
Geranial			**1382**		
Neral			**1301**		
Eugenol	**1229**	**275**		**6601**	2
β-Caryophylene	7	5	325	174	22
Humulene	18	16	55	177	85
2005 dry seasonal production (lb/ac)	6745	6760	6768	6707	6556

Table 3. Average concentration (mg per pound) and production potential (gm per acre) for impact chemicals extracted from various air dried herbs.

	Summer Savory		Winter Savory	Oregano	Thyme
Impact chemical	Common	Aromata	Winter Savory	Turkish	German Winter
Concentration in mg/lb dry wt					
Carvacrol	307	793	1386	3234	57
Thymol			11		519
β-Caryophylene	8	20	36	46	20
Production potential in gm/ac					
Carvacrol	1246	1466	1091	4414	7
Thymol			9		62
β-Caryophylene	32	38	29	63	2
Cummulative seasonal production (lb/ac)	4057 (2005 season)	1848 (2005 season)	787 (2006 season)	1365 (2006 season)	120 (2006 season)

Eggplant Variety Trial

Spring 2006, Bixby, Oklahoma

Brian Kahn, Robert Havener, Dan Valdez, Lynda Wells

Introduction and Objectives: Eggplant is a minor vegetable, but is popular for direct marketing and as an ethnic specialty. This trial was designed to evaluate yield and fruit quality of 11 purple eggplant cultivars. The same 11 cultivars also had been trailed in 2005.

Materials and Methods: Seeds were sown in Speedling-type flats (128 cells per flat) filled with a peat-based plug and seedling mix on March 24, 2006. A preplant application of urea to supply 50 lbs/A of N was made at Bixby on April 17, followed by an application of napropamide at 1.25 lbs/A (a.i.) and incorporation. On April 28, 9 plants/plot were transplanted to the field. Plots were 15.8 ft long with 5.9 ft between rows. Varieties originally were replicated 4 times in a randomized block design. Due to transplant loss, the study was later reconfigured as a completely randomized design with 3 replications. Insecticide applications began on May 18 and continued through August 3, with a total of 7 applications. Fungicide applications (azoxystrobin or copper hydroxide) were made on July 3, 17, and 24 and on August 3. Plants were sidedressed with 50 lbs/A of N from urea on June 5. Harvest began on June 22 and continued 2 times weekly until August 7. Data were collected on marketability and weight per fruit.

Results and Summary: Plants were under heat and drought stress despite being irrigated, creating a severe test. The two major reasons for culling fruit were scarring or *Phomopsis* rot.

'Santana' and 'Classic' will continue to be recommended for Oklahoma producers desiring a large, long oval eggplant. 'Nadia' should be trialed again. 'Dusky', 'Epic' and 'Twilight' were in a smaller fruit size group and might be considered for the earliest markets. 'Black Bell' was notably susceptible to *Phomopsis* fruit rot in both years and is not recommended. 'Vernal' did not seem to have the genetic potential to produce large fruits in both years. 'Black Beauty' was included as an open-pollinated comparison, and was much inferior to the hybrids for both yield and fruit quality. 'Megal' and 'Vittoria' were European-type eggplants; they produced smaller fruits with a shape varying from a very elongated oval to cylindrical. 'Megal' fruits were shiny and almost black, and had the better appearance of these two.

Table 1. Eggplant Variety Trial – Bixby, 2006[z]

		Marketable		Early mkt.	Cull		Total[x]	% mkt. by count	Avg. mkt. fruit wt.
Cultivar	Company/ source	(bu/A)[w]	(thou/A)	(bu/A)	(bu/A)	(thou/A)	(bu/A)	(%)	(lbs)
Santana	Rupp	623	19.2	80	229	7.9	853	72	1.07
Classic	Chesmore	560	20.0	89	332	12.5	892	61	0.91
Twilight	Twilley	389	16.6	67	635	27.5	1025	38	0.77
Nadia	Seedway	331	12.5	68	425	17.1	756	42	0.87
Epic	Chesmore	327	14.6	68	451	20.8	778	42	0.73
Vittoria	Twilley	314	24.2	33	374	34.1	688	42	0.43
Dusky	Chesmore	301	13.7	30	229	11.2	530	55	0.72
Black Bell	Chesmore	288	9.6	89	556	23.3	844	31	0.98
Megal	Seedway	276	19.2	22	210	17.1	487	53	0.48
Vernal	Holmes	270	12.9	61	400	21.2	670	37	0.69
Black Beauty	Chesmore	181	5.4	17	458	15.4	639	26	1.06
	Mean	351	15.2	57	391	18.9	742	45	0.79
	LSD $_{05}$	169	5.8	NS	189	8.8	214	16	0.12

[z] Transplanted April 28, 2006 (3 plots each). Plot size (data area, excluding end guards): 5.9' x 5.9' ; 3 data plants per plot. Harvested: 6/22/06 to 8/7/06 (14 picks).

[y] Early harvest: 6/22/06 through 7/6/06 (5 picks).

[x] Total=marketable + cull.

[w] One bushel (bu) = 33 lbs.

Hoop House Seeding Date Trial for Onion Transplant Production

Jim Shrefler and Tony Goodson, OSU, WWAREC, Lane
Sam McClure, Grower Cooperator

Introduction and Objectives: Transplanted onions are grown in Oklahoma by home and market gardeners and farmers looking for alternative crops. Transplant sources available to growers for the typical February-March transplant period are limited to bare-root transplants that are produced in states having milder winter climates than Oklahoma. In recent years, the quality of commercially available transplants has been questionable at times. The availability of specific cultivars is limited and not highly reliable. Consequently, there is a need for a more predictable source of quality onion transplants. Previous work showed that hoop-houses can be useful for growing onion transplants and that mid to late October was a good time to seed onions in the hoop-house for late February to early March transplanting. The objective of these trials was to further assess the importance of onion seeding date for hoop-house transplant production.

Materials and Methods: Transplanted onion seeding trials were conducted using the cultivars Candy and 1015Y. Onions were seeded in an unheated hoop-house in 2005 on October 18, 25, and November 2. Transplants were removed from the hoop houses and set in the field at two locations: Calvin on March 7 and at Lane on March 16. Onions were planted six inches apart in two rows spaced 3 feet apart on beds that were spaced 6 feet between centers to give a plant density of approximately 29,000 plants per acre. Fertilizer was applied based on OSU soil test recommendations. Prior to harvest, data was collected on bolting (seed stalk formation). The trial was harvested at top fall and onion tops were removed. Onions were classified based on bulb diameter (A= <2 inches, B= 2-3 inches, C= 3-4 inches, and D= >4 inches) and estimated yield was determined.

Results: Onion planting date trial results are shown in Tables 1, 2 and 3. No more than a trace (<1% of plants) of seed stalk formation was detected (data not shown) at either site. At each site, both onion cultivars produced bulbs ranging in size from less than 2 inches in diameter to greater than 4 inches (Tables 1 and 2). Planting date did not have a significant affect on the percentage of bulbs found in the size categories A, B, C, or D (data not shown). Cultivar had an affect on B and D size bulbs at both sites. In both cases, Candy produced less B size, and more D size bulbs, than did 1015-Y. Total yield was also greater for Candy than for 1015-Y. Although seeding date did not result in statistically significant effects on onion bulb diameter categories, it did have an affect on total onion yield at the Lane site (Table 3).

These results provide additional evidence that onion transplants grown in hoop houses in southeast Oklahoma can produce bulbs with diameters greater than 3 inches and that the potential for seed stalk production is minimal.

Table 1. Harvest data for the hoop-house onion transplant planting-date trial at Calvin.

Cultivar	Bulb diameter categories[1] (Percent of total) A	B	C	D	Yield (100 lbs units / acre)
1015Y	2.2	23.7	53	22.1	211
Candy	0.5	5.2	33.7	60.5	307
Statistical significance[2]	ns	*	ns	*	*

[1] Bulb diameter size classes: A = 2 inches or smaller, B = 2 to 3 inches, C = 3 to 4 inches and D = greater than 4 inches.
[2] Means within a column having an " * " in the last row are significantly different. "ns" indicates means are not statistically different within a column.

Table 2. Harvest data for the hoop-house onion transplant planting-date trial at Lane.

Cultivar	Bulb diameter categories[1] (Percent of total) A	B	C	D	Yield (100 lbs units / acre)
1015Y	0.8	31.5	64.7	3.0	157
Candy	0.3	8.3	73.8	17.6	201
Statistical significance[2]	ns	*	ns	*	*

[1] Bulb diameter size classes: A = 2 inches or smaller, B = 2 to 3 inches, C = 3 to 4 inches and D = greater than 4 inches.
[2] Means within a column having an " * " in the last row are significantly different. "ns" indicates means are not statistically different within a column.

Table 3. The effect of planting date on yields of transplanted hoop-house onions.

Plant Date[1]	Yield (100 lbs units / acre) Calvin	Lane
Oct. 18	270	195
Oct. 25	264	179
Nov. 2	243	162
LSD @0.05	ns	21.2

[1] Plant date is the date of seeding in a hoop house at Lane. Plants were removed from the hoop house and transplanted to the field on March 7 and 16 at Calvin and Lane, respectively.
[2] Means within a column that differ by more than the LSD value for the column are significantly different. "ns" indicates means are not statistically different within a column.

Transplanted onion cultivar observational (non replicated) trial at Bixby

Jim Shrefler, OSU, WWAREC, Lane
Robert Havener, OSU, Oklahoma Vegetable Research Station, Bixby

Introduction and Objectives: Transplanted onions are grown in Oklahoma by home and market gardeners and farmers looking for alternative crops. A limitation to onion production in the area is the availability of productive cultivars and sources of quality plants. As new cultivars become available these need to be tested to determine suitability to local conditions and to their productivity from hoop house grown transplants. The objective of this project was to observe the performance of these onions at this location.

Materials and Methods: Onion plants were grown from seed in hoop houses at Lane, Oklahoma during the period Nov. 2005 – March 2006. These were transplanted to the field at Bixby on April 4, 2006. Immediately after planting, the herbicides Goal and Prowl were applied over the onions at rates of 1 pint per acre using a hand boom. Onions were irrigated with drip as needed. Onions were harvested on July 14 and onions were classified based on bulb diameter (A= <2 inches, B= 2-3 inches, C= 3-4 inches, and D= >4 inches).

Table 1. Harvest data for the onion cultivar trial at Bixby.

	Bulb diameter categories[1] (Percent of total)				
Cultivar	**A**	**B**	**C**	**D**	**Disease Incidence[2]**
Aurora	0	77	23	0	M
Candy	0	40	45	15	M
Sweet Caroline	60	40	0	0	Tops already gone due to maturity
1015-Y	20	45	20	15	S
Redline	15	55	30	0	M
Cimarron	0	60	40	0	S
Denali	0	25	75	0	S
Sequoia	0	50	50	0	S
Renegade	10	35	55	0	M
Cowboy	0	45	50	5	M-S

[1] Bulb diameter size classes: A = 2 inches or smaller, B = 2 to 3 inches, C = 3 to 4 inches and D = greater than 4 inches.
[2] Foliar disease identified as Purple Blotch was observed in late June. S indicates severely affected onion leaves and M indicates a moderate affect.

Auxigro for yield enhancement in Onions

Jim Shrefler and Tony Goodson, OSU, WWAREC, Lane
Sam McClure, Grower Cooperator

Introduction and Objectives: Onions are grown in Oklahoma by market gardeners and farmers looking for alternative crops. While large bulbs are often desirable, producing these depends on various factors including proper cultivar choice, planting date, fertilization, irrigation, and growing conditions. Auxigro, a plant grow regulator, has been shown to be another factor that can enhance yields. The objective of these trials was to assess the effect of Auxigro on yield and bulb size in transplanted onions.

Materials and Methods: Transplanted onions of the cultivar Candy were planted March 15, 2006 at Calvin, OK. Onions transplants were obtained from a commercial transplant producer in Arizona. Onions were planted six inches apart in four rows spaced 9 inches apart on beds that were spaced 6 feet between centers to give a plant density of approximately 60,000 plants per acre. Auxigro treatments were applied as foliar sprays using either a single or a split application (Table 1). Treatments were applied in 20 gallons per acre of water and included Silwet surfactant at 0.025% v/v. Early (bulb swell) and late applications were made April 27 and June 13, respectively. Early application was made at initial bulb swell (onions had 4-6 leaves) and late applications were made 1 month before anticipated top fall. Fertilizer and other pest and weed control treatments were applied to the trial along with an adjacent commercial planting. Fertilizer was applied based on soil test and OSU Extension vegetable fertilizer recommendations. The trial was harvested on July 11, which corresponded to 50% top fall and onion tops were removed. Onions were classified based on bulb diameter (B= 2-3 inches, C= 3-4 inches, and D= >4 inches), weighed, and estimated yield was determined.

Results are shown in Tables 1. No significant differences were found.

Table 1. Harvest data for the Auxigro yield enhancement trial at Calvin.

	Bulb diameter categories[1] (Percent of total)			Yield
Treatment	**B**	**C**	**D**	**(100 lbs units / acre)**
Untreated	10	65	24	437
Auxigro at 4 oz. / acre at initial bulb swell + followed by Auxigro at 4 oz. / acre at 1 month before maturity	6	63	31	465
Auxigro at 8 oz. / acre applied at initial bulb swell	14	53	33	447
Auxigro at 8 oz. / acre applied at 1 month before maturity	9	59	32	455
Statistical significance[2]	NS	NS	NS	NS

[1] Bulb diameter size classes: B = 2 to 3 inches, C = 3 to 4 inches and D = greater than 4 inches.
[2] Means within a column having an "ns" indicates means within the column are not statistically.

Snapbean Variety Trial for Heat Tolerance

Spring 2006

Lynn Brandenberger, Lynda Wells, Robert Havener
Oklahoma State University

Introduction and objective: Snapbean is an important crop for Oklahoma producers counting for a significant portion of vegetable crop acreage within the state. Producers have traditionally produced snapbeans for use by the canning industry, with some acreage for fresh market. One need that producers have is to widen the planting-marketing window for this crop. Planting is usually limited to early spring plantings and possibly fall plantings due to problems with pod set from high summer temperatures. This study was developed to determine what cultivars are more tolerant to high temperatures particularly in respect to flowering and pod set.

Methods: The study was completed in spring 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. Design included a randomized block design with four replications each plot consisted of 1 row 20 feet long. Nineteen snapbean cultivars were included in the trial. Plots were direct seeded on 5/16/06 using a research cone planter (Kincaid Manufacturing, Haven, KS) with row centers 36 inches apart at a seeding rate of approximately 10 seeds per foot. Weed control was accomplished with 0.95 lb ai/acre of Dual Magnum (s-metolachlor) applied PRE immediately following planting. Plots were fertilized with a total of 45 lbs of N per acre split between two applications. Cultivars were harvested on three different dates 7/07/06, 7/10/06, and 7/18/06 with harvest date determined by removing 10 seeds from pods of a cultivar then measuring the length of the seeds when placed end to end. Plots were harvested when 10 seeds were approximately 110 mm in length. One meter of each plot was harvested. Data recorded at harvest included lodging ratings, yield, and quality data.

Results and discussion: Pod quality ratings ranged from 3.0 to 4.1 (1 to 5 scale with 5 being highest quality). A majority of cultivars had ratings at or above 3.4, Caprice and Ulysses had the highest ratings with 4.1 and 3.9, respectively (Table 1). Pod lengths were longest for Embassy, Titan, and EnvySlurry that had pod lengths of 3.9, 3.9, and 3.7 inches, respectively. All pod lengths were at least 2.9 inches. Plant weights were recorded for harvested plants from each plot except those harvested on the first harvest date. Based upon harvested plant weight and pod weights a percent pod weight was determined. Four cultivars had pod weight percentages of 21.1% or higher with Ambra, Diplomat, Gold Rush, and Titan recording 21.1, 21.3, 22.3, and 22.8%, respectively. Cull weights were relatively low on a per acre basis, ranging from 0.6 to 5.9 bu/acre. Culls were highest for GB 84, Gold Rush, Envy, and Cruiser which had cull weights of 5.9, 3.9, 3.9, and 3.7 bu/acre, respectively. Yield was considerably lower than those recorded in similar tests completed in 2005. Cultivars in the trial recorded yields that ranged from 11 to 108 bushel/acre. The highest yielding cultivars were Ambra, Gold Rush, SB 4285, Titan, and Ulysses that had yields of 108, 96, 94, 89, and 92 bu/acre, respectively.

Days from planting to harvest ranged from 52 to 63 days (Table 2). Embassy, Hayden, Herrera, Roma II, SB 4285, and Ulysses were all harvested 52 days after planting. Vigor ratings ranged from 1.9 to 4.8 (1 to 5 scale with 5 having the highest level of vigor). Caprice, Goldrush, and Titan had the highest levels of vigor recording 4.8, 4.8, and 4.5 for vigor, respectively. Maturity ranged from 2.8 to 4.8 (1 to 5 scale with 5 having the highest level of maturity). Ulysses, SB 4285, Goldrush, Envy, Embassy, and Caprice had the highest maturity ratings and recorded 4.8, 4.0, 4.1, 4.1, 4.0, 4.0, and 4.0, respectively. Lodging was highest for GB 83, GB 84, and Roma II that recorded 39, 34, and 31% lodging, respectively. No differences were observed in pod-set height.

Harvested beans were sized according to sieve sizes 1 to 5 with each size category being weighed. The percentage of beans by weight within a specific sieve size varied considerably between the five sizes recorded (Table 3). To help reduce confusion from a large amount of data, sizes 1 and 2 were combined, sizes 3 and 4 were combined and percentages by weight for these combinations and size 5 by itself are presented in Table 4. Two cultivars, GB 83 and Envy had the lowest combined percentages of sieve size 1 & 2, recording 1.8 and 3.5%, respectively. Although no statistical differences were observed for the combined 3 & 4 sieve sizes, these did range from 51.9 to 85.5%. Producers may note that Caprice and Titan had combined 3 & 4 sieve size percentages of 85.5 and 80.1%, respectively. The percentage of size 5 pods was highest for GB 83 and Envy that had 46.3 and 31.0% size 5 pods, respectively.

In conclusion, this late season trial provided an excellent opportunity to observe how snapbean cultivars would perform under high temperature and its related stresses. The largest issue being, will a cultivar set pods and yield at higher temperatures. Major differences were observed for yield in the trial. Ambra, Gold Rush, SB 4285, Titan, and Ulysses were the high yielding cultivars in the trial. In addition to yield, these cultivars also had acceptable quality ratings and yielded well in the combined 3 and 4 sieve size catagory. Obviously, the yields reported in this trial are considerably lower than what producers would require, but the five cultivars previously mentioned do appear to have more potential for later season plantings than others that were in the trial.

Acknowledgements: The authors wish to thank Allen Canning, Asgrow-Seminis, Harris Moran, Pureline, and Syngenta seeds for financial support of this study.

Table 1. Snap bean variety trial, Bixby, Oklahoma, 2006. Pod quality, pod length, plant wt, cull wt, yield.

Variety	Source	Pod quality[z]	Pod length(in)	Pod weight (%)[y]	Cull wt. (bu/ac)[x]	Yield (bu/ac)[y]
Ambra	Harris Moran	3.8 a-c [w]	3.4 a-d	21.1 a	1.0 bc	108 a
Caprice	Harris Moran	4.1 a	3.0 cd	7.2 bc	1.1 bc	32 de
Cruiser	Asgrow/Seminis	3.1 bc	3.2 b-d	8.2 bc	3.7 ab	22 de
Dart	Harris Moran	3.3 bc	3.1 cd	9.8 bc	0.9 bc	37 c-e
Diplomat	Syngenta	3.8 a-c	3.2 b-d	21.3 a	1.3 bc	71 a-d
Ebro	Asgrow/Seminis	3.6 a-c	3.1 b-d	15.4 ab	1.2 bc	43 b-e
Embassy	Syngenta	3.4 a-c	3.9 a	n/a	1.1 bc	61 a-e
Envy	Harris Moran	3.4 a-c	3.7 ab	8.5 bc	3.9 ab	43 b-e
GB 83	Pureline	3.0 c	3.3 a-d	2.2 c	1.5 bc	11 e
GB 84	Pureline	3.0 c	3.8 ab	10.5 bc	5.9 a	57 a-e
Gold Rush	Pureline	3.4 a-c	3.4 a-d	22.3 a	3.9 ab	96 ab
Hayden	Syngenta	3.5 a-c	3.2 b-d	n/a	1.7 bc	24 de
Herrera	Syngenta	3.4 a-c	3.0 cd	n/a	1.7 bc	58 a-e
Igloo	Pureline	3.6 a-c	3.5 a-d	5.0 bc	0.8 bc	18 de
Roma II	Syngenta	3.1 bc	2.9 cd	n/a	3.1 a-c	56 a-e
SB4285	Syngenta	3.6 a-c	3.3 a-d	n/a	0.6 c	94 ab
Tapia	Asgrow/Seminis	3.6 a-c	2.9 d	14.8 ab	2.3 bc	52 a-e
Titan	Asgrow/Seminis	3.4 a-c	3.9 a	22.8 a	2.8 bc	89 a-c
Ulysses	Asgrow/Seminis	3.9 ab	3.5 a-c	n/a	2.8 bc	92 a-c

[z] Pod quality on a 1 to 5 scale, 1=poor, 5=excellent.
[y] Pod weight % = total pod weight/total weight of plants and pods x 100.
[x] Cull wt and Yield= bushels per acre, one bushel = 30 lbs.
[w] Numbers followed by the same letter are not significantly different based upon Duncan's multiple range test with P=0.05.

Table 2. Snap bean variety trial, Bixby, Oklahoma, 2006. Days to harvest, vigor, maturity, % lodging, pod set height.

Variety	Source	Days to harvest	Vigor[z]	Maturity[z]	% lodging[y]	Pod set Height (in.)
Ambra	Harris Moran	55	4.0 a-e [x]	3.1 bc	21 d-f	14.5 a
Caprice	Harris Moran	63	4.8 a	4.0 ab	19 ef	11.8 a
Cruiser	Asgrow/Seminis	63	1.9 g	3.3 bc	24 d-f	11.8 a
Dart	Harris Moran	55	3.6 c-f	2.8 c	13 fg	10.8 a
Diplomat	Syngenta	55	3.1 f	3.5 bc	8 g	14.0 a
Ebro	Asgrow/Seminis	55	3.1 f	3.9 a-c	8 g	13.5 a
Embassy	Syngenta	52	4.1 a-d	4.0 ab	14 fg	11.5 a
Envy	Harris Moran	63	3.5 d-f	4.0 ab	29 b-d	11.5 a
GB 83	Pureline	63	3.1 f	3.9 a-c	39 a	8.3 a
GB 84	Pureline	63	3.8 b-f	3.4 bc	34 ab	11.8 a
Gold Rush	Pureline	55	4.8 a	4.1 ab	20 d-f	15.5 a
Hayden	Syngenta	52	4.3 a-d	3.9 a-c	13 fg	13.5 a
Herrera	Syngenta	52	3.3 ef	3.6 a-c	9 g	10.5 a
Igloo	Pureline	55	4.3 a-d	3.3 bc	14 fg	12.0 a
Roma II	Syngenta	52	3.8 b-f	3.5 bc	31 a-c	8.5 a
SB4285	Syngenta	52	3.0 f	4.1 ab	9 g	10.3 a
Tapia	Asgrow/Seminis	55	3.8 b-f	3.8 a-c	6 g	9.3 a
Titan	Asgrow/Seminis	55	4.5 ab	4.0 ab	20 d-f	11.8 a
Ulysses	Asgrow/Seminis	52	4.4 a-c	4.8 a	20 d-f	10.0 a

[z] Vigor and Maturity ratings on a 1 to 5 scale, 1=poor, 5=excellent.
[y] %Lodging=percentage of plants that lodged.
[x] Numbers followed by the same letter are not significantly different based upon Duncan's multiple range test with P=0.05.

Table 3. Snap Bean Variety Trial, Bixby, Oklahoma, 2006. Pod sieve sizes.

		Sieve size (% by wt.)[z]				
Variety	**Source**	**1**	**2**	**3**	**4**	**5**
Ambra	Harris Moran	1.8 cd[z]	25.1 a-c	45.9 ab	23.2 a	4.0 cd
Caprice	Harris Moran	0.7 d	10.7 c-e	52.0 ab	33.5 a	3.1 cd
Cruiser	Asgrow/Seminis	10.4 a	24.0 a-d	47.9 ab	11.3 a	6.4 cd
Dart	Harris Moran	0.6 d	34.5 ab	53.8 a	11.1 a	0.0 d
Diplomat	Syngenta	0.8 d	30.9 a-c	59.8 a	8.5 a	0.0 d
Ebro	Asgrow/Seminis	1.2 d	28.9 a-c	35.3 a-c	27.1 a	7.5 cd
Embassy	Syngenta	7.9 ab	17.6 b-e	36.9 a-c	35.6 a	2.0 cd
Envy	Harris Moran	0.8 d	2.6 de	12.9 cd	52.7 a	31.0 ab
GB 83	Pureline	0.6 d	1.2 e	6.8 d	45.1 a	46.3 a
GB 84	Pureline	0.9 d	11.0 c-e	39.1 ab	32.9 a	16.1 b-d
Gold Rush	Pureline	5.5 a-d	40.1 a	44.0 ab	10.4 a	0.0 d
Hayden	Syngenta	5.3 a-d	34.4 ab	27.1 b-d	25.2 a	8.0 cd
Herrera	Syngenta	0.5 d	14.4 b-e	34.5 a-c	28.1 a	22.5 bc
Igloo	Pureline	7.2 a-c	22.1 a-e	54.0 a	16.7 a	0.0 d
Roma II	Syngenta	1.2 d	21.2 a-e	37.6 a-c	29.8 a	10.2 cd
SB4285	Syngenta	1.3 d	28.7 a-c	35.7 a-c	32.5 a	1.8 cd
Tapia	Asgrow/Seminis	0.8 d	23.9 a-d	57.1 a	18.2 a	0.0 d
Titan	Asgrow/Seminis	3.2 b-d	13.8 b-e	54.8 a	25.3 a	2.9 cd
Ulysses	Asgrow/Seminis	2.5 b-d	20.8 a-e	55.8 a	20.9 a	0.0 d

[z] Numbers followed by the same letter are not significantly different based upon Duncan's multiple range test with P=0.05.

Table 4. Snap Bean Variety Trial, Bixby, Oklahoma, 2006. Combined pod sieve sizes.

		Sieve size (% by wt.)^z		
Variety	**Source**	**1 & 2**	**3 & 4**	**5**
Ambra	Harris Moran	26.9 a-d ^{z}	69.1 a	4.0 cd
Caprice	Harris Moran	11.4 c-e	85.5 a	3.1 cd
Cruiser	Asgrow/Seminis	34.4 a-c	59.2 a	6.4 cd
Dart	Harris Moran	35.2 a-c	64.8 a	0.0 d
Diplomat	Syngenta	31.8 a-c	68.2 a	0.0 d
Ebro	Asgrow/Seminis	30.1 a-c	62.4 a	7.5 cd
Embassy	Syngenta	25.5 a-e	72.5 a	2.0 cd
Envy	Harris Moran	3.5 de	65.5 a	31.0 ab
GB 83	Pureline	1.8 e	51.9 a	46.3 a
GB 84	Pureline	11.9 c-e	72.0 a	16.1 b-d
Gold Rush	Pureline	45.6 a	54.4 a	0.0 d
Hayden	Syngenta	39.6 ab	52.4 a	8.0 cd
Herrera	Syngenta	15.0 c-e	62.5 a	22.5 bc
Igloo	Pureline	29.3 a-c	70.7 a	0.0 d
Roma II	Syngenta	22.4 a-e	67.4 a	10.2 cd
SB4285	Syngenta	30.0 a-c	68.2 a	1.8 cd
Tapia	Asgrow/Seminis	24.7 a-e	75.3 a	0.0 d
Titan	Asgrow/Seminis	17.0 b-e	80.1 a	2.9 cd
Ulysses	Asgrow/Seminis	23.3 a-e	76.7 a	0.0 d

^{z} Numbers followed by the same letter are not significantly different based upon Duncan's multiple range test with P=0.05.

Spring 2006 Sweet Corn Variety Trial

Bixby, Oklahoma

Brian Kahn, Lynda Wells, Robert Havener

Introduction and Objectives: High quality sweet corn is a very popular vegetable in Oklahoma. Small scale production can be sold directly on the farm or at roadside stands, farmer's markets and local stores. Large scale production requires a considerable investment in harvesting equipment and packing facilities. Corn earworm is a serious insect pest, and sweet corn production should not be attempted without an adequate insecticide spray program during the silking to harvest stages.

The genetics of sweetness in corn have become increasingly complicated. For many years, varieties could be classified as either normal sweet (su_1), sugary-enhanced (se), or supersweet (sh_2). Now varieties with genetic combinations have been introduced to the market. Check with your seed company representative before planting a new variety to learn about isolation requirements.

Objectives of this trial were to evaluate 22 varieties (yellow or bicolor) for yield, earliness, and overall quality. All varieties were in the sh_2 isolation group.

Materials and Methods: Plots were direct seeded on May 4. Plots were 20 ft long with 3 feet between rows and 2 rows per plot. Varieties were replicated 3 times in a randomized block design. Plots were sprayed with S-metolachlor herbicide on May 4, at the rate of ½ pint/acre. Stand establishment and early seedling vigor were rated on May 18. Plots were thinned to 20 plants per row on June 1. Fertilizer was applied two times, May 4 at 50 lbs. N/acre and June 1 at 60 lbs. N/acre. Insecticide applications began on June 5 (just before silking) and continued throughout the harvest period. Supplemental water was applied with overhead irrigation. Each variety was harvested one time at its peak maturity.

Results and Summary: Results are shown on the following page. The trial received heavy rains during stand establishment, creating a good test for early vigor. By mid-June, however, the plants were under heat and drought stress despite being irrigated. Some plots were so poor that for all entries, only the two best replications were used for data analysis. Centest's 'MX 350BC' was a crop failure, and stands of 'Mirai 130Y' and 'Big Time' were so poor that a grower probably would have abandoned the plantings.

Full-season corns tend to have better yield and quality than earlier cultivars. An exception was 'Optimum', which was superior to 'Holiday' in both 2005 and 2006. 'Obsession' and 'Passion' should be trialed again; both produced some nice ears, but 'Passion' had the highest cull production in the trial. The two Xtra-Tender™ cultivars also were relatively high in percentage of cull ears. 'XTH 1174' was a relatively early yellow corn used in the guard rows. It emerged well. 'GSS 0966' did not perform quite as well as in some previous trials, but is still recommended. The insect protection built into 'GSS 0966' and 'BSS 0977' was very evident this year.

One objective of this trial was to compare several Mirai™ cultivars with other sweet corns. Mirai™ cultivars are marketed as having particularly good eating quality. Taste is very subjective; however, several people in our research group tested Mirai™ cultivars against others harvested on the same days, and most felt that the eating quality was very good. 'Mirai 334BC' was the most impressive Mirai™ entry in 2006, in contrast to 2005 when it had the highest cull production in the trial. This cultivar had above-average earworm damage in both years. Local growers have reported that stand establishment appears to be an issue with many of the Mirai™ cultivars. We would encourage Mirai™ growers to carefully follow cultural guidelines provided by Centest, and to follow a good corn earworm management program.

Producers should consider data from several years before selecting varieties, and always test a new variety on a small acreage at first.

Table 1. Spring 2006 Sweet Corn Variety Trial, Bixby[z] .

Variety	Company/ Source	Genetics	Stand rating[y]	Market yield (sacks/A)[x]	Yield (tons/A) Market	Yield (tons/A) Culls	Number days to harvest	In-shuck rating[w]	Shucked rating[w]	Avg ear length (inches)	Corn earworm damage[v]
Ranger	Seedway	yellow	2.7	188	2.8	0.2	74	1.8	2.0	6.6	2.8
Passion	Seedway	yellow	4.3	185	3.4	2.5	70	1.5	2.5	7.5	4.8
GSS 3186	Syngenta	yellow	3.3	178	3.2	0.5	74	2.0	2.8	7.1	3.8
Mirai 334BC	Centest	bicolor	4.7	169	2.6	0.6	63	3.3	3.0	7.5	5.0
Obsession	Seedway	bicolor	2.2	160	2.8	0.7	70	2.8	3.5	7.3	4.0
Sentinel	Seedway	yellow	3.0	157	3.0	1.1	74	2.0	3.5	7.3	3.0
Optimum	Crookham	Augmented bicolor	3.0	154	2.2	0.9	67	3.5	3.5	6.9	4.8
Mirai 302BC	Centest	bicolor	1.6	148	2.2	1.0	63	3.3	3.3	7.1	4.5
BSS 0977	Syngenta	Attribute® bicolor	4.0	145	1.8	0.4	74	2.5	3.3	7.0	1.0
Surpass	Crookham	bicolor	2.3	145	1.9	0.4	70	3.8	3.8	6.9	4.5
Double Up	Seedway	bicolor	2.2	141	2.1	1.4	63	3.0	2.8	7.1	5.0
Mirai 301BC	Centest	bicolor	1.6	141	2.2	0.3	67	3.5	3.0	6.8	4.3
Mirai 308BC	Centest	bicolor	1.9	132	1.6	1.0	63	3.3	3.5	6.9	5.0
Majesty	Rupp	bicolor	1.3	129	2.2	1.5	70	2.3	3.5	6.7	4.8
GSS 0966	Syngenta	Attribute® yellow	3.0	123	1.5	0.1	74	3.0	3.5	6.8	1.5
Xtra Tender 281A	Rupp	HQ bicolor	4.0	111	1.8	1.5	70	2.8	3.3	6.5	5.0
Mirai 336BC	Centest	bicolor	3.0	111	1.9	1.5	67	3.3	4.3	7.6	5.0
Mirai 131Y	Centest	yellow	2.3	102	1.3	0.8	63	3.0	3.0	7.3	4.5
Xtra Tender 278A	Seedway	bicolor	2.7	98	1.5	2.0	67	3.0	4.5	6.7	5.0
Mirai 130Y	Centest	yellow	1.0	77	1.0	0.2	67	4.3	4.0	6.7	5.0
Holiday	Crookham	Augmented bicolor	3.0	74	1.3	1.5	74	3.0	3.5	7.2	4.5
Big Time	Syngenta	bicolor	1.6	55	0.7	0.4	74	2.8	3.5	6.6	4.3
		Mean	2.7	133	2.0	0.9	69	2.9	3.3	7.0	4.2
		$LSD_{0.05}$	1.4	NS	NS	0.8	--	0.8	1.1	NS	0.8

[z]Seeded May 4, 2006; Plot size: 1.8m x 6.0m (2 rows/plot, 3 plots each variety, plots thinned to 20 plants/row.) Harvested 7/06/06 to 7/17/06
[y]Rating: 1=may not make stand, 2= minimal stand, 3=average with some gaps, 4=good vigor with some gaps, 5=good vigor and must thin.
[x]One sack = 60 ears
[w]Rating: 1=best, 5=poorest
[w]Rating: 1=no damage, 2=earworm damage <½" from tip, 3=earworm damage <1" from tip, 4=earworm damage <1½" from tip, 5=earworm damage >1½" from tip.
[v]Earworm control: Sevin WP, Asana & Lannate were applied 5 times between silking & harvest to entire planting.

Tomato Variety Trial

Spring 2006, Bixby, Oklahoma

Brian Kahn, Robert Havener, Lynda Wells, Dan Valdez

Introduction and Objectives: Commercial tomato production in Oklahoma is almost exclusively for fresh market. Oklahoma tomato crops usually are established with transplants in the spring for summer production. This trial was designed to evaluate yield and fruit quality of 20 determinate tomato cultivars. Plants were grown using surface drip irrigation and the stake-and-weave cultural system.

Materials and Methods: Plants were started in the greenhouse on March 20, 2006. Peat pots 2¼ inches in diameter were used with a peat-based plug and seedling mix. Plants were removed from the greenhouse to be "hardened off" on April 17. A preplant application of urea to supply 50 lbs/A of N was made at Bixby on April 17, followed by an application of trifluralin at 0.5 lbs/A (a.i.) and incorporation. Plants were transplanted to the field on April 20. There were 6 plants per plot arranged in a randomized block design with 3 replications. Plots were 5.9 ft x 11.8 ft. with plants spaced at 24 in. within rows. Each plant received one cup of a starter solution made from 12 lbs. 15-30-15 fertilizer plus 1 pint diazinon per 200 gallons of water. Overhead sprinklers were used until the drip irrigation system was installed on April 24. Metal posts for the stake-and-weave system were installed beginning on May 15. Plants were pruned by removing all suckers up to the one immediately below the first flower cluster on May 22, after which the first string was installed. Additional strings were installed as needed during the season. Plants were sidedressed with 50 lbs/A of N from urea on May 22. Insecticide applications began on May 18 and continued through August 3, with a total of 7 applications. Fungicide applications began on July 3 and continued through August 3, with a total of 4 applications. Harvest began on June 19 and continued 2 times weekly until August 10, with a total of 16 harvests.

Results and Discussion: Results are shown on the following pages. This trial was beset by multiple problems. Early marketable yields were very low due to a combination of rabbit damage to some plant terminals and phenoxy herbicide injury (apparently due to drift from an off-station application). Radial fruit cracking was common. Plants subsequently grew out well but were under heat and drought stress for the duration of the trial, despite being irrigated. As a result, we could not demonstrate statistical differences in marketable fruit yield. A late infection of tomato spotted wilt virus was noted on two guard row plants of 'Sunmaster', suggesting that resistance to this disease may become more important in eastern Oklahoma tomato crops. However, the disease did not limit marketable yields in our trial this year.

Tomato Variety Trial – Bixby, 2006[z]

Variety/line	Seed source	Yield (ctns/A)[y]				Average mkt. fruit wt. (lbs)
		Marketable	Early mkt[x]	Culled[w]	Total[v]	
QualiT 23	Syngenta	1479	9	488	1967	0.41
Floralina	Twilley	1372	13	360	1732	0.39
Solar Fire	Seedway	1351	23	449	1800	0.45
Amelia	Seedway	1189	4	490	1679	0.48
Mountain Fresh Plus	Seedway	1147	1	317	1464	0.35
Florida 47	Chesmore	1114	16	398	1512	0.43
Sun Leaper	Syngenta	1080	6	409	1489	0.40
Florida 91	Chesmore	1031	13	451	1482	0.50
BHN 444	Twilley	1029	10	724	1753	0.44
BHN 640	Seedway	992	24	556	1548	0.42
Paragon	Johnny's	990	18	421	1411	0.39
Road Runner III	Twilley	979	7	361	1340	0.48
Indy	Syngenta	973	13	638	1611	0.39
Crista	Seedway	969	0	419	1388	0.49
Talladega	Syngenta	952	0	541	1493	0.44
Top Gun	Twilley	911	13	366	1277	0.43
Soraya	Seedway	891	13	276	1167	0.48
Applause	Seminis	876	54	477	1353	0.44
QualiT 21	Syngenta	865	0	646	1511	0.50
Sebring	Syngenta	833	3	468	1301	0.38
	Mean	1051	12	463	1514	0.43
	$LSD_{0.05}$	NS	20	187	NS	0.06

zTransplanted: April 20, 2006
Plot size: 5.9' x 11.8'; 6 plants per plot.
Harvested: 6/19/06 to 8/10/06 (16 picks).
yOne ctn (carton) = 25 lbs.
xEarly harvest: 6/19/06 to 7/13/06 (8 picks).
wPredominant reasons for culls were cracking and insect damage.
vTotal = marketable + culls.

Spring Tomato Replicated Variety Trial – Bixby, 2006

Summary of notes recorded by B.A. Kahn throughout the trial. Specific observations of vines were performed on 10 and 27 July. All notes based on at least three plots per variety/line. An asterisk (*) indicates a variety claimed to have resistance to tomato spotted wilt virus (TSWV).

Variety/line	Notes
Amelia *	Popular in Arkansas; perhaps the best TSWV-resistant variety in the trial.
Applause	Distinctive plants – short, fat vines with big leaves but limited fruit cover. May not be optimally supported by stake-and-weave. Relatively early.
BHN 444*	Had the most cracking in the trial.
BHN 640*	Performed much like BHN 444; also had a lot of cracking.
Crista*	Adequate vines.
Floralina	Some culls came late due to sunburn; still below average in total culls.
Florida 47	Adequate vines.
Florida 91	Had the least cracking in the trial. Some culls came late due to sunburn; still slightly below average in total culls.
Indy	Had a lot of cracking.
Mt. Fresh Plus	Vigorous vines held up well; had minimal sunburn. Fruit tended to have a good appearance but also were relatively small. Will continue to be recommended for Oklahoma producers where fruit size is not an issue.
Paragon	Will continue to be a recommended variety for Oklahoma.
QualiT 21	Had a lot of cracking.
QualiT 23	Set well. Vigorous vines held up well; had minimal sunburn.
RFT 6153	GUARD ROWS ONLY. Relatively large, vigorous vines.
RoadRunner III	Had a few misshapen fruit; still below average in total culls.
Sebring	Some culls came late due to sunburn; plant vigor varied plot-to-plot.
Solar Fire	Some culls came late due to sunburn; still slightly below average in total culls.
Soraya	Had the lowest cull production in the trial, but also below the average for marketable yield. Plant vigor varied plot-to-plot.
Sun Leaper	Will continue to be a recommended variety for Oklahoma.
Sunstart	GUARD ROWS ONLY. Relatively early; limited vines; exposed fruit.
Talladega*	Had a lot of cracking.
Top Gun*	Had the second lowest incidence of cracking in the trial.
Valley Girl	GURAD ROWS ONLY. Heavy set of relatively small fruit; vines declining by 27 July.

Organic Tomato Cultivar Evaluations

Lane Agricultural Center - 2006

Warren Roberts, Merritt Taylor, Jonathan Edelson, Jim Shrefler, Benny Bruton, Penny Perkins-Veazie, Sam Pair, Angela Davis, Wayne Fish, Vince Russo, Chuck Webber

Eighteen cultivars of tomatoes were grown in a certified organic farming system at the Lane Agricultural Center in 2006. Four cultivars were indeterminant, and the remainder were determinant. All treatments and practices used were in compliance with the USDA National Organic Program certification. All cultivars were trellised. All plants were started in a greenhouse, using organically approved materials and practices, and were later transplanted to an organic certified field at the Lane Agricultural Center. Indeterminant cultivars were trellised using an overhead, single-wire, string tie system. Determinant cultivars were trellised using a stake-and-weave system. All plants were 18 inches apart within the row, and rows were on 9 foot centers.

The summer was very hot and dry, and few diseases were encountered on the cultivars. The main pest problem was an outbreak of striped blister beetles. Attempts were made to eradicate the beetles by using an air blast from a hand-held leaf blower to knock the beetles to the ground, and then to kill the beetles with a flame thrower. This approach was not efficient time-wise, and dust stirred by the air blast allowed the beetles a chance to return to the plants before they could be eradicated. A neem extract was also applied to the beetles, but with little immediate impact. Then, an application of pyrethrum (Pyganic) was made to the beetles, and good control was obtained.

Cultivar	Company	Type	Total Yield (tons/acre)	Marketable fruit/plant	Culls Fruit/ plant	BER fruit/ plant	Insect fruit/ plant	Disease Fruit/ plant	Avg. fruit weight (lbs)
Sun Leaper	Tomato Growers Supply	D	11.78	23	2	1	1	0	.29
Mountain Spring	DeWitt Seed	D	7.78	12	2	1	0	1	.41
Celebrity	DeWitt Seed	D	6.26	13	3	1	0	2	.31
Amelia	DeWitt Seed	D	5.34	7	4	3	0	1	.49
BNH-444	Johnny Seeds	D	5.07	8	3	2	0	1	.38
Christa	Randy Gardner	D	5.02	8	4	4	0	0	.44
Mountain Delight	DeWitt Seed	D	4.85	28	4	3	1	0	.30
Florida 91	Tomato Growers Supply	D	4.52	7	5	2	0	3	.43
Sun Master	Tomato Growers Supply	D	4.40	6	7	4	0	3	.40
Smarty	Randy Gardner	D	4.39	155	.1	0	0	.1	.02
Solar Set	Tomato Growers Supply	D	4.36	7	3	2	0	1	.35
Classica	Totally Tomato	D	3.59	13	23	23	0	0	.15
Mountain Fresh	DeWitt Seed	D	3.22	6	4	3	0	1	.29
Florida 47	DeWitt Seed	D	2.85	5	2	2	0	0	.33
NC 05114	Randy Gardner	I	2.33	21	1	1	0	0	.09
NC 0455	Randy Gardner	I	1.23	3	2	2	0	0	.22
NC 0652	Randy Gardner	I	0.34	1	2	1	0	1	.19
Manapal	Heirloom Tomatoes	I	0.03	0.2	.2	0	0	0	.11

Transplants were started on April 3, 2006 and transplanted on May 17, 2006
First harvest was June 25, 2006 and last harvest was August 25,2006
BER = Number of fruit damaged by blossom end rot, Insect = number of fruit damaged by insects, Disease = number of fruit damaged by diseases

Watermelon Nutritional Study

Summer 2006

Lynn Brandenberger, Hailin Zhang, Lynda Wells
Oklahoma State University
Cooperating with Dennis and Virgil Slagell SSS Farms, Hydro, Oklahoma

Introduction and objective: Fertilizer use in commercial watermelon production often includes the use of nitrogen at rates between 100 to 120 pounds of N/acre and Potassium at up to 250 pounds of K_2O/acre. The objective of this study was to determine if lower rates of nitrogen and supplemental potassium would result in changes in yield and quality of watermelon compared to rates used in the past.

Methods: The study was completed in summer 2006 at the SSS Farm near Hydro, Oklahoma. It included a randomized block design with three replications with 4 treatments made up of different rates of nitrogen and potassium (Table 1).The study was transplanted on 5/30/06 to 80% 'Banner' (Triploid seedless cultivar) and 20% 'Allsweet' (Diploid pollinator cultivar) into a loamy sand soil. Plots consisted of three rows 20 feet long on 9 foot row centers with an in-row plant spacing of 2.5 feet (approximately 1,500 plants/acre) for a total of 8 plants/row x 3 rows for a total of 24 plants/plot. Soil samples were collected from each plot on 5/30/06 and sent to be analyzed by the Oklahoma State Soil Testing lab (Table 3). Potassium treatments (60 lb P_2O_5/acre) were applied immediately following soil sampling using 0-0-60 fertilizer. A nitrogen application was made by the producers on 6/15/06 to the entire study area at a rate of 40 lb actual nitrogen/acre utilizing urea (46-0-0). Additional nitrogen applications were made utilizing urea (46-0-0) at the appropriate rates to plots on 7/05/06 and 7/26/06 (Table 1). Harvest data including individual fruit weights and number of cull fruit was recorded on 8/07/06, 8/18/06, and 9/06/06.

Results and discussion: No differences were observed for any of the different parameters that were recorded in this study (Table 2). The authors conclude several things from this. First, based upon the results of soil tests that were conducted (Tables 3 and 4), it appears that levels of all nutrients that were measured were adequate for plant growth and crop production. There was very little variation in the pH level of the samples, and soil makeup i.e. percentages of sand, silt and clay (soil type) were consistent between plots. Second, watermelon is not known to be a crop that requires high levels of nitrogen, the main component of treatments in the study. Because of this, possibly the low rate of nitrogen was adequate to produce yields that were not different from any of the higher rates. There were a few things that could be changed in the methods used to carry out the study that may increase the potential to see differences in future work. First, it was very difficult to separate out the vines between the plots. There is a need to design plot sizes and row configurations in the future to allow for better separation of vines, this alone could potentially make a difference in future work. Second, the authors would suggest adding a check treatment to the study that would receive no nitrogen to determine if residual nitrogen from previous crops may be adequate for crop growth and development. Third, adding a fourth replication to the study could help to reduce the effect of variability between plots, thereby allowing for differences between treatments to be observed.

Acknowledgements: The authors wish to thank Dennis and Virgil Slagell for the support and help given to make this study possible.

Table 1. Treatment descriptions and application informationfor watermelon nutritional study, Hydro, OK, 2006.

Treatment descriptions				
Treatment	**Nitrogen rate**	**Number of applications**	**Nitrogen application rates**	**Potassium application rate**
1	40	1	40	0
2	80	2	40	0
3	120	3	40	0
4	80	2	40	60

Application information				
Treatment #	**Date**	**Type of application**	**Material used**	**Rate actual lb /acre**
4	5/30/06	Potassium	Potassium chloride (0-0-60)	60
1,2,3,4	6/15/06	Nitrogen	Urea (46-0-0)	40
2,3,4	7/05/06	Nitrogen	Urea (46-0-0)	40
3	7/26/06	Nitrogen	Urea (46-0-0)	40

Table 2. Harvest data for watermelon nutritional study, Hydro, OK, 2006.

Treatment lb/acre	Sugar leak (#)[z]	Bottle neck (#)[y]	Foliage rating (0-5)[x]	Fruit/acre (#)[w]	Yield (lb/acre)[v]	Fruit size (lbs)[u]
40-N	168 a[t]	13 a	2.0 a	1,063 a	20,290 a	19.0 a
80-N	121 a	67 a	2.7 a	1,058 a	19,454 a	18.4 a
120-N	148 a	148 a	2.0 a	948 a	17,333 a	18.5 a
80-N, 60-K	141 a	188 a	2.7 a	1,016 a	17,927 a	18.1 a

[z]Sugar leak counts were made at harvest on 8/07/06, 8/18/06, 9/07/06.
[y]Bottle necked misshapen fruit counts were made at harvest on 8/07/06, 8/18/06, 9/07/06.
[x]Foliage ratings were made on a 0 to 5 rating scale where 0 = absence of foliage and 5 = totally undamaged foliage with complete foliage coverage by vines on 9/07/06.
[w]Fruit/acre were determined for each harvest date on 8/07/06, 8/18/06, 9/07/06.
[v]Yield/acre was determined from the total of each of the three harvests on 8/07/06, 8/18/06, 9/07/06.
[u]Fruit size is an average of all fruit from each of the three harvest dates on 8/07/06, 8/18/06, 9/07/06.
[t]Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Table 3. Soil test results including pH, N-P-K, SO4, Ca, Mg as lbs/acre. Soil samples collected on 6/01/06.

Plot	pH	N (lbs/A)	P (lbs/A)	K (lbs/A)	SO4 (lbs/A)	Ca (lbs/A)	Mg (lbs/A)
101	6.9	18	158	336	12.33	1553	287
102	7	26	184	306	13.6	1368	269
103	7	13	176	353	8.9	1467	257
104	6.6	18	204	378	9.7	1435	248
201	6.7	11	102	238	11.2	1696	288
202	6.7	12	140	262	10.1	1451	257
203	7	13	168	261	9.3	1521	259
204	6.8	19	200	347	10.5	1631	278
301	6.6	14	88	213	14.8	1705	304
302	6.7	12	115	212	11.6	1521	260
303	6.9	13	135	245	9.6	1517	266
304	6.8	24	199	390	11.5	1641	314
Averages	**6.8**	**16**	**156**	**295**	**11.1**	**1542**	**274**

Table 4. Soil test results including ppm of Fe, Zn, B, Cu, % of organic matter, sand-silt-clay.

Plot	Fe (ppm)	Zn (ppm)	B (ppm)	Cu (ppm)	OM (%)	Sand%	Silt%	Clay%
101	11.8	1	0.14	0.3	0.54	80	10	10
102	15.5	0.9	0.12	0.3	0.31	82.5	10	7.5
103	16.2	0.6	0.11	0.3	0.3	82.5	10	7.5
104	18.9	0.9	0.09	0.3	0.49	80	12.5	7.5
201	10	0.6	0.11	0.3	0.33	82.5	7.5	10
202	12.2	0.8	0.09	0.3	0.33	82.5	7.5	10
203	14.6	0.9	0.1	0.3	0.33	85	7.5	7.5
204	16.9	1	0.11	0.3	0.46	82.5	7.5	10
301	9.7	0.5	0.09	0.3	0.32	85	7.5	7.5
302	9.6	0.7	0.08	0.3	0.3	82.5	7.5	10
303	10.8	0.8	0.31	0.3	0.29	85	7.5	7.5
304	14.8	1.3	0.14	0.4	0.61	82.5	7.5	10
Averages	**13.42**	**0.8**	**0.1**	**0.3**	**0.4**	**82.7**	**8.5**	**8.8**

Disease Management

Evaluation of Fungicides for Control of Pumpkin Powdery Mildew

Perkins, 2006

John Damicone and Lucas Pierce, Entomology and Plant Pathology

Introduction and Objective: Powdery mildew, caused by the fungus *Sphaerotheca fuliginae*, is the most important foliar disease of pumpkin in Oklahoma. The disease is favored by moderate temperatures (<95F), cloudy conditions, and high humidity. Rainfall is not necessary for powdery mildew development. The disease can be effectively controlled with a spray program using sulfur (e.g. Microthiol), DMI fungicides (Nova, Procure), strobilurin fungicides (e.g. Flint), and chlorothalonil (e.g. Bravo). Resistance to DMI and strobilurin fungicides in the powdery mildew fungus can develop quickly, even within a single season. For example, control of powdery mildew with strobilurin fungicides in Oklahoma has declined in recent years. The objective of this trial was to evaluate powdery mildew control using Quintec, a newly registered fungicide, and V-10118, an experimental fungicide, both with unique modes of action, and either alone or in alternation with a DMI fungicide (Procure) or a strobilurin fungicide (Flint).

Materials and Methods: The trial was located at the OSU Research Station in Perkins. Granular fertilizer (5-10-31 N-P-K at 200 lb/A) was incorporated prior to direct seeding the variety 'Connecticut Field' on 14 June at a rate of 3 seeds per ft. The herbicides Curbit 3E at 3.4 pt/A and Sandia 75WG at 0.75 oz/A were broadcast after planting to control weeds. Plots were top-dressed with additional granular fertilizer (46-0-0 N-P-K at 100 lb/A) on 25 July. Plots were single, 25-ft-long rows spaced 15 ft apart. Plots were then thinned to a 2-ft within row spacing. Squash bugs were controlled with Ambush 2E at 12.8 oz/A on 7-day intervals from 1 Aug to 5 Sep. Treatments were arranged in a randomized complete block design with four replications. Fungicides were broadcast through flat-fan nozzles (8002vk) spaced 18 inches apart using a CO_2-pressurized wheelbarrow sprayer. The sprayer was calibrated to deliver 24 gal/A at 40 psi. Fungicides were applied six times on 7-day intervals beginning at flowering on 24 July. Plots received sprinkler irrigation as needed to maintain plant growth and promote disease development. Disease was assessed by visually estimating the percentage of leaves with symptoms (including defoliation) and defoliation alone in three areas of each plot on 19 Oct. Yield was taken on 19 Oct.

Results; Due to the extended hot and dry conditions during the growing season, powdery mildew did not appear until just before harvest. In untreated check plots, powdery mildew reached moderate levels by harvest when defoliation from the disease just began (Table 1). The ratings were taken about 5 weeks after the last fungicide application. The Procure/Quintec alternation treatments and the Procure/Pristine alternation provided the best control. Powdery mildew control with V-10118 was improved by the addition of the surfactant Silwet L77. Bacterial leaf spot, caused by the bacterium *Xanthomonas campestris* pv. *cucurbitae*, became severe in this trial. When warm rainy conditions prevail, this disease can kill vines prematurely. Because the disease is caused by a bacterium, none of the fungicides had any effect on levels of bacterial leaf spot. Yields in this trial were high, but because of the late-season disease development, there were no differences among treatments. Bacterial leaf spot infection of fruit, evident by numerous small fruit spots, was severe in the harvested pumpkins, affecting about 1/3 of the fruit.

Conclusions: The best powdery mildew control was achieved with the alternation of fungicides having different modes of action. The fungicide Quintec, has a unique mode of action and should prove useful in the management of powdery mildew. Information on the control of bacterial leaf spot is not available and control of this disease might prove difficult where it becomes established. Pristine was as effective as mancozeb in controlling anthracnose. This fungicide may prove useful in Oklahoma because it also has good activity on gummy stem blight, and emerging disease, and downy mildew. Reason and Tanos are reported to have good activity against downy mildew, but will have to be tank-mixed or alternated with another fungicide for anthracnose control. Actinovate was not effective and may or may not be useful against other cucurbit diseases

Acknowledgements: The assistance of Rick Matheson and the farm crew at the Perkins Research Station in irrigating the trial is appreciated.

Table 1. Effects of fungicides on control of powdery mildew and bacterial leaf spot of pumpkin ('Connecticut Field'), Perkins - 2006.

Treatment and rate/A (timing)[1]	Powdery mildew leaves w/ PM (%)	Powdery mildew defolia-tion (%)	Bacterial leaf spot leaves w/ BLS (%)	Bacterial leaf spot defolia-tion (%)	Yield (cwt/A)
Procure 480SC 6 fl oz (1-6)	39.6 bc	0.0	70.8 a	24.2 a	390.5 a
Procure 480SC 6 fl oz (1,3,5) Flint 50WG 2 oz (2,4,6)	36.7 bc	0.0	79.9 a	29.6 a	346.7 a
Quintec 2.08F 6 fl oz (1,3,5) Procure 480SC 6 fl oz (2,4,6)	8.7 d	0.0	76.2 a	11.2 a	394.1 a
Procure 480SC 6 fl oz (1,3,5) Quintec 2.08F 6 fl oz (2,4,6)	10.4 d	0.0	81.7 a	31.6 a	329.4 a
Procure 480SC 6 fl oz (1,3,5) Pristine 38WG 15 oz (2,4,6)	10.2 d	0.0	74.1 a	23.3 a	311.3 a
V-10118 0.4E 6.4 fl oz (1-6)	49.2 b	0.0	73.3 a	30.0 a	360.6 a
V-10118 0.4E 6.4 fl oz + Silwet L77 0.125%	24.2 cd	0.0	81.7 a	35.0 a	401.4 a
Quintec 2.08F 6 fl oz (1-6)	23.5 cd	0.0	70.4 a	20.8 a	441.4 a
Check	80.0 a	7.5	75.4 a	28.3 a	400.3 a
LSD (P=0.05)[2]	23.0		NS	NS	NS

[1] Timing numbers 1 to 6 corresponds to the spray dates of 1=1 Aug, 2=8 Aug, 3=15 Aug, 4=22 Aug, 5=29 Aug, and 6=5 Sep.

[2] Least significant difference. Means in a column followed by the same letter are not statistically different. NS=treatment effect not significant.

Evaluation of Fungicides for Control of Spinach Anthracnose

Stillwater, 2006

John Damicone and Wesley Scruggs, Entomology and Plant Pathology

Introduction and Objective: White rust is the most important foliar disease of spinach in Oklahoma. However, anthracnose, caused by the fungus *Colletotrichum dematium*, has been occasionally observed as a minor leaf disease. In the fall of 2004, anthracnose was a severe problem in some commercial spinach fields in eastern Oklahoma that had received fungicide sprays for white rust. In 2004, none of the fungicides registered for use on spinach were effective in controlling anthracnose. The objective of this trial was to evaluate a broad range of fungicides for the control of spinach anthracnose.

Materials and Methods: The trial was conducted at the Oklahoma State University Plant Pathology Research Farm in Stillwater in a field of Norge loam previously cropped to spinach. Granular fertilizer (75-0-0 lb/A N-P-K) was incorporated into the soil prior to seeding on 14 Mar. The herbicide Dual Magnum II 7.6E at 0.67 pt/A was broadcast immediately after seeding. Plots were top-dressed with additional granular fertilizer (50-0-0 lb/A N-P-K) on 17 Apr. Plots consisted of 4-row beds, 20-ft long, with rows spaced 15 in. apart. An isolate of the pathogen recovered from a commercial spinach fields in the fall of 2004 was grown for 3 weeks on moistened, double-autoclaved oat kernels at room temperature. The inoculum was broadcast at a rate of 100 ml/plot on 27 April, just prior to the first fungicide application. The experimental design was a randomized complete block with four blocks separated by a 5-ft-wide fallow buffer. Treatments were broadcast through flat-fan nozzles (8002vk) spaced 18 inches apart with a CO_2-pressurized wheelbarrow sprayer. The sprayer was calibrated to deliver 25 gal/A at 40 psi. Treatments were applied on 7-day intervals beginning 27 Apr. Plots received a total of about 4 inches of sprinkler irrigation to promote stand establishment, plant growth, and disease development. Rainfall (inches) during the cropping period totaled 1.82 in Mar, 5.14 in Apr, and 3.12 in May. Disease incidence (percentage of leaves with anthracnose) and severity (percentage of leaf area with anthracnose) were assessed on 22 May. Six, 1-ft row segments were harvested arbitrarily from the middle two rows of each plot. The harvested leaves were bulked, mixed, and disease severity was visually estimated on 30 blindly sampled leaves.

Results: Rainfall was about 1 and 2 inches below normal (30-year average) in March and May, but was about 2 inches above normal during April. Average daily temperature for March and May were 2^{o}F above normal and 6^{o}F above normal in April. Stand establishment was a problem in this trial and plants in some areas of the trial were stunted and had leaf burn from an unknown cause. Anthracnose developed to severe levels, but levels were variable between replications. While there were trends for reduced levels of anthracnose for the Switch, Carbio, and Bravo treatments, there were no statistical differences among treatments (Table 1).

Conclusions: Control of anthracnose has proven to be difficult in inoculated small plots. None of the treatments were effective in this trial or in 2005. However, this trial was not definitive because it was difficult to distinguish anthracnose from the undiagnosed problem that caused plant stunting and leaf burn.

Acknowledgements; Financial support from Allen Canning Co. is greatly appreciated. The valuable assistance of Rocky Walker and Brian Heid, OSU Plant Pathology Farm, in the establishment and maintenance of the trial at Stillwater is acknowledged.

Table 1. Evaluation of fungicides for control of anthracnose on spinach (‘Melody’), Stillwater - 2006.

Treatment and rate/A (Timing[1])	Anthracnose (%)[2]	
	leaves (%)	leaf area (%)
Untreated check	48.2 a	25.8 a
Quadris 2.08F 12.3 fl oz (1-3)	60.2 a	29.5 a
Cabrio 20EG 0.75 lb (1-3)	40.0 a	17.1 a
Kocide 4.5LF 2 pt (1-3)	52.7 a	25.0 a
Cuprofix Disperss 20DF 4 lb (1-3)	48.2 a	23.7 a
Bravo 6F 1.5 pt (1-3)	43.2 a	19.5 a
Scala 5SC 18 fl oz (1-3)	52.5 a	27.2 a
Tanos 50DF 8 oz (1-3)	42.2 a	21.8 a
Procure 50W 6 oz (1-3)	56.0 a	25.3 a
Endura 70WG 6 oz (1-3)	50.7 a	26.4 a
Topsin 70W 8 oz (1-3)	48.2 a	22.8 a
Switch 62.5WG 12.5 oz (1-3)	35.7 a	17.8 a
Maneb 75DF 2 lb (1-3)	49.0 a	27.2 a
LSD(P≤0.05)[3]	NS	NS

[1] Application numbers (1-3) correspond to the spray dates of 1=27 Apr, 2=3 May, 3=8 May.
[2] Disease incidence = % leaves with anthracnose; disease severity = % leaf area with anthracnose on 22 May.
[3] Least significant difference. Means in a colum followed by the same letter are not statistically different. NS= treatment effect not significant at P≤0.05.

Evaluation of Fungicide Programs for Spinach White Rust

Stillwater, 2006

John Damicone and Wesley Scruggs, Entomology and Plant Pathology

Introduction and Objective: White rust, caused by the fungus *Albugo occidentalis*, is the most important foliar disease of spinach in Oklahoma. Multiple fungicide applications are generally required to effectively manage white rust. Quadris and Amistar (azoxystrobin) are the primary fungicide used to manage white rust. Cabrio (pyraclostrobin) was registered for use on spinach in 2005 and is highly effective against white rust. However, these group 11 (strobulurin) fungicides have been prone to resistance problems with a few diseases of other crops. Therefore, resistance management guidelines have been developed and labelled which require the alternation of Quadris and Cabrio with fungicides that have a different mode of action. Unfortunately, there are few fungicides registered for use on spinach with non-group 11 modes of action. An objective of this study was to evaluate fungicide programs for white rust that use alternating modes of action for resistance management. Ridomil/Copper and Aliette, registered for use on spinach, and Ranman an experimental fungicide, were evaluated in alternation with Quadris, Amistar, and Cabrio. The experimental fungicide Previcur Flex and a formulation of phosphorous acid (Phostrol) were also evaluated with Quadris and Cabrio. A weather-based advisory program for white rust was released on-line in 2005 at http://agweather.mesonet.org/. A second objective was to evaluate spray programs with Quadris and Cabrio in alternation with non-group 11 fungicides using the advisory program in comparison to calendar (7-day) programs.

Materials and Methods: The trial was conducted at the Oklahoma State University Plant Pathology Research Farm in Stillwater in a field of Norge loam with a history of white rust and previously cropped to spinach. Granular fertilizer (75-0-0 lb/A N-P-K) was incorporated into the soil prior to seeding on 14 March. The herbicide Dual Magnum II 7.6E at 0.67 pt/A was broadcast immediately after seeding. Plots were top-dressed with additional granular fertilizer (50-0-0 lb/A N-P-K) on 13 Apr. Plots consisted of 4-row beds, 20-ft long, with rows spaced 15 in. apart. The experimental design was a randomized complete block with four blocks separated by a 5-ft-wide fallow buffer. Treatments were broadcast through flat-fan nozzles (8002vk) spaced 18 inches apart with a CO_2-pressurized wheelbarrow sprayer. The sprayer was calibrated to deliver 25 gal/A at 40 psi. Treatments were applied on 7-day intervals beginning at the first true-leaf stage or when recommended by the weather-based advisory program for spinach white rust using a weather station within 0.5 miles of the test site. Plots received a total of about 3.5 inches of sprinkler irrigation to promote stand establishment, plant growth, and disease development. Rainfall (inches) during the cropping period totaled 1.82 in Mar, 5.14 in Apr, and 3.12 in May. Disease incidence (percentage of leaves with rust) and severity (percentage of leaf area with rust) were assessed on 22 May. Six, 1-ft row segments were harvested arbitrarily from the middle two rows of each plot. The harvested leaves were bulked, mixed, and disease severity was visually estimated on 30 blindly sampled leaves.

Results: Rainfall was about 1 and 2 inches below normal (30-year average) in March and May, but was about 2 inches above normal during April. Average daily temperature for March and May were 2^{o}F above normal and 6^{o}F above normal in April. White rust did not appear until May, but reached high levels in the untreated check (Table 1). The advisory program, which uses temperature and the duration of high relative humidity to determine the need for fungicide applications, recommended two fungicide applications. Rain received during late April and early May along with irrigation promoted white rust development. All of the fungicide programs reduced levels of white rust compared to the untreated check. However, none of the fungicide programs provided adequate disease control. Treatments with Cabrio and Quadris which normally have low (<5%) disease severity ratings, had ratings over 20%.

Conclusions: It was difficult to draw conclusions regarding the superiority of one treatment over another because of the high disease levels in all treatments. Applications made on 1 May and 3 May were made on rainy days and the treatments may not have dried sufficiently to be effective.

Acknowledgements: The valuable assistance of Rocky Walker and Brian Heid, OSU Plant Pathology Farm, in the establishment and maintenance of the trial at Stillwater is acknowledged.

Table 1. Evaluation of fungicide programs for control of white rust on spinach ('Melody'), Stillwater - 2006.

Treatment and rate/A (Timing[1])	White rust (%)[2] leaves w/rust	White rust (%)[2] leaf area w/ rust
Untreated check	71.5 a	40.2 a
Amistar 80DF 4 oz (1,3) Ridomil Gold Copper 65W 2.5 lb (2) Aliette 80WG 3 lb (4)	75.7 a	27.7 bc
Quadris 2.08F 12.3 fl oz (1,3) Ridomil Gold Copper 65W 2.5 lb (2) Aliette 80WG 3 lb (4)	53.2 a	14.8 d
Cabrio 20EG 0.75 lb (1,3) Ridomil Gold Copper 65W 2.5 lb (2) Aliette 80WG 3 lb (4)	61.0 a	21.2 bcd
Cabrio 20EG 0.5 lb (1,3) Ridomil Gold Copper 65W 2.5 lb (2) Aliette 80WG 3 lb (4)	70.0 a	23.1 bcd
Quadris 2.08F 12.3 fl oz (1,3) Ranman 400F 2.75 fl oz + Sylwett L-77 2.0 fl oz (2,4)	51.7 a	14.0 d
Cabrio 20EG 0.75 lb (1,3) Ranman 400F 2.75 fl oz + Sylwett L-77 2.0 fl oz (2,4)	65.0 a	15.9 d
Quadris 2.08F 12.3 fl oz (A1) Ridomil Gold Copper 65W 2.5 lb (A2)	71.0 a	27.8 cd
Cabrio 20EG 0.75 lb (A1) Ridomil Gold Copper 65W 2.5 lb (A2)	73.5 a	30.7 ab
Quadris 2.08F 12.3 fl oz (1,3) Phostrol 6.7L 3.5 pt (2,4)	64.2 a	23.2 bcd
Cabrio 20EG 0.75 lb (1,3) Phostrol 6.7L 3.5 pt (2,4)	51.7 a	13.5 d
Quadris 2.08F 12.3 fl oz (1,3) Previcur Flex 6L 2.0 fl oz (2,4)	74.0 a	25.8 bc
Cabrio 20EG 0.75 lb (1,3) Previcur Flex 6L 2.0 fl oz (2,4)	56.5 a	18.9 cd
LSD($P \leq 0.05$)[3]	NS	10.3

[1] Application numbers (1-4) correspond to the calendar spray dates of 1=18 Apr, 27 Apr, 3=3 May, and 4=8 May. Applications numbers (A1 and A2) were made according to the white rust advisory program on A1=18 Apr, and A2=1 May.

[2] Disease incidence (leaves with rust) and disease severity (leaf area with rust) taken on 22 May.

[3] Least significant difference. Values in a column followed by the same letter are not statistically different. NS=treatment effect not significant.

Evaluation of Fungicides for Control of Watermelon Anthracnose

Perkins, 2006

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Introduction and Objective: Anthracnose, caused by the fungus *Colletotrichum obiculare*, is the most important foliar disease of watermelon. The disease is favored by warm, rainy weather. While resistant varieties are not available, the foliar phase of the disease is relatively easy to control with fungicide programs using cholorthalonil (e.g. Bravo), mancozeb (e.g. Dithane), thiophanate-methyl (e.g. Topsin), and strobilurin fungicides (Quadris, Cabrio) are very effective. Fruit infections, which are problematic in marketing, have proven more difficult to control in experimental plots that are artificially inoculated. New fungicides have recently been registered for use on cucurbits. However, little information is available on their activity against anthracnose. Newly registered fungicides were evaluated in full-season programs against anthracnose.

Materials and Methods: The trial was located at the OSU Research Station in Perkins. Granular fertilizer (5-10-31 N-P-K at 200 lb/A) was incorporated prior to direct seeding the variety 'Delta' on 14 June at a rate of 3 seeds per ft. The herbicides Curbit 3E at 3.4 pt/A and Sandia 75WG at 0.75 oz/A were broadcast after planting to control weeds. Plots were top-dressed with additional granular fertilizer (46-0-0 N-P-K at 100 lb/A) on 25 July. Plots were single, 25-ft-long rows spaced 15 ft apart. Plots were then thinned to a 2-ft within row spacing. Squash bugs were controlled with Ambush 2E at 12.8 oz/A on 1 Aug and 15 Aug. Plots were inoculated by sprinkling oat kernels colonized by the anthracnose fungus along the center of each plot on 25 July. Treatments were arranged in a randomized complete block design with four replications. Fungicides were broadcast through flat-fan nozzles (8002vk) spaced 18 inches apart using a CO_2-pressurized wheelbarrow sprayer. The sprayer was calibrated to deliver 24 gal/A at 40 psi. Fungicides were applied six times on 7-day intervals beginning at flowering on 24 July. Plots received sprinkler irrigation to promote plant growth and disease development. Disease was assessed by visually estimating the percentage of leaves with symptoms and defoliated in three areas of each plot. Yield of marketable melons weighing 14 or more lb was taken on 1 Sep and 21 Sep. Each harvested melon was classified as infected or healthy based on the presence or presence or absence of fruit spots, respectively.

Results: Anthracnose first appeared in late August and reached severe levels by the end of harvest when unsprayed plots were almost completely defoliated (Table 1). Penncozeb, a formulation of mancozeb, provided excellent disease control on the foliage. Pristine, a combination of boscalid (Endura) and chlorothalonil (e.g. Bravo), also provided excellent disease control that was similar to Penncozeb. Tanos reduced disease incidence and defoliation compared to the untreated plots, but disease levels were high and disease control was not acceptable. Reason and Actinovate (a biological fungicide) were not effective in controlling foliar anthracnose. Total yield was not increased by any of the fungicide treatments (Fig. 1). The lack of a statistical yield response to effective fungicide treatments was probably due to the late-season disease development and variability inherent in small plot watermelon trials. However fruit infection by the anthracnose fungus was severe in this trial. Up to 50% of the melons had lesions, mostly on their undersides. Penncozeb and Pristine, which provided excellent foliar disease control, also had high levels of fruit infection. The failure of treatments that are effective against the foliar phase of anthracnose in controlling fruit infection has been observed in most previous anthracnose trials conducted. This phenomenon may be a result of the artificial inoculation of plots.

Conclusions: Pristine was as effective as mancozeb in controlling anthracnose. This fungicide may prove useful in Oklahoma because it also has good activity on gummy stem blight, and emerging disease, and downy mildew. Reason and Tanos are reported to have good activity against downy mildew, but will have to be tank-mixed or alternated with another fungicide for anthracnose control. Actinovate was not effective and may or may not be useful against other cucurbit diseases

Acknowledgements: The assistance of Rick Matheson and the farm crew at the Perkins Research Station in irrigating the trial is appreciated.

Table 1. Effects of fungicides on control of anthracnose on watermelon ('Delta'), Perkins - 2006.

Treatment and rate/A (timing)[1]	Anthrac-nose (%)[2]	Defolia-tion (%)[3]	Yield (cwt/A)[4]		
			Healthy	Infected	Total
Penncozeb 75DF 3.0 lb (1-6)	6.2 c	1.7 c	185.6	106.7	292.4
Tanos 50DF 8 oz (1-6)	77.1 b	60.8 b	131.7	95.1	226.8
Reason 4.13F 5.5 fl oz (1-6)	87.5 ab	75.0 ab	125.8	111.7	237.5
Pristine 38WG 18.5 fl oz (1-6)	13.7 c	2.9 c	171.9	84.9	256.8
Actinovate SP 6 oz + Latron B-1956 0.125% (1-6)	87.5 ab	68.3 ab	151.6	142.0	293.7
Check	96.6 a	87.5 a	80.6	123.6	204.2
LSD (P=0.05)[5]	13.5	22.9	NS	NS	NS

[1] Timing numbers 1 to 6 corresponds to the spray dates of 1=24 July, 2=1 Aug, 3=8 Aug, 4=15 Aug, 5=22 Aug, and 6=29 Aug.
[2] Leaves with symptoms of anthracnose including defoliation foliar disease on 19 Sep.
[3] Leaves defoliated on 19 Sep.
[4] Marketable melons weighing 14 lb or more taken on 21 Sep and 5 Oct. Infected melons had anthracnose fruit spots.
[5] Least significant difference. Means in a column followed by the same letter are not statistically different. NS=treatment effect not significant.

Watermelon Foliar Fungicide Timing Trial - Lane

Jim Shrefler, Tony Goodson, Benny Bruton, and John Damicone

Introduction and objectives: Foliar diseases can be a threat to watermelon production in Oklahoma. Any of several diseases including Anthracnose, Downy Mildew and Powdery Mildew can result in yield and fruit quality loss when foliage is damaged. Effective fungicides are available for the control of these diseases. However, growers are faced with the challenge of determining when to apply fungicides to obtain maximum effectiveness. Several options available for determining fungicide application timing include using preset schedules (for example, weekly), applying based on general weather forecasts, or applying when disease symptoms appear. Each of these has benefits and downsides. The last, although often used, is a particularly poor choice because fungicides are most effective when applied as a preventive practice rather than as a "cure". An additional means of deciding when to apply fungicides is an anthracnose forecaster that was developed for determining fungicide application timing in watermelon. The forecaster is available on the Oklahoma Mesonet with the recommendation that the forecaster be used on a trial basis until its dependability can be verified. One concern is that the forecaster is specific for anthracnose. Consequently, forecasts obtained with the forecaster do not consider the infection of watermelon by other diseases. This trial was conducted to compare the efficacy of two broad spectrum fungicide treatments using application timings based on a preset schedule and the anthracnose forecaster.

Materials and Methods: The trial was conducted at Lane, Oklahoma at the Wes Watkins Agricultural Research and Extension Center on a sandy loam soil. Beds four feet in width were constructed on 12-foot centers. A single row of watermelon (XT 100) was direct seeded June 7, 2006 at the center of each bed. Sandea herbicide applied at 0.75 oz per treated acre and Curbit applied at 2 pints per treated acre were applied to the beds after planting. Crop stand was thinned to 2 plants per 2 feet of row. Drip irrigation was used once the crop was established.

Experimental treatments included an untreated check and fungicide treatments of 1. a tank mix of Dithane 75DF and Topsin 70WP and 2. Bravo Weatherstick. Each of these was applied using two decision-making options: 1. apply at first flowering and then weekly thereafter or 2. apply at first flowering and then based on recommendation by the Mesonet anthracnose forecaster. For all applications, Dithane was used at 2 lbs. product per treated acre, Topsin at ½ lb. and Bravo Weatherstick at 1.5 pints. All applications were made using 21 gallons per acre of spray mixture. The sprayer consisted of a tractor mounted boom fitted with 8003 flat fan nozzles, spaced 20 inches on a straight boom, which were connected to a closed tank system that uses pressurized air to deliver the spray mixture. Spray mixtures were prepared in either 3 or 5 gallon tanks and agitated immediately before spray application. Fungicide application was initiated when staminate flowers first became evident on approximately 50% of the plants. Initial fungicide applications were made on July 14. Subsequent applications were made to the weekly treatments on 7-14, 7-26, 8-4, 8-15, 9-5, 9-20, 9-28, and 10,3 and to the forecaster treatments on 8-22.

The experimental design was a randomized complete block with four replications. Individual plots consisted of a 40 foot long section of a single watermelon row. Treatment applications covered an expanse of 24 feet that was centered on the plot row. The tractor on which the spray boom was mounted traveled with wheels centered on the adjacent row and did not drive over the vines. Visual evaluations of injury on watermelon foliage were made on 8-11 and 8-28 and of defoliation on 9-20. Marketable size fruits were harvested and weighed on 8-21 and 8-28.

Results and Discussion: Visible injury of foliar became evident at about Aug. 11 (Table 1) and at Sept. 20 substantial defoliation was obvious in some areas of the field. However, no significant differences were detected among the treatments for any of the evaluations.

All mature watermelon fruit were harvested on August 21 and August 28. Total yields and yields for individual harvest dates are presented in Table 2. No significant differences were found among treatments for any of the harvest dates or for total harvested yield.

Foliage loss in this trial was gradual. Leaf samples were collected from areas of the field with injury on October 1. No specific foliar diseases were recognized in these samples. Conditions were very hot and without rainfall during most of the period of the trial. Consequently, some watermelon injury may have been due to environmental factors. After the initial fungicide application, the Anthracnose Model resulted in making only one fungicide application compared to 8 scheduled applications.

Table 1. Visual evaluation of foliar disease of watermelon foliar fungicide trial at Lane.

		Visual Disease Evaluation[1]		
Fungicide Treatment	**Application timing**	**% diseased crown[2] 8-11**	**% damage[3] 8-28**	**% defoliated[4] 9 -20**
Untreated	---	17.5	26.5	40
Dithane + Topsin	Weekly	6.5	17.5	26.5
Dithane + Topsin	Forecaster	6.5	17.75	23.5
Bravo	Weekly	13.5	22	33.25
Bravo	Forecaster	17.5	33.5	34.5
		NS[5]	NS	NS

[1] Visual evaluations where 0 = no disease or defoliation and 100 = all leaves affected.
[2] Injury includes leaves with bronzing or yellowing and bare areas due to foliage loss.
[3] Injury is primarily lesions observed on leaves.
[4] Portion of foliage lost from a complete canopy.
[5] NS indicates no statistical differences in the means within a column.

Table 2. Fruit yield in the 2006 watermelon foliar fungicide timing trial at Lane.

Fungicide Treatment	**Application Timing**	**Yield (lbs. per acre)[1]** August 21	August 28	Total
Untreated	---	8455	51550	60005
Dithane + Topsin	Weekly	3415	65864	69278
Dithane + Topsin	Forecaster	6739	59642	66381
Bravo	Weekly	3684	57813	61497
Bravo	Forecaster	5864	49148	55012
		NS[2]	NS	NS

[1] All fruit of marketable size at 8-21 and 8-28. Lowest individual fruit weight at 8-28 was 7 lbs.
[2] NS indicates no statistical differences in the means within a column.

Weed Management

Basil Preemergence Herbicide Screening Study

Spring 2006

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Oklahoma State University

Background and objective: Basil is being investigated as an alternative crop in Oklahoma. Weed control in this crop is limited to pre-plant applications of postemergence herbicides since no preemergence herbicides are labeled for use within the state on the crop. Due to the lack of labeled preemergence herbicides, the objective of this study was to identify and begin development of pre herbicides for use in this crop.

Methods: The study was completed in spring 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. Study design was a randomized block design with four replications that included 21 herbicides in 26 treatments and untreated and weeded checks (Table 1). On 5/23/06 two pre-plant incorporated treatments were applied (hand-boom $C0_2$ sprayer) and incorporated (tractor drawn rototiller) then Basil (Johnny's cultivar 'Italian Large Leaf') was direct seeded with a pneumatic planter (Monosem Inc.) in 1 row on 12 inch row centers with three other plant species in three adjacent rows. Preemergence treatments were applied on 5/24/06 to previously planted plots and irrigated immediately following with 0.5 inches of overhead irrigation to incorporate all treatments. Plots received a total of 25 lbs/acre of nitrogen on 7/10/06. Supplemental water for the study was provided through overhead irrigation with the study area receiving 1 to 2 inches of water per week. Crop injury ratings were recorded on 6/20/06, efficacy ratings on 6/20/06, and yield on 7/28/06.

Results and discussion: Thirteen treatments (Aim + Dual Magnum, Roundup + Dual Magnum, Barricade, Define, Dual Magnum alone, Dual Magnum + Nortron applied post, KIH 485, Caparol, Outlook, Goal and Spartan) resulted in 93 to 100% control of Palmer amaranth (Table 1). Kerb, Eptam, Far-Go, Lorox, Nortron, Prowl H2O, Command 3ME, and Everest had 43 to 86% control of Palmer amaranth. Basil was very sensitive to a majority of the herbicides that were included in the study. Only Lorox at 0.1 and 0.2 lb ai/acre, Everest, and Spartan had injury ratings less than 50%, injury for these treatments was 39, 49, 40, and 40%, respectively. Six treatments had yields that were near equal or above 13,817 lb fresh weight/acre that was recorded for the weeded check. Yields of these Six were: 24,272 lb/acre for Spartan, 17,831 lb/acre for Everest, 16,803 and 15,937 lb/acre for Lorox at 0.1 and 0.2 lb ai/acre, 12,783 lb/acre for Nortron at 0.5 lb ai/acre, and 12,191 lb/acre for Command 3ME at 0.375 lb ai/acre.

Although there were few herbicides that were not extremely injurious to basil, there were five compounds that appear to have some potential for use as preemergence herbicides with this crop. These include Spartan, Everest, Lorox, Nortron, and Command 3ME. Of these, Spartan, Everest, and Lorox out yielded the weeded check. The authors would conclude that all five of these compounds should be investigated further, specifically looking at different rates to determine if lower rates will improve yields further.

Acknowledgements: The authors wish to thank IR-4 for partial financial support of this study. Authors wish to thank Case Medlin for supplying chemicals for this study.

Table 1. Spring 2006 Basil preemergence weed control, Bixby, OK.

Treatment lbs ai/acre	Palmer amaranth (%control)[z]	Injury %[y]	Yield lb/acre[x]
Untreated check	0 h [w]	45 e	9972 b-f
Weeded check	36 g	20 f	13817 bc
Aim 2 EC 0.03 + Dual Magnum 0.65	100 a	100 a	0 f
Aim 2 EC 0.015 + Roundup 1.0 + Dual Magnum 0.65	100 a	100 a	0 f
Barricade 4FL 0.66	95 a	100 a	1400 f
Define DF 0.3	99 a	100 a	0 f
Define DF 0.6	99 a	100 a	0 f
Dual Magnum 0.65	99 a	100 a	0 f
Dual Magnum 0.65 + Nortron 0.164 post + NIS .25% post	98 a	100 a	0 f
Kerb 1.0	54 e-g	86 ab	7138 c-f
Eptam 7E (PPI) 1.3	43 fg	66 cd	3903 d-f
Eptam 7E (PPI) 3.5	51 e-g	80 a-c	3357 d-f
Far-Go 1.25	63 d-f	96 a	488 f
Far-Go 1.5	49 e-g	96 a	2387 ef
KIH 485 60 WDG 0.05	100 a	100 a	0 f
Caparol 1.0	100 a	100 a	0 f
Lorox 0.1	64 c-f	39 e	16803 a-c
Lorox 0.2	86 a-c	49 e	15937 a-c
Nortron 0.5	55 e-g	58 de	12783 b-d
Nortron 1.0	89 ab	94 a	343 f
Outlook 0.125	93 a	96 a	999 f
Outlook 0.5	100 a	100 a	0 f
Prowl H_2O 0.5	85 a-d	99 a	796 f
Command 3ME 0.375	69 b-e	68 cd	12191 b-e
Command 3ME 0.75	80 a-d	90 ab	180 f
Everest 0.01	81 a-d	40 e	17831 ab
Goal 1.6 EC 0.25	95 a	73 b-d	7690 c-f
Spartan 0.05	100 a	40 e	24272 a

[z] Pigweed weed control ratings on 6/20/06

[y] Plant injury ratings on 6/20/06

[x] Yield data on 7/28/06

[w] Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Basil Postemergence Herbicide Screening Study

Spring 2006

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Background and objective: Basil is being investigated as an alternative crop in Oklahoma. Weed control in this crop is limited to pre-plant applications of postemergence herbicides since no postemergence herbicides are labeled for use within the state on the crop. Due to the lack of labeled postemergence herbicides, the objective of this study was to identify post herbicides for future studies in this crop.

Methods: The study was completed in spring 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. Study design was a randomized block design with four replications that included 5 herbicides in 9 treatments (Table 1). On 5/23/06 Basil (Johnny's cultivar 'Italian Large Leaf') was direct seeded with a pneumatic planter (Monosem Inc.) in 1 row on 12 inch row centers with three other plant species in three adjacent rows. Postemergence treatments were applied on 6/27/06 to basil that was in the 4 to 6 leaf growth stage. Supplemental water for the study was provided through overhead irrigation with the study area receiving 1 to 2 inches of water per week. Crop injury ratings were recorded on 7/03/06.

Results and discussion: Crop injury ranged from 3% to 43% (Table 1). Compounds included in the study that are generally considered to have post activity were Kerb, Lorox, and Stinger. Of these, Stinger and Kerb appeared to be well tolerated by Basil (5 to 8% damage at the low rates) and Lorox was not well tolerated (41 to 43% damage). The other two compounds in the study were Outlook and Prowl H_2O, these compounds are generally considered to have preemergence activity on weeds. Low levels of injury were observed from these materials (3 to 15%). In conclusion, the authors are encouraged by the results of this preliminary study. Recommendations would be to carry out rate defining studies on Kerb and Stinger for postemergence weed control and to do the same with Outlook and Prowl H_2O for use as layby preemergence treatments.

Acknowledgements: The authors wish to thank IR-4 for partial financial support of this study. Authors wish to thank Case Medlin for supplying chemicals for this study.

Table 1. Spring 2006 Basil postemergence weed control, Bixby, OK.

Treatment lbs ai/acre	**% Injury**[z]
Kerb 1.0	8 bc[y]
Lorox 0.1	43 a
Lorox 0.2	41 a
Outlook 0.125	3 c
Outlook 0.25	10 bc
Outlook 0.5	8 bc
Prowl H_2O 0.5	15 bc
Stinger 0.09	5 bc
Stinger 0.188	28 ab

[z]Visual ratings of injury based on percentage scale on 7/03/06
[y]Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Cilantro Preemergence Herbicide Screening Study

Spring 2006

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Background and objective: Cilantro is being investigated as an alternative crop in Oklahoma. Weed control in this crop is limited to pre-plant applications of postemergence herbicides because no preemergence herbicides are labeled for use within the state on the crop. Due to the lack of labeled preemergence herbicides, the objective of this study was to identify and begin development of pre herbicides for use in this crop.

Methods: The study was completed in spring 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. Study design was a randomized block design with four replications that included 19 herbicides in 26 treatments and untreated and weeded checks (Table 1). On 4/17/06 two pre-plant incorporated treatments were applied (hand-boom $C0_2$ sprayer) and incorporated (tractor drawn rototiller) then cilantro (Johnny's cultivar 'Santo') was direct seeded with a pneumatic planter (Monosem Inc.) in four rows on 12 inch row centers. Preemergence treatments were applied on 4/18/06 to previously planted plots and irrigated immediately following with 0.5 inches of overhead irrigation to incorporate all treatments. Plots received a total of 70 lbs/acre of nitrogen in three split applications on 5/02/06, 5/15/06, and 5/25/06. Supplemental water for the study was provided through overhead irrigation with the study area receiving 1 to 2 inches of water per week. Crop injury ratings were recorded on 5/05/06 and 5/18/06, efficacy ratings and plant counts on 5/30/06, and yield on 6/15/06.

Results and discussion: The number of plants recorded on 5/30/06 ranged from 2 to 17 plants per 0.5 $meter^2$ (Table 1). Plant numbers were 10 or above for 14 of the treatments and the untreated and weeded checks. Prowl H2O had 17 plants, which was the highest number recorded in the study. Crop injury on 5/05/06 and 5/18/06 was highest for Outlook at 0.5 lb ai/acre which had 48 and 65% injury for the early and later date, respectively. Kerb, Command 3ME at 0.75 lb ai/acre, and Goal also had injury ratings that were high and recorded 36 and 35, 35 and 20, and 45 and 44% damage for the early and late dates, respectively. Control of Palmer amaranth was above 85% for seven of the treatments. Dual Magnum, Barricade, Define at 0.6 lb ai/acre, Dual Magnum + Nortron post, KIH 485 at 0.05 lb ai/acre, and Outlook at 0.5 lb ai/acre had 91, 86, 86, 85, 85, 89% control, respectively. Four treatments and the weeded check had yields that exceeded 1,500 lb fresh weight/acre. The weeded check was highest with 3,032 lb/acre, followed by Barricade, Define at 0.6 lb ai/acre, KIH 485 at 0.05 lb ai/acre, and Prowl H_2O that recorded 2,724, 1,696, 1,824, and 1,597 lb/acre, respectively.

The goal in any screening study is to identify compounds that will control weeds while not damaging the crop enough to reduce yields drastically compared to the weeded check. In this study, four compounds appear to have potential to do that. Barricade, Define, KIH 485, and Prowl H_2O injured the crop very little (0 to 16%), but it appears that Palmer amaranth control could be improved (61 to 86%). The authors would conclude that future studies should be undertaken to determine if higher rates of these compounds would result in higher levels of weed control and thereby higher yields, or if higher rates would injure the crop more, thereby reducing yields further. Only more work will tell.

Acknowledgements: The authors wish to thank IR-4 for partial financial support of this study. Authors wish to thank Case Medlin for supplying chemicals for this study.

Table 1. Spring 2006 Cilantro pre emergence weed control, Bixby, OK.

Treatment lbs ai/acre	Number plants[z]	Injury %[y] 5/5/06	Injury %[y] 5/18/06	Palmer amaranth control %[x]	Yield lbs./acre[w]
Untreated check	11 a-f[v]	0 g	0 e	0 i	1144 c-f
Weeded check	15 a-d	0 g	0 e	100 a	3032 a
Aim 2 EC 0.03 + Dual Magnum 0.65	9 a-f	13 e-g	8 e	94 ab	1342 c-f
Aim 2 EC 0.015 + Roundup 1.0 + Dual Magnum 0.65	11 a-f	14 d-g	18 c-e	79 a-d	877 c-f
Barricade 4FL 0.66	15 a-c	0 g	4 e	86 ab	2724 ab
Define DF 0.3	6 c-f	11 e-g	18 c-e	61 b-f	685 c-f
Define DF 0.6	15 a-d	6 e-g	10 e	86 ab	1696 b-d
Dual Magnum 0.65	15 a-d	19 c-g	14 de	91 ab	1255 c-f
Dual Magnum 0.65 + Nortron 0.164 post + NIS .25% post	12 a-e	20 c-g	19 c-e	85 ab	1063 c-f
Kerb 1.0	5 d-f	36 a-c	35 b-d	28 f-i	325 d-f
Eptam 7E (PPI) 1.3	10 a-f	10 e-g	11 e	9 hi	256 ef
Eptam 7E (PPI) 3.5	5 c-ef	23 c-f	10 e	40 e-h	122 f
Far-Go 1.25	15 a-d	3 fg	3 e	19 g-i	743 c-f
Far-Go 1.5	8 a-f	5 e-g	3 e	24 g-i	529 c-f
KIH 485 60 WDG 0.05	9 a-f	9 e-g	16 c-e	85 ab	1824 bc
KIH 485 60 WDG 0.15	3 ef	25 b-f	39 bc	100 a	430 c-f
Lorox 0.1	16 ab	4 e-g	3 e	44 d-h	1196 c-f
Lorox 0.2	12 a-e	15 c-g	5 e	20 g-i	627 c-f
Nortron 0.5	9 a-f	0 g	6 e	23 g-i	749 c-f
Nortron 1.0	9 a-f	20 c-g	6 e	14 g-i	383 d-f
Outlook 0.125	11 a-f	3 fg	10 e	38 e-h	1063 c-f
Outlook 0.5	3 ef	48 a	65 a	89 ab	93 f
Prowl H_2O 0.5	17 a	10 e-g	9 e	61 b-f	1597 b-e
Command 3ME 0.375	12 a-f	26 b-e	9 e	41 e-h	970 c-f
Command 3ME 0.75	10 a-f	35 a-d	20 c-e	11 g-i	70 f
Everest 0.01	11 a-f	13 e-g	13 de	48 c-g	500 c-f
Goal 1.6 EC 0.25	2 f	45 ab	44 b	71 a-e	93 f
Spartan 0.05	6 b-f	21 c-g	23 b-e	81 a-c	1260 c-f

[z]Number plants=actual number of cilantro plants in 0.5 meter^2.
[y]Injury=visual ratings of injury based on percentage scale.
[x]Palmer amaranth (*Amaranthus palmeri* S. Wats.) control ratings on 5/30/06.
[w]Yield in lb fresh weight/acre 6/15/06.
[v]Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Cilantro Postemergence Herbicide Screening Study

Spring 2006

Lynn Brandenberger, Lynda Wells, Robert Havener
Oklahoma State University

Background and objective: Cilantro is being investigated as an alternative crop in Oklahoma. Weed control in this crop is limited to pre-plant applications of postemergence herbicides because no other herbicides are labeled for use within the state on the crop. Due to the lack of labeled postemergence herbicides, the objective of this study was to identify and begin development of post herbicides for use in this crop.

Methods: The study was completed in spring 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. Study design was a randomized block design with four replications that included 6 herbicides in 9 treatments and untreated and weeded checks (Table 1). On 4/17/06 cilantro (Johnny's cultivar 'Santo') was direct seeded with a pneumatic planter (Monosem Inc.) in four rows on 12 inch row centers. Postemergence treatments were applied on 5/17/06 to previously planted plots with crop plants in the 4 true-leaf stage of growth. Plots received a total of 70 lbs/acre of nitrogen in three split applications on 5/02/06, 5/15/06, and 5/25/06. Supplemental water for the study was provided through overhead irrigation with the study area receiving 1 to 2 inches of water per week. Crop injury ratings were recorded on 5/24/06, efficacy ratings and plant counts on 5/30/06, and yield on 6/15/06.

Results and discussion: Number of plants was recorded approximately 3 weeks following post applications and varied significantly (Table 1). Treatments including Lorox at 0.2 lb ai/acre, Outlook at 0.125 lb ai/acre, and Prowl H_2O had significantly more plants than the untreated check. Both rates of Stinger had zero plants counted. Injury was recorded on 5/24/06 all treatments except for Stinger recorded no injury. Stinger at 0.09 and 0.188 lb ai/acre had 66 and 71% injury, respectively. Control of Palmer amaranth ranged from zero for the untreated check to 100% for the weeded check. Herbicide treatments that included Lorox provided the highest levels of control without weeding. Lorox at 0.1 and 0.2 lb ai/acre had 61 and 89% control of Palmer amaranth. Yield was highest for Lorox at 0.1 lb ai/acre followed by the weeded check and Lorox at 0.2 lb ai/acre. Yields for these three treatments were 3,177, 3,032, and 2,974 lb fresh weight/acre.

In conclusion, for postemergence weed control, Lorox appears to be very effective and safe for use in cilantro. The authors would recommend that further study be carried out to determine the optimal rate and timing of applications for this herbicide for use in this crop.

Acknowledgements: The authors wish to thank IR-4 for partial financial support of this study. Authors wish to thank Case Medlin for supplying chemicals for this study.

Table 1. Spring 2006 Cilantro post emergence weed control, Bixby, OK.

Treatment lbs ai/acre	Number plants[z]	Injury (%)[y]	Palmer amaranth (% control)[x]	Yield (lb/acre)[w]
Untreated check	11 c[v]	0 c	0 d	738 cd
Weeded check	15 bc	. .	100 a	3032 a
Kerb 1.0	16 bc	0 c	6 cd	1069 cd
Lorox 0.1	16 bc	0 c	61 b	3177 a
Lorox 0.2	27 a	1 c	89 a	2974 ab
Outlook 0.125	29 a	0 c	34 c	2021 a-c
Outlook 0.25	21 a-c	0 c	31 c	1650 a-c
Outlook 0.5	19 a-c	0 c	33 c	1615 a-c
Prowl H_2O 0.5	22 ab	0 c	29 c	1388 b-d
Stinger 0.09	0 d	66 b	14 cd	0 d
Stinger 0.188	0 d	71 a	16 cd	0 d

[z] Number plants=number of cilantro plants counted in 0.5 meter^2 on 5/30/06.
[y]Injury= visual ratings of injury based on percentage scale on 5/24/06.
[x]Palmer amaranth (*Amaranthus palmeri* S. Wats.) control ratings on 5/30/06.
[w]Yield in lb fresh weight/acre 6/15/06.
[v]Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Dill Preemergence Herbicide Screening Study

Spring 2006

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Oklahoma State University

Background and objective: Dill is being investigated as an alternative crop in Oklahoma. Weed control in this crop is limited to pre-plant applications of postemergence herbicides since no preemergence herbicides are labeled for use within the state on the crop. Due to the lack of labeled preemergence herbicides, the objective of this study was to identify and begin development of pre herbicides for use in this crop.

Methods: The study was completed in spring 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. Study design was a randomized block design with four replications that included 21 herbicides in 26 treatments and untreated and weeded checks (Table 1). On 5/23/06 two pre-plant incorporated treatments were applied (hand-boom $C0_2$ sprayer) and incorporated (tractor drawn rototiller) then Dill (Harris Seed cultivar 'Dukat') was direct seeded with a pneumatic planter (Monosem Inc.) in 1 row on 12 inch row centers with three other plant species in three adjacent rows. Preemergence treatments were applied on 5/24/06 to previously planted plots and irrigated immediately following with 0.5 inches of overhead irrigation to incorporate all treatments. All plots were hand weeded on 6/23/06. Plots received a total of 25 lbs/acre of nitrogen on 7/10/06. Supplemental water for the study was provided through overhead irrigation with the study area receiving 1 to 2 inches of water per week. Crop injury ratings were recorded on 6/20/06, efficacy ratings on 6/20/06, and yield on 7/28/06.

Results and discussion: Thirteen treatments (Aim + Dual Magnum, Roundup + Dual Magnum, Barricade, Define, Dual Magnum alone, Dual Magnum + Nortron applied post, KIH 485, Caparol, Outlook, Goal and Spartan) resulted in 93 to 100% control of Palmer amaranth (Table 1). Crop injury ranged from 46 to 100%. Six treatments had 61% or less injury, which compares favorably with the untreated and weeded check (65 and 66% injury). Far-Go at 1.25 and 1.5 lb ai/acre, Caparol, Lorox at 0.1 and 0.2 lb ai/acre, and Prowl H_2O had 61, 56, 55, 46, 59, 51% injury, respectively. Thirteen other treatments had 92% or higher injury. These treatments included Aim + Dual Magnum, Aim + Roundup, Define, Dual Magnum alone, Dual Magnum + Nortron post, Kerb, KIH 485, Nortron at 1.0 lb ai/acre, Outlook, Everest, and Spartan. Two treatments yielded higher than 1,200 lbs fresh weight/acre. Lorox at 0.1 lb ai/acre and Prowl H_2O had yields of 1,260 and 1,893 lb/acre, respectively. All other treatments had yields that were not significantly different from the untreated and weeded checks.

This study had some unique situations that developed because of the lateness of study initiation and lack of labor to weed the study early on. To compound this, even the untreated and weeded checks had very sparse plant stands. As a result, even the checks recorded high levels of plant injury and low yields. All that aside, the authors would conclude that Lorox and Prowl H_2O should be investigated further to define rates for use in Dill. Additionally, Far-Go, Barricade and Caparol should also be considered for future work.

Acknowledgements: The authors wish to thank IR-4 for partial financial support of this study. Authors wish to thank Case Medlin for supplying chemicals for this study.

Table 1. Spring 2006 Dill pre emergence weed control, Bixby, OK.

Treatment lbs ai/acre	Palmer amaranth (% control)[z]	Injury (%)[y]	Yield lb/acre[x]
Untreated check	0 h[w]	65 d-f	180 d
Weeded check	36 g	66 d-f	47 d
Aim 2 EC 0.03 + Dual Magnum 0.65	100 a	100 a	0 d
Aim 2 EC 0.015 + Roundup 1.0 + Dual Magnum 0.65	100 a	99 a	151 d
Barricade 4FL 0.66	95 a	68 c-f	819 b-d
Define DF 0.3	99 a	96 a	215 d
Define DF 0.6	99 a	100 a	0 d
Dual Magnum 0.65	99 a	100 a	0 d
Dual Magnum 0.65 + Nortron 0.164 post + NIS .25% post	98 a	100 a	99 d
Kerb 1.0	54 e-g	92 a-c	52 d
Eptam 7E (PPI) 1.3	43 fg	69 c-f	76 d
Eptam 7E (PPI) 3.5	51 e-g	80 a-e	279 d
Far-Go 1.25	63 d-f	61 ef	418 cd
Far-Go 1.5	49 e-g	55 e-g	860 b-d
KIH 485 60 WDG 0.05	100 a	99 a	0 d
Caparol 1.0	100 a	56 ef	953 b-d
Lorox 0.1	64 c-f	46 g	1260 a-c
Lorox 0.2	86 a-c	59 ef	813 b-d
Nortron 0.5	55 e-g	88 a-d	35 d
Nortron 1.0	89 ab	100 a	0 d
Outlook 0.125	93 a	94 ab	70 d
Outlook 0.5	100 a	100 a	87 d
Prowl H_2O 0.5	85 a-d	51 fg	1893 a
Command 3ME 0.375	69 b-e	68 c-f	662 b-d
Command 3ME 0.75	80 a-d	70 b-f	639 cd
Everest 0.01	81 a-d	100 a	0 d
Goal 1.6 EC 0.25	95 a	86 a-d	157 d
Spartan 0.05	100 a	100 a	0 d

[z]Palmer amaranth (*Amaranthus palmeri* S. Wats.) control ratings on 6/20/06.
[y]Visual ratings of injury based on percentage scale on 6/20/06.
[x]Yield in lb fresh weight/acre on 7/28/06.
[w] Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Dill Postemergence Herbicide Screening Study

Spring 2006

Lynn Brandenberger, Lynda Wells, Robert Havener, Dan Valdez
Oklahoma State University

Background and objective: Dill is being investigated as an alternative crop in Oklahoma. Weed control in this crop is limited to pre-plant applications of postemergence herbicides since no postemergence herbicides are labeled for use within the state on the crop. Due to the lack of labeled postemergence herbicides, the objective of this study was to identify post herbicides for future studies in this crop.

Methods: The study was completed in spring 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. Study design was a randomized block design with four replications that included 5 herbicides in 9 treatments (Table 1). On 5/23/06 Dill (Harris Seed cultivar 'Dukat') was direct seeded with a pneumatic planter (Monosem Inc.) in 1 row on 12 inch row centers with three other plant species in three adjacent rows. Postemergence treatments were applied on 6/27/06 to dill that was in the 4 leaf growth stage. Supplemental water for the study was provided through overhead irrigation with the study area receiving 1 to 2 inches of water per week. Crop injury ratings were recorded on 7/03/06.

Results and discussion: Crop injury ranged from 0% to 21% (Table 1). Compounds included in the study that are generally considered to have post activity were Kerb, Lorox, and Stinger. Of these, Lorox and Kerb appeared to be well tolerated by Dill (0 to 7% damage) and Stinger was not as well tolerated (20 to 21% damage). The other two compounds in the study were Outlook and Prowl H_2O, these compounds are generally considered to have preemergence activity on weeds. Low levels of injury were observed from these materials (0 to 14%). In conclusion, the authors are encouraged by the results of this preliminary study. Recommendations would be to carry out rate defining studies on Lorox and Kerb for postemergence weed control and to do the same with Outlook and Prowl H_2O for use as layby preemergence treatments.

Acknowledgements: The authors wish to thank IR-4 for partial financial support of this study. Authors wish to thank Case Medlin for supplying chemicals for this study.

Table 1. Spring 2006 Dill post emergence weed control, Bixby, OK.

Treatment lbs ai/acre	%Injury[z]
Kerb 1.0	7 a[y]
Lorox 0.1	0 a
Lorox 0.2	0 a
Outlook 0.125	0 a
Outlook 0.25	0 a
Outlook 0.5	14 a
Prowl H_2O 0.5	4 a
Stinger 0.09	21 a
Stinger 0.188	20 a

[z]Visual ratings of injury based on percentage scale on 7/03/06.
[y]Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Cowpea Tolerance to Sandea Herbicide

Spring 2006

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Oklahoma State University

Introduction and objective: Cowpeas are an important crop for vegetable producers in Oklahoma, used primarily for canning in the processing industry. A large portion of acreage within the state utilizes preemergence herbicides for weed control in this crop. One issue that is becoming a challenge to producers is the development of herbicide resistant weed species. As the number of labeled herbicides continues to decrease and more pressure is placed on remaining compounds, resistant weed populations are increasing. Several new compounds have been identified that provide excellent control of weed species within the state, but crop tolerance of these compounds often varies between cultivars and breeding lines. The University of Arkansas has recently identified several advanced cowpea breeding lines that appear to have tolerance to Sandea (halosulfuron). The objective of this study was to screen several advanced breeding lines and a cultivar for tolerance to Sandea applied preemergence at different potential use rates.

Methods: The study was carried out at the Oklahoma State University Vegetable Research Station at Bixby, Oklahoma. Plots were direct seeded on 6/20/06 using a research cone planter, each plot having 4 rows of the plot cultivar or breeding line planted on 36 inch row centers at approximately 8 seeds per foot. Following planting the entire study area received a preemergence application of Dual Magnum (S-metolachlor at 0.75 lb ai/acre) tank-mixed with Pursuit (imazethapyr at 0.063 lb ai/acre) for weed control. Herbicide treatments were applied with a tractor attached research sprayer with an 8.6 foot wide spray boom on 6/23/06. Treatments included 10 cultivar/breeding lines, each receiving Sandea at 0.048, 0.096 lb ai/acre and untreated as a check (Table 1). The entire study area received approximately 0.5 inch of overhead irrigation immediately following herbicide treatment application. Plots were arranged in a randomized block design with 3 replications. The entire study area received 25 lb/acre of nitrogen on 7/10/06 using urea (46-0-0). Plant counts, injury, and flowering were recorded on 7/10/06, additional injury ratings were recorded on 7/25/06. Plots were defoliated on 9/20/06 and harvested on 10/02/06. Data recorded at harvest included dry yields and percent moisture utilizing a Dickey John grain moisture meter.

Results and discussion: No differences were observed for crop injury on either 7/10/06 or 7/25/06 (Table 1). Percent flowering varied considerably, ranging from 5 to 70%. On 7/10/06, 01-117, 01-111, and Early Scarlet were the earliest flowering breeding lines/cultivar with an average of 68% flowering for all three. No differences in flowering were observed for these particular breeding lines/cultivar between the untreated or Sandea treated treatments. Yield was highest for the 01-174 Sandea at 0.048 lb ai/acre treatment, this treatment yielded 1,016 lb/acre. The untreated and Sandea at 0.96 lb ai/acre 01-174 treatments yielded 762 and 678 lbs/acre, respectively. The next highest yielding treatments included 01-103 untreated and Sandea at 0.048 lb ai/acre treatments which yielded 738 and 714 lbs/acre, respectively. No differences were recorded for moisture content of the different treatments.

First, it appears that earliness of flowering is not affected by Sandea. All breeding lines/cultivars in the study exhibited no differences in flowering between the untreated and treated plots. When yield is considered, the 01-174 line appears to have the most yield potential followed by the 01-103 line. Based upon the data the authors would conclude that Sandea at 0.048 lb ai/acre did not negatively affect flowering or yield for a majority of the breeding lines/cultivar in the study. Furthermore, we would recommend that additional examination of the highest yielding lines for tolerance to Sandea be carried out to determine if these results will remain similar over different seasons.

Table 1. Tolerance of cultivars and cowpea breeding lines to Sandea herbicide, Bixby, OK 2006.

Cultivar	Treatment lbs ai/ac	Plant count /acre	Injury[z]		Flowering[y] (%)	Yield lbs/acre[x]	Moisture[w] (%)
			7/10/06	7/25/06	7/10/06		
01-103	Untreated	139,392 a [v]	10 a	0 a	7 d	738 bc	12.9 a
01-103	0.048	145,200 a	10 a	2 a	7 d	714 bc	12.1 a
01-103	0.096	151,008 a	5 a	3 a	7 d	617 b-f	12.2 a
01-140	Untreated	129,228 a	5 a	0 a	10 d	375 e-h	15.6 a
01-140	0.048	129,228 a	5 a	2 a	12 d	351 e-h	15.5 a
01-140	0.096	136,488 a	5 a	0 a	10 d	351 e-h	14.0 a
01-174	Untreated	110,352 a	2 a	0 a	17 d	762 b	11.3 a
01-174	0.048	108,900 a	2 a	0 a	18 d	1016 a	11.5 a
01-174	0.096	117,612 a	8 a	2 a	18 d	678 b-d	12.0 a
01-117	Untreated	137,940 a	5 a	0 a	68 a	557 b-g	12.2 a
01-117	0.048	164,076 a	0 a	0 a	68 a	617 b-f	11.6 a
01-117	0.096	135,036 a	7 a	0 a	68 a	641 b-e	11.4 a
01-111	Untreated	132,132 a	15 a	0 a	70 a	375 e-h	9.5 a
01-111	0.048	146,652 a	12 a	2 a	68 a	387 d-h	9.9 a
01-111	0.096	137,940 a	5 a	2 a	68 a	532 b-g	11.6 a
01-180	Untreated	142,296 a	3 a	0 a	5 d	448 c-h	17.9 a
01-180	0.048	140,844 a	3 a	0 a	5 d	399 d-h	16.5 a
01-180	0.096	153,912 a	7 a	2 a	5 d	254 h	14.9 a
01-181	Untreated	145,200 a	7 a	0 a	8 d	387 d-h	11.5 a
01-181	0.048	139,392 a	5 a	0 a	10 d	411 d-h	13.3 a
01-181	0.096	149,556 a	3 a	0 a	8 d	328 f-h	11.2 a
01-184	Untreated	148,104 a	2 a	0 a	50 bc	315 gh	14.4 a
01-184	0.048	142,296 a	2 a	0 a	50 bc	411 d-h	11.9 a
01-184	0.096	146,652 a	2 a	0 a	50 bc	472 b-h	12.2 a
01-198	Untreated	164,076 a	3 a	0 a	38 c	351 e-h	13.5 a
01-198	0.048	130,680 a	3 a	0 a	38 c	399 d-h	12.6 a
01-198	0.096	169,884 a	2 a	0 a	40 c	315 gh	13.0 a
Early Scarlet	Untreated	146,652 a	5 a	0 a	68 a	508 b-h	9.4 a
Early Scarlet	0.048	121,968 a	8 a	0 a	68 a	508 b-h	9.8 a
Early Scarlet	0.096	151,008 a	5 a	2 a	67 ab	532 b-h	10.1 a

[z]Injury=Percent injury based upon visual rating to plants on 7/10/06 and 7/25/06.
[y]Flowering=Percent flowering based upon visual rating on 7/10/06.
[x]Yield determined by mechanically harvested with a plot combine on 10/02/06.
[w]Percent moisture determined using a Dickey-John grain moisture meter at harvest.
[v]Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Cowpea Tolerance to Spartan Herbicide

Spring 2006

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Introduction and objective: Cowpeas are an important crop for vegetable producers in Oklahoma, used primarily for canning in the processing industry. A large portion of acreage within the state utilizes preemergence herbicides for weed control in this crop. One issue that is becoming a challenge to producers is the development of herbicide resistant weed species. As the number of labeled herbicides continues to decrease and more pressure is placed on remaining compounds, resistant weed populations are increasing. Several new compounds have been identified that provide excellent control of weed species within the state, but crop tolerance of these compounds often varies between cultivars and breeding lines. The University of Arkansas has recently identified several advanced cowpea breeding lines that appear to have tolerance to Spartan (sulfentrazone). The objective of this study was to screen several advanced breeding lines and cultivars for tolerance to Spartan applied preemergence at different potential use rates.

Methods: The study was carried out at the Oklahoma State University Vegetable Research Station at Bixby, Oklahoma. Plots were direct seeded on 6/19/06 using a research cone planter, each plot having 4 rows of the plot cultivar or breeding line planted on 36 inch row centers at approximately 8 seeds per foot. Following planting the entire study area received a preemergence application of Dual Magnum (S-metolachlor at 0.75 lb ai/acre) tank-mixed with Pursuit (imazethapyr at 0.063 lb ai/acre) for weed control. Herbicide treatments were applied with a tractor attached research sprayer with a 8.6 foot wide spray boom on 6/23/06. Treatments included 10 cultivars/breeding lines, each receiving Spartan at 0.1875, 0.375 lb ai/acre and untreated as a check (Table 1). The entire study area received approximately 0.5 inch of overhead irrigation immediately following herbicide treatment application. Plots were arranged in a randomized block design with 3 replications. The entire study area received 25 lb/acre of nitrogen on 7/10/06 using urea (46-0-0). Plant counts, injury, and flowering were recorded on 7/10/06, additional injury ratings were recorded on 7/25/06. Plots were defoliated on 9/20/06 and harvested on 10/02/06. Data recorded at harvest included dry yields and percent moisture utilizing a Dickey John grain moisture meter.

Results and discussion: There were no differences in plant counts or crop injury on 7/10/06 (Table 1). On 7/25/06 injury ratings generally corresponded to a rate effect with the highest rate of sulfentrazone resulting in the highest levels of injury. Early Scarlet and 00-855 recorded the highest level of injury on 7/25/06 with ratings of 22 and 18% injury, respectively. Injury was primarily observed as stunting (fewer and smaller leaves and shortening of internodes). Percent flowering was recorded 7/10/06 and generally a rate effect was observed, with higher rates resulting in less flowering. Two cultivars, Early Scarlet and Arkansas Blackeye # 1 had significantly more flowering than the other eight cultivar/breeding lines in the study. Early Scarlet and Arkansas Blackeye # 1 had flowering that ranged from 68 to 75% flowering compared to 7 to 38% for the others. Yield ranged from 201 to 605 lb dry weight/acre. The highest yielding culivar/breeding lines in the study were 92-551, 01-243, Early Scarlet, and 01-1764 that had yields of 605, 537, 535, and 499 lb/acre, respectively. Only Erect Set had significantly higher moisture levels at harvest with 18.6 and 18.5% moisture for its untreated check and the 0.1875 lb ai/acre rate of sulfentrazone.

During the course of this study differences were observed for injury, flowering, yield and for moisture in the harvested peas. Injury to the crop was highest for Early Scarlet at the 0.375 lb ai/acre rate, but at only 22% this would be considered nearly tolerable for crop injury. The lower rate of sulfentrazone (0.1875 lb ai/acre) did not vary from the untreated check for any of the cultivar/breeding lines which indicates that cowpea is generally tolerant to sulfentrazone. Ultimately yield potential is the bottom line for cultivar performance. Although yields were low in this study there were differences observed. Based on the results, the authors would conclude that 92-551, 01-243, Early Scarlet, and 01-1764 merit further investigation as cultivar/breeding lines that are tolerant of sulfentrazone.

Table 1. Tolerance of cultivars and cowpea breeding lines to Spartan herbicide, Bixby, OK 2006.

Cultivar	Treatment lbs ai/ac	Plant count /acre	Injury[z] (%) 7/10/06	Injury[z] (%) 7/25/06	Flowering[y] 7/10/06	Yield lbs/acre[x]	Moisture[w] (%)
Early Scarlet	Untreated	126,324 a[v]	0 a	0 d	75 a	382 a-f	11.5 b
Early Scarlet	0.1875	117,612 a	3 a	0 d	73 a	535 ab	11.7 b
Early Scarlet	0.375	117,612 a	3 a	22 a	68 a	293 b-f	12.4 b
Early Acre	Untreated	114,708 a	0 a	0 d	28 b-e	249 c-f	11.7 b
Early Acre	0.1875	119,064 a	2 a	15 a-d	20 b-e	244 d-f	11.1 b
Early Acre	0.375	123,420 a	2 a	13 a-d	18 c-e	244 d-f	11.2 b
Erect Set	Untreated	116,160 a	0 a	0 d	13 de	307 b-f	18.6 a
Erect Set	0.1875	116,160 a	5 a	7 b-d	8 de	235 ef	18.5 a
Erect Set	0.375	111,804 a	3 a	17 a-c	7 e	201 f	14.5 ab
Coronet	Untreated	136,488 a	0 a	0 d	37 bc	457 a-f	12.6 b
Coronet	0.1875	139,392 a	2 a	0 d	38 b	382 a-f	12.6 b
Coronet	0.375	107,448 a	7 a	10 a-d	35 bc	353 a-f	12.2 b
CT Pinkeye	Untreated	126,324 a	0 a	0 d	28 b-d	271 c-f	13.8 b
CT Pinkeye	0.1875	114,708 a	10 a	8 a-d	28 b-d	312 b-f	13.0 b
CT Pinkeye	0.375	126,324 a	7 a	13 a-d	22 b-e	281 b-f	12.6 b
AR Blackeye # 1	Untreated	98,736 a	0 a	0 d	75 a	421 a-f	12.9 b
AR Blackeye # 1	0.1875	116,160 a	0 a	5 b-d	72 a	305 b-f	12.2 b
AR Blackeye # 1	0.375	119,064 a	0 a	15 a-d	73 a	247 c-f	13.2 b
92-551	Untreated	135.036 a	0 a	0 d	10 de	252 c-f	15.6 ab
92-551	0.1875	126,324 a	5 a	3 cd	10 de	305 b-f	16.0 ab
92-551	0.375	98,736 a	5 a	15 a-d	8 de	605 a	14.4 ab
01-1764	Untreated	121,968 a	0 a	0 d	13 de	365 a-f	11.4 b
01-1764	0.1875	117,612 a	0 a	0 d	10 de	499 a-d	13.6 b
01-1764	0.375	130,680 a	0 a	8 a-d	8 de	390 a-f	13.7 b
01-243	Untreated	137,940 a	0 a	0 d	28 b-d	508 a-c	13.7 b
01-243	0.1875	101,640 a	2 a	0 d	27 b-d	537 ab	12.7 b
01-243	0.375	121,968 a	0 a	2 d	27 b-d	467 a-e	13.0 b
00-855	Untreated	127,776 a	0 a	0 d	23 b-e	395 a-f	13.6 b
00-855	0.1875	127,776 a	2 a	5 b-d	20 b-e	460 a-f	13.9 b
00-855	0.375	130,680 a	3 a	18 ab	15 de	254 c-f	12.2 b

[z]Injury=Percent injury based upon visual rating to plants on 7/10/06 and 7/25/06.
[y]Flowering=Percent flowering based upon visual rating on 7/10/06.
[x]Yield determined by mechanically harvested with a plot combine on 10/02/06.
[w]Percent moisture determined using a Dickey-John grain moisture meter at harvest.
[v]Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Organic Weed Control in Cowpea

Summer 2006

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Introduction and objective: Cowpea is a major vegetable crop within the state of Oklahoma. It is utilized as both a processing crop by the canning industry and as a fresh market crop for farmer's and roadside markets. Traditionally weed control in this crop is primarily handled with preemergence and some postemergence herbicides, but recently fresh market producers have shown an interest in examining possible organic means of weed control. The objective of this study was to determine the potential for weed control using organic practices and products and to provide a comparison between this and the traditional use of herbicides.

Methods: The study was direct seeded to cowpea (Empire cultivar) on 6/15/06 utilizing a research belt-cone planter. Herbicide and cornglutenmeal (CGM) treatments were applied on 6/16/06. Each plot consisted of four rows on 36 inch row centers twenty feet in length. Plots were arranged in a randomized complete block design utilizing four replications. Weeded checks were hand weeded on 6/29/06. All organic treatments, weeded checks and unweeded checks were cultivated on 7/07/06 and 7/25/06 and hand weeded on 7/07/06, 7/28/06, and 9/26/06. Plots receiving herbicide were hand weeded on 9/26/06. All plots were machine harvested on 10/02/06.

Results and discussion: Control of Palmer amaranth (pigweed) was highest for Dual + Pursuit and the weeded check compared to all other treatments (Table 1). Dual (0.75 lb ai/acre) + Pursuit (0.063 lb ai/acre) had 95% control and the weeded check had 76% control. Carpetweed control was highest for Dual + Pursuit and the weeded check that had 96 and 71% control, respectively. The number of Palmer amaranth and carpetweed corresponded to the control ratings for these two weed species. CGM at 2178 lb/acre applied solid and the weedy check had higher numbers of Palmer amaranth compared to Dual + Pursuit and the weeded check. Carpetweed numbers were higher for CGM 2178 lb/acre banded, CGM 6534 lb/acre applied solid, and the weedy check compared to Dual + Pursuit and the weeded check. No differences were observed for the number of goosegrass weeds.

Costs involved in controlling weeds in the study included herbicides, hand weeding, and tractor cultivations. Estimated cost for hand weeding was ten dollars per hour and tractor cultivation was ten dollars per acre. Herbicide costs were estimated based upon material costs and the rates used. All treatments except for the herbicide treatment were hand weeded three times, while the herbicide treatment was hand weeded once in preparation for machine harvesting. Hand weeding costs varied considerably between CGM treatments and the herbicide treatment (Table 2). CGM at 2178 lb/acre applied solid had the highest cost for hand weeding ($172.00) and was higher in cost than either the weeded check or herbicide treatments that recorded 66.00 and 45.00 dollars/acre, respectively. Tractor cultivation costs were the same for all treatments except for the herbicide treatment that was not cultivated. Total costs were highest for CGM 2178 lb/acre applied solid and the weedy check. CGM 2178 lb/acre applied solid and the weedy check that had costs of $181.48 and $178.48 per acre, respectively compared to considerably lower costs of $75.48 and $90.73 per acre, respectively, for the weeded check and the herbicide treatment.

Yield ranged from 261 to 508 lb/acre (Table 3), but no significance was observed among treatments, although a trend was observed. Both the weeded check and the herbicide treatment recorded the two highest yields at 508 and 468 lb/acre, respectively. The authors would deduce that due to variability in the field's weed population that yield varied considerably between replications and therefore it was not possible to determine significance in yields.

There were significant differences observed in this study for weed control and the associated costs. The primary result of this work concerns cost of production. Cost-wise, the weeded check and the herbicide treatment recorded the lowest costs, and in general these two treatments yielded highest. Based on the results the authors would conclude that further study is needed to come to solid conclusions, but traditional methods of cultivation and hand weeding appear to be more than adequate to provide for weed control for organic producers of cowpea.

Acknowledgements: The authors wish to thank John Marble.

Table 1. Organic weed control on cowpeas, hand weeding, weed control, weed counts at Bixby, OK, 2006.

	Weed control[z] (%)		Number of weeds (1 square ft.)[z]		
Treatment	**Pigweed**	**Carpet weed**	**Pigweed**	**Carpetweed**	**Goosegrass**
CGM (2178 lb/acre) banded	29 b[y]	15 ef	8 a-c	7 a	1 a
CGM (2178 lb/acre) solid	23 b	25 de	12 a	3 ab	3 a
CGM (6534 lb/acre) banded	33 b	34 cd	7 a-c	4 ab	1 a
CGM (6534 lb/acre) solid	40 b	43 c	5 a-c	5 a	1 a
Weeded check	76 a	71 b	3 bc	1 b	1 a
Weedy check	0 c	0 f	9 ab	6 a	1 a
Dual (0.75 lb ai/acre) + Pursuit (0.063 lb ai/acre)	95 a	96 a	0 c	0 b	0 a

[z] Weed control ratings and Number of weeds on 7/7/06.
[y] Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Table 2. Organic weed control on Cowpeas, time and cost of hand weeding and tractor cultivation, Bixby, OK, 2006.

	Hand weeding[z]		Tractor Cultivation[y]		
Treatment	**hours/acre**	**(cost/acre)**	**(hours/acre)**	**(cost/acre)**	**Total cost**
CGM (2178 lb/acre) banded	12.0	120.00	0.95	9.48	129.48
CGM (2178 lb/acre) solid	17.2	172.00	0.95	9.48	181.48
CGM (6534 lb/acre) banded	11.7	117.00	0.95	9.48	126.48
CGM (6534 lb/acre) solid	12.4	124.00	0.95	9.48	133.48
Weeded check	6.6	66.00	0.95	9.48	75.48
Weedy check	16.9	169.00	0.95	9.48	178.48
Dual (0.75 lb ai/acre) + Pursuit (0.063 lb ai/acre) herbicide cost $45.73/acre	4.5	45.00	0.00	0.00	90.73

[z]Hand weeding costs were estimated using a cost of $10.00/hour.
[y]Tractor cultivation costs were estimated for two cultivations taking 0.475 hours each time using a cost of $10.00/hour per cultivation.

Table 3. Organic weed control on cowpeas, yield and percent moisture on 10/2/06 Bixby, OK, 2006.

Treatment	**Un-corrected yield (lb/acre)**	**Moisture (%)**
CGM (2178 lb/acre) banded	382 a[z]	14.7 a
CGM (2178 lb/acre) solid	312 a	15.0 a
CGM (6534 lb/acre) banded	285 a	13.8 a
CGM (6534 lb/acre) solid	274 a	13.6 a
Weeded check	508 a	12.9 a
Weedy check	261 a	13.5 a
Dual (0.75 lb ai/acre) + Pursuit (0.063 lb ai/acre)	468 a	13.7 a

[z] Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Pepper Preemergence Herbicide Screening Study

May, 2006, Caddo County, Oklahoma

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Cooperating with Dean Smith

Background and objective: Examination of new weed control materials is important in vegetable crops due to the small number of acres grown and the diminishing number of herbicides labeled. This is particularly true for peppers as labeled compounds are lost in the re-labeling process and producers have indicated that a search for new herbicides is needed. The objective of this study was to observe several preemergence herbicides for crop safety in pepper and to provide data for making sound decisions regarding the pursuit of new weed control in this important Oklahoma crop.

Methods: This study was carried out in a commercial pepper field of OSU ‘Super Hot’ that was transplanted on 5/01/06. Plants were arranged in rows with 3 foot row centers and spaced approximately 2.5 feet apart in the row. Treatments included Define (flufenacet) at 0.6 lb ai/acre, Dual Magnum (S-metolachlor) at 0.65 lb ai/acre, KIH 485 at 0.15 lb ai/acre, (Lorox (linuron) at 0.2 lb ai/acre, Nortron (ethofumesate) at 1.0 lb ai/acre, and Outlook (dimethenamid-P) at 0.5 lb ai/acre and an untreated check. All treatments were applied on 5/19/06 over the top of transplants as a preemergence application with a handheld spray boom with an overall rate of 20 gallons of spray solution per acre. The study was arranged in a randomized block design with four replications. Plots included two rows of peppers twenty feet in length. Data recorded included number of plants per plot and crop injury ratings on 7/05/06 and number of pepper fruit counted on 10/12/06.

Results and discussion: Injury was highest for KIH 485, but there were no differences recorded for plant injury between the different treatments (Table 1). Injury ranged from 0 for the untreated check to 13% for KIH 485. In general 13% injury is not considered to be excessive and in fact injury at or above 20% is considered to be an acceptable risk for many producers. No differences were observed for either the number of plants per plot or for the average number of pepper fruit per plant. The number of fruit per plant should provide some indication of yield potential for each of the treatments.

Acknowledgements: The authors wish to thank Dean Smith for his efforts and support in the completion of this study.

Table 1. Pepper herbicide study, Hinton, OK

Treatment lbs ai/ac	Percent injury	Number plants in 6’ x 20’	Average number fruit/plant
Untreated check	0 a[z]	19 a	270 a
Define DF 0.6	8 a	17 a	356 a
Dual Magnum 0.65	8 a	17 a	376 a
KIH 485 60 WDG 0.15	13 a	15 a	366 a
Nortron 1.0	4 a	19 a	377 a
Outlook 0.5	4 a	18 a	323 a

[z] Numbers in a column followed by the same letter exhibited no significant differences based on Duncan’s Multiple Range Test where P=0.05.

Spinach Response to Eptam

Fall 2005

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Background and objective: Spinach is an important crop to Oklahoma producers for canning and fresh market. Herbicides for weed control in this crop are very limited. Because of these limitations, the objective of this study was to determine if Eptam (EPTC) is a potential preemergence herbicide for use on spinach.

Methods: The study was completed between fall of 2005 and spring of 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. The study design was a randomized block design with four replications that included 5 herbicide treatments and un-weeded check (Table 1). On 10/07/05 four pre-plant incorporated treatments were applied (tractor mounted PTO pump sprayer) and incorporated (tractor mounted roto-tiller) then spinach ('Avon') was direct seeded for the entire study. One preemergence treatment was applied on 10/07/05 to the previously planted plots and irrigated immediately following with 0.5 inches of overhead irrigation to incorporate all treatments. All plots received a total of 30 lb/acre N-60 lb/acre P-30 lb/acre K in one application on 10-25-05. Additional fertilizer was applied on 2/10/06 as 102 lbs/acre of nitrogen utilizing 34-0-0. Supplemental water for the study was supplied through overhead irrigation with the study area receiving 1 to 2 inches of water per week. Plant counts and crop injury were recorded on 10/19/05 and yield on 3/06/06.

Results and discussion: The number of plants was reduced by all rates of Eptam above 1.3 lb ai/acre (Table 1). The fewest plants recorded were in plots receiving 3.1 lb of Eptam applied preemergence which had 2.7 plants per 3.3 feet in two rows. All rates of Eptam caused considerable injury to spinach. Yield ranged from 2,021 to 23,932 lb/acre fresh weight. The highest yield was from the untreated check that yielded 23,932 lb/acre. Other treatments including 1.3, 2.2, 3.1, 3.5 lb ai/acre of Eptam applied PPI and 3.1 lb ai/acre of Eptam preemergence had yields of 14,281, 8,216, 2,282, 2,021, and 3,978 lb/acre fresh weight, respectively.

In conclusion, the authors would not recommend the use of Eptam for preemergence control of weeds in spinach crops without further investigations to develop application methods and rates that would make the herbicide safer for use on spinach.

Acknowledgements: The authors wish to thank Gowan Co. for support of this study.

Table 2. Eptam (EPTC) herbicide study on spinach.

Treatment lbs ai/acre	Number plants [z]	Percent Injury [y]	Yield lbs./acre [x]
Untreated check	6.5 a [w]	0 b	23932 a
1.3 lb ai/acre PPI	5.4 ab	71 a	14281 b
2.2 lb ai/acre PPI	3.1 b	73 a	8216 bc
3.1 lb ai/acre PPI	3.5 b	91 a	2282 c
3.5 lb ai/acre PPI	3.5 b	89 a	2021 c
3.1 lb ai/acre Pre	2.7 b	74 a	3978 c

[z] Number plants=average number of spinach plants in 2 rows, 3.3 feet long.
[y] Percent Injury=percent injury on 10/19/05.
[x] Yield=Harvest date 3/6/06.
[w] Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Screening Spinach Cultivars for Tolerance to Raptor

Fall 2005

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Background and objective: Spinach is an important crop to Oklahoma producers for canning and fresh market. Herbicides for weed control in this crop are very limited. Preliminary work by the University of Arkansas has indicated that tolerance to Raptor (imazamox) varies between spinach cultivars. Based on the preliminary work, the objective of this study was to determine the tolerance of four spinach cultivars to Raptor when used as both a preemergence and a postemergence herbicide.

Methods: The study was completed between fall of 2005 and spring of 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. The study design was a randomized block design with four replications that included four cultivars, four herbicide treatments, and an un-weeded check (Table 1). Spinach was direct seeded on 10/06/05 with a research cone planter. Each plot consisted of two rows 18 inches apart that were 20 feet long. Preemergence treatments were applied on 10/07/05 at an overall rate of 25gpa and postemergence treatments were applied on 11/10/05 at an overall rate of 30 gpa and included a non-ionic surfactant at 0.25% V/V. Both applications were made with a tractor mounted PTO pump sprayer. The study area was irrigated immediately following the pre applications with 0.5 inch of overhead irrigation to incorporate all treatments. All plots received a total of 30 lb/acre N-60 lb/acre P-30 lb/acre K in one application on 10-25-05. Additional fertilizer was applied on 2/10/06 as 102 lbs/acre of nitrogen utilizing 34-0-0. Supplemental water for the study was supplied through overhead irrigation with the study area receiving 1 to 2 inches of water per week. Plant counts and crop injury were recorded on 10/19/05, crop injury on 11/23/05, and crop injury and yield on 3/06/06.

Results and discussion: No differences were observed in the number of spinach plants on 10/19/05 (Table 1). Injury for pre treatments on 10/19/05 ranged from 5 to 75%. The highest levels of injury were recorded for the 0.031 lb ai/acre rate with F 380, AR 415, Avon, and 17047 having 75, 65, 54, and 61% injury, respectively. Crop injury ranged from 0 to 82% on 11/23/05. Pre treatments at the highest rate of Raptor (0.031 lb ai/acre) had the highest injury, with cultivars F 380, AR 415, Avon, and 17047 recording 82, 76, 56, and 79%, respectively. The only post treatment on 11/23/05 with injury higher than 40% was AR 415 at the 0.031 rate which had 49% injury. Injury was recorded just prior to harvest on 3/06/06 and was quite dramatic, all cultivars receiving the pre treatment at 0.0155 lb ai/acre recorded 0% injury and a majority of the post treatments had 100%. Yields of cultivars that received pre treatments of Raptor at 0.0155 lb ai/acre were highest for 17047, F 380, and AR 415 that recorded yields of 23,932, 16,824, and 15,063 lb fresh weight/acre. Only AR 415 did not record a difference between the 0.031 and 0.0155 rates of Raptor, but all cultivars exhibited a trend of reduced yields from the higher rates. All post treatments had zero yields.

Although Raptor pre caused significant injury to all the cultivars in the study, all recovered and some even out yielded the untreated checks. The highest yielding treatment in the study was 17047 treated pre with Raptor at the 0.0155 rate. This cultivar appears to have good tolerance to Raptor at the lower rate and shows promise as cultivar that will tolerate this herbicide. None of the cultivars appear to have tolerance to Raptor as a post treatment at the rates used in the study.

Table 1. 2005-06 Tolerance of spinach varieties to Raptor (Imazamox).

Variety	Treatment lbs ai/acre	Number plants [z]	Percent Injury [x]			Yield [w] lb/acre
			10/19/05	11/23/05	3/6/06	
F 380	Untreated check	8.0 a [y]	5 d	0 d	0 d	13042 cd
F 380	Raptor pre 0.0155	6.3 a	39 a-d	36 b-cd	0 d	16824 a-c
F 380	Raptor pre 0.031	3.3 a	75 a	82 a	75 ab	2413 fg
F 380	Raptor post 0.0155	5.8 a	. .	30 b-d	100 a	0 g
F 380	Raptor post 0.031	3.5 a	. .	40 bc	100 a	0 g
AR 415	Untreated check	5.5 a	18 cd	0 d	0 d	21650 ab
AR 415	Raptor pre 0.0155	9.3 a	46 a-c	20 b-d	0 d	15063 b-d
AR 415	Raptor pre 0.031	6.8 a	65 ab	76 a	25 cd	9977 c-f
AR 415	Raptor post 0.0155	8.3 a	. .	30 b-d	100 a	0 g
AR 415	Raptor post 0.031	5.8 a	. .	49 a-c	100 a	0 g
Avon	Untreated check	7.5 a	4 d	0 d	0 d	7630 d-g
Avon	Raptor pre 0.0155	7.8 a	48 a-c	34 b-d	0 d	12781 cd
Avon	Raptor pre 0.031	6.8 a	54 a-c	56 ab	48 bc	3978 e-g
Avon	Raptor post 0.0155	8.0 a	. .	19 b-d	75 ab	0 g
Avon	Raptor post 0.031	7.0 a	. .	34 b-d	100 a	0 g
17047	Untreated check	8.5 a	29 b-d	0 d	0 d	23084 a
17047	Raptor pre 0.0155	7.8 a	49 a-c	15 cd	0 d	23932 a
17047	Raptor pre 0.031	6.8 a	61 ab	79 a	25 cd	11151 c-e
17047	Raptor post 0.0155	6.8 a	. .	20 b-d	100 a	0 g
17047	Raptor post 0.031	8.5 a	. .	34 b-d	100 d	0 g

[z] Number plants=actual number of spinach plants in a 1 row, 3.3 feet long on 10/19/05.
[y] Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.
[x] Percent Injury=percent injury on 10/19/05.
[w] Yield in pounds fresh weight/acre, harvested on 3/6/06.

Pre, PPI, and Post Use of Fargo and Eptam on Spinach

Spring 2006

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Background and objective: Spinach is an important crop to Oklahoma producers for use in the canning industry and for fresh market. Preemergence weed control in this crop is limited to Dual Magnum (S-Metolachlor). Due to limited preemergence herbicides, the objective of this study was to determine if Fargo (triallate) or Eptam (EPTC) have potential for use in spinach alone or in combination with one another or Prefar (bensulide) in spinach.

Methods: The study was completed in spring 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. The study design was a randomized block design with four replications with plots consisting of 4 rows of spinach 20 feet in length. There were 6 herbicide treatments and un-weeded and weeded checks (Table 1) included in the study. On 4/11/06 six pre-plant incorporated treatments were applied (hand-boom $C0_2$ sprayer) and incorporated (tractor drawn roto-tiller) then spinach (Asgrow cultivar 'Padre') was direct seeded with a pneumatic planter (Monosem Inc.) in four rows on 12 inch row centers. Post lay-by treatments of Eptam were applied over the top of existing plants at the 3 to 5 true-leaf growth stage on 5/12/06. Immediately following planting and lay-by treatment application, plots received 0.5 inch of overhead irrigation to further incorporate the treatments. All plots received a total of 70 lb/acre of nitrogen in three split applications on 5/02/06, 5/15/06, and 5/25/06. Supplemental water for the study was supplied through overhead irrigation with the study area receiving 1 to 2 inches of water per week. Crop injury ratings were recorded on 5/12/06 and 5/18/06, efficacy ratings and plant counts on 5/30/06, and yield on 6/08/06.

Results and discussion: Plant numbers varied significantly, ranging from 1.3 to 7 plants per 0.5 $Meter^2$ (Table 1). The weeded check, Far-Go at 3 lb ai/acre, and Far-Go at 3 lb ai/acre + Eptam at 7 lb ai/acre post had 7, 5.8, and 7 plants per 0.5 $Meter^2$. Other treatments and the untreated check ranged from 1.8 to 3.3 plants per 0.5 $Meter^2$. Crop injury varied on both days that they were recorded. On 5/12/06, Far-Go at 6 lb ai/acre, Far-Go + Prefar tank-mix, Far-Go + Eptam 7E post, and Far-Go + Eptam 20G post had 56, 66, 72, and 56% injury, respectively. On 5/18/06 crop injury had decreased, but was still significantly higher for, Far-Go at 6 lb ai/acre, Far-Go + Prefar tank-mix, Far-Go + Eptam 7E post, and Far-Go + Eptam 20G post compared to the untreated check. These ratings ranged from 28 to 55% compared to 0 for the untreated check. Control of Palmer amaranth ranged from 0 for the untreated check to 100% for the weeded check on 5/30/06. Far-Go at 6 lb ai/acre, Far-Go + Eptam 7E post, and Far-Go + Eptam 20G post had control ratings of 84, 80, and 78%, respectively, and were not significantly different from the weeded check. Yield ranged from 116 lb/acre for the untreated check to a high of 4,019 lb/acre for the weeded check. Far-Go at 3 lb ai/acre + Eptam at 7E post and Far-Go at 6 lb ai/acre + Eptam 20G post had yields of 2,447 and 2,637 lb/acre, and were not significantly different from the weeded check.

Although yields were lower than expected, there were differences observed in number of plants, injury, weed control, and yield. Far-Go at 6 lb ai/acre appears to be very injurious to spinach, both reducing plant numbers and general plant growth. The Far-Go + Prefar treatment was also quite injurious. When Far-Go rates were reduced to 3 lb ai/acre much less injury was observed and yields improved even when it was followed with Eptam at 7 lb ai/acre at lay-by. Far-Go at 6 lb ai/acre + Eptam 20G post at 4.8 lb ai/acre resulted in the second highest yield next to the weeded check. The authors hypothesize that the lower rate of Eptam 20G (4.8 lb) compared to the higher rate of Eptam 7E (7 lb) resulted in less damage and thereby higher yields at harvest. In conclusion, the authors would recommend that future studies include lower rates of Far-Go (3 to 5 lb ai/acre) in combination with Eptam as a lay-by treatment at lower rates (3 to 5 lb ai/acre).

Acknowledgements: The authors wish to thank Gowan Co. for financial support of this study.

Table 1. Spring 2006 Far-Go, Eptam herbicide study on spinach, Bixby, OK.

Treatment (lb ai/acre)	Number plants [z]	% Injury [y] 5/12/06	% Injury [y] 5/18/06	Palmer amaranth (% control) [x]	Yield fresh weight (lb/acre) [w]
Untreated check	3.3 bc[v]	0 b	0 d	0 e	116 c
Weeded check	7.0 a	. .	. .	100 a	4,019 a
Far-Go (PPI) 3.0	5.8 ab	16 b	8 cd	33 d	1,255 bc
Far-Go (PPI) 6.0	2.5 c	56 a	44 ab	84 ab	749 bc
Far-Go (PPI) 3.0 + Eptam 7E post 7.0	7.0 a	11 b	5 cd	73 bc	2,447 a-c
Far-Go (PPI) 3.0 + Prefar 2.0	1.8 c	66 a	45 ab	56 cd	1016 bc
Far-Go (PPI) 6.0 + Eptam 7E post 7.0	1.3 c	72 a	55 a	80 a-c	426 bc
Far-Go (PPI) 6.0 + Eptam 20G post 4.8	3.3 bc	56 a	28 bc	78 a-c	2,637 ab

[z]Number plants=actual number of spinach plants in 0.5 meters^2 on 5/30/06.
[y]% injury=rating of percent injury to plants on 5/12/06 and 5/18/06.
[x]Palmer amaranth % control=rating of control on 5/30/06.
[w]Yield of fresh weight recorded on 6/8/06.
[v]Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Spinach Preemergence Herbicide Screening Study

Spring 2006

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Background and objective: Spinach is an important crop to Oklahoma producers for use in the canning industry and for fresh market. Weed control in this crop is limited to Dual Magnum (S-Metolachlor) preemergence, Spin-Aid (phenmedipham), Stinger (clopyralid), Select (clethodim), and Poast (sethoxydim) postemergence. Due to limited preemergence herbicides, the objective of this study was to identify and begin development of new pre herbicides for use in this crop.

Methods: The study was completed in spring 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. The study design was a randomized block design with four replications that included 22 herbicide treatments and un-weeded and weeded checks (Table 1). On 4/11/06 two pre-plant incorporated treatments were applied (hand-boom $C0_2$ sprayer) and incorporated (tractor drawn rototiller) then spinach (Asgrow cultivar 'Padre') was direct seeded with a pneumatic planter (Monosem Inc.) in four rows on 12 inch row centers. Preemergence treatments were applied on 4/12/06 to previously planted plots and irrigated immediately following with 0.5 inches of overhead irrigation to incorporate all treatments. All plots received a total of 70 lbs/acre of nitrogen in three split applications on 5/02/06, 5/15/06, and 5/25/06. Supplemental water for the study was supplied through overhead irrigation with the study area receiving 1 to 2 inches of water per week. Crop injury ratings were recorded on 4/26/06 and 5/09/06, efficacy ratings and plant counts on 5/30/06, and yield on 6/08/06.

Results and discussion: The number of plants per 0.5 meter squared varied for several of the treatments. It ranged from 0 for the two higher rates of KIH 485 to nine plants for Far-Go at 1.5 lbs ai/acre (Table 1). The four treatments with higher plant numbers included the weeded check, Far-Go at 1.25 and 1.5 lbs ai/acre, and Lorox at 0.1 and 0.2 lbs ai/acre. Crop injury was lowest for the untreated and weeded checks followed by Far-Go and Lorox treatments. Injury was observed primarily as stunting, but the KIH 485 and the Eptam treatments resulted in few to no emerged seedlings. Control of Palmer amaranth (Amaranthus palmeri S. Wats.) was highest for the weeded check followed by treatments with Barricade, Define, Dual Magnum, and KIH 485. Although yields were lower due to the study beginning late in the season, there were differences observed in yield. Yield ranged from a high of 5,173 lbs/acre for Dual Magnum to 0 lbs/acre for Eptam and KIH 485 treatments. The weeded check yielded 4,019 lbs/acre and Define at 0.3 lbs ai/acre, Far-Go at 1.25 lbs ai/acre, Nortron at 0.5 lbs ai/acre, and Outlook at 0.125 lbs ai/acre yielded 4,495, 3,446, 3,171, 4,228 lbs/acre, respectively.

Acknowledgements: The authors wish to acknowledge partial financial support from U.S.D.A.'s IR-4 project. Authors wish to thank Case Medlin for supplying chemicals for this study.

Table 1. Spring 2006 Spinach pre emergence weed control, Bixby, OK.

Treatment lbs ai/acre	Number plants [z]	Percent Injury 4/26/06	Percent Injury 5/9/06	Amaranth control [y]	Yield lbs./acre [x]
Untreated check	5.8 abcd [w]	0 e	0 i	0 g	999 cde
Weeded check	7.0 ab	0 e	0 i	100 a	4019 ab
Aim 0.03	2.3 def	38 cd	25 defgh	23 fg	627 de
Aim 0.015 + Roundup .125	1.3 ef	48 bc	68 c	45 cdef	267 e
Barricade 4FL 0.66	2.3 def	8 de	69 c	71 abc	1179 cde
Define DF 0.3	5.5 abcd	8 de	21 efghi	70 abc	4495 ab
Define DF 0.6	4.7 bcde	36 cd	40 de	75 abc	3314 abc
Dual Magnum 0.65	6.5 abc	14 de	10 ghi	75 abc	5173 a
Kerb 1.0	0.3 f	93 a	98 ab	51 bcdef	186 e
Eptam 7E (PPI) 1.3	0.0 f	91 a	97 ab	18 fg	0 e
Eptam 7E (PPI) 3.5	0.0 f	100 a	100 a	26 defg	0 e
Far-Go 1.25	7.3 ab	10 de	2 hi	25 efg	3446 abc
Far-Go 1.5	9.0 a	0 e	4 hi	29 defg	2254 bcde
KIH 485 0.05	1.3 ef	48 bc	76 bc	89 ab	633 de
KIH 485 0.1	0.0 f	93 a	100 a	95 a	0 e
KIH 485 0.15	0.0 f	91 a	99 a	95 a	0 e
Lorox 0.1	7.0 ab	0 e	9 ghi	26 defg	2416 bcde
Lorox 0.2	7.3 ab	4 e	19 efghi	43 cdef	2097 bcde
Nortron 0.5	6.3 abcd	6 de	11 ghi	36 cdefg	3171 abcd
Nortron 1.0	2.3 def	30 cde	45 d	29 defg	1347 cde
Outlook 0.125	6.5 abc	23 cde	15 fghi	29 defg	4228 ab
Outlook 0.25	5.8 abcd	25 cde	29 defg	30 defg	2509 bcde
Outlook 0.5	1.3 ef	71 ab	73 c	63 abcde	424 e
Prowl H_2O 0.5	2.8 cdef	18 cde	38 def	64 abcde	2416 bcde

[z] Number plants=actual number of spinach plants in 0.5 square meter on 5/30/06.
[y] Amaranth (Palmer amaranth) control ratings on 5/30/06
[x] Yield data on 6/8/06
[w] Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Spinach Postemergence Herbicide Screening Study

Spring 2006

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Background and objective: Spinach is an important crop to Oklahoma producers for use in the canning industry and for fresh market. Postemergence weed control in this crop is limited to Spin-Aid (phenmedipham) Stinger (clopyralid), Select (clethodim), and Poast (sethoxydim). Due to the limited number of postemergence herbicides, the objective of this study was to identify and begin development of new post herbicides for use in this crop.

Methods: The study was completed in spring 2006 at the Oklahoma Vegetable Research station in Bixby, Oklahoma. The design was a randomized block design with four replications that included 9 herbicide treatments and un-weeded and weeded checks (Table 1). On 4/11/06 spinach (Asgrow cultivar 'Padre') was direct seeded with a pneumatic planter (Monosem Inc.) in four rows on 12 inch row centers. No preemergence treatments were applied. Postemergence treatments were applied on 5/12/06 with a four nozzle hand boom sprayer (CO_2 research sprayer) at an overall rate of 30 gallons/acre. All plots received a total of 70 lbs/acre of nitrogen in three split applications on 5/02/06, 5/15/06, and 5/25/06. Supplemental water for the study was supplied through overhead irrigation with the study area receiving 1 to 2 inches of water per week. Crop injury ratings were recorded on 5/18/06, efficacy ratings and plant counts on 5/30/06, and yield on 6/08/06.

Results and discussion: No differences were observed between treatments regarding the number of plants per 0.5 meter^2 (Table 1). Crop injury ranged from 0 to 84%. Lorox at 0.1 and 0.2 lb ai/acre had the highest percentage of injury with 35 and 84%, respectively. All other treatments had injury that ranged from 1 to 13%. Control of Palmer amaranth varied considerably between treatments. The weeded check and Lorox at 0.2 lb ai/acre had the highest levels of weed control in the study with 100 and 85% control, respectively. The weeded check yielded the highest with 4,019 lb/acre fresh weight. The untreated check and herbicide treatments did not vary in yield, but were significantly lower in yield than the weeded check.

Preemergence herbicides that were applied post in the manner of a lay-by treatment resulted in acceptable levels of crop injury, but did little to control weeds. Although Lorox at 0.2 lb ai/acre provided significant control of Palmer amaranth, it also caused a high level of injury. Yields were considerably lower than those recorded in a previous study in spinach grown over-winter, but this study was planted late in the spring and no preemergence weed control was used. The authors recommend that further work include the use of Dual Magnum as a preemergence weed control for all treatments, earlier applications of treatments i.e. within 2wk of planting and that Lorox should not be included as a post treatment on spinach.

Acknowledgements: The authors wish to acknowledge partial financial support from IR-4 for this project. Authors wish to thank Case Medlin for supplying chemicals for this study.

Table 1. Spring 2006 Spinach post emergence weed control, Bixby, OK.

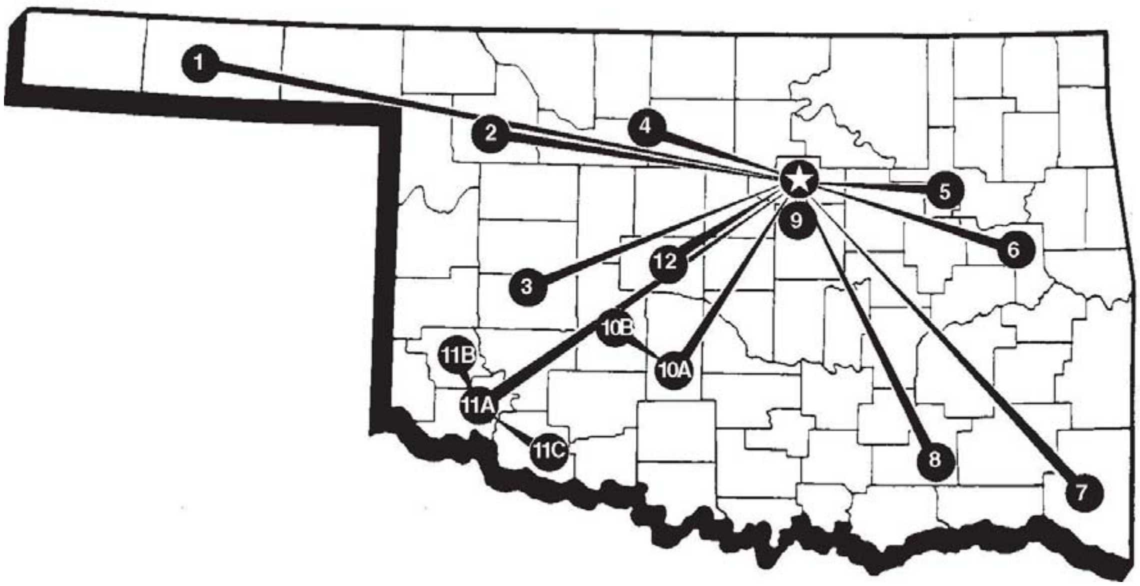
Treatment lbs ai/acre	Number of plants[z]	Injury on 5/18/06 (%)[y]	Palmer amaranth control (%)[x]	Fresh yield (lb/acre)[w]
Untreated check	5.8 a[v]	0 d	0 c	999 b
Weeded check	7.0 a	. .	100 a	4,019 a
Kerb 1.0	4.8 a	0 d	9 bc	1,539 b
Lorox 0.1	3.0 a	35 b	23 b	738 b
Lorox 0.2	1.5 a	84 a	85 a	70 b
Outlook 0.125	5.5 a	4 d	3 c	941 b
Outlook 0.25	4.0 a	5 cd	4 bc	912 b
Outlook 0.5	7.3 a	5 cd	8 bc	1,069 b
Prowl H_2O 0.5	4.8 a	1 d	1 c	691 b
Stinger 0.09	5.3 a	3 d	18 bc	976 b
Stinger 0.188	2.8 a	13 c	11 bc	1,138 b

[z]Number plants=actual number of spinach plants in 0.5 meter^2.
[y]Injury on 5/18/06=% of injury to crop plants
[x]Palmer amaranth control ratings on 5/30/06
[w]Yield data on 6/8/06
[v]Numbers in a column followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

SI (METRIC) CONVERSION FACTORS

Symbol	When you know	Multiply by	To Find	Symbol	Symbol	When you know	Multiply by	To Find	Symbol
Approximate Conversions to SI Units					*Approximate Conversions from SI Units*				
		LENGTH					**LENGTH**		
in	inches	25.40	millimeters	mm	mm	millimeters	0.0394	inches	in
ft	feet	0.3048	meters	m	m	meters	3.281	feet	ft
yd	yards	0.9144	meters	m	m	meters	1.094	yards	yds
mi	miles	1.609	kilometers	km	km	kilometers	0.6214	miles	mi
		AREA					**AREA**		
in^2	square inches	645.2	square millimeters	mm^2	mm^2	square millimeters	0.00155	square inches	in^2
ft^2	square feet	0.0929	square meters	m^2	m^2	square meters	10.764	square feet	ft^2
yd^2	square yards	0.8361	square meters	m^2	m^2	square meters	1.196	square yards	yd^2
ac	acres	0.4047	hectacres	ha	ha	hectacres	2.471	acres	ac
mi^2	square miles	2.590	square kilometers	km^2	km^2	square kilometers	0.3861	square miles	mi^2
		VOLUME					**VOLUME**		
fl oz	fluid ounces	29.57	milliliters	mL	mL	milliliters	0.0338	fluid ounces	fl oz
gal	gallon	3.785	liters	L	L	liters	0.2642	gallon	gal
ft^3	cubic feet	0.0283	cubic meters	m^3	m^3	cubic meters	35.315	cubic feet	ft^3
yd^3	cubic yards	0.7645	cubic meters	m^3	m^3	cubic meters	1.308	cubic yards	yd^3
		MASS					**MASS**		
oz	ounces	28.35	grams	g	g	grams	0.0353	ounces	oz
lb	pounds	0.4536	kilograms	kg	kg	kilograms	2.205	pounds	lb
T	short tons (2000 lb)	0.907	megagrams	Mg	Mg	megagrams	1.1023	short tons (2000 lb)	T
		TEMPERATURE (exact)					**TEMPERATURE (exact)**		
°F	degrees Fahrenheit	(°F-32) /1.8	degrees Celsius	°C	°C	degrees Fahrenheit	9/5(°C)+ 32	degrees Celsius	°F
		FORCE and PRESSURE or STRESS					**FORCE and PRESSURE or STRESS**		
lbf	poundforce	4.448	Newtons	N	N	Newtons	0.2248	poundforce	lbf
lbf/in^2	poundforce per square inch	6.895	kilopascals	kPa	kPa	kilopascals	0.1450	poundforce per square inch	lbf/in^2

THE OKLAHOMA
AGRICULTURAL EXPERIMENT STATION
SYSTEM COVERS THE STATE



✪ **MAIN STATION—*Stillwater and adjoining areas***

1. **Oklahoma Panhandle Research and Extension Center—*Goodwell***
2. **Southern Plains Range Research Station—*Woodward***
3. **Marvin Klemme Range Research Station—*Bessie***
4. **North Central Research Station—*Lahoma***
5. **Oklahoma Vegetable Research Station—*Bixby***
6. **Eastern Research Station—*Haskell***
7. **Kiamichi Forestry Research Station—*Idabel***
8. **Wes Watkins Agricultural Research and Extension Center—*Lane***
9. **A. Agronomy Research Station—*Perkins***
   B. Oklahoma Fruit and Pecan Research Station—*Perkins*
10. **A. South Central Research Station—*Chickasha***
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