2017 Vegetable Trial Report

January 2018

MP-164.8

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 2017.

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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Boise, ID 83711-4188
www.syngenta.com

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Crop Culture

Bio-Intensive Cover Cropping for Soil Improvement

Cimarron Valley Research Station
Lynn Brandenberger[1], Lynda Carrier, George Kuepper[2], and Josh Massey

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Introduction and Objectives: Soil health is critical for the continued productivity of production soils in the vegetable industry. One aspect of soil health is the level of organic matter contained in field soils. Often within the state soil organic matter may be well below 1% (0.5 to 0.7%). Organic matter in soils is critical because of its effect on nutrient stabilization, water availability, tilth, crop establishment, and crop dependence on the soil for rooting and growth. States in the southern plains like Oklahoma have a warm season that is several months longer than in the northern plains. The result of all the warm weather is that the soil microbes that break down organic matter have more time to work. This coupled with clean-tillage systems which speed up microbial activity and which are predominant in vegetable farming adds to the reduction of soil organic matter. Organic matter can be added to soil in a number of ways including compost, manure, organic fertilizers, etc. Some of the issues associated with these sources of organic matter obviously include availability and cost, but also may include the potential for food-borne disease. As an alternative, cover crops can be thought of as a "Grow in Place" source of organic matter with lower potential for contamination of fresh produce. Cover crops have an added advantage in that they protect the soil from erosion and can reduce available weed-seeds by shading out weed populations. The objective of this long-term study (5 year) is to compare three different cover crop regimens to a clean fallow system to determine each treatment's effect on soil organic matter levels and crop responses to them.

Materials and Methods: The study area was divided into four different areas (each area is 90' x 330') within the fenced vegetable area at the Cimarron Valley Research Station (Figure 1). Three of the areas will follow a specific cover crop regime and the fourth area will be maintained as a fallow area when not planted to crops. The three cover crop and fallow areas are:

Treatment area # 1 cover crop combinations:

a. Cool season: Cereal rye + Crimson clover
b. Warm season: Sorghum-sudan + Cowpea

Treatment area # 2 cover crop combinations:

a. Cool season: Wheat + Crimson clover
b. Warm season: Forage cowpea

Treatment area # 3 cover crop combinations:

a. Cool season: Cereal rye + Austrian winter pea + Tillage radish
b. Warm season: Pearl millet + Forage cowpea

Treatment area #4 fallow treatment:

a. Both cool and warm seasons will consist of clean fallow using either tillage, mowing, with some postemergence herbicides to maintain the area when not planted to crops.

Each area will be utilized for vegetable crop research plots and will be rotated between a summer and winter cover crop each year. This would mean that if a vegetable crop is not being grown in a given area there will be a cover crop growing on any open land within the three cover crop areas.

Replicated soil samples (3 samples) were collected from each area this past fall and sampling will continue each year for the duration of the study. Soil sample results include pH, N-P-K, and percent organic matter.

Results: Soil pH ranged from 6.2 in the fallow section to 6.8 in section one (Table 1). Section one had the highest soil pH with 6.8 and the fourth section was lowest at 6.2. Although there were differences, in general all sections had a soil pH that shouldn't result in nutrient availability issues.

Both nitrogen and phosphorus were generally low, nitrogen ranging from approximately 21 to 31 lbs. per acre and phosphorus ranging from approximately 21 to 34 lbs. per acre (Table 1). Although there were differences between sections for these nutrients those differences were not large and each section would benefit from the addition of nitrogen and phosphorus. Potassium levels ranged from 374 to 488 lbs. per acre. Section four had the highest level of potassium at 488 lbs. per acre, but even section one which had 374 lbs. per acre would be considered adequate for a majority of vegetable crops.

Organic matter ranged from 1.8% for sections one and three to 2.2 and 2.4%, respectively, for sections two and four (Table 1). Both sections two and four had the highest levels of organic matter which is interesting from the standpoint that section four is the fallow only section with no cover crops. It's likely that there is some organic matter carryover from the Bermuda grass cover that was part of this section prior to fencing the vegetable area.

In conclusion, this being the first year of this study it will be interesting to see how things develop regarding both fertility and organic matter in the different sections and the authors look forward to observing other aspects of soil quality as the study continues.

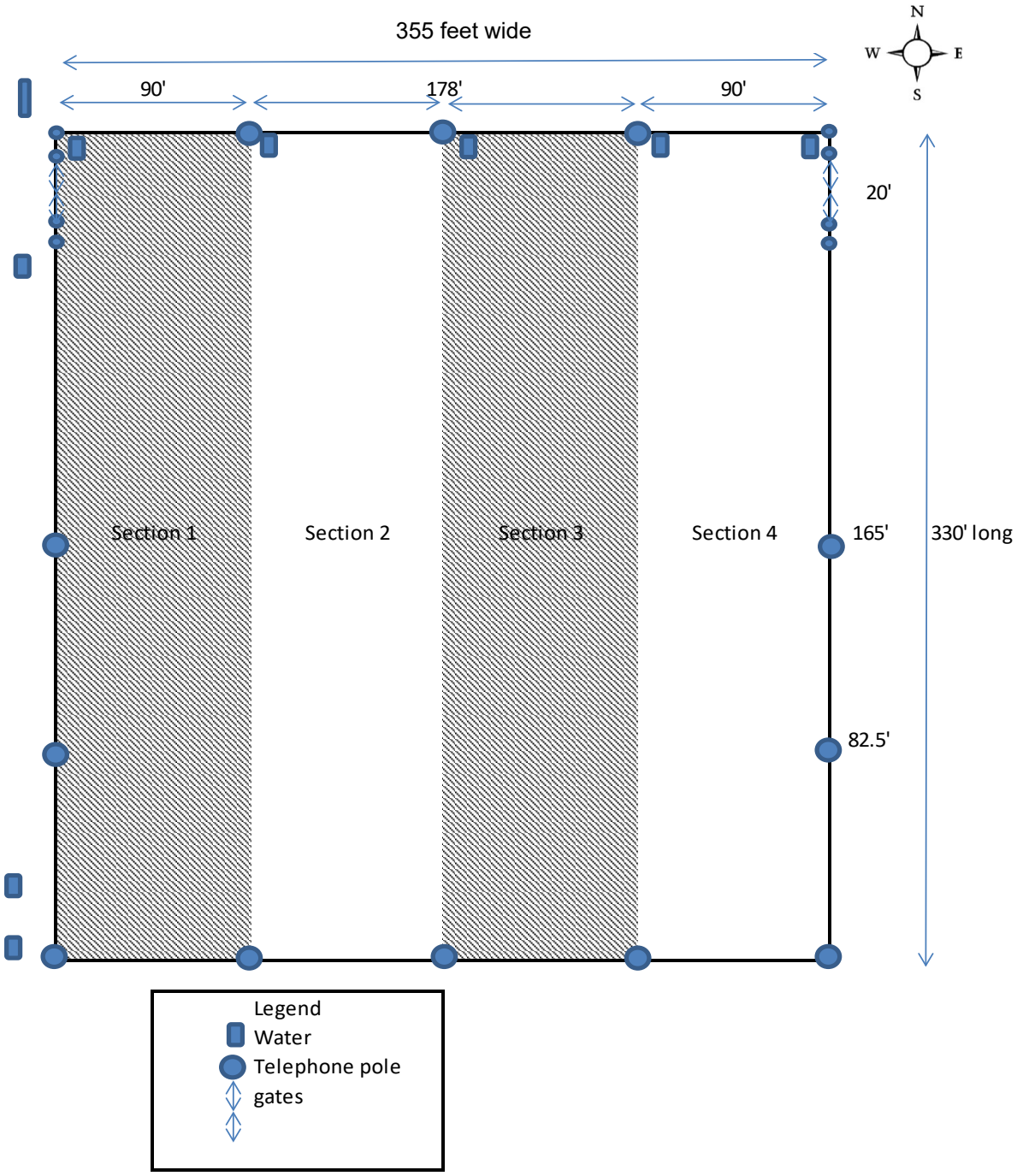
Acknowledgements: The authors would like to thank the staff at the Cimarron Valley Experiment station for assistance with this study.

Table 1. 2017 Soil sample results, Cimarron Valley Research Station, Perkins, OK

		lbs./acre			%
Section	**pH**	**Nitrogen**	**Phosphorus**	**Potassium**	**Organic matter**
1	6.8 a[z]	22.0 b	21.3 b	374 c	1.8 b
2	6.5 b	23.3 b	30.7 a	433 b	2.2 a
3	6.4 b	20.7 b	21.7 b	394 bc	1.8 b
4	6.2 c	31.3 a	34.3 a	488 a	2.4 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.

Figure 1. Cover crop and fallow areas at Cimarron Valley Research Station.



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Direct Seeding Establishment of Bell and Spice Pepper

Cimarron Valley Research Station
Andi Nichols, Lynn Brandenberger and Lynda Carrier
Oklahoma State University

Introduction: Pepper crops grown within the state of Oklahoma include peppers for fresh market such as farmer's markets, restaurants, etc. and pungent peppers grown for capsaicin for flavoring salsas and sauces and other uses. Organic and freshly grown peppers can fetch a higher price at market making them a valuable crop for producers. Spice peppers contain three times more vitamin C than oranges. They also contain high amounts of vitamin E and A as well as folic acid and potassium. Oklahoma producers face many challenges during the production cycle including production soils low in organic matter, high cost and labor involved in transplanting and potential disease problems from greenhouse grown transplants. A preliminary study was begun this spring to determine the possibility of direct seeding peppers for both fresh market and for capsaicin for flavorings, etc.

Methods and Materials: This year's study was direct seeded on June 6th with soil temperatures averaging 74^{o} F at planting time. California Wonder bell peppers and spice peppers were planted at ½ inch depth with our research plot planter at a seeding rate of approximately 16-18 seeds/row foot. Following direct seeding each 30 foot plot of either non-pungent or pungent pepper was then divided in half and the north half of each plot was treated with peat moss over the top of the planted row. Water needs were supplied using drip irrigation lines installed at the soil surface next to the seeded row. Plant counts were recorded during the second week of May to determine the effect of soil temperature and organic matter (peat moss) applied over the row. Treatments applied were as follows:

Results and Discussion: Pungent and non-pungent pepper data was collected pre and post-harvest. Pre harvest data was collected on plant number and plant height per plot. Harvest data was collected differently for bell and spice peppers. Bell pepper harvest data was collected on fresh weight of marketable peppers, number of marketable peppers, fresh weight for culls and number of cull peppers. Spice pepper harvest data was collected on plant dry weight only. Results from data showed no significant differences. These results were expected as this trial was intended for preliminary data collected for a larger project that is to begin in spring 2018.

Conclusions: Results from this trial will provide researchers with enough data to plan the upcoming spring 2018 trial. The future study will potentially consider research on seed priming, seed treatments for disease control, different pre-plant cover crops and other methods to ensure viable plant stands of direct seeded peppers in Oklahoma.

Table 1. Direct seeding Bell pepper, Perkins, Ok

Treatment	Plant counts 6/26/17	Plant counts 10/11/17	Plant Height (in.)	Market weight (grams)	Number market fruit	Weight of culls (grams)	Number culls
Moss cover	84[z]	5	10.6	1023	9.3	388	9.5
no cover	79	4	8.6	262	3.5	112	3.8

[z] No significant differences based on Duncan's Multiple Range Test where P=0.05.

Table 2. Direct seeding spice pepper, Perkins, Ok

Treatment	Plant counts 6/26/17	Plant counts 10/11/17	Plant Height (in.)	Dry weight of Plants (grams)
Moss cover	28[z]	3.0	12.7	228
no cover	41	2.5	7.4	130

[z] No significant differences based on Duncan's Multiple Range Test where P=0.05.

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Cabbage Cultivar Trial

Cimarron Valley Research Station
Lynn Brandenberger, Lynda Carrier, Joshua Massey
Oklahoma State University

Introduction: Cabbage is an important crop for fresh market vegetable farms in Oklahoma. Cabbage and other brassica heading crops (broccoli, cauliflower, etc.) can be grown both in the spring and early fall growing seasons.

Methods and Materials: The cabbage trial included 18 different varieties ranging from green to red and savoy types. The trial was transplanted on March 24th from transplants started on February 24th. The system for growing the trial included free-standing raised beds with a single drip irrigation line/bed installed using a bedder-shaper, with no plastic mulch. Cover crop was left between the rows of cabbage and consisted of winter wheat plus crimson clover. The trial was organized in a randomized block design with three replications. Each plot included 12 transplants arranged in staggered double-rows with six transplants per row and 1.5 feet between transplants in their respective row. Weed control for the trial consisted of a preemergence herbicide (Spartan Charge) applied prior to transplanting and hand-hoeing/weeding. The trial was hand hoed three times during the season. Fertility for the trial was based upon soil test results that called for the application of nitrogen only. Nitrogen was applied through the drip irrigation system utilizing urea (46-0-0) as our nitrogen source and the total amount applied was 200 lbs. of actual nitrogen per acre. Management of insect pests included scouting and the application of approved insecticides for control primarily of cabbage looper.

Yield Results: We observed that the cover crop strips helped considerably by providing wind protection during the growing season. In general the trial was successful with several cultivars that performed well, but there were some disease issues in addition to insect pressure on the trial. Cottony leak blight caused by Pythium fungi attacked the crop along with the bacterial pathogen Pseudomonas which caused a soft rot. Although these pathogens did not devastate the trial there were occasional loses due to them.

Actual days to harvest ranged from 67 to 88 days in the trial (Table 1). Artost had the lowest number of days to harvest (67) of all cultivars in the trial and was followed by Charmont, Gallican, and Platinum Dynasty which recorded 70 days and Blue Vantage a known standard with 73 days from transplanting to harvest. Other cultivars recorded from 77 (Pennant) to 88 days to harvest.

Green Types generally had higher numbers of heads per acre (9,397 average) compared to the Reds (8,059 average) and the Savoys (8,954 average). The Green cabbages varied significantly for number of marketable heads of cabbage (Table 1). Artost had the highest number of heads with 10,527 followed by Platinum Dynasty and Capture, both with 9,801 heads of cabbage per acre. Red cabbage varied significantly in number of marketable heads per acre with Kosaro YR and Red Jewel both having 9,801 heads per acre the highest number recorded for this group. The number of marketable heads of cabbage did not vary for savoy types with both Clarissa and Melissa recording 9,438 heads and Savoy Ace producing 7,986 heads per acre.

Overall yield per acre varied significantly for Green and Red groups, but not for the Savoy types (Table 1). Generally between groups there was a wide range in yield with averages for the Green, Red, and Savoy types being 28,040, 14,201, and 18,041 lbs. per acre, respectively. Significant differences were observed in the Green types, the four highest yielding cultivars were Artost, Capture, Escazu, and Gallican with yields of 34,086, 31,545, 30,782, and 30,274 lbs. per

acre, respectively. Average yields for Red types varied significantly ranging from 8,240 to 18,695 lbs. per acre for Ruby Perfection and Kosaro YR, respectively. Savoy cabbages in the trial had average yields that were 15,573, 18,223, and 20,328 lbs. per acre, respectively, for cultivars Clarissa, Savoy Ace, and Melissa.

Average weight per head varied significantly within the different types and ranged from a high of 3.4 to a low of 1.4 lbs. per head (Table 1). Average weight per head varied significantly for the Green types with Escazu having the largest at 3.4 lbs. per head for that type. Head weight varied significantly for Red types and ranged from a high of 2.0 and 1.9 lbs. per head for Cairo and Kosaro YR, respectively to a low of 1.4 for Ruby Perfection. Savoy types varied significantly for average head weight with Clarissa, Melissa, and Savoy Ace having head weights of 1.6, 2.2, and 2.3 lbs. per head, respectively.

Quality Results: Data that was collected related to quality included compactness, internal core length in heads, height and diameter of heads, and a sweetness rating based on tasting each cultivar.

Compactness was rated on a 1 to 5 scale with 1 representing a loose and puffy head and 5 heads that were solid and compact (Table 1). Compactness varied from 2.3 for Blue Vantage to a high of 4.2 for Escazu. Top rated Green types were Escazu, Artost, and Bronco which had ratings of 4.2, 4.0, and 3.9, respectively. Several Red types had compactness ratings of 4.0 and above. Cairo, Kosaro YR, Red Jewel, and Ruby Perfection had ratings of 4.2, 5.0, 4.4, and 4.2, respectively. Savoy types in general were less compact with ratings of 3.1, 2.4, and 2.6 for Clarissa, Melissa, and Savoy Ace, respectively.

Core length was measured in inches and shorter core lengths are considered desirable. Core length varied considerably with the shortest core length being 2.2 inches for Savoy Ace (Table 2). Green type core lengths varied significantly and the three shortest core lengths were 2.7 inches for both Blue Vantage and Pennant and 2.6 inches for Capture. Red types varied with the three shortest being for Cairo, Kosaro YR, and Red Jewel which recorded core lengths of 2.6, 2.6, and 2.8 inches, respectively. Core lengths for Savoy types did not vary significantly and ranged from 2.2 to 2.6 inches.

Head heights were measured in inches and were measured from the top of the head to the base of the trimmed butt. Heights for Green types ranged from 9.3 to 10.8 inches (Table 2). Artost and Gallican (10.8 and 10.5 inches) were significantly higher than Charmont which was 9.3 inches in height. Red cabbage types did not vary significantly in height, but ranged from 7.7 to 8.6 inches. Savoy types varied significantly in head height with Clarissa, Melissa, and Savoy Ace recording heights of 9.2, 10.0, and 10.5 inches, respectively.

Head diameter was measured in inches from side to side on cut cabbage at the widest point of measured heads. Overall head diameter ranged from 4.5 to 7.0 inches for all cabbage types and each of the three types had significant differences for head diameter between cultivars in their groups (Table 2). Green type cultivars ranged from 5.7 to 7.0 inches in diameter. Artost, Capture, and Pennant recorded head diameters o 6.9, 7.0, and 6.5 inches, respectively. Capture having the largest head diameter was more globe shaped than other cultivars in the trial. Red cabbages ranged from a low of 4.5 to 5.4 inches in diameter. Cairo, Kosaro YR, Red Dynasty, Red Jewel, and Ruby Perfection had head diameters of 5.4, 5.0, 5.1, 5.0, and 4.5 inches, respectively. Savoy cultivars had head diameters of 5.9, 6.4, and 6.1 inches, respectively, for Clarissa, Melissa, and Savoy Ace.

Sweetness ratings were based upon a 1 to 5 scale with 1 representing bitter taste and 5 representing very sweet. Each plot was rated for sweetness by taking a taste sample from three representative heads and individually rating each of the three samples. Although these were subjective ratings researchers were able to ascertain differences between different samples based upon bitterness and sweetness. In general, early harvested cultivars tended to have higher levels of sweetness than later harvested cultivars. Green cultivars ranged in sweetness from a low of 2.2 to a high of 5.0 (Table 2). Artost and Escazu were significantly sweeter than other green cultivars in the trial with ratings of 5.0 and 4.1 on the 1 to 5 scale. Although Escazu was one of the later maturing cultivars (83 days to harvest) remarkably it was second for sweetness and for yield (31,545 lbs. per acre) for the entire trial. Red cabbages ranged in sweetness ratings from a low of 1.7 to 2.9. These cultivars varied significantly for sweetness with Red Dynasty and Red Jewel having the highest ratings recorded (2.8 and 2.9, respectively). Savoy types also varied significantly with Melissa being the sweetest at 3.4 and both Clarissa and Savoy Ace having ratings of 2.9 and 3.0, respectively.

Conclusions: Seed company comments about each cultivar are summarized in Table 3. In general there were several Green cabbage cultivars that yielded well and also were sweeter on the average than either the Savoy or Red cabbages in the trial. The highest yielding cabbage Artost was also the earliest (67 days) and the sweetest (5.0 sweetness rating). Although the Red cultivars tended to be lower yielding and smaller in size many consumers appreciate the color that these cultivars bring to prepared dishes and are interested in purchasing them. Of the Reds both Red Dynasty and Red Jewel had acceptable sweetness ratings (2.8 and 2.9, respectively) and of the two, Red Jewel reported higher yields. Regarding sweetness ratings, the researchers couldn't get enough of the two cultivars with sweetness ratings above 4.0 (Artost and Escazu). In conclusion, the authors want to caution farmers that these results are only from one season and further on-farm trialing would be advisable for cabbage growers prior to settling on cultivars to use in their operations.

Acknowledgements: The authors wish to thank personnel from the Cimarron Valley Research Station for their help and assistance in completing this trial and also wish to thank seed companies for supplying seed for this trial.

Table 1. 2017 Spring Cabbage Variety Trial, Marketable Yield data Perkins, OK.

			Marketable Yield[z]			
Cultivar	**Seed Source**	**Days to Harvest**	**Count (no./acre)**	**Yield (lbs./acre)**	**Avg. wt./head (lbs.)**	**Compact -ness[x]**
Green Types						
Artost	Seedway/Bejo	67	10,527 Ay	34,086 a	3.3 ab	4.0 ab
Blue Vantage	Twilley	73	7,623 b	20,401 b	2.7 bc	2.3 c
Bronco	Seedway/Bejo	75	9,438 ab	28,496 ab	3.0 ab	3.9 ab
Capture	Seedway/Bejo	83	9,801 a	30,782 a	3.2 ab	2.5 c
Charmant	Sakata	70	9,438 ab	21,526 b	2.3 c	3.7 ab
Escazu	Syngenta	83	9,438 ab	31,545 a	3.4 a	4.2 a
Gallican	Syngenta	70	9,438 ab	30,274 a	3.2 ab	2.6 c
Pennant	Syngenta	77	9,075 ab	28,423 ab	3.1 ab	2.6 c
Platinum Dynasty	Hummert	70	9,801 a	26,898 ab	2.7 abc	3.6 b
Red Types						
Cairo	Seedway/Bejo	83	7,623 ab	15,173 ab	2.0 a	4.2 b
Kosaro YR	Seedway/Bejo	73	9,801 a	18,695 a	1.9 a	5.0 a
Red Dynasty	Hummert/Twilley	77	7,623 ab	11,616 bc	1.5 b	2.6 c
Red Jewel	Twilley	80	9,801 a	17,279 ab	1.8 ab	4.4 b
Ruby Perfection	Twilley	88	5,445 b	8,240 c	1.4 b	4.2 b
Savoy Types						
Clarissa	Seedway/Bejo	88	9,438 a	15,573 a	1.6 b	3.1 a
Melissa	Twilley	88	9,438 a	20,328 a	2.2 a	2.4 a
Savoy Ace	Twilley	77	7,986 a	18,223 a	2.3 a	2.6 a

[z]Marketable yield: Heads weighing less than 1.5 lbs. each were considered too small to be marketable for green and savoy cabbage, Red cabbage less than 1.0 lbs. were considered too small to be marketable Cull reasons=doubles and too small.

[x]Numbers in a column and type section (Green, Red, Savoy) followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

[x]Compactness Scale is 1=loose and puffy to 5=solid and compact.

Table 2. 2017 Spring Cabbage Variety Trial, Cabbage Quality data, Perkins, OK.

		Head measurements in inches			
Cultivar	**Seed Source**	**Core length[z]**	**Height[y]**	**Diameter[x]**	**Sweetness[w]**
		Green Types			
Artost	Seedway/Bejo	3.2 ab[v]	10.8 a	6.9 ab	5.0 a
Blue Vantage	Twilley	2.7 cd	9.9 ab	6.3 cd	2.5 d
Bronco	Seedway/Bejo	3.5 a	10.0 ab	6.1 cd	3.5 c
Capture	Seedway/Bejo	2.6 d	10.2 ab	7.0 a	3.4 c
Charmant	Sakata	2.9 bcd	9.3 b	5.7 d	3.0 c
Escazu	Syngenta	2.8 bcd	10.3 ab	6.3 bc	4.1 b
Gallican	Syngenta	3.1 abc	10.5 a	6.5 abc	2.1 d
Pennant	Syngenta	2.7 bcd	10.0 ab	6.3 bc	3.5 c
Platinum Dynasty	Hummert	2.8 bcd	10.2 ab	6.2 cd	2.2 d
		Red Types			
Cairo	Seedway/Bejo	2.6 b	8.6 a	5.4 a	1.7 b
Kosaro YR	Seedway/Bejo	2.6 b	8.2 a	5.0 ab	2.1 ab
Red Dynasty	Hummert/Twilley	2.9 b	8.4 a	5.1 a	2.8 a
Red Jewel	Twilley	2.8 b	7.9 a	5.0 ab	2.9 a
Ruby Perfection	Twilley	3.2 a	7.7 a	4.5 b	2.0 ab
		Savoy Types			
Clarissa	Seedway/Bejo	2.6 a	9.2 b	5.9 b	2.9 b
Melissa	Twilley	2.3 a	10.0 ab	6.4 a	3.4 a
Savoy Ace	Twilley	2.2 a	10.5 a	6.1 ab	3.0 b

z Core length=measurement from center cut, length of growing point (core)
y Height is measured from top of head (outer wrapper leaves removed) to base of trimmed butt.
x Diameter distance across a cut cabbage side to side.
w Sweetness rating scale 1-5, 5=very sweet, 1=bitter, poor flavor.
vNumbers in a column and type section (Green, Red, Savoy) followed by the same letter exhibited no significant differences based on Duncan's Multiple Range Test where P=0.05.

Table 3. Seed company notes for 2017 Cabbage Variety Trial, Perkins, OK

Variety	Company	type	Days to harvest	Descriptions from Seed Companies
Artost	Seedway/bejo	green	68	Uniform with excellent density and holding ability. Good yields; cut early for a boxed cabbage or later for slaw. Adapted to most growing regions of the US and Canada. Replaces Morris.
Blue Vantage	Twilley	green	72	Mid-season maturity with large, dense heads which are short cored. 3.5 - 4 lbs. Fusarium yellows race 1 resistant and tip-burn tolerant. Ideal for fresh and coleslaw markets In Texas, it is a standard variety for long-distance shipping.
Bronco	Seedway/bejo	green	80	Very fancy, heads protected by waxy leaves. Nice sweet flavor. Excellent yields, shipping quality, and disease resistance. Heads stay small enough for boxing.
Capture	Seedway/bejo	green	85	An excellent choice if you need large, flavorful heads for slaw. When grown at high density, attractive heads for fresh market boxing. Very strong black rot resistance and widely-adapted, including the South.
Charmant	Sakata	green	65	Uniform, solid, medium-sized round heads 2.5 - 3 lbs. with blue-green color, a tight internal structure and a short core. Has holding ability in early-market. Resistant to Fusarium yellows race 1 Fresh mkt, for processing and shipping
Escazu	Syngenta	green	98	Yield and high quality heads. Beautiful blue-green leaves wrap around 3-5 lb., 7-8" round heads.
Gallican	Syngenta	green	73	Early maturing, uniform plants with tolerance to environmental stresses. High yields, good field holding ability. Medium frame plant produces 6.5" round heads with green wrappers.
Pennant	Syngenta	green	88	Noted for its wide adaption, holding ability helps maximize its potential. Heads boast excellent interior quality, sweet flavor and tolerance to tip burn. Medium frame plant produces large 8" heads with blue-green wrappers.
Platinum Dynasty	Hummert	green	70	A new CMS hybrid with outstanding uniformity and excellent tolerances to Yellows, Black Rot and Tip Burn. Round 3-6 lb. heads are blue green in color and minimum wrapper leaves. Fresh market or processing
Cairo	Seedway/bejo	Red	85	Very uniform, dense red for summer, and fall production. Darkest, roundest fresh market red cabbage available. Great yields

Variety	Company	type	Days to harvest	Descriptions from Seed Companies
Kosaro YR	Seedway/bejo	Red	74	Improved early red variety making a large round head, early. The color is excellent, inside and out. The plant is compact but provides sufficient wrap leaves.
Red Dynasty	Hummert&Twilley	Red	80	Extra-large round headed 7-12 lbs. Wrappers and interior leaves are red. Main-season holds well in field and storage. Fresh market processing
Red Jewel	Twilley	Red	75	This variety is a high-yielding red cabbage hybrid with uniform maturity. Short core, 6" across weighing about 3 lbs. Ideal for both fresh and shredder markets.
Ruby Perfection	Twilley	Red	80	Deepest red color. Oval, large 3-4 lbs. Vigorous, uniform plants. Excellent interiors
Clarissa	Seedway/bejo	Savoy	78	Early, compact, dense internal structure, short core, with a dark-green, heavily savoyed leaf. Ideal for close spacing and tolerates heat.
Melissa	Twilley	Savoy	80	Dark-green solid heads with nice wrappers. Main season 6-7" diam. Average 2.5 lbs. Rich sweet savoy flavor, excellent for slaw or mixed salad.
Savoy Ace	Twilley	Savoy	78	Deep green color, uniform, rounded, averaging 3.5 lbs. Excellent interiors, adapted to all areas

Figure 1. 2017 Cabbage trial photos of cultivars

Artost	Charmant
	
Blue Vantage	**Escazu**
	
Bronco	**Gallican**
	

Capture	Pennant
	
Cairo	Platinum Dynasty
	
Kosaro YR	Red Jewel
	

Red Dynasty	Ruby Perfection
	
Clarissa	Melissa
	
Savoy Ace	
	

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Cowpea Variety Trial

Cimarron Valley Research Station
Perkins, OK
In conjunction with University of Arkansas Cowpea Breeding Program
Lynn Brandenberger, Lynda Carrier, Joshua Massey
Oklahoma State University

Introduction: Cowpea is a well-adapted summer crop for the southern U.S. It is naturally drought and heat tolerant which makes for a great summer legume crop both for fresh and processing markets. Another aspect of cowpea is the amount of nutrition that this crop can provide. Cowpeas have high levels of complex carbohydrates, protein, and several compounds such as folate which is critical for the development of healthy babies during pregnancy. The objective of this study was to provide Oklahoma producers with information on crop maturity and yield potential of advanced breeding lines and cultivars from the University of Arkansas breeding program.

Methods and Materials: The trial included 3 replications of 15 entries in a randomized block design. Plots received preplant nitrogen fertilizer on 6/19/17 with 50lbs. N/acre using urea (46-0-0) broadcast over the site just prior to finish tillage. Plots consisted of two rows 20 feet long with 36 inches between rows. Seed were spaced 5 seeds per foot and were direct seeded on 6/19/17 utilizing a research plot planter. Immediately following planting all plots received a preemergence application of Dual Magnum at 1.0 lb. ai/acre tank-mixed with Pursuit at 0.063 lb. ai/acre followed by an overhead irrigation of approximately 0.5 inches for herbicide incorporation. Supplemental water was supplied from drip-irrigation utilizing one drip-line per row. Notes were recorded mid-July for flower color, percent fruit set, and plant growth habit. Observations were made of one replication of the trial in late July for bloom color, percent fruit set, and growth habit. Plots were evaluated for percent flowering and percent dry pods on 8/2/17. Pre-harvest defoliation of the trial was done with an application of Gramoxone at a rate of 2 pints/acre on 9/5/17 followed by harvest with a plot combine on 9/8/17. Data collected at harvest included percent moisture of the harvested cowpeas and yield.

Results: Bloom color observations were made primarily for use in identifying cultivars and breeding lines for future work (Table 1). Percent pod set ranged from zero to 98%. Cultivars/lines that had 95% or higher pod set in late July included 16-167, Early Scarlet, 09-393, and 16-182. Cultivars/lines that had less than 10% pod set included Ebony, Early Acre, and 09-741. Plant growth habits ranged from fully determinant to a range of determinant-indeterminant (indeterminant=viney growth habit). Ebony and Early Acre had indications of being viney in their growth habits while 16-167 was primarily determinant with some tendency toward a viney growth habit.

Flowering ratings were recorded on 8/2/17 and were estimates of how complete flowering was for each cultivar/line at that point in time. Ratings used a 0 to 100% scale where 0 would indicate no flowering observed and 100% would indicate that flowering was complete. Flowering ranged from lows of 2 and 5% for Ebony and 09-741, respectively to highs of 78 and 88% for 16-182 and Early Scarlet, respectively (Table 2). Differences in flowering were significant with the highest flowering being recorded for Early Scarlet, 16-182, 09-393, 16-167, and AR BE # 1 at 88, 78, 73, 62, and 60%, respectively.

The percentage of mature dry pods was also recorded on 8/2/17. This rating provided an indicator of how mature set pods were with 0 indicating only recently set green pods and 100% indicating all set pods were close to being dry enough for harvest. Percent dry pods ranged from a low of 5% for Ebony to a high of 92% for 07-303 (Table 2). Several lines ranged from 17 to 50% dry pods. There were seven cultivar/lines that had higher percentages of dry pods, these included 16-167, AR-09-692, Early Scarlet, Excel, 09-393, 07-303, and 16-182 that recorded 68, 65, 65, 93, 70, 72, 92, and 77 %dry pods, respectively.

All plots were machine harvested on 9/8/17 using a plot combine. Seed moisture at harvest was recorded along with plot yield, lower seed moisture being an indicator of crop maturity. Seed moisture was highest for Ebony, Empire, and 09-393 which recorded 14.3, 12.1, and 12.3% moisture, respectively (Table 2). Seed moisture was lowest for 07-303, Early Acre, and 01-1781 at 8.2, 9.5, and 9.8, respectively.

Yields in pounds of seed per acre were recorded for the 9/8/17 harvest. The highest yielding cultivar/lines were 09-741, Ebony, 01-1781, and Empire which recorded yields of 1,139, 955, 935, and 929 lbs. per acre, respectively (Table 2). There were also several other cultivar/lines that although they had lower yields than the above mentioned cultivar/lines did not differ statistically in yield from them, these included AR-ES-01, AR-09-692, Early Scarlet, and Excel.

Conclusions: There are several cultivar/lines of cowpea in the trial that have potential for commercial production in Oklahoma. Seed types in the trial ranged widely from cream types (no eye) to red and black seed coats, blackeye, pinkeye, and what we called red Holsteins and a black calico (Figure 1.). Some cultivar/lines were early maturing while others required a longer season to fully mature. Several yielded well with high yielders ranging from 900 lbs. per acre and higher. The authors would encourage farmers to keep an eye out for newly released cultivars from the list of numbered advanced breeding lines and to carry out their own on-farm trials with the established cultivars that were in the trial.

Acknowledgements: The authors want to thank our collaborators Steve Eaton and Dennis Motes at the University of Arkansas for their advice and for providing seed for the completion of this trial.

Table 1. 2017 Cowpea Variety Trial, Perkins, OK, Late July observations on flower color, % fruit set, and growth habit.

Variety	Seed type	Bloom color	% Pod set	Growth habit[z]
Ebony	Black	Purple	0	D to I
16-167	Black Calico	White	98	D+
AR BE #1	Blackeye	White	85	D
09-671	Blackeye	White	50	D
Early Acre	Cream	White	2	D to I
01-1781	Cream	White	20	D
AR-ES-01	Cream Crowder	White	15	D
AR-09-692	Pinkeye	White	35	D
Early Scarlet	Pinkeye	White	95	D
Empire	Pinkeye	White	15	D
Excel	Pinkeye	White	70	D
09-393	Pinkeye	White	95	D
07-303	Red	Purple	30	D
09-741	Red Holstein	White	5	D
16-182	Red Holstein	White	95	D

Growth habit[z] D=determinant, D+=Primarily determinant with some tendency toward viney growth, I=indeterminant, D to I=Not really determinant, but somewhere between.

Table 2. 2017 Cowpea Variety Trial, Perkins, OK, Flowering and harvest data results.

Variety	Seed type	% Flowering 8/2/17	% Dry Pods 8/2/17	Seed moisture at Harvest (%) 9/8/17	shelled yield (lbs./acre)[y] 9/8/17
Ebony	Black	2 f[z]	5 d	14.3 a	955 ab
16-167	Black Calico	62 abc	68 ab	10.1 bcde	541 b
AR BE #1	Blackeye	60 abcd	45 bc	10.8 bcd	617 b
09-671	Blackeye	43 cde	50 bc	10.6 bcde	455 b
Early Acre	Cream	12 f	22 cd	9.5 de	623 b
01-1781	Cream	20 ef	28 cd	9.8 cde	935 ab
AR-ES-01	Cream Crowder	17 ef	18 cd	10.0 bcde	762 ab
AR-09-692	Pinkeye	30 def	65 ab	11.8 bcd	815 ab
Early Scarlet	Pinkeye	88 a	93 a	11.5 bcd	826 ab
Empire	Pinkeye	17 ef	17 cd	12.1 abc	929 ab
Excel	Pinkeye	47 cde	70 ab	10.9 bcd	801 ab
09-393	Pinkeye	73 abc	72 ab	12.3 ab	507 b
07-303	Red	55 bcd	92 a	8.2 e	599 b
09-741	Red Holstein	5 f	22 cd	10.4 bcde	1139 a
16-182	Red Holstein	78 ab	77 ab	10.4 bcde	451 b

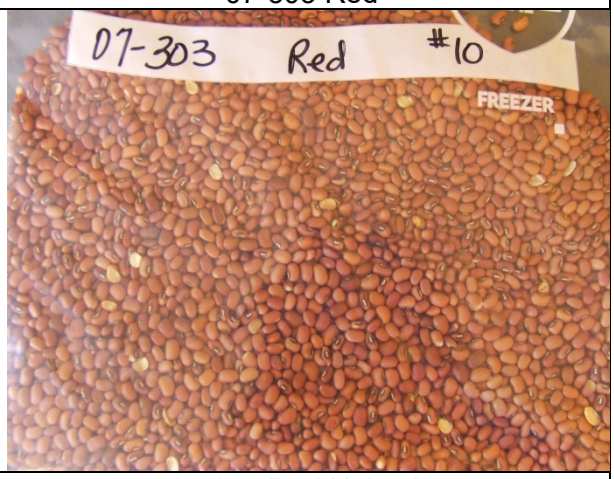
[y] Dry shelled wt.=mechanically harvested on 9/8/17 yield in lbs./acre.

[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.

Figure 1. 2017 Cowpea trial, Shelled peas photos

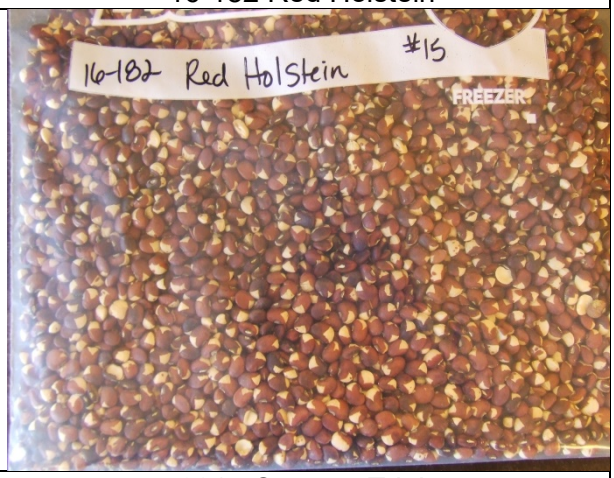
09-741 Red Holstein

07-303 Red

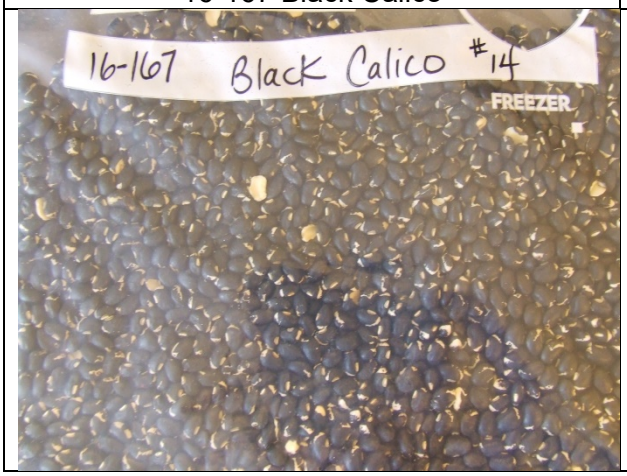


Ebony

16-182 Red Holstein



16-167 Black Calico



2017 Cowpea Trial

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Irrigation Requirements of Indigenous Legume Crops

Cimarron Valley Research Station
Perkins, OK
Joshua Ringer, Lynda Carrier, Lynn Brandenberger, Justin Moss, & Jim Shrefler
Oklahoma State University

Introduction: Small holder producers in both disadvantaged and Native American communities strive to produce marketable legumes that receive higher economic value. There is great demand from schools, smaller grocery chains, local food focused restaurants, and Native American nations to buy locally produced food. These entities require a consistent high quality product in order for them to buy from small holder producers. Small holder producers need to know how to grow and produce traditional heirloom varieties of legumes from Native American communities to have higher value products to sell to these consumers. This project is a continuation of a three year study. This is the second year and will focus on using two varieties of legumes supplied from Sovereign Tribal Nations that are based in Oklahoma. The purpose of this study is to understand the response of different traditional heirloom legumes to four different moisture regimes to provide information for Native American producers to plan for irrigation systems to support market gardening production.

During year 2 (2017) adjustments were made to the research design to further fine tune the research. The main lessons learned from year 1 was the confirmation of the two types of beans with the cowpea varieties (Battered Buffalo Skull peas; Pottawatomie Pea) growing best in summer and the Hidatsa Indian Red Bush Bean growing best in the cooler early spring season and early fall season. The study was narrowed to only two varieties; Pottawatomie Pea and Battered Buffalo Skull Peas – Vigna species with one additional irrigation moisture regime (emergence only). Year 2 plot design consisted of two varieties X four treatments X three repetitions.

Varieties

- Pottawatomie Pea – Vigna species
- Battered Buffalo Skull Peas (BBS) - Vigna u. species

The four treatments for Year 2 were

- T0 as a control with no irrigation
- T1 as critical point or mid-point irrigation
- T2 as full irrigation
- T3 as emergence only irrigation

Field Preparation

The soil was tilled in order to have a clean planting area free of debris and weeds. A pre-emergence herbicide (Dual Magnum at 0.95 lbs. A.I.) was applied for weed control using a back-pack sprayer. Once the decision was made to replant another application of Herbicide Dual Magnum 0.95 lbs. ai/acre using a back pack sprayer was applied. All subsequent weeding was manually done using a Rogue Hoe™ Scuffle Hoe which is commonly used by market gardeners. The weeding required was minimal throughout the growing season.

Planting

Initial planting was on May 16, 2017. Soil temperatures were at 70^{o} Fahrenheit which is the borderline for cowpea planting. Cowpea's prefer 70^{o} F and warmer for germination. Emergence was extremely poor. Subsequent germination rates showed very low viability for the Battered

Buffalo Skull peas and only a little better germination rates for Pottawatomie Peas. Because of this the plots were replanted on June 19, 2017. In both cases the plots were planted with a tractor driven plot planter.

Irrigation Set up
The irrigation system was built using drip irrigation to provide different irrigation treatments. The system consisted of the T1 irrigation line and a T2 irrigation line. The T3 irrigation line was run off of the T2 irrigation line and then disconnected after emergence. Each line was supplied with irrigation water from the Research Station water source. The source line was connected to an Orbit™ battery operated digital irrigation timer which provided water at the required intervals. A Dywer™ WM2-A-C-03 analog water meter allowed for accurate measurement of the irrigation water flow throughout the study. During times of heavy rainfall the irrigation timers were delayed.

Harvesting
Due to the constraints on labor that would be required with hand harvesting a plot combine/thresher was used to harvest the plots. Four days prior to harvest a chemical desiccant was applied to the plots to allow for ease of harvest. In addition, the cover crop between rows was mechanically mowed with a tractor powered brush mower to prevent any impediment to machine harvesting. The harvest was conducted on September 29, 2017.

Processing
After machine processing the beans were cleaned by hand to remove any small particles of shells that remained.

Data Collection
Data collection consisted of weekly gathering of irrigation application amounts and plant development. Harvesting data consisted of shelled bean and pea weight.

- Completed second growing season (2nd year) for the irrigation study
- Tracked irrigation amounts and Rainfall
- Noted first flowering, pod set, and harvest dates.
- Shelled Harvest weight amounts were weighed and recorded.

Table 1. 2017 ODAFF Native American traditional legumes study, Perkins, OK

	Pottawatomie Pea		Battered Buffalo Skull Pea	
Water treatment	**Weight shelled lbs./acre**	**% Moisture shelled peas**	**Weight shelled lbs./acre**	**% Moisture shelled peas**
No irrigation	1031 a[z]	7.9 a	978 a	8.6 a
Critical point irrigation	905 a	5.7 a	1321 a	8.3 a
Full irrigation	1360 a	12.3 a	1704 a	9.3 a
Emergence only	1389 a	11.6 a	1147 a	8.7 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.

Table 2. 2017 ODAFF Native American traditional legumes study, Perkins, OK

Water treatment	**Irrigation (in)**	**Rainfall (in)**	**Total water usage (irrigation + rainfall)**
No irrigation	0	13.33	13.33
Critical point irrigation	6.72	13.33	20.05
Full irrigation	9.22	13.33	22.55
Emergence only	1.20	13.33	14.53

Results:

Overall yields for Pottawatomie Pea did not vary significantly, but ranged from a low of 905 lbs/acre for the critical point irrigation treatment to a high of 1,389 lbs/acre for emergence only irrigation. Overall yield of Battered Buffalo Skull peas ranged from a low of 978 lbs/acre for the no irrigation treatment to 1,321 and 1,704 lbs/acre for the critical point and full irrigation treatments, respectfully. This means that a significant increase in yield should not be expected if drip irrigation was provided to these species. This was true for year one and year two.

Problems and Delays:
Poor germination of the seeds due to delayed processing of beans required a replanting of the second season trials but that delay was remedied by a replanting. Besides this delay there have not been additional unexpected delays, impediments, or challenges that have prevented the project moving forward. There have been some challenges that the research team is working on as the project moving forward. Native American seed savers and small scale producers have concerns about use of inorganic chemical use. There are two trains of thought for Native American preferences for production that the researchers have encountered in the State. One group prefers organic production practices and specifically prefers not to use inorganic herbicides and pesticides. The other group is open to an integrated pest management approach (IPM) which encourages wise use of pesticides.

Acknowledgements: The Oklahoma Department of Agriculture, Food, & Forestry (ODAFF) provided funding for this study. The authors also want to thank Cimarron Valley Research Station Manager Josh Massey, and private collaborators for support, maintenance, and care of this trial. Special acknowledgement is given to Lynda Carrier for assisting with this study throughout 2017.

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Pumpkin Variety Trial

Cimarron Valley Research Station
Perkins, OK
Lynn Brandenberger, Lynda Carrier, Joshua Massey
Oklahoma State University

Introduction: Pumpkins are an important cash crop for vegetable producers within the state. Many cultivars of pumpkin contain high levels of beta carotene and other important nutrients for those that consume them. That said a major market for pumpkins within the U.S. is the fall holiday market which includes pumpkins for decorating and making Jack O' Lanterns. With this in mind a pumpkin trial was planned and carried out with the objective of trialing several types of pumpkin to determine their performance under Oklahoma growing conditions.

Methods and Materials: Trial plots were established by direct seeding using a tractor mounted research planter on 6/13/17 in strip-tilled rows for the 28 cultivars (Table 1) in the trial (22 replicated 3 times and six as single plot observational cultivars). Planting was on non-bedded bare soil with 10ft. row centers and finished seed spacing of approximately one seed per foot in the 30ft. long plots (30 seeds/plot). Strips of winter cover crops were left between every two rows as a wind-break and some were utilized for spray alleys. All plots received a mix of preemergence herbicide that included Sandea (halosulfuron) at 0.024 lbs. active ingredient (ai/acre) per acre, Command 3ME (clomazone) at 0.15 lbs. ai/acre, and Curbit (ethalfluralin) at 0.56 lbs. ai/acre on 6/13/17. Herbicides were incorporated from a rain-shower of approximately 0.7 inch within 24 to 36 hours. Plots received approximately 90 lbs. of actual nitrogen per acre from urea (46-0-0) applied through the drip irrigation system. Plots were scouted for pest problems weekly and insect control was initiated on 7/21/17 primarily control of squash bug, disease control began on 7/28/17 for control of powdery mildew and other pathogens. Crop water needs were met using regular scheduled irrigations from the drip irrigation system. The trial utilized a randomized block design with all replicated cultivars having three replications and the specialty cultivars were treated as a single plot observational trial.

Results: Disease ratings were recorded on 9/1/17 due to the presence of crop disease symptoms, the rating scale used was a 1 to 5 scale where 1 represented the highest level of disease symptoms and 5 represented no symptoms. Symptoms included some wilting and eventual death of infected plants. A plant sample was examined by the Plant Disease and Insect Diagnostic Laboratory (PDIDL) at Oklahoma State University. The pathogen was confirmed as Cucurbit Yellow Vine Disease (CYVD) caused by the bacterial pathogen *Serratia marcescens*. In the medium sized Jack O' Lantern group, Mvskoke (Creek/Seminole) Pumpkin exhibited the highest level of tolerance to CYVD with a rating of 3.5 (Table 2). Other cultivars in this group ranged from a high of 2.8 (Camaro PMR and Captain Jack) to lows of 1.5, 1.6, and 1.7 for Howden, Rival PMR, and Mr. Wrinkles, respectively. In the small sized Jack O' Lantern group White Flat Boer Ford and Valenciano recorded the highest tolerance to CYVD with ratings of 3.2 and 3.0, respectively, compared to other cultivars that ranged from 1.7 to 2.3. Within the Pie Pumpkins no differences were recorded for disease tolerance, but ratings were 1.5, 1.5, 2.3, and 2.5 for Winter Luxury, Early Abundance, Baby Wrinkles, and Hijinks, respectively. Disease ratings for pumpkins in the specialty observational plots ranged from a low of 1.7 to 3.7. Speckled Hound and Blaze had the highest levels of disease tolerance with ratings of 3.7 and 3.6 (Table 5).

Yield in pounds per acre varied significantly for each group of pumpkins (Table 2). Generally speaking the medium sized Jack O' Lantern types recorded the highest yields, but within each

group there were differences between cultivars. The medium size Jack O' Lantern group varied from a high of 31,663 lbs. of fruit per acre to a low of 5,764 lbs. per acre. The four highest yielding cultivars in this group were Camaro PMR, Mvskoke (Creek/Seminole), Mustang PMR, and Rival PMR which recorded 31,663, 26,523, 24,505, and 24,064 lbs. of fruit per acre, respectively. Yield for the small sized Jack O' Lantern types was highest for Racer Plus and White Flat Boer Ford which recorded 18,682 and 18,048 lbs. of fruit per acre, respectively. The three highest yielding Pie pumpkins included Darling, Fall Splendor Plus, and Hijinks which had yields of 18,905, 12,090, and 16,393 lbs. per acre, respectively. Other cultivars in this group ranged from a low of 4,695 to a high of 8,930 lbs. per acre. Yield for the specialty pumpkins was reported as number of fruit per plot due to the small number of plots and variance in plot stands (Table 4). Specialty pumpkins ranged from a high of 108 fruit/plot for Blaze to a low of 8 fruit/plot for Kakai.

The number of fruit per acre for the medium size Jack O' Lantern group ranged from 387 fruit per acre for Captain Jack to a high of 3,582 for Camaro PMR (Table 2). The five cultivars that set the highest number of fruit were Camaro PMR, Mvskoke (Creek/Seminole), Mustang PMR, Rival PMR, and Spartan that recorded fruit per acre of 3,582, 2,275, 2,130, 2,565, and 2,178, respectively. Fruit numbers for the small size Jack O' Lantern group ranged from a high of 3,001 for Racer Plus to a low of 871 fruit per acre for Cracker Jack. Moonshine, Racer Plus, Valenciano, and White Flat Boer Ford produced 2,226, 3,001, 1,549, and 2,226 fruit per acre, respectively. The three cultivars of Pie pumpkins that produced the highest number of fruit per acre included Darling, Fall Splendor Plus, and Hijinks which had 4,840, 4,549, and 3,388 fruit per acre, respectively. Specialty pumpkins ranged from a low of 8 fruit per plot to a high of 108 fruit per plot. Blaze, Speckled Hound, and Toad produced the highest number of fruit per plot with 108, 57, and 76 fruit per plot, respectively (Table 4).

Average fruit weights for the medium sized Jack O' Lantern pumpkins ranged from a low of 7.9 to a high of 14.7 lbs. per fruit (Table 2). Captain Jack, Mvskoke (Creek/Seminole), and Mr. Wrinkles had average fruit weights of 14.7, 12.1, and 12.3 lbs. per fruit, respectively, as the largest in this category. Spartan, Rival PMR, Howden, and Camaro PMR had the smallest sized fruit in this category with average fruit weights being 7.9, 9.2, 8.7, and 9.1 lbs., respectively. Fruit weight for the small Jack O' Lantern types ranged from 4.4 to 7.7 lbs. Cracker Jack, Moonshine, Racer Plus, Valenciano, and White Flat Boer Ford had average fruit weights of 6.8, 4.4, 6.4, 5.4, and 7.7 lbs. per fruit, respectively. Pie pumpkins Fall Splendor Plus and Early Abundance had average fruit weights of 2.7 and 2.8 lbs. per fruit. Other pie types had average fruit weights of 4.6, 3.9, 4.9, and 3.7 lbs. per fruit, respectively, for Baby Wrinkles, Darling, Hijinks, and Winter Luxury. Average fruit weights for the three smaller specialty pumpkins were 2.4, 1.2, and 1.7 lbs. per fruit, respectively, for Blaze, Carnival, and Toad (Table 4). The three larger specialty pumpkins included Kakai, Knuckle Head, and Speckled Hound which had fruit weights of 8.4, 7.0, and 3.6 lbs., respectively.

Fruit uniformity ratings were recorded on both harvest dates. Ratings were for fruit size, shape, and color consisted of a rating scale of 1 to 5 with 1=least uniform and 5=most uniform (Tables 3 and 5). In the medium sized Jack O' Lantern category there were no differences observed in uniformity ratings for size (Table 3). Uniformity ratings for size ranged from 1.8 for Diablo to a high of 3.2 for Howden. Differences were observed in size uniformity for small sized Jack O' Lantern pumpkins. Valenciano was the least uniform in size with a rating of 1.8 while Moonshine and Racer Plus were the most uniform in size with ratings of 3.9 and 3.5, respectively. Pie pumpkin size uniformity ratings ranged from 3.0 to 4.7. The three lowest ratings were recorded for Early Abundance, Fall Splendor Plus, and Winter Luxury which had 3.0, 3.0, and 3.8, respectively. More uniform in size were Baby wrinkles, Darling, and Hijinks which recorded 4.2,

4.5, and 4.7, respectively. Specialty pumpkin size uniformity was lowest for Kakai, Knuckle Head and Speckled Hound with ratings that ranged from 2.5 to 3.0 (Table 5). Higher size uniformity was recorded for Blaze, Carnival, and Toad which recorded 5.0 for each cultivar.

Shape uniformity ratings were highest for Camaro PMR (3.7) and Rival PMR (4.0) in the medium sized Jack O' Lantern group (Table 3). The lowest shape uniformity rating in this group was for Mvskoke (Creek/Seminole) which had a rating of 1.8. No differences were recorded for shape uniformity ratings in the small sized Jack O' Lantern group. Within this group ratings ranged from 2.8 to 4.2 for white Flat Boer Ford and Racer Plus, respectively. Shape uniformity differed between cultivars of the Pie group. Early Abundance had the lowest shape uniformity rating with 4.0 while the highest uniformity was recorded for both Baby Wrinkles and Winter Luxury both with ratings of 4.7. In the specialty pumpkins Blaze, Carnival, and Toad all had shape uniformity ratings of 5.0 (Table 5). Lower ratings were recorded for Kakai, Knuckle Head, and Speckled Hound which had shape uniformity ratings of 4.0, 4.0, and 3.0, respectively.

Color uniformity ratings did not vary for cultivars in the medium sized Jack O' Lantern group (Table 3). Ratings ranged from 2.3 for Mvskoke (Creek/Seminole) to a high of 3.3 for Howden. Color uniformity did not vary for small sized Jack O' Lantern pumpkins, but did range from 2.3 for Valenciano to 3.5 for both Moonshine and Racer Plus. Pie pumpkins differed for color uniformity ratings. Ratings ranged from a high of 4.2 for Darling and 4.1 for Hijinks to a low of 3.0 for Early Abundance. Specialty pumpkin color uniformity ratings were 5.0, 4.5, and 4.8, respectively, for Blaze, Carnival, and Toad (Table 5). Lower ratings were recorded for Kakai, Knuckle Head, and Speckled Hound which were 3.5, 3.8, and 3.0, respectively.
Circumferences of the peduncle (stem) of fruit were recorded at harvest for each cultivar. In the medium Jack O' Lantern group peduncle circumference varied from a low of 2.4 inches for Mvskoke (Creek/Seminole) to a high of 7.4 inches for Captain Jack (Table 3). Peduncle circumference was highest for Racer Plus (4.5 inches) and lowest for White Flat Boer Ford (2.6 inches) in the small sized Jack O' Lantern group. Other cultivars in the group ranged from 3.2 to 3.7 inches in circumference. The Pie pumpkin group varied from a low of 3.1 inches for Hijinks and Winter Luxury to a high of 4.6 and 4.5 for Early Abundance and Darling, respectively. Peduncle circumferences were 2.2, 1.2, 3.4, 4.2, 2.7, 2.1 inches for Blaze, Carnival, Kakai, Knuckle Head, Speckled Hound, and Toad, respectively, in the Specialty pumpkin group (Table 5).

Fruit circumference did not vary for cultivars in the medium sized Jack O' Lantern group (Table 3). Cargo recorded the largest fruit circumference of 33.1 inches while Spartan the smallest was 27.9 inches in circumference. For the small sized Jack O' Lantern pumpkins White Flat Boer Ford had the largest circumference at 32.5 inches while the remaining cultivars of this group ranged from 22.7 (Moonshine) to 28 inches for Valenciano. The Pie pumpkin group did record some differences in fruit circumferences, but ranged in size from 18.9 to 25.5 inches in circumference. Baby Wrinkles, Darling, Early Abundance, Fall Splendor Plus, Hijinks, and Winter Luxury had fruit circumferences of 22.4, 18.9, 20.6, 20.8, 25.5, and 21.8 inches, respectively. Fruit circumference for the specialty pumpkins ranged from a low of 14.4 inches for Carnival and Toad to a high of 28.7 and 28.0 for Kakai and Knuckle Head, respectfully (Table 5).

Fruit height was measured and recorded at harvest for each cultivar in the trial. The medium sized Jack O' Lantern group had fruit heights that varied significantly between cultivars (Table 3). Captain Jack recorded the most height at 11.3 inches while Mr. Wrinkles and Mvskoke (Creek/Seminole) had heights of 9.9 and 9.7 inches, respectively. Earlipack and Diablo had the least height with 7.8 and 7.9 inches, respectively. In the small sized Jack O' Lantern group

Cracker Jack had the most height with 7.3 inches. Other cultivars in this group had heights of 5.5, 6.4, 4.9, 4.2 inches, respectively, for Moonshine, Racer Plus, Valenciano, and White Flat Boer Ford. Pie pumpkins had heights that ranged from 4.7 (Early Abundance) to 8.1 inches (Darling). Others within this group were Baby Wrinkles (6.2 inches), Fall Splendor Plus (4.8 inches), Hijinks (6.1 inches), and Winter Luxury (5.4 inches). Fruit height for the specialty pumpkins ranged from 9 inches for Knuckle Head to 3.4 inches for Carnival (Table 5).

Fruit width in the medium sized Jack O' Lantern group did not vary significantly and ranged in width from 7.8 inches for Spartan to 9.4 inches for both Captain Jack and Cargo PMR (Table 3). Small Jack O' Lantern pumpkins ranged in width from 6.8 inches for Moonshine to a high of 10.2 inches for White Flat Boer Ford. The remainder of the Small Jack O' Lantern cultivars ranged between 7.4 (Cracker Jack) to 8.5 inches (Valenciano). The widest Pie pumpkin was Hijinks (7.7 inches) and the least wide was Darling (5.4 inches). Other pumpkins in this group included Baby Wrinkles (6.5 inches), Early Abundance (5.8 inches), Fall Splendor Plus (6.1 inches), and Winter Luxury (6.6 inches). Fruit width for the Specialty pumpkins was 6.6, 4.5, 9.3, 8.1, 7.0, and 4.4 inches, respectfully, for Blaze, Carnival, Kakai, Knuckle Head, Speckled Hound, and Toad.

Conclusions: This year's trial included 22 cultivars from four different seed sources for the replicated trial and six different cultivars for the specialty pumpkin observational trial. Overall most cultivars were hybrids, but we did include a couple of open-pollinated (OP) cultivars in the trials in the medium sized Jack O' Lantern group. Those two cultivars included Howden which is a standard that has been around a long time and the other OP was Mvskoke (Creek/Seminole) which was a Native American Heirloom cultivar. The interesting result was that the Mvskoke (Creek/Seminole) cultivar exhibited some of the highest levels of disease tolerance that we evaluated and it was our second best overall yielding cultivar coming in second in yield to Camaro PMR. Although prized because of its high level of beta carotene this pumpkin performed well in other ways, but there was quite a bit of variability in fruit size and this should be taken into consideration for the seedsman interested in doing on-farm trials. Racer Plus and White Flat Boer Ford yielded well as smaller sized Jack O' Lantern pumpkins, but growers will want to study the results to decide if these might merit consideration for their operations. In the pie pumpkins both Darling and Hijinks yielded well overall with average fruit weights in the 4 to 5 lbs. range. The specialty pumpkins were provided by Johnny's and Sakata seed, but seed were limited and therefore we were only able to plant one plot of each cultivar. Because of this we did have some issues with poor stands from some of these and as a result we didn't analyze data from these plots as there were no replications to compare data from.

Consumer preferences were noted for each of the types included in the trial. Observations indicated that the most popular types included the multi-colored specialty types including: Both Blaze and Carnival were well received as were Kakai, Knuckle-Head and Toad. Speckled hound was the least desired of the specialty pumpkins; most of the speckled hound were pale green in color and had little or no handles (peduncles) as several broke off at harvest. Preferences for the Jack O' Lantern types included those with dark orange color and a round shape as were the white colored pumpkins. Rival PMR and Camaro PMR both had nice color and shape, Captain Jack was taller and had a very large handle which made it more difficult to carry. White Flat Boer Ford was shaped more like a patty pan squash, but was well received as being unusual. Both Moonshine and Valenciano being white pumpkins were popular. The Mvskoke pumpkin was well received due to it being a Native American heirloom, 'peach' color and its diverse shapes. Pie pumpkins with good handles were popular, Fall Splendor Plus and Hijinks both had longer handles and children were able to pick them up easily. The least desired in the pie pumpkins was Darling, as it is much taller than wide and tipped over easily.

Variety trials provide growers with information to help them make the best choices for producing a particular crop on their farm. Every farm is different and often cultivars will have specific areas that they will perform well in and other areas where they do not. Cultivar performance will also vary from year to year due to differences in weather, disease, and insect pressure. The authors want to state that it is an advantage for growers to do some trialing of promising cultivars on their own farm before “betting” the entire year’s crop on a specific cultivar. Last, the authors would encourage the reader to take a look at the photos in Figure 1 that show the mature pumpkin fruit at harvest.

Acknowledgements: The authors wish to thank personnel from the Cimarron Valley Research Station for their help and assistance in completing this trial and also wish to thank seed companies for supplying seed for this trial.

Table 1. 2017 Pumpkin variety trial, Perkins, OK, Variety descriptions from seed companies.

Variety	Seed Source	Hybrid or Open pollinated	Type	Days to maturity	Weight in lbs.	Color
Group 1 Jack O' Lantern medium size						
Camaro PMR	Twilley	Hybrid	Jack O' Lantern	110	20-23	Orange
Captain Jack	Sakata	Hybrid	Jack O' Lantern	110	30	Orange
Cargo PMR	Johnny's	Hybrid	Jack O' Lantern	100	20-25	Orange
Diablo	Sakata	Hybrid	Jack O' Lantern	100	18-22	Orange
Earlipack	Sakata	Hybrid	Jack O' Lantern	95	18-22	Orange
Howden	Twilley	Open pollin.	Jack O' Lantern	115	20-30	Orange
Mvskoke (Creek/Seminole)	Sanmann	Open pollin.	Jack O' Lantern	100	16	Orange
Mr. Wrinkles	Sakata	Hybrid	Jack O' Lantern	100	20-30	Orange
Mustang PMR	Seedway	Hybrid	Jack O' Lantern	100	22	Orange
Rival PMR	Johnny's	Hybrid	Jack O' Lantern	90	15-20	Orange
Spartan	Sakata	Hybrid	Jack O' Lantern	95	20-25	Orange
Group 2 Jack O' Lantern small size						
Cracker Jack	Sakata	Hybrid	Jack O' Lantern	105	12-16	Orange
Moonshine (White)	Johnny's	Hybrid	Jack O' Lantern	110	8-12	White
Racer Plus	Johnny's	Hybrid	Jack O' Lantern	85	12-16	Orange
Valenciano (White)	Johnny's	Hybrid	Jack O' Lantern	110	10-15	White
White Flat Boer Ford	Sakata	Hybrid	Jack O' Lantern	110-120	10-15	White
Group 3 Pie						
Baby Wrinkles	Sakata	Hybrid	Pie	100	6-9	Orange
Darling	Johnny's	Hybrid	Pie	90	6-8	Orange
Early Abundance	Twilley	Hybrid	Pie	90	4-6	Orange
Fall splendor Plus	Sakata	Hybrid	Pie	105	4-6	Orange
Hijinks	Sakata	Hybrid	Pie	100	7-9	Orange
Winter Luxury	Johnny's	Hybrid	Pie	105	6-9	Orange
Specialty types						
Blaze	Johnny's	Hybrid	Specialty	100	3	Bi-color
Carnival	Johnny's	Hybrid	Specialty	95	1.5	Multi-color
Kakai	Johnny's	Hybrid	Specialty	100	5-8	Orange/grn.
Knuckle Head	Johnny's	Hybrid	Specialty	105	12-16	Warty
Speckled Hound	Johnny's	Hybrid	Specialty	100	3-6	Bi-color
Toad	Sakata	Hybrid	Specialty	85	1.5-2.5	Warty

Table 2. 2017 Pumpkin replicated variety trial, Perkins, OK, Harvest data from 9/18/17 and 9/29/17 harvests.

Variety	Seed Source	Disease[y]	Yield (lbs/acre)	Number fruit/acre	Average wt. (lbs.)
Group 1 Jack O' Lantern medium size					
Camaro PMR	Twilley	2.8 ab	31,663 a	3,582 a	9.1 b
Captain Jack	Sakata	2.8 ab	5,764 d	387 d	14.7 a
Cargo PMR	Johnny's	2.1 bcd	13,537 bcd	1,355 bcd	10.0 b
Diablo	Sakata	1.8 bcd	11,572 cd	1,162 cd	10.4 ab
Earlipack	Sakata	2.1 bcd	19,510 abcd	2,033 bc	9.4 b
Howden	Twilley	1.5 d	9,273 d	1,065 cd	8.7 b
Mvskoke (Creek/Seminole)	Sanmann	3.5 a	26,523 ab	2,275 bc	12.1 ab
Mr. Wrinkles	Sakata	1.7 cd	13,678 bcd	1,113 cd	12.3 ab
Mustang PMR	Seedway	2.5 bc	24,505 abc	2,130 bc	11.4 ab
Rival PMR	Johnny's	1.6 cd	24,064 abc	2,565 ab	9.2 b
Spartan	Sakata	2.0 bcd	17,274 bcd	2,178 bc	7.9 b
Group 2 Jack O' Lantern small size					
Cracker Jack	Sakata	2.2 ab	5,818 b	871 b	6.8 ab
Moonshine (White)	Johnny's	2.3 ab	9,065 ab	2,226 ab	4.4 b
Racer Plus	Johnny's	1.7 b	18,682 a	3,001 a	6.4 ab
Valenciano (White)	Johnny's	3.0 a	8,354 ab	1,549 ab	5.4 ab
White Flat Boer Ford (White)	Sakata	3.2 a	18,048 a	2,226 ab	7.7 a
Group 3 Pie					
Baby Wrinkles	Sakata	2.3 a	8,930 cd	1,984 c	4.6 a
Darling	Johnny's	1.9 a	18,905 a	4,840 a	3.9 ab
Early Abundance	Twilley	1.5 a	4,695 d	1,694 c	2.8 b
Fall splendor Plus	Sakata	1.8 a	12,090 bc	4,549 a	2.7 b
Hijinks	Sakata	2.5 a	16,393 ab	3,388 b	4.9 a
Winter Luxury	Johnny's	1.5 a	8,596 cd	2,275 bc	3.7 ab

[y] Disease to vines= 1-5 scale with 5 being no disease, and 1 most disease.

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

Table 3. 2017 Pumpkin replicated variety trial, Perkins, OK, Fruit quality and uniformity characteristics.

	Uniformity ratings[x] (1-5) 5=Best			Circumference[y] (in.)		Fruit Shape (in.)	
Variety	**Size**	**Shape**	**Color**	**Ped.**	**Fruit**	**Height**	**Width**
Group 1 Jack O' Lantern medium size							
Camaro PMR	2.7 a[z]	3.7 a	2.8 a	4.3 bcd	29.1 a	8.0 bc	8.4 a
Captain Jack	2.5 a	3.5 ab	2.8 a	7.4 a	31.8 a	11.3 a	9.4 a
Cargo PMR	2.3 a	2.8 ab	2.5 a	5.5 ab	33.1 a	8.8 bc	9.4 a
Diablo	1.8 a	2.5 ab	2.5 a	4.8 bc	29.0 a	7.9 bc	8.4 a
Earlipack	2.3 a	3.2 ab	3.0 a	3.9 bcd	31.3 a	7.8 c	8.8 a
Howden	3.2 a	3.0 ab	3.3 a	4.5 bc	29.3 a	8.3 bc	8.3 a
Mvskoke (Creek/Seminole)	2.0 a	1.8 b	2.3 a	2.4 d	32.2 a	9.7 abc	9.3 a
Mr. Wrinkles	2.8 a	3.0 ab	2.8 a	3.3 cd	29.8 a	9.9 ab	8.6 a
Mustang PMR	2.5 a	2.3 ab	2.8 a	4.8 bc	31.3 a	9.3 abc	8.9 a
Rival PMR	3.0 a	4.0 a	3.2 a	4.8 bc	30.0 a	8.1 bc	9.1 a
Spartan	2.5 a	3.5 ab	2.5 a	4.1 bcd	27.9 a	8.3 bc	7.8 a
Group 2 Jack O' Lantern small size							
Cracker Jack	2.8 ab	3.5 a	3.3 a	3.7 b	25.8 b	7.3 a	7.4 b
Moonshine (White)	3.9 a	3.8 a	3.5 a	3.5 bc	22.7 b	5.5 bc	6.8 b
Racer Plus	3.5 a	4.2 a	3.5 a	4.5 a	27.4 ab	6.4 b	8.3 ab
Valenciano (White)	1.8 b	3.3 a	2.3 a	3.2 bc	28.0 ab	4.9 cd	8.5 ab
White Flat Boer Ford (White)	2.3 b	2.8 a	3.0 a	2.6 c	32.5 a	4.2 d	10.2 a
Group 3 Pie							
Baby Wrinkles	4.2 ab	4.7 a	3.8 ab	4.3 ab	22.4 b	6.2 b	6.5 b
Darling	4.5 ab	4.3 ab	4.2 a	4.5 ab	18.9 c	8.1 a	5.4 c
Early Abundance	3.0 c	4.0 b	3.0 b	4.6 a	20.6 bc	4.7 c	5.8 bc
Fall splendor Plus	3.0 c	4.3 ab	3.3 ab	4.0 b	20.8 bc	4.8 c	6.1 bc
Hijinks	4.7 a	4.3 ab	4.1 ab	3.1 c	25.5 a	6.1 b	7.7 a
Winter Luxury	3.8 b	4.7 a	3.2 ab	3.1 c	21.8 b	5.4 c	6.6 b

[x] Uniformity ratings= 1-5 scale, 1=least, 5=most uniform in size, shape, and color within a cultivar

[y] Circumference and fruit shape measurements taken on three fruit per plot that were closest to the average weight per fruit for that plot. Ped=peduncle or stem.

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

Table 4. 2017 Specialty Pumpkin Demonstration varieties, Perkins, OK Harvested on 9/11/17 and 9/29/17.

Variety	Seed Source	Number seeds planted[z]	Number Plants	% Germ.	Yield Number fruit	Avg. wt. (lbs.)	Average Number fruit/plant
Specialty Pumpkins							
Blaze	Johnny's	34	27	79	108	2.4	4.0
Carnival	Johnny's	20	12	60	28	1.2	2.3
Kakai	Johnny's	38	2	5	8	8.4	4.0
Knuckle Head	Johnny's	42	24	57	29	7.0	1.2
Speckled Hound	Johnny's	38	33	87	57	3.6	1.7
Toad	Sakata	40	22	55	76	1.7	3.5

[z]Specialty pumpkins were not replicated and had a limited number of seeds.

Table 5. 2017 Specialty Pumpkin Demonstration varieties, Perkins, OK Uniformity and fruit characteristics.

		Uniformity ratings[y] (1-5) 5=Best			Circumference[z] (in.)		Fruit Shape (in.)	
Variety	Disease[x]	Size	Shape	Color	Ped.	Fruit	Height	Width
Specialty Pumpkins								
Blaze	3.6	5.0	5.0	5.0	2.2	20.7	3.6	6.6
Carnival	1.2	5.0	5.0	4.5	1.2	14.4	3.4	4.5
Kakai	2.3	3.0	4.0	3.5	3.4	28.7	7.4	9.3
Knuckle Head	1.4	3.3	4.0	3.8	4.2	28.0	9.0	8.1
Speckled Hound	3.7	2.5	3.0	3.0	2.7	22.9	4.2	7.0
Toad	1.7	5.0	5.0	4.8	2.1	14.4	3.7	4.4

[x] Disease to vines= 1-5 scale with 5 being no disease, and 1 most disease.
[y] Uniformity ratings= 1-5 scale, 1=least, 5=most uniform in size, shape, and color within a cultivar
[z] Circumference and fruit shape measurements taken on three fruit per plot that were closest to the average weight per fruit for that plot. Ped=peduncle or stem.

Figure 1. 2017 Pumpkin replicated variety trial, Perkins, OK, Photo record of mature pumpkin fruit at harvest.

Camaro PMR

Captain Jack

Cargo PMR

Diablo

Earlipack

Howden

Mvskoke (Creek/Seminole)	Mr. Wrinkles
	
Mustang PMR	**Rival PMR**
	
Spartan	**Cracker Jack**
	

Moonshine	Racer Plus
	
Valenciano	**White Flat Boer Ford**
	
Baby Wrinkles	**Darling**
	

Early Abundance	Fall Splendor Plus
	
Hijinks	**Winter Luxury**
	

Figure 2. Specialty Pumpkins	
Blaze	Carnival
	
Kakai	Knuckle Head
	
Speckled Hound	Toad
	

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Spring 2017 Sweet Corn Variety Trial

Cimarron Valley Research Station Perkins, OK
Lynda Carrier, Lynn Brandenberger, and Josh Massey

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 or using a cultivar that has been genetically engineered for corn earworm resistance (GMO).

The genetics of sweetness in corn have become increasingly complicated. For many years, varieties could be classified either as normal sweet (su_1), sugary-enhanced (se), or supersweet (sh_2). Currently varieties with genetic combinations for sweetness have been introduced into 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 9 varieties (yellow or bicolor) for yield, earliness, and overall quality. All varieties were in the se isolation group (sugary enhanced).

Materials and Methods: Plots were fertilized with 50 lbs. N/acre, harrowed, and then direct seeded on April 25. Plots were 20 ft. long with 3 feet between rows and included 2 rows per plot. Varieties were replicated 3 times in a randomized block design. Plot soil was sprayed after direct seeding with S-metolachlor herbicide on April 25, at the rate of 1.5 pints/acre. Plots were rated for seedling vigor on May 22 and then thinned to 20 plants per row. A top-dressing of urea was applied on May 22 and June 15 at a rate of 50 lbs. N/acre. Insecticide applications began June 27 at silking and continued through the harvest period. Supplemental water was applied with micro sprinkler irrigation. Each variety was harvested once at its peak maturity.

Results and Summary: Results are shown on the following page. The standard of comparison was 'BC 0805' an Attribute® cultivar. Attribute is the trademark for Syngenta's genetically engineered earworm resistance (GMO) there were two cultivars with Attribute; BC 0805 and BC0528. Remedy is a BC0805 with improved insect resistance in Attribute II®. Attribute II is the latest technology in insect protection with higher control of lepidopteran pests as well as herbicide tolerance to glyphosate herbicides. Remedy performed extremely well against corn ear worm damage, resulting in very few culls, most of the culls were due to poor fill or lack of kernels (Figure 1). Three cultivars from Twilley all performed at the top for marketable yield, 'Incredible R/M', 'Bodacious R/M' and 'Delectible R/M' with 197, 178 and 172 sacks/acre respectively (Table 1). Alto a Seedway cultivar was the earliest variety in the trial, most varieties earlier than 72 days do not perform well in Oklahoma. Alto performed below average, but should be considered for an early market sweet corn as Alto had excellent vigor. Primus did not germinate therefore we were unable to collect any data. We had over 4 inches of rain immediately following planting which may have affected germination, however all the other varieties had good stands and all three plots of Primus had no emergence. Producers should consider data from several years before selecting varieties, and always test a new variety on a small acreage at first.

Acknowledgements: The authors wish to thank personnel from the Cimarron Valley Research Station for their help and assistance in completing this trial and also wish to thank seed companies for supplying seed for this trial.

Table 1. Spring 2017 Sweet Corn Variety Trial, Cimarron Valley Research Station, Perkins, OK[z].

Variety	Company/ Source	C[y]	Vigor rating[x]	Market yield (sacks/A)[w]	Yield (tons/A) Market	Culls	Number days to harvest	In-shuck rating[v]	Shucked rating[v]	Avg ear dia. (inches)	Avg ear length (inches)	Corn earworm damage[u]
Incredible R/M	Twilley	Y	3.5	197	3.1	0.9	86	2.8	2.8	1.8	7.5	3.5
Bodacious R/M	Twilley	Y	5.0	178	2.7	0.7	77	2.9	2.8	1.8	7.1	3.4
Delectable R/M	Twilley	BC	3.8	172	3.2	0.8	86	3.0	2.3	2.0	8.3	2.9
Utopia	Seedway	BC	4.5	144	2.4	1.1	78	2.4	3.2	1.8	8.1	3.5
Remedy	Syngenta	BC	5.0	138	1.9	0.6	83	2.8	2.8	1.6	8.0	1.0
BC 0528	Syngenta	BC	4.8	138	2.2	1.1	83	2.3	3.5	1.7	8.1	2.5
Alto	Seedway	BC	5.0	132	1.5	2.1	73	4.0	3.5	1.7	6.7	4.3
BC 0805	Syngenta	BC	5.0	92	1.5	0.9	83	2.5	3.8	1.7	8.3	3.5
Primus	Syngenta	BC	1.0									
	Mean		4.2	149	2.3	1.0	81	2.8	3.1	1.7	7.7	3.1
	LSD $_{0.05}$		0.7	173	3.0	0.9	--	1.3	1.1	0.1	0.9	1.6

[z]Seeded April 25, 2016; Plot size: 6' x 20' (2 rows/plot, 3 plots each variety, plots thinned to 20 plants/row.) Harvested 7/5/16 to 7/14/16.

[y]C=kernel color.

[x]Vigor rating: 1=will not make stand, 5=thick stand and good vigor.

[w]One sack = 60 ears.

[v]Appearance rating: 1=best, 5=poorest.

[u]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. Earworm control: Asana, Lannate, PermaStar,and Sevin were alternated and applied a total of 6 times between silking & harvest to entire planting.

Figure 1. 2017 Sweet corn trial at Cimarron Valley Research Station Perkins, OK, harvest photos.

Alto	BC0528
	
BC0805	Bodacious
	
Delectable	Incredible
	
Remedy	Utopia

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Spring 2017 Sweet Corn Transplant Study

Cimarron Valley Research Station Perkins, OK
Lynda Carrier, Lynn Brandenberger, and Josh Massey
Oklahoma State University

Introduction and Objectives: Earliness of Sweet corn in the late spring and early summer months is becoming increasingly popular for attracting consumers to early fresh markets. Consumers will pay higher prices for early season sweet corn, as with most fresh produce the early-bird gets the highest price. There are several advantages to transplanting corn, first, the time in the field is reduced and therefore fewer weed problems and less earworm pressure early in the season. Using transplants will assure a good stand, where direct seeding would either require thinning or would leave gaps in the rows. Transplanting also has an advantage of avoiding cold soil and wet conditions that effect germination. Since many of the early cultivars (72 days or less) that are direct seeded are not well adapted to Oklahoma conditions, some producers are beginning to try different methods to achieve early market sweet corn. Objectives of this trial were to establish plants in the greenhouse and transplant to the field in early March and subsequent weekly plantings, realizing it is possible for early plantings to be exposed to freezing temperatures. Then determine if transplants will affect earliness of harvest and how early in the season sweet corn can be marketed.

Materials and Methods: BSS 0977 (Syngenta) sweet corn seeds were direct seeded in 128 cell Speedling flats (1 ½" wide x 2 ½" tall/ cell). Seeding included 1 treated seed per cell using a peat based growing mix and then seeded Speedling flats were placed in the greenhouse for germination and growth. When transplants were about 6" tall, they were hardened off outdoors prior to transplanting, this is crucial for planting outdoors with wind and cooler temperatures. Prior to transplanting, herbicide and fertilizer were applied in the field. S-metolachlor (Dual Magnum) herbicide was applied at a rate of 2 pints/acre and plots were fertilized with 50 lbs. N/acre. Plants were transplanted by hand weekly in 4 row plots, 15' long with plants spaced 1' apart (15 plants per row) in the row and rows being 3' apart. Following transplanting, the plot area was irrigated with micro sprinklers to incorporate herbicide. A top-dressing of urea was applied at a rate of 50 lbs. N/acre for each planting approximately 30 days after transplanting. The first 4 plantings did not receive any insecticide treatment. The last 3 transplant dates starting with 4/6/17 were sprayed with insecticide 2 times a week until harvest for control of corn ear worm. Supplemental water was applied through the micro sprinkler irrigation system.

Results and Summary: We attempted a 2/28/17 transplant just to see how early we could plant without a freeze, we expected this planting would be too early and freeze, which it did. The next transplant date on 3/16/17 did not show freezing temperatures in the forecast, as a result we did not receive below freezing temperatures. Survival rate on the transplants was above 90%, there were only a few plants that died. **Table 1** has the number of marketable ears and days from transplant to harvest, looking at the days to harvest it is more days than direct seeded plants but harvest was 2-3 weeks earlier than a direct seeded plant would be if planted in mid to late April. The 3/16/17 transplants were over mature at harvest and could have been harvested a few days earlier. The last planting on 4/20/17 also resulted in a harvest before traditional direct seeded. The later plantings also resulted in fewer days to harvest due to the warmer conditions. The opportunity to reach the fresh market 2-4 weeks before traditional direct seeding would allow consumers access to fresh sweet corn earlier in the season. One of the problems noted on transplants was the growth pattern of the plants, transplants tasseled at 2' tall and the plants

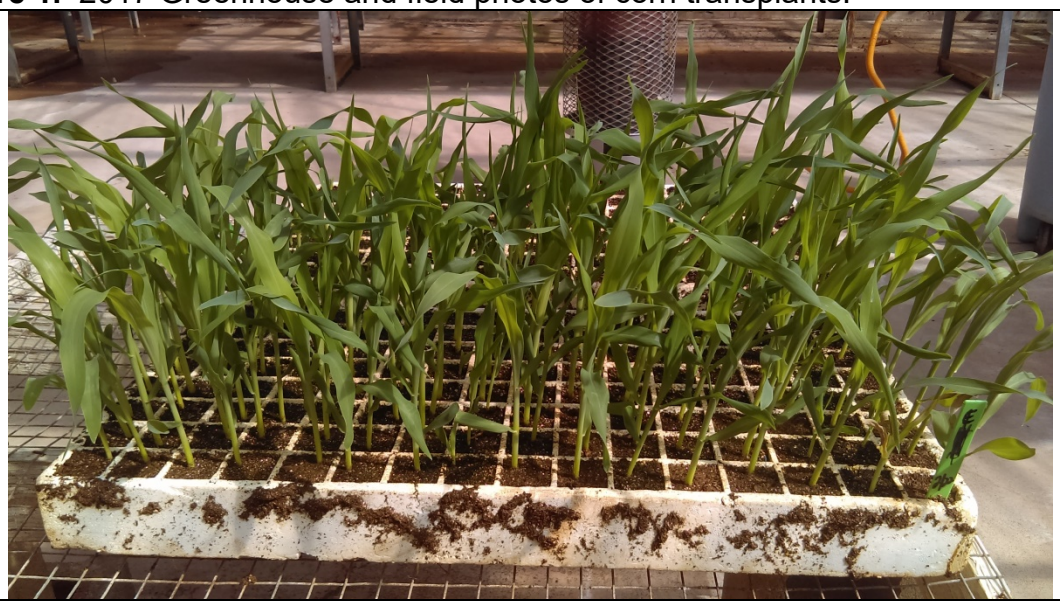
ultimately were stunted. Allowing transplants to become too advanced prior to transplanting resulted in stunted plants in the field (Figure 1). However, the ear size was not affected by plant stunting. Future trialing will extend the study to include multiple varieties with vigorous growth and germination and include marketable weights.

Table 1. Sweet corn transplant study, Perkins, OK

Start in greenhouse	Transfer to field	Harvest date	# Marketable ears	# Days from transplant to harvest
2/6/17	2/28/17	All plants froze	0	
2/6/17	3/16/17	6/15/17	52	91
2/22/17	3/23/17	6/23/17	34	92
3/6/17	3/30/17	6/23/17	57	85
3/6/17	4/6/17	6/27/17	45	82
3/15/17	4/13/17	6/27/17	55	75
3/15/17	4/20/17	6/27/17	41	68

Each plot had 4 15' rows, spaced 1' apart within rows. Rows spaced 3' apart.(60 plants/plot)

Figure 1. 2017 Greenhouse and field photos of corn transplants.



	
March 16 transplant day	May 13 during growing season

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Pest Management

Preemergence Weed Control in Pepper

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In Cooperation with
Schantz Family Farms, Hydro, OK

Introduction: Oklahoma pepper production includes both fresh market and peppers for processing. Crops are normally established with transplants once the danger from low temperatures is past. Slow growth of the crop due to erratic weather (cool fronts) can result in serious weed competition due to weedy species that are better adapted to wide temperature swings. Several weed species including Palmer amaranth (Amaranthus palmeri), tumble pigweed (Amaranthus albus L.), carpetweed (*Mollugo verticillata* L.), goathead (Tribulus terrestris L.), spurge (Euphorbia species), buffalobur (Solanum rostratum Dun.), and purslane (Portulaca oleracea L.) are major competitors with spring pepper crops. Although some herbicides are labeled for this crop, many are not effective enough to be the sole means of control. Weed control with herbicides is supplemented by cultivation and hand hoeing. Costs for hand hoeing can easily be several hundred dollars per acre if labor is available. Therefore there is a need to identify potential preemergence herbicides that can be utilized for controlling broadleaf weeds in pepper fields particularly early in the season. The objective of this study was to screen herbicides that may have potential for weed control in commercial pepper production when applied early in the season as a pre-plant preemergence application.

Methods and Materials: All treatments in this study were applied pre-transplant to clean tilled soil on 4/28/17 with transplanting taking place on 5/2/17. A major rain event (4.5 inches) occurred within 12 hours of herbicide application. Treatments included 14 different preemergence treatments and an untreated check for comparison. Herbicide treatments in the study included Callisto (mesotrione) at 0.088 and 0.132 lbs. ai/acre, Dual Magnum (S-metolachlor) at 0.75 lbs. ai/acre, Fierce (flumioxazin + pyroxasulfone) at 0.414 and 0.62 lbs. ai/acre, League (imazosulfuron) at 0.094 lbs. ai/acre, Reflex (fomesafen) at 0.25 and 0.50 lbs. ai/acre, Spartan Charge (carfentrazone + sulfentrazone) at 0.1 and 0.2 lbs. ai/acre, combination of Spartan Charge at 0.1 lbs. ai/acre + Dual Magnum at 0.75 lbs. ai/acre, Surflan (oryzalin) at 0.56 lbs. ai/acre, and Zidua (pyroxasulfone) at 0.05 and 0.075 lbs. ai/acre. Treatments were applied to plots four rows wide (12 feet) by 15 feet in length in a randomized design with three replications on 4/28/17. All treatments were applied with two passes of a six foot hand-boom CO_2 plot sprayer at an overall rate of 25 gallons per acre and were incorporated into the soil with rainfall. Plots had crop plant counts recorded on 6/8/17 along with ratings for crop phytotoxicity, Palmer amaranth (*Amaranthus palmeri* S. Wats.), carpetweed (*Mollugo verticillata* L.), and spotted spurge (*Euphorbia maculata* L.) weed control. Further plant counts, plant heights and weed control ratings were recorded on 8/15/17.

Results: Viable pepper plants were counted in the middle two rows of each plot on two different dates and varied significantly for each date (Table 1). The number of plants on 6/8/17 ranged from a low of zero to 10.3 plants per plot. Both rates of Fierce resulted in no viable plants in any of the plots. Spartan charge at 0.2 lbs. ai/acre had significantly fewer plants (6.0) compared to League and Surflan treatments both of which had an average of 10.3 plants per plot. Plant numbers on 8/15/17 ranged from a low of zero for both Fierce treatments to a high of 13 plants for Reflex at the 0.5 lb. rate. League and Spartan Charge at 0.1 lb. had significantly fewer plants (4.0 and 3.0, respectively) than Reflex at the 0.5 lb. rate.

Crop injury ratings taken on 6/8/17 were on a percentage basis where 0% represented no injury and 100 represented no live plants. Crop injury varied from a low of zero for the untreated check to a high of 100% for both of the Fierce treatments (Table 1). Zedua at 0.075 lbs. ai/acre had the second highest injury rating with 47% and was significantly higher than all of the other treatments except for Fierce. Treatments that had 10% or less crop injury included Callisto at both rates, Dual Magnum, Spartan Charge at 0.1 lb., and Surflan.

Plant heights were recorded on 8/15/17 to provide a measure of crop growth. Plant height varied significantly with the eight highest averages ranging from 12.0 inches to a high of 17.3 inches (Table 1). Spartan Charge + Dual Magnum, Dual Magnum alone, and Surflan recorded the three highest heights at 17.3, 16.3, and 15.3 inches, respectively. Other treatments had plant heights that ranged from 7.3 (League) to 10.7 inches (Zidua at 0.05 lbs. ai/acre). All Fierce treatments resulted in no live plants therefore the plant height was recorded as zero inches.

Weed control (weed control rated on a 0 to 100% scale) was rated on both 6/8/17 and 8/15/17 for Palmer amaranth and on 6/8/17 only for carpetweed and spurge (Table 2). On 6/8/17 control of Palmer amaranth was significantly higher for Fierce compared to five of the other treatments (Table 2, Figure 1). Both rates of Fierce provided 100% control of Palmer amaranth on this date while Dual Magnum alone had 80% control, Surflan had 88% control, Reflex at 0.25 and 0.50 had 82 and 93%, respectively. Zedua at both rates provided 92% control. Control ratings for Palmer amaranth on 8/15/17 ranged from 0 to a high of 87%. Fierce at 0.41 and 0.62 lbs. ai/acre had the highest levels of control at 87 and 85% control, respectively. Other treatments that exhibited potential control of Palmer amaranth also included Reflex at 0.5 and Zidua at 0.075 lbs. ai/acre which had 62 and 50% control of this weed species, respectively.

Control of carpetweed on 6/8/17 ranged from 0 to 100% for the untreated check and the herbicide treatments (Table 2). Both rates of Fierce along with League, Surflan, and Zidua at 0.075 lbs. ai/acre recorded 100% control of carpetweed. Other herbicide treatments ranged from 0 to 67% control. Spartan Charge + Dual Magnum had 65% control of carpetweed and Reflex at 0.50 lbs. ai/acre had 67% control of the same species.

Spotted spurge control on 6/8/17 ranged from 0 for the untreated control to 100% for several herbicide treatments (Table 2). Both rates of Fierce and League recorded 100% control of spotted spurge. Surflan and Zidua at 0.05 and 0.075 lbs. ai/acre recorded 93, 92, and 100% control, respectively.

Conclusions: First, screening new materials for weed control in pepper in this study was very productive from the standpoint that we observed some very strong crop and weed responses to the herbicides that were included in the study. Pepper was very sensitive to both rates of Fierce (Figure 1) that were used and to a lesser extent the higher rate of Zidua. Crop damage from these materials was evidenced by the death of all pepper transplants in the Fierce plots and a higher crop injury rating (47%) and lower plant height (8.5 inches) for Zidua at the higher rate. Though there were serious concerns for crop safety with Fierce, this material provided the highest level of weed control in the study and warrants a second look in future trials at reduced rates. Zidua should also be considered for further study at different rates and application times. Surflan provided weed control at the June rating that was nearly 90% for Palmer amaranth, and higher for carpetweed and spurge. Surflan caused very little damage to the crop and warrants an expanded look using different rates and timings.

Acknowledgements: The authors wish to thank the Schantz family for their encouragement and support of this study.

Table 1. 2017 Pepper Herbicide study, Hydro, Ok

	Number plants in 2 - 15' rows		% injury to crop	Plant Height (in.)
Treatment (lbs. ai/acre)	**6/8/17**	**8/15/17**	**6/8/17**	**8/15/17**
Untreated check	6.7 ab[z]	7.7 abc	0 d	9.0 ab
Callisto Pre 0.088	7.7 ab	9.7 ab	10 cd	14.7 a
Callisto Pre 0.132	6.3 ab	4.0 bc	2 cd	10.7 ab
Dual Magnum 0.75	8.0 ab	9.7 ab	10 cd	16.3 a
Fierce Pre 0.414	0.0 c	0.0 c	100 a	0.0 b
Fierce Pre 0.62	0.0 c	0.0 c	100 a	0.0 b
League Pre T 0.094	10.3 a	4.0 bc	13 cd	7.3 ab
Reflex Pre 0.25	8.0 ab	8.3 abc	17 cd	14.0 a
Reflex Pre 0.50	7.3 ab	13.0 a	20 cd	12.0 a
Spartan Charge 0.1	6.3 ab	3.0 bc	10 cd	13.7 a
Spartan Charge 0.2	6.0 b	7.0 abc	23 c	14.7 a
Spartan Charge 0.1 + Dual Magnum 0.75	10.0 ab	8.0 abc	17 cd	17.3 a
Surflan Pre 0.56	10.3 a	7.3 abc	7 cd	15.3 a
Zidua Pre 0.05	8.0 ab	7.0 abc	18 cd	10.7 ab
Zidua Pre 0.075	7.7 ab	4.3 abc	47 b	8.5 ab

[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.

Table 2. 2017 Pepper Herbicide study, Hydro, Ok

Treatment (lbs. ai/acre)	% Control			
	Palmer Amaranth		Carpet weed	Spurge
	6/8/17	8/15/17	6/8/17	6/8/17
Untreated check	0 e[z]	0 d	0 d	0 d
Callisto Pre 0.088	48 c	22 bcd	43 bc	40 bcd
Callisto Pre 0.132	32 cd	8 cd	15 cd	10 cd
Dual Magnum 0.75	80 ab	13 cd	45 bc	38 bcd
Fierce Pre 0.414	100 a	87 a	100 a	100 a
Fierce Pre 0.62	100 a	85 a	100 a	100 a
League Pre T 0.094	77 b	7 cd	100 a	100 a
Reflex Pre 0.25	82 ab	33 bcd	35 bcd	40 bcd
Reflex Pre 0.50	93 ab	62 ab	67 ab	65 ab
Spartan Charge 0.1	23 d	17 bcd	0 d	2 d
Spartan Charge 0.2	37 cd	7 cd	25 cd	27 bcd
Spartan Charge 0.1 + Dual Magnum 0.75	80 ab	17 bcd	65 ab	52 abc
Surflan Pre 0.56	88 ab	17 bcd	100 a	93 a
Zidua Pre 0.05	92 ab	38 bcd	90 a	92 a
Zidua Pre 0.075	92 ab	50 abc	100 a	100 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.

Figure 1. Spring 2017 Pepper herbicide trial photos on 6/8/2017

Untreated check	Reflex 0.50
	
Callisto Pre 0.088	**Spartan Charge 0.1**
	
Callisto Pre 0.132	**Spartan Charge 0.2**
	

Dual Magnum 0.75	Spartan Charge 0.1 + Dual Magnum 0.75
	
Fierce 0.414	Surflan 0.56
	
Fierce 0.62	Zidua 0.05
	

League 0.094	Zidua 0.075
	
Reflex 0.25	
	Pictures taken on June 8, 2017

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Bacterial Spot on Bell Peppers

Evaluation of bactericides and biocontrols (*Xanthomonas euvesicatoria*) on bell peppers, Stillwater, 2017

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Bacterial spot is a widespread foliar disease of peppers in Oklahoma. Bactericides and biocontrols were evaluated on the susceptible cultivar 'King Authur' at the OSU Entomology and Plant Pathology Research Farm in Stillwater, OK in a field of Easpur loam previously cropped to wheat. Bactericides were coppers (Kocide, Cueva), and fungicides with activity on bacteria (Dithane, Quintec). Actiguard and heat-killed bacteria are reported to induce plant resistance to bacterial diseases. Microbial pesticides (biocontrols) were Serenade and Double Nickel. The herbicide Treflan 4E at 1.5 pt/A and granular fertilizer (46-0-0 lb/A N-P-K) were incorporated into the soil prior to transplanting on 9 May 2017. The herbicides Prowl H2O 3.4F at 2 pt/A and Dual II Magnum 7.64E at 0.75 pt/A were directed to the row middles on 26 May for additional weed control. Plots were top-dressed with granular fertilizer (46-0-0 N-P-K) on 20 Jun. Insects were controlled with Warrior II 2.08F at 1.75 fl oz on 20 Jun. Plots consisted of two, 9-ft-long rows spaced 36-in. apart. Each row contained 6 plants spaced 1.5 ft apart. The experimental design was a randomized complete block with three blocks separated by a 5-ft-wide fallow buffer. Treatments were directed to plants with three, 8003VK flat-fan nozzles per row a CO_2-pressurized wheelbarrow sprayer equipped with flat-fan nozzles (8003vk) spaced 18-in. apart. The sprayer was calibrated to deliver 54 gal/A at 40 psi. Heat killed *Pseudomonas syringae* isolate DC3000 was used to induce disease resistance by heating a bacterial suspension (10^7 cfu/ml) to 60°C for 1 hr. The cooled suspension was applied directly. The sprayer was calibrated to deliver 54 gal/A at 40 psi. Treatments were applied on 7-day intervals beginning 1 Jun. Plots were inoculated with a mixture of three prevalent races of *Xanthomonas euvesicatoria* by spraying to runoff at 10^8 cfu/ml on 9 Jun after the second treatment application. Rainfall during the cropping period totaled 2.61 in. for May, 2.88 in. for Jun, 3.86 in. for Jul, and 5.81 in. for Aug. Plots received sprinkler irrigation as needed to promote crop and disease development. Disease incidence, the percentage of leaves with foliar disease including defoliation and defoliation alone were visually assessed in three areas per plot on 18 Jul and 15 Aug. Plots were harvested six times from 26 Jun to 17 Aug and fruit were classified as marketable or diseased. Data were analyzed by analysis of variance and means were separated with where indicated by a significant treatment effect ($P \leq 0.05$).

Compared to the 30-yr average, rainfall was 4.45 in. below normal in May and Jun, and 3.73 in. above normal for Jun and Jul. Average monthly temperatures were nearly normal except for Aug which was 4.6°C below normal. Bacterial spot reached moderate levels compared to previous trials at this site. On 18 July, all treatments except Serenade and heat-killed *P. syringae* reduced levels of bacterial spot compared to the non-treated check. On 15 Aug., only the Kocide+Dithane and Quintec-Kocide treatments had lower levels of disease. Plot yields of marketable peppers were negatively correlated with bacterial spot incidence ($r=-0.38$, $P=0.04$) but not defoliation on 18 Jul, and were not correlated with levels of bacterial on 15 Aug. Yields were numerically highest for the Kocide+Dithane and Kocide treatments, but treatment effects on marketable yield were not statistically significant. None of the treatments caused plant injury symptoms (phytotoxicity).

Treatment and rate/A (timing)[z]	Bacterial spot (%)		Defoliation (%)		Market-able Yield (cwt/A)
	18 July	15 Aug.	18 July	15 Aug.	
Non-treated check	43.9 a	37.8 ab	19.4 a	22.2 ab	190.4 a
Serenade ASO 2 qt (1-11)	36.7 ab	44.5 a	16.1 ab	25.0 ab	193.3 a
Double Nickle LC 1 qt + Cueva 2 qt (1-11)	24.4 cde	37.2 ab	7.2 c-f	21.1 ab	202.2 a
Heat-killed *Pseudomonas syringae* 10^8cfu/ml (1-11)	35.5 ab	33.9 abc	13.9 abc	18.9 abc	186.9 a
Kocide 3000 1.24 lb + Dithane 75DF 2 lb (1-11)	14.4 ef	17.2 d	3.9 f	6.1 d	243.6 a
Actigard 50WG 0.5 oz (1,3,5,7,9,11) Kocide 3000 1.25 lb (2,4,6,8,10)	9.4 f	33.9 abc	4.4 ef	15.5 a-d	206.0 a
Kocide 3000 1.25 lb (1-11)	12.2 f	25.0 bcd	2.8 f	12.2 bcd	233.1 a
Quintec 2.08F 6 fl oz (1,3,5,7,9,11) Kocide 3000 1.25 lb (2,4,6,8,10)	19.4 def	19.5 cd	6.1 def	8.3 d	172.4 a
BMJ WG 2.45 oz/A (1-11)	27.8 bcd	23.3 bcd	11.1 b-e	9.5 cd	167.3 a
BMJ WG 2.45 oz/A (1,3,5,7,9,11) BMJ WG 2.45 oz/A + Kocide 3000 1.25 lb + Dithane 75DF 2 lb (2,4,6,8,10)	31.1 bc	25.5 bcd	11.7 bcd	16.1 a-d	172.4 a

[z] Applications (1 to 11) were made at 1=1 Jun, 2=8 Jun, 3=15 Jun, 4=22 Jun, 5=29 Jun, 6=6 Jul, 7=13 Jul, 8=20 Jul, 9=27 Jul, 10=3 Aug, and 11=10 Aug.

[y] Means followed by the same letter are not statistically different at P=0.05.

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Disease and Yield Response of Pepper Cultivars

Disease and yield responses of pepper cultivars to a bactericide program for control of bacterial spot (Xanthomonas euvesicatoria), Stillwater, 2017

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Pepper cultivars with different resistance to bacterial spot were grown with and without a bactericide spray program in order to identify the best management strategy. The trial was located at the OSU Entomology and Plant Pathology Research Farm in Stillwater, OK in a field of Easpur loam previously cropped to wheat. The herbicide Treflan 4E at 1.5 pt/A and granular fertilizer (46-0-0 lb/A N-P-K) were incorporated into the soil prior to transplanting on 9 May 2017. The herbicides Prowl H2O 3.4F at 2 pt/A and Dual II Magnum 7.64E at 0.75 pt/A were directed to the row middles on 26 May for additional weed control. Plots were top-dressed with granular fertilizer (46-0-0 N-P-K) on 20 Jun. Insects were controlled with Warrior II 2.08F at 1.75 fl oz on 20 Jun. The experimental design was a split plot, randomized complete block with three blocks separated by a 5-ft-wide fallow buffer. The main plots were a bactericide spray program with copper hydroxide + mancozeb (Kocide+Dithane) or not, and the subplots were pepper cultivar. Pepper cultivars represented bell and chili types either susceptible (S) or resistant (R) to bacterial spot. Sub-plots consisted of single 9-ft-long rows spaced 36-in. apart. Each sub-plot row contained 6 plants spaced 1.5 ft apart. The bactericide mixture was directed to plants with three, 8003VK flat-fan nozzles per row a CO_2-pressurized wheelbarrow sprayer equipped with flat-fan nozzles (8002vk) spaced 18-in. apart. The sprayer was calibrated to deliver 54 gal/A at 40 psi. The bactericide mixture was applied on 7-day intervals beginning 1 Jun. Plots were inoculated with a mixture of three prevalent races of *X. euvesicatoria* by spraying one plant per sub-plot to runoff at 10^8 cfu/ml on 9 Jun after the second treatment application. Rainfall during the cropping period totaled 2.61 in. for May, 2.88 in. for Jun, 3.86 in. for Jul, and 5.81 in. for Aug. Plots received sprinkler irrigation as needed to promote crop and disease development. Disease incidence, the percentage of leaves with foliar disease including defoliation and defoliation alone were visually assessed in three sections of each sub-plot on 15 Aug. Plots were harvested six times from 26 Jun to 17 Aug. Bacterial spot developed on fruit after the harvest period and incidence of bacterial spot symptoms on fruit (mostly on fruit peduncles) was assessed on 10 fruit per plot on 3 Oct. Yield of the super-hot chili cultivar 'Ocala', grown for edible capsaicin oleoresin production, was not assessed. Data were analyzed by analysis of variance and main effect means were separated at P=0.05. Where the treatment x cultivar interaction was significant P=0.05, differences in sprayed vs. non-sprayed plots were compared at P=0.05.

Compared to the 30-yr average, rainfall was 4.45 in. below normal in May and Jun, and 3.73 in. above normal for Jun and Jul. Average monthly temperatures were nearly normal except for Aug which was 4.6°C below normal. Bacterial spot reached moderate levels (50% disease, 25% defoliation) compared to previous trial at this site. The bactericide program reduced levels of bacterial spot for the susceptible but not resistant cultivars, which had minimal disease development and no defoliation. Defoliation levels were generally only 10% or less. On 15 Aug, the bactericide program and cultivars affected defoliation, although cultivar had the greatest effect. 'Ciclon' had the highest defoliation while the resistant cultivars had no defoliation. Yields were negatively correlated (P=0.05) with final (15 Aug) bacterial spot incidence on 15 Aug (r=-40) and with defoliation on 15 Aug (r=-0.37). Yields for the bactericide program were numerically higher than the non-treated check for susceptible cultivars, but the effect was not statistically significant. Among cultivars yields were highest for the resistant cultivar Aristotle and lowest for

the susceptible cultivar Compadre. Fruit disease incidence was lowest for the resistant cultivars, highest for the susceptible cultivars, and was not reduced by bactericide program.

	Treatment[z]		
	Kocide + Dithane	**NT Check**	**Average[y]**
Cultivar (type and *Xe* reaction)[y]	Bacterial spot (%) 15 Aug		
Okala (Chili S)	20.0 b[w]	33.9 a	26.9
Ciclon (Jalapeno R *Xe* 1-3)	0.0 a	0.0 a	0.0
Compadre (Jalapeno S)	33.9 b	52.2 a	43.1
Aristotle (Bell R *Xe* 1-3)	0.0 a	0.0 a	0.0
King Arthur (Bell S)	24.4 b	35.0 a	29.7
Bayonet (Bell R *Xe* 1-5, 7-9)	0.0 a	0.0 a	0.0
Average[v]	13.1	20.2	
	Defoliation (%) 15 Aug		
Okala (Chili S)	5.0	15.0	10.0 b[u]
Ciclon (Jalapeno R *Xe* 1-3)	0.0	0.0	0.0 c
Compadre (Jalapeno S)	17.2	24.4	20.8 a
Aristotle (Bell R *Xe* 1-3)	0.0	0.0	0.0 c
King Arthur (Bell S)	12.8	13.9	13.3 b
Bayonet (Bell R *Xe* 1-5, 7-9)	0.0	0.0	0.0 c
Average[v]	5.8 b[w]	8.9 a	
	Yield (cwt/A)		
Ciclon (Jalapeno R *Xe* 1-3)	245.7	245.2	245.4 bc[u]
Compadre (Jalapeno S)	234.4	179.6	207.0 c
Aristotle (Bell R *Xe* 1-3)	314.5	374.2	344.4 a
King Arthur (Bell S)	294.1	266.7	280.4 ab
Bayonet (Bell R *Xe* 1-5, 7-9)	271.5	310.2	290.0 ab
Average[v]	272.1 a[w]	275.2 a	
	Fruit disease (%)		
Ciclon (Jalapeno R *Xe* 1-3)	13.3	6.7	10.0 b[u]
Compadre (Jalapeno S)	93.3	86.7	90.0 a
Aristotle (Bell R *Xe* 1-3)	6.7	13.3	10.0 b
King Arthur (Bell S)	93.3	90.0	91.7 a
Bayonet (Bell R *Xe* 1-5, 7-9)	13.3	6.7	10.0 b
Average[v]	44.0 a[w]	40.7 a	

[z] Kocide 3000 at 1.25 lb/A + Dithane 75DF at 2 lb/A were applied weekly from 1 Jun to 10 Aug for a total of 11 applications. NT Check = non-treated check.
[y] Reported reaction of pepper cultivars to *X. euvesicatoria* (*Xe*) races indicated, R= resistant, S= Susceptible.
[x] Averaged over treatment.
[w] Values in a row followed by the same letter are not statistically different at P=0.05.
[v] Averaged over cultivar.
[u] Values in a column followed by the same letter are not statistically different at P=0.05.

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Disease and Yield Response of Tomato Cultivars

Disease and yield responses of tomato cultivars to Velum One for control of root-knot nematode (Meloidogyne incognita), Coyle, 2017

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Root-knot nematode is a common disease problem of tomatoes in Oklahoma. The objective of this trial was to evaluate Velum One, a new nematicide and fungicide with very low toxicity compared to previous nematicide or soil fumigant treatments. Tomato cultivars with differential resistance to root-knot nematode were grown with and without the fungicide/nematicide Velum One in order to identify the best management strategy. The trial was located at a commercial farm near Coyle, OK in a field of Konawa fine sandy loam previously fallowed but with a history of tomato cropping. The field had a preplant count of 12 root-knot nematodes per 100 cc soil. The experimental design was a split plot, randomized complete block with three replications. The main plots were cultivar and the sub-plots were nematicide application with Velum One compared to an untreated check. Tomato cultivars were susceptible to root-knot nematode (Mountain Spring), intermediate in resistance (Red Mountain), or resistant (Fletcher). Velum One 4.17F at 6.84 fl oz/A was applied on 9 May in an 18-in. band with a backpack sprayer calibrated to deliver 17 gal/A. Following incorporation and covering rows with plastic mulch and drip irrigation tape, tomatoes were transplanted on 15 May. Sub-plots consisted of single 9-ft-long rows spaced 8 ft apart. Each sub-plot row contained 6 plants spaced 1.5 ft apart. Rainfall during the cropping period totaled 2.62 in. for May, 3.02 in. for Jun, 5.08 in. for Jul, and 3.60 in. for Aug. Plots received drip irrigation as needed to promote crop development. Plant growth was evaluated by measuring plant height and vigor (% of best sub plot in each rep) on 11 Jun. Plots were harvested 9 times from 21 Jul to 18 Aug. After the last harvest, three plants per plot were uprooted and the percentage of the root system with galls was visually assessed. Data were analyzed by analysis of variance and main effect averages were separated at P=0.05. Where the treatment x cultivar interaction was significant at P=0.05, differences in treated vs. non-treated plots was determined.

Compared to the 30-yr average, rainfall was 3.81 in. below normal in May and Jun, and 2.9 in. above normal for Jun and Jul. Average monthly temperatures were nearly normal except for Aug which was 4.6°C below normal. Application of Velum One and cultivar resistance had no effects on plant growth parameters. Similarly, yield did not differ among cultivars or nematicide treatments. The root gall ratings explained the lack of treatment or cultivar effects on plant growth and yield. Despite the presence of pre-plant root knot nematodes in soil samples, root galls only developed to very low levels and did not differ among cultivars or nematicide treatments. There was not sufficient root-knot pressure to evaluate the effectiveness of Velum One or the genetic resistance of the tomato cultivars.

	Treatment[z]		
Cultivar (root-knot reaction)[x]	**Velum One**	**NT Check**	**Average[y]**
	Plant height (in.) 11 Jun		
Mountain Spring (S)	22.8	23.7	23.3 a[u]
Red Mountain (IR)	18.6	22.2	20.4 a
Fletcher (R)	24.1	23.5	23.8 a
Average[v]	21.8 a[w]	23.2 a	
	Vigor (%) 11 Jun		
Mountain Spring (S)	84.6	87.4	86.0 a[u]
Red Mountain (IR)	76.8	79.4	78.1 a
Fletcher (R)	78.7	87.2	83.0 a
Average[v]	80.0 a[w]	84.7 a	
	Marketable yield (cwt/A)		
Mountain Spring (S)	304.9	303.3	304.1 a[u]
Red Mountain (IR)	316.2	289.6	302.9 a
Fletcher (R)	230.7	261.0	245.8 a
Average[v]	283.9 a[w]	284.6 a	
	Galled roots (%)		
Mountain Spring (S)	3.3	6.7	5.0 a[u]
Red Mountain (IR)	6.7	2.5	4.5 a
Fletcher (R)	12.5	6.6	9.6 a
Average[v]	7.5 a[w]	5.3 a	

[z] Velum One at 6.84 fl oz was applied in an 18-inch band and incorporated into the soil prior to transplanting. NT Check=non-treated check.
[y] Averaged over treatment.
[x] Resistance response of cultivars to root-knot nematode, R=resistant, IR=intermediate resistance, S=susceptible.
[w] Values in a row followed by the same letter are not statistically different at P=0.05.
[v] Averaged over cultivar.
[u] Values in a column followed by the same letter are not statistically different at P=0.05.

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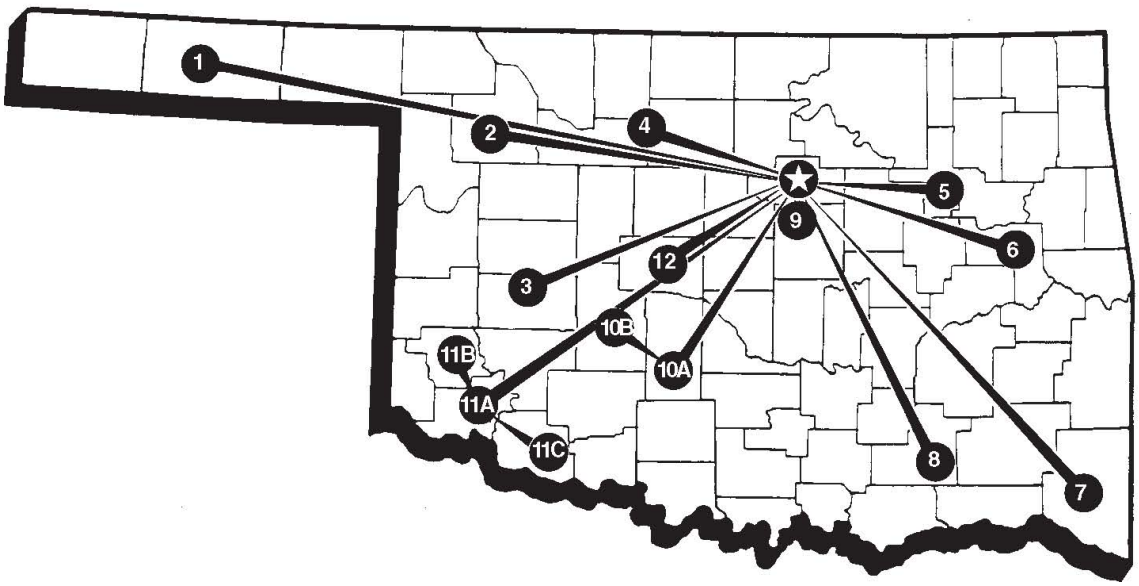
SI (METRIC) CONVERSION FACTORS

Approximate Conversions to SI Units					*Approximate Conversions from SI Units*				
Symbol	**When you know**	**Multiply by**	**To Find**	**Symbol**	**Symbol**	**When you know**	**Multiply by**	**To Find**	**Symbol**
		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. **Cimarron Valley Research Station—*Perkins***
10. **A. South Central Research Station—*Chickasha***
    B. Caddo Research Station—*Ft. Cobb*
11. **A. Southwest Research and Extension Center—*Altus***
    B. Sandyland Research Station—*Mangum*
    C. Southwest Agronomy Research Station—*Tipton*
12. **Grazingland Research Laboratory—*El Reno***