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Contents

Beef Cattle Management

5 Effects of Supplementing Corn Silage to Fall-Calving Heifers and Cows Grazing Tall Fescue on Cow Performance

12 Effects of Supplementing Corn Silage to Fall-Calving Heifers and Cows Grazing Bermudagrass and Calf Performance and Physiology – Year 2

17 Form of Supplement and Addition of Ionophore Effects on Steer Performance while Grazing Bromegrass – Year 2

Crops

21 Hard Red and Soft Red Winter Wheat Variety Testing – 2024

27 Wheat Variety Test Results for South Central Kansas – 2024

34 Corn, Soybean and Sunflower Production – 2024 Summary

41 Role of Soil Nutrient Status in Microbial Activity and Disease

Weather

45 Southeast Kansas Climate Summary for 2024

49 Acknowledgments

50 Research and Extension Personnel

Kansas Agricultural Experiment Station Research Reports are available at
http://newprairiepress.org/kaesrr/

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Effects of Supplementing Corn Silage to Fall-Calving Heifers and Cows Grazing Tall Fescue on Cow Performance

J.K. Farney, T. M. Jones

Summary
The objective was to test the effect of fescue cultivars and supplemental feeding of cows grazing fescue pastures on cow performance and pasture management. Primiparous and multiparous Angus-based crossed cows (n = 48) averaging 140 ± 0.5 days of gestation at turnout, were randomly allocated and stratified to pasture treatment by parity. Each pasture contained three cows of different ages, consisting of a young (first-calf heifer), middle-aged (3-5 yrs.), and old (≥ 6 yrs.) cow. Treatment was a 2 by 2 factorial design with two types of pasture (toxin producing: TOXIC or non-toxin producing fescue: NONTOXIC) and two levels of supplemental feeding (non-supplemented: NON or supplemented at 1% of body weight on a dry matter basis of corn silage: SUPP). Toxic fescue pastures consisted of K-31 endophyte infected tall fescue (n = 8) tested at 1709 ppm ± 0.36 for ergot alkaloids with an 89.1% infection rate. Non-toxic pastures consisted of novel (MaxQ) and endophyte free varieties (n = 8). Cows were fed silage (32-42% dry matter and 7.83% crude protein) daily in fence-line bunks, with feeding amount being adjusted at each weigh date. Cows were weighed on 2 consecutive days prior to turnout (~middle of the second trimester), beginning of the third trimester, ~2 weeks prior to the estimated calving date for herd, and at peak lactation (~60 days after calving). Body weight (BW), body condition score (BCS), hair score (based on a 1-5 scale; HS), hair length measured over the 3rd rib (HL), and rump fat (RF) measurements were taken at each weigh date during gestation. Calves were weighed at birth and used in weigh-suckle-weigh to estimate milk output. Forage accumulation (FA) and forage mass (FM) were estimated every 28 days using the paired-cage method. There were no grass type x supplementation interactions ($P > 0.19$) for any measurement, other than HS and HL. Prior to calving, there was a tendency for cows grazing NONTOXIC to have heavier weights ($P = 0.10$); this continued through peak lactation ($P = 0.10$). Supplementation did not affect BW ($P > 0.32$), BCS ($P > 0.22$), or RF ($P > 0.21$) during gestation; but during lactation SUPP increased BCS ($P = 0.007$) over NON. Hair length and HS were greater for cows grazing TOXIC pastures at the beginning of third trimester ($P = 0.06$) and immediately prior to calving ($P = 0.04$). NONTOXIC-NON cows had a greater reduction in HL than those grazing TOXIC-NON with supplementation on both grass types being intermediate ($P = 0.05$). Calf birth weight and estimates of milk output were not different for grass type or supplementation ($P > 0.23$). Forage mass tended to be 11% greater in TOXIC pastures than NONTOXIC ($P = 0.06$) and SUPP pastures tended to have 6% greater FM than NON ($P = 0.09$). Non-toxic pastures, overall, result in greater cattle performance. Supplementation did not offset toxicity but did result in greater available forage.

Introduction
Notably, fescue toxicosis is known for its signature negative impacts on livestock, with some of the most prominent visual symptoms being an inability to shed summer hair coats, fat necrosis, and fescue foot (Hemken et al., 1984; Stuedemann and Hoveland,

1988). The endophyte fungus that works cohesively with toxic fescue to ensure drought and predation resistance is also infamous for producing ergot alkaloids known to have vasoconstricting properties, which hinder proper circulatory function (Aiken and Strickland, 2013). Cattle grazing endophyte infected fescue tend to pant, excessively salivate, and spend more time in either shade, mud, or water sources (Stuedemann and Hoveland, 1988; Rottinghaus et al, 1991; Beck et al., 2008; Evans et al., 2012). As far as feeder calves are concerned, their "unthrifty" appearance has been well documented, along with decreased feed intake and altered posture, which results in a lesser price at auction (Paterson et al., 1995). Compromised reproductive efficiency in heifers and cows has also been associated with grazing toxic fescue, accompanied by delayed puberty and increased respiration rates (Schmidt and Osborn, 1993; Paterson et al., 1995; Strickland et al., 2011).

The cattle industry has investigated mitigation strategies with hopes of eliminating the more than one-billion-dollar price disadvantage that comes with grazing fescue pasture across the United States (Strickland et al., 2011). Supplemental feeding has been proven to assist in alleviating tall fescue toxicosis by means of substitution in the diet (Roberts and Andrae, 2004). Grain, oil seeds, milling byproducts, silage, and non-toxic hay have been deemed solutions in the fight against fescue toxicity (Roberts and Andrae, 2004). As the cattle select the alternatives previously mentioned, they decrease the intake of fescue and thus reduce the amount of toxin being ingested, resulting in improved animal performance (Elizalde et al., 1998).

The focus of this study was to examine how the inclusion of corn silage would impact function and performance of cattle grazing non-toxic fescue and if this supplemental feeding would reduce the effect of grazing toxic tall fescue during the late gestation period of fall calving cows.

Experimental Procedures

The study was conducted at the Mound Valley Branch of the Southeast Research and Extension Center in Mound Valley, Kansas. The facility consisted of eight non-toxin producing fescue and eight toxin producing fescue pastures.

The experiment was a 2 by 2 factorial design. The two fescue types were toxin producing (**TOXIC**) and non-toxin producing (**NONTOXIC**), with the two levels of supplemental feeding being either non-supplemented (**NON**) or supplemented at 1% of BW corn silage on a DM basis in fence-line bunks (**SUPP**). Both groups were offered access to free choice mineral. Following a two-day weigh period to adjust for feed allocation, cattle were turned out on May 21, 2024, gathered for a single day of midpoint measurements on June 18, 2024, and a weigh period on August 28, 2024. The initial weight measurement corresponded to cows in mid-gestation, the mid-point measurement was at the beginning of the third trimester, and August measurement was about 2 weeks prior to estimated start of calving. Following the calving period, pairs were gathered and sorted for calf weigh-suckle-weigh on December 2, 2024.

Corn silage consisted of 32-42% DM and 7.83% CP content respectively.

Weight Measures

Cattle were restrained in an Arrowquip Q-Power 107 Series hydraulic squeeze chute (Arrowquip, Woodlands, Manitoba, Canada), with weights being recorded by a Gallagher TWR chute scale head (Gallagher Group Limited, Riverside, MO). Average weights at the beginning and middle of the experiment were used to adjust feed allocation. Initial, middle, and ending weights were used to determine total body weight change. Calf birthweight was also collected via the hanging calf scale. Weights were recorded in pounds (lbs).

Body Condition Score and Rump Fat

Three independent evaluators recorded body condition scores at each measurement period using the standard 1-9 scale. Rump fat was recorded using an ALOKA 500 ultrasound machine (Hitachi, LTD., Wallingford, CT) with a 3.5-megahertz short probe capturing the image in Cattle Performance Enhancement Company (CPEC, Kansas). Measurement was taken over the rump by a trained technician and recorded in millimeters (mm).

Hair Score and Hair Length

One independent tech evaluated hair scores at each measurement period using the standard 1-5 scale. Hair length was measured chute-side using a slide ruler and recorded in millimeters (mm).

Pasture Measurements

Forage mass: Forage mass per square foot was collected every 28 days by sampling a 1 by 1 ft area that was being grazed by the cows in four locations through each pasture. This measurement was used to determine the amount of available forage for the cows. These samples were clipped with about one inch of stem remaining.

Forage accumulation: This was used to determine the amount of forage that was growing and was measured using the paired-cage method. Within each pasture there were four exclusion cages that were sampled via clipping a sample every 28 days. Then the cages were moved to another location within the pasture. To calculate forage accumulation the amount of forage measured within the exclusion cage was used and then the amount of forage measured from outside the cage during the previous 28 days was subtracted.

Results and Discussion

Weight Measures

Body weight gains measured during second trimester and third trimester measurements were not statistically significant between treatments. However, prior to calving there was a tendency ($P = 0.10$) for cows on NONTOXIC fescue pastures to have heavier weight than those on TOXIC fescue pastures and this continued through early lactation ($P = 0.10$; Table 1). Over the entire time grazing these pastures (mid-second trimester through early lactation) there was a tendency for the cows that were on NONTOXIC fescue pastures to have a greater weight gain ($P = 0.09$) than those grazing TOXIC fescue pastures (129 lb vs. 83 lb, respectively). Supplemental feeding did not impact cow weight gains at any measured point ($P > 30$). There was no difference in calf birth weight based on whether the dams were supplemented with silage; however, calves that were born to cows grazing TOXIC fescue pastures had a lighter birth weight than those grazing NONTOXIC pastures (68 lb vs. 77 lb, respectively).

Body Condition Score and Rump Fat

Cattle did not show a significant change in BCS during gestation, but during early lactation cows that were supplemented after calving had a greater body condition score and body condition score change ($P < 0.01$, Table 1). The total BCS change was positive for the supplemented cows and was negative for those that were not supplemented. Fescue type had no impact on BCS scores ($P > 0.20$). Rump fat changes were not able to be detected as different for any treatments.

Hair Score and Hair Length

Cattle grazing toxic fescue without supplementation showed classic symptoms of fescue toxicosis by having a handicapped ability to shed their winter hair coat with an interaction tendency (Table 2). The cows on toxic pastures that were supplementally fed had "slicker" hair coats than those not consuming the silage. Supplementation did not improve hair measurements in a non-toxic pasture. Total hair length change tended to be affected by fescue cultivar (Table 2).

Forage measurements

Forage mass tended to be 11% greater for TOXIC pastures as compared to NONTOXIC ($P = 0.06$). Forage accumulation was not different, thus indicating that there may have been less intake of TOXIC fescue, which has been reported in other studies. Additionally, in pastures where cows were SUPP, there was a tendency ($P = 0.09$) for there to be 9.8% more available forage than the pastures where cows were non-supplemented

Conclusions

Cow weights and calf birth weights were impacted by type of fescue that the cows were grazing more than by supplementally feeding corn silage. Fescue cultivars that were non-toxin producing increased cow gains and resulted in greater calf birth weights than toxin producing pastures. Possibly this could occur because the cows voluntarily consume more non-toxic pasture than toxic. Supplemental feeding of cows had the greatest impact while they were in early lactation, resulting in less condition loss. Additionally, supplementally feeding corn silage on fescue during the summer resulted in ~10% more available forage.

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Table 1. Cow and calf performance results

Item	Non-Toxic[1]		Toxic[2]			*P*-value		
	NON[3]	SUPP[4]	NON[3]	SUPP[4]	SEM[5]	Fescue[6]	Supp[7]	Fes × Supp[8]
Second trimester weight, lb	1206	1314	1189	1216	70	0.41	0.34	0.57
Third trimester weight, lb	1391	1492	1343	1380	70	0.26	0.33	0.64
Prior to calving weight, lb	1481	1544	1371	1440	66	0.10	0.32	0.97
Early lactation weight, lb	1349	1431	1259	1312	62	0.10	0.30	0.82
Gestation weight change, lb	274	230	182	224	34	0.17	0.97	0.62
Lactation weight change, lb	-132	-113	-111	-128	34	0.93	0.97	0.62
Weight change second trimester through early lactation, lb	143	117	70	96	27	0.09	0.99	0.33
Second trimester BCS	5.74	5.89	5.76	5.76	0.18	0.78	0.66	0.66
Third trimester BCS	6.19	6.36	5.94	6.78	0.25	0.42	0.22	0.68
Prior to calving BCS	6.92	7.14	6.65	6.86	0.29	0.20	0.30	0.97
Early lactation BCS	6.00	7.58	5.88	7.33	0.25	0.45	<0.001	0.80
Gestation BCS change	1.18	1.29	0.89	1.10	0.36	0.30	0.49	0.82
Lactation BCS change	-0.67	0.92	0.38	1.00	0.29	0.53	<0.001	0.72
BCS change second trimester through early lactation	0.08	1.75	-0.29	1.42	0.37	0.35	<0.001	0.96
Calf birth weight, lb	78	77	68	69	3.3	0.01	0.89	0.85
Milk output estimate, lb	18	35	19	22	8.2	0.48	0.27	0.44

[1] Non-toxic: treatment consists of fescue cultivars that are non-toxin producing and included MaxQ and endophyte-free varieties.
[2] Toxic: treatment that consists of toxic fescue variety of Kentucky 31 (K31) fescue.
[3] NON: treatment applied to pastures where cows were not supplemented.
[4] SUPP: supplement treatment where cows in pastures were supplemented daily with 1% of body weight as corn silage on DM basis.
[5] SEM: standard error of means.
[6] Fescue: treatment comparisons between NONTOXIC and TOXIC pastures.
[7] Supp: treatment comparisons between NON-supplemented and SUPP (supplemented).
[8] Fes × Supp: interaction comparison between fescue type and supplementation method.

Table 2. Hair length and hair score measurements

	Non-Toxic[1]		Toxic[2]			*P*-value		
Item	**NON[3]**	**SUPP[4]**	**NON[3]**	**SUPP[4]**	**SEM[5]**	**Fescue[6]**	**Supp[7]**	**Fes × Supp[8]**
Second trimester hair length, mm	17	14	16	17	1.6	0.67	0.47	0.31
Third trimester hair length, mm	10	10	15	13	1.7	0.06	0.53	0.63
Prior to calving hair length, lb	7	9	13	10	1.4	0.04	0.51	0.10
Gestation hair length change, mm	-10[b]	-4[ab]	-1[a]	-4[ab]	2.2	0.21	0.92	0.05
Second trimester hair score[9]	4.3	4.3	4.4	4.7	0.2	0.21	0.67	0.40
Third trimester hair score	1.8	1.1	3.3	2.3	1.7	0.07	0.25	0.76
Prior to calving hair score	1.2	1.4	2.5	1.7	0.4	0.08	0.49	0.21
Gestation hair score change	-3.2	-2.8	-1.9	-3	0.5	0.26	0.43	0.15

[1] Non-toxic: treatment consists of fescue cultivars that are non-toxin producing and included MaxQ and endophyte-free varieties.
[2] Toxic: treatment that consists of toxic fescue variety of Kentucky 31 (K31) fescue.
[3] NON: treatment applied to pastures where cows were not supplemented.
[4] SUPP: supplement treatment where cows in pastures were supplemented daily with 1% of body weight as corn silage on DM-basis.
[5] SEM: standard error of means.
[6] Fescue: treatment comparisons between NONTOXIC and TOXIC pastures.
[7] Supp: treatment comparisons between NON-supplemented and SUPP (supplemented).
[8] Fes × Supp: interaction comparison between fescue type and supplementation method.
[9] Hair score is based on scale of 1-5 with 1 being slick hair and 5 having 100% of hair not shed.

Effects of Supplementing Corn Silage to Fall-Calving Heifers and Cows Grazing Bermudagrass and Calf Performance and Physiology – Year 2

J.K. Farney, T. M. Jones

Summary

The objective was to test the effect of supplemental feeding on cows grazing bermudagrass pastures on cow-calf performance and pasture management. In a completely randomized design, (n = 24) primiparous and multiparous Angus-based cross cows were allocated to bermudagrass pasture with one of two levels of supplemental feeding (non-supplemented or supplemented at 1% of BW on a DM basis of corn silage). Each treatment consisted of (n = 4) pastures stocked with three cows of different ages, a young (first-calf heifer), middle-aged (3-5 yrs.), and old (≥ 6 yrs.) cow, each averaging 146 ± 3 d of gestation at turnout. Cows were fed silage (32-42% DM and 7.83% CP) daily in fence-line bunks, with feeding amount being adjusted at each weigh date. Cows were weighed on two consecutive days prior to turnout (middle of the second trimester), midpoint (beginning of the third trimester), and at about 2 weeks prior to the estimated calving date for the herd. Body weight, body condition score (BCS), hair score, hair length, and rump fat measurements were taken at each weigh date. Following the final measurement day, cows were relocated to calving pastures consisting of a mixture of bermudagrass, tall fescue, and prairie grass. Calves were weighed at birth and used in weigh-suckle-weigh to estimate milk output. Forage accumulation (FA) and forage mass (FM) were estimated every 28 days using the paired-cage method. Supplementation did not affect cow body weight, body condition score, hair score, or hair length during gestation ($P > 0.13$). During peak lactation, BCS ($P > 0.35$) and cow weights ($P = 0.79$) were not different. Calf birth weight was not affected by their dams being fed corn silage in late gestation ($P = 0.91$). Although visual BCS did not differ, cows that were supplemented with corn silage measured a greater rump fat accumulation than non-supplemented cows through the end of the second trimester ($P = 0.06$). Forage mass and forage accumulation did not differ ($P > 0.78$) based on supplementation method. Corn silage supplementation during late gestation, while cows graze growing bermudagrass, had no physiological effects on cows or calves. Contrary to a previous year, supplementation had no effect on available forage.

Introduction

Bermudagrass (*Cynodon dactylon*) is revered as the go-to warm season perennial for pasture and hay production in the southern U.S. (Hill et al., 2001). Bermudagrass has multiple different hybrids, but the most prevalent cultivar is Coastal bermudagrass, which occupies more than 4 million acres nationwide and was developed by Glenn Burton, USDA-ARS, Tifton, GA. This cultivar gained popularity for its notable adaptability, stability, yield, and quality (Hill et al., 2001). Bermudagrass is usually known to inhabit the deep southeastern sectors of the U.S. (Aiken, 2002). Bermudagrass can also be used in conjunction with cool season forages like fescue (Stokes et al., 1988), ryegrass, and/or clover (Rouquette, 2017) to extend the grazing season in the central plains (Peel, 2003; Mullenix and Rouquette, 2018). According to Kallenbach (2015), 50% or less of available dry matter (DM) in a mixed-species pasture is credited to fescue, especially in the summer months. This percentage relies heavily on annual precipitation, fertilization, grazing management, and the interspecies competition that can be expected in the dynamic of pairing cool- and warm-season grass growth (Kallenbach, 2015).

A two-year study by Aiken (2002) investigated the impact of supplemental feeding of yearling steers grazing bermudagrass with different amounts of ground corn on their average daily gain (ADG) and feed cost. The researchers concluded that feeding steers at 0.99 and 2.97 lb per calf per day increased ADG, with the 2.97 lb per calf per day treatment having the lowest cost per additional ADG unit for the grain and cattle prices during the time of the experiment (1998-1999; Aiken, 2002). Wheeler, et al., (2002) looked at how the supplemental feeding of protein (soybean meal) in increasing amounts to beef cows on stockpiled bermudagrass pasture affected performance. Cows being supplemented lost more weight and body condition during the first year of the study than their non-supplemented contemporaries. But in year two, supplemented cows gained more weight and lost less body condition. Additionally, forage intake tended to increase in supplemented cows, though the amount of protein supplementation did not have an effect (Wheeler et al., 2002). In a digestion trial with (n = 4) steers, forage intake increased 16% and organic matter (OM) intake increased 30% in supplemented steers compared to non-supplemented steers (Wheeler et al., 2002). Diet OM digestibility also increased 14.5% and total digestible OM intake increased 49% in supplemented compared to non-supplemented steers.

The goal of this study was to explore how the inclusion of corn silage would affect the physiology and performance of cattle grazing bermudagrass pasture, with a secondary objective of increasing forage savings in an intense drought environment.

Experimental Procedures

Cow and Calf Measurements

The study was conducted at the Mound Valley Branch of the Southeast Research and Extension Center in Mound Valley, Kansas. Cows were allocated to one of eight bermudagrass pastures, with four pastures being non-supplemented and four pastures being supplemented at 1% of BW corn silage on a DM basis in fence-line bunks. Both treatments had access to free choice mineral. Following a two-day weigh period, cattle were turned out on May 21, 2024, then weighed again on July 7, 2024, and at end of the study for two consecutive weights on September 19, 2024. These time points corresponded with mid-gestation, beginning of third trimester, and about 2 weeks prior to the start of calving. Following turnout to calving pastures, pairs were gathered and sorted for a calf weigh-suckle-weigh on December 2, 2024.

Weight measures: Cattle were restrained in an Arrowquip Q-Power 107 Series hydraulic squeeze chute (Arrowquip, Woodlands, Manitoba, Canada), with weights being recorded by a Gallagher TWR chute scale head (Gallagher Group Limited, Riverside, MO). Average weights at the beginning and middle of the experiment were used to adjust feed allocation. Initial, middle, and ending weights were used to determine the total body weight change. Calf birth weight was also collected via hanging scale. Weights were recorded in pounds (lbs).

Body condition score and rump fat: Three independent evaluators recorded body condition scores at each measurement period using the standard 0-9 scale. Rump fat was recorded using an ALOKA 500 ultrasound machine (Hitachi, LTD., Wallingford, CT) with a 3.5-megahertz short probe capturing the image in Cattle Performance Enhancement Company software. Measurement was taken over the rump by a trained technician and recorded in millimeters (mm).

Hair score and hair length: One independent technician evaluated hair scores at each measurement period using the standard 1-5 scale. Hair length was taken chute side using a slide ruler and recorded in millimeters (mm).

Calf weigh-suckle-weigh: Pairs were gathered and sorted, with calves being separated from dams overnight. Calves were then weighed empty. After empty weight was recorded, calves were turned back in with their dams to nurse until full. Then calves were sorted once more and weighed to get a "full" weight. The empty weight was then subtracted from the full weight to determine the change in calf body weight due to milk and multiplied by two for a 24-hour estimate of milk production.

Pasture Measurements

Forage mass: Forage mass per square foot was collected every 28 days by sampling a 1 by 1 ft area that was being grazed by the cows in four locations through each pasture. This measurement was used to determine the amount of available forage for the cows. These samples were clipped with about one inch of stem remaining.

Forage accumulation: This was used to determine the amount of forage that was growing and was measured using the paired-cage method. Within each pasture there were four exclusion cages that were sampled via clipping a sample every 28 days. Then the cages were moved to another location within the pasture. To calculate forage accumulation the amount of forage measured within the exclusion cage was used and then the amount of forage measured from outside the cage during the previous 28 days was subtracted.

Results

Cow Performance

There was no statistical difference in body weight change between treatment groups from the middle of second trimester to about 2 weeks prior to calving (Table 1). There was also no difference regarding supplemental feeding on calf birth weight, and there was no difference in estimated milk production of the cows via the weigh-suckle-weigh measurement methods. Additionally, cow body condition score and rump fat thickness were not impacted by supplementation methods. Cows all had slick hair coats and were not impacted by the feeding regimen.

Pasture Measurements

Contrary to results in 2023, there was no difference in forage mass or accumulation with supplementation.

Conclusions

Supplementally feeding the late gestation, fall-calving cows grazing bermudagrass pasture did not impact cow or calf performance. Also, there was no difference in forage production.

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Table 1. Cow and calf performance results

	Treatment			
Item	**Non- Supple-mented**	**Supplemented**	**SEM**	***P*-value**
Mid second trimester weight, lb	1218	1194	73	0.82
Beginning third trimester weight, lb	1361	1370	83	0.93
Prior to calving weight, lb	1481	1476	85	0.96
Gestation weight gain, lb	264	282	21	0.57
Peak lactation weight, lb	1250	1276	66	0.79
Lactation weight change, lb	-199	-200	22	0.37
Body weight change through lactation, lb	67	75	6	0.91
Mid second trimester BCS (scale 1-9)	5.13	4.99	0.34	0.78
Beginning third trimesters BCS	6.68	6.89	0.21	0.50
Prior to calving BCS	7.19	7.13	0.23	0.83
Gestation change in BCS	1.62	1.50	0.22	0.70
Lactation BCS	5.82	5.92	0.25	0.79
Change in BCS during lactation	-1.55	-0.92	0.28	0.13
Mid second trimester rump fat, mm	6.86	7.61	0.81	0.51
Prior to calving rump fat, mm	10.36	13.81	1.52	0.12
Calf birth weight, lb	79	74	4	0.43
Calf weight due to milk, lb[1]	21.4	22.1	1.87	0.95

[1] Calf weight gain from empty is used to estimate a cow's milk production.

Table 2. Pasture production based on treatments (results are on a dry matter basis)

	Treatment			
Item	**Non-Supplemented**	**Supplemented**	**SEM**	***P*-value**
Forage mass, lb/a	4374	4253	300	0.78
Forage accumulation, lb/a	4105	4960	1309	0.72

Form of Supplement and Addition of Ionophore Effects on Steer Performance while Grazing Bromegrass – Year 2

J. K. Farney, J. Jacquerez

Summary
Stocker steers were grazed on bromegrass from April to end of August and were supplemented with several different types of products. Treatment structure was a completely randomized design with five treatments. Treatments evaluated included mineral only (MIN); free-choice supplementation in a block format (Mintrate 40: BLOCK); and hand-fed supplement of corn:dried distillers grains at 0.25% of body weight on a dry matter basis offered three times per week (HAND). Additionally, ionophore (Rumensin; RU) was included in one block and one hand-fed supplement. Steers were weighed every 28 days while on grass. Steers received an ultrasound scan prior to placement in a feedlot. Monthly pastures were clipped to measure biomass. Steers that were hand-fed had greater ADG and were heavier at the end of the grazing period as compared with self-fed supplementation ($P = 0.02$). There was no difference in ADG, total gain, or final weight based on addition or not of an ionophore ($P > 0.37$). Hand-fed steers tended ($P = 0.07$) to have greater gains and final weight as compared to mineral only steers. There was no difference in gains between steers that were self-fed protein blocks as compared to MIN ($P = 0.78$). The gain advantages for hand feeding were observed by 84 d of grazing ($P = 0.03$). Steers that were supplemented tended to have greater muscle depth than MIN ($P = 0.07$) while there were no differences in marbling scores ($P > 0.27$) nor backfat thickness ($P > 0.52$) between any comparisons. There was no difference in available biomass between treatment groups ($P > 0.50$). Hand feeding supplements to cattle results in greater performance as compared to self-fed feeds evaluated. Cost of gain (COG), based on 2024 cost of products and assuming a 20-mile delivery, calculated to the lowest COG for MIN cattle, followed by hand-fed supplements, with the most expensive being the protein blocks. During the finishing period there were no differences in total gain, ADG, dry matter intake, nor feed to gain conversion for any treatments or specific comparisons ($P > 0.16$). However, the steers that were hand-fed supplements on grass were heavier at 140 days on feed as compared to self-supplemented steers ($P = 0.06$) and there was a tendency for steers that were supplemented on grass to have heavier weights at the end of feeding than those receiving only mineral ($P = 0.06$). Overall, if a producer was retaining ownership of calves through both the stocker and feedlot phase, they will gain an additional 46 pounds per head by supplementing with a corn:dried distillers grains delivered daily while in the stocker period over mineral only or a self-fed protein block.

Introduction
Supplementation is important in cattle production because it can (1) fill a need for a necessary nutrient; (2) allow increased gains on same acreage; (3) could allow for increased number of cattle on same acreage; (4) supply feed additives; (5) better monitoring of animals from a husbandry perspective; and (6) stretch forage supply, to name a few. Cattle management is different based on geographic location, access to labor, distance to cattle from feed source, forage types, and economic goals, and thus a variety

of supplements for grazing cattle have been developed to meet operational objectives. Determining which supplement best fits an operation can be daunting. Therefore, the purpose of this study is to evaluate the effect on weight gain of stocker steers grazing bromegrass during the summer based on (1) method of supplementation (hand-fed versus self-fed); and (2) addition of ionophore into the supplement.

Methods

Twenty brome pastures were used at the Southeast Research and Extension Center in Parsons, KS. Pastures were fertilized in March based on recommendations from soil test for P and K and all pastures had 100 lbs N applied in 46-0-0 form.

Supplement specifics: The hand-fed supplement (HAND) is a 50:50 blend of cracked corn:dried distillers grains (DDG) with or without Rumensin (138 g/ton; HANDRU) fed at 0.25% of body weight daily, offered 3 times a week on Monday, Wednesday, and Friday. The block treatments were Mintrate 40 Red Block (ADM Alliance Nutrition; BLOCK) and the Mintrate Red RU (BLOCKRU). Blocks were fed free-choice to the steers and placed in bunks to contain all pieces of the block. The control (CON) treatment were steers that were fed a free-choice mineral (MIN).

Weekly, the blocks were weighed to estimate intake. A new block was added when less than ¼ of the old block remained in the feed tub.

Cattle specifics: Weaned and vaccinated steers (584 ± 10.2 lb) were used and stocked at four head per pasture on 5-acre pastures. There were four pastures of each treatment. To manage for rumen fill effects, four days before turnout steers were fed a 50:50 diet of wheat middlings and DDG at 2% of body weight for three full days. On days -1 and 0 (day of turnout) steers were weighed on two consecutive days and placed on brome pastures (May 23, 2024). Steers were wormed prior to turnout with a white wormer (Valbazen, Zoetis Inc.). During May, insecticide eartags were inserted. Steers received an ultrasound scan (Aloka 500 with CPEC feedlot software) to detect any differences in ribeye area, backfat, and marbling on the last day of the grazing period (September 24, 2024; 121 days on grass).

Feedlot specifics: Steers were placed in a feedlot at Mound Valley, KS; implanted with a terminal implant (Revalor XS), then placed on a step-up diet to reach a finishing diet. Steers were penned in feedlot by contemporary pasture group. The finishing diet (on DM basis) was 85% whole shelled corn, 10% corn silage, and 5% supplement (contains minerals, vitamins, urea, Tylan, and Rumensin). Steers were weighed every 28 days.

Results and Discussion

Grazing (stocker phase)

There was no difference in grazing ADG when comparing all the treatments ($P = 0.13$; Table 1). However, grazing ADG was affected by category of supplementation where hand-fed steers had a greater ADG than free-choice supplements ($P = 0.02$; Table 1). This advantage was observed after cattle had been on trial for 84 d and was maintained until reaching the feedlot ($P < 0.05$; Table 1) and resulted in heavier final weight off-grass ($P = 0.07$; Table 1). There was no difference in grazing ADG based on addition of ionophore ($P = 0.13$) nor was there a difference in ADG based on whether the calves were supplemented or received mineral only ($P = 0.13$). This result is slightly confusing, as the weighed average for the block fed calves was the same as the mineral calves and this treatment lowered the gain of "supplemented" calves so that we could not distinguish the difference in supplemented versus non. Ultrasound data at the end of the grazing period (d 121) indicated very few differences between the feeding systems. The only difference detected was a tendency ($P = 0.07$) for greater back fat in hand-fed calves.

Forage biomass

There was no difference in forage biomass production based on supplement ($P = 0.33$; Table 1). The amount of forage available was sufficient to meet animal needs and intakes.

Feedlot

The steers that were hand-fed started the feedlot phase numerically heavier in weight than other treatments, even though it was not statistically significant. During the feeding period, there was no difference in ADG, total gain, gain to feed, nor dry matter intake based on stocker supplement system. However, the numerically heavier steers that were hand-supplemented on grass did have significantly heavier weights at 140 days on feed as compared to BLOCK and MIN treatments, with BLOCKRU being intermediate ($P = 0.03$; Table 1). This heavier weight at 140 days on feed resulted in whole system gains being larger for HAND than MIN and BLOCK treatments ($P = 0.09$; Table 1) with BLOCKRU and HANDRU being intermediate.

Table 1. Steer gain and carcass measures during the grazing, feedlot, and entire system

	P-value									
Item	**CON[1]**	**BLOCKk[2]**	**BLOCKRU[2]**	**HAND[3]**	**HANDRU[3]**	**SEM[4]**	**Trt[5]**	**Supp vs No[6]**	**Hand vs Self[7]**	**Ion.[8]**
Start weight, lb	584	585	586	582	587	11	0.99	0.93	0.95	0.74
Final grazing weight, lb	759	750	762	792	800	21	0.39	0.49	0.07	0.63
Grazing gain, lb	175	164	174	208	212	20	0.37	0.54	0.06	0.72
Grazing ADG, lb/d	1.45	1.36	1.44	1.72	1.76	0.16	0.13	0.37	0.02	0.39
Final feedlot weight, lb	1313^{c}	1323^{bc}	1341^{abc}	1406^{a}	1390^{ab}	25	0.03	0.06	0.01	0.97
Feedlot ADG, lb/d	4.00	4.1	4.14	4.41	4.19	0.13	0.29	0.17	0.19	0.50
Feedlot gain, lb	560	575	581	618	587	18	0.29	0.16	0.19	0.50
Dry matter intake, lb/hd/d	23.3	24.6	23.9	24.6	24.0	0.9	0.78	0.35	0.96	0.46
Feed:Gain	4.07	4.21	4.04	3.91	4.01	0.03	0.67	0.90	0.28	0.85
System ADG, lb/d	2.82	2.83	2.88	3.16	3.13	0.03	0.09	0.13	0.02	0.98
System gain, lb	735^{b}	739^{b}	752^{ab}	826^{a}	826^{ab}	8	0.09	0.13	0.02	0.98
Back fat, mm	4.20	3.94	3.64	3.90	4.02	0.54	0.98	0.57	0.95	0.87
Marbling[9]	4.92	4.91	5.04	4.86	5.11	0.16	0.82	0.76	0.89	0.28
Loin depth, mm	46.8	49.1	48.9	51.5	49.1	1.4	0.27	0.07	0.13	0.840
Pasture biomass, DM lb/acre	5851	6300	6920	6605	5809	429	0.33	0.26	0.36	0.84

[abcd]Values indicate treatment differences within row with $P < 0.05$.
[1]CON: control treatment received free choice mineral (Wildcat Feed, LLC).
[2]BLOCKk: Mintrate 40 block (ADM Alliance Nutrition) and BlockRU: Mintrate RedRU block includes Rumensin at 300 g/ton (ADM Alliance Nutrition).
[3]HAND: 50:50 blend of dried distillers grains (DDG) and cracked corn offered at 0.25% of body weight, 3 times per week (Monday, Wednesday, and Friday) and HandRU: 50:50 blend of DDG and cracked corn with Rumensin as 139 g/ton offered at 0.25% of body weight, 3 times per week (Monday, Wednesday, and Friday).
[4]SEM: standard error of means.
[5]Trt: *P*-value comparison between all 6 treatments.
[6]Supp. vs. No: *P*-value comparison non-supplemented (CON) and supplemented (MIX30, Block, BlockRU, Hand, and HandRU).
[7]Hand vs. Self: *P*-value comparison between free-choice treatments (MIX30, Block, BlockRU) and hand-fed treatments (Hand and HandRU).
[8]Ion.: *P*-value comparison between treatments with ionophore (BlockRU and HandRU) or without ionophore (Block and Hand).
[9]Ultrasound marbling score: 5.0-5.9 is Small 00-90 (CUP labs, 2007; *https://www.cuplab.com/Files/content/V.%201%20IMF%20or%20Marbling%207-1-07.pdf*).
[10]U.S. Department of Agriculture marbling scores: 300-399: Slight 0-90; 400-499: Small 0-90; and 500-599: Modest 0-90.

Hard Red and Soft Red Winter Wheat Variety Testing – 2024

G.F. Sassenrath, G. Blackburn, J. Lingenfelser,[1] and X. Lin[1]

Summary
This is a summary of the winter wheat production conditions in Kansas, with particular emphasis on the variety trial results from southeast Kansas in 2024. The fall of 2023 was dry, slightly impacting wheat establishment, but overall yields were above average of previous variety trials. Overall yields in the variety tests were much higher than the state averages at Parsons for both hard and soft wheat varieties. Above average rainfall in the spring did not result in significant disease pressure.

Introduction
Crop production is dependent on many factors, including cultivar selection, environmental conditions, soil, and management practices. This report summarizes the environmental conditions during the 2023-2024 winter wheat growing season in comparison to previous years and the historical averages for the state of Kansas. Fifteen hard red and 13 soft red wheat varieties were tested at Parsons.

Experimental Procedures
The Kansas State University Crop Performance Tests were conducted in replicated research fields throughout the state. This report summarizes winter wheat production for Parsons, KS. Wheat varieties were tested in Parsons silt loam soil at the Southeast Research and Extension Center (SEREC) in Parsons. All crop variety trials are managed with conventional tillage. Individual variety results are available at the K-State Crop Performance Test webpage (*http://www.agronomy.k-state.edu/outreach-and-services/crop-performance-tests/*).

Wheat was drilled in 7-inch rows at 1.2 million seed/acre (approx. 90 lb/acre) in conventional tillage with an Almaco plot drill in Parsons on October 4, 2023, and harvested on June 7, 2024. Plots were 7-ft wide by 27.5-ft long. Fertilizer was applied before planting at a rate of 65-50-50 lb/acre N-P-K (dry), with an additional 60 lb N/acre (dry) applied in February for both hard red and soft red cultivars. No fungicide or herbicides were applied to the wheat crop.

State reported crop yield data were downloaded from the National Agricultural Statistics Service Crop database (*https://quickstats.nass.usda.gov/*). Weather data were collected from the Kansas Mesonet website (*http://mesonet.k-state.edu/agriculture/degreedays/*) for a weather station located at the SEREC in Parsons. Cumulative rainfall was calculated on a water year (WY) basis from October 1, 2023, through June 30, 2024.

Results and Discussion
Fall of 2023 was very dry until late October (Figure 1). Rainfall throughout the winter and early spring was near average. Significant rain was received from late April through the end of June. Fortunately, most heading occurred before the heavy rain, so disease

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pressure did not significantly reduce yields. Heading began on April 15, with all varieties heading by April 24, 2024.

Acreage planted to winter wheat in Kansas decreased slightly in 2024 to 7.6 million acres (Figure 2). This is below the 50-year average of 10.5 million acres. Percent harvested acres was much higher in 2024, with 94% of planted acres harvested, higher than the 50-year average of 91%, and much higher than the 71% of planted acres harvested in 2023. Average statewide wheat yield was 43 bu/acre, an increase from last year and above the 50-year average of 38 bu/acre.

Yields for hard and soft winter wheat varieties in Parsons were above those harvested from previous variety trials (Figure 3). The average hard red winter wheat yield in 2024 in Parsons was 95.1 bu/acre with a test weight of 59.3 lb/bu (Table 1). Soft red wheat yield was 101.9 bu/acre, with a test weight of 58.3 lb/bu. While the soft red wheat yielded better than the hard red wheat, the difference was not as great as measured in previous years. The yields exceeded the 17-year variety averages of 58 bu/acre for hard red and 72.7 bu/acre for soft red varieties. Multiple year performance metrics for individual cultivars are presented in Table 1 (Hard Red Varieties) and Table 2 (Soft Red Varieties) from the Parsons variety trials.

Conclusions

2024 was a reasonably good year for wheat. Statewide yields were above average. Wheat crop growth and establishment were good and were not hindered by disease with late spring rains.

Acknowledgments

These data are part of the SRP 1186 2024 Kansas Performance Tests with Winter Wheat Varieties and will be available online, contribution number 25-030-S.

Table 1. Multiyear comparison of hard red winter wheat yields from variety trials at Parsons, KS

		2020		2021		2022		2023		2024	
Company	Variety	Yield, bu/a	Test weight, lb/bu	Yield, bu/a	Test weight, lb/bu	Yield, bu/a	Test weight, lb/bu	Yield, bu/a	Test weight, lb/bu	Yield, bu/a	Test weight, lb/bu
Syngenta AgriPro	Prolific					**82.2**	57.6	69.6	61	95.9	59.5
AGSECO	AG Radical	76.1	56.6	28	50	**75.2**	56	**86.9**	60.7	**103.7**	58.8
KWA Wildcat Gen	Everest	78.9	60.8	49.8	54.1	64	57.8	65.5	61	81.1	60.3
KWA Wildcat Gen	Providence					66.5	56.5	77.2	61.4	**98.6**	59.1
KWA Wildcat Gen	Zenda	**86.1**	60.8	**66.1**	55.2	**75.3**	58.2	58	61.5	85.1	60
Limagrain	LCS Atomic AX									95.7	59.2
Limagrain	LCS Runner									91.8	58.9
OGI	High Cotton									87.9	60.2
Polansky	Golden Hawk									**98.4**	58.8
Polansky	High Country							64.7	60.4	84.7	59.4
Polansky	Rock Star			**67.5**	54.6	**78.2**	55.6	71.4	60.9	96.1	58.3
WestBred	WB4269	**86.8**	60.3	**61.8**	54.3	67.1	55.7	**75.3**	60.4		
WestBred	WB4401	**108.8**	61.5	**92**	57.8	73	53.8	**84.4**	60.4	**100.7**	58.7
WestBred	WB4422					**85**	58	**80.2**	61.7	**102.3**	60.6
WestBred	WB4523					72.3	54.1	**80.7**	61	**103.5**	58.9
WESTBRED	WB4632							61.5	60.5		
WestBred	WB4699	**94.5**	58.7	39.5	50.7	**82.6**	56	**76.4**	60	**100.3**	58.8
Yearly average, hard red winter wheat		81.1	59.2	55.5	55.1	74.6	56.3	72.5	60.8	95.1	59.3

Yields above average are highlighted in bold.

Table 2. Multiyear comparison of soft red winter wheat yields from variety trials at Parsons, KS

		2020		2021		2022		2023		2024	
Company	Variety	Yield, bu/a	Test weight, lb/bu	Yield, bu/a	Test weight, lb/bu	Yield, bu/a	Test weight, lb/bu	Yield, bu/a	Test weight, lb/bu	Yield, bu/a	Test weight, lb/bu
AgriMAXX	492			**99.9**	56.3	81	57.5			102.1	60
AgriMAXX	503	**113.9**	60.1	**102.5**	56.2	80.6	55.7	77	58.8	105.0	59.5
AgriMAXX	505	**112.2**	60.7	**100.3**	57.2	**88.9**	57.7	**85.7**	60.2	103.2	59.1
AgriMAXX	513			**99.3**	55	**86.9**	56.7	81.4	59.5	101.2	58.6
AgriMAXX	514			**93.3**	54.4	**87.5**	55.3	**84.6**	58.8	104.8	57.4
AgriMAXX	535							84.2	60.2	104.1	58
AgriMAXX	545									101.4	56.7
AgriMAXX	EXP 2105					**87.1**	55.1				
AgriMAXX	EXP 2405									**110.5**	57.3
Beachner	GB0206			**96.4**	53.7	**86.2**	55.8	**90.7**	58.4		
Beachner	GB0208			89.9	55.1	**88.7**	56.2	83.4	59.6		
Beachner	Roane			71.7	56.4						
DuPont Pioneer	25R50	97.5	59.3			81.8	54.6				
DuPont Pioneer	25R65									104.8	57
DuPont Pioneer	25R74	**110.4**	61.6			**92.6**	54.8			104.1	58.3
DuPont Pioneer	25R76					79.1	55.8			91.3	58.8
Dupont Pioneer	25R77	103	61.6								
WestBred	WB24545									97.4	59.3
WestBred	WB2606					82.8	56.3	72.8	58.8	95	58.6
Yearly average, soft red winter wheat		102.4	59.5	90.4	54.9	85.2	56	83.8	59.3	101.9	58.3

Yields above average are highlighted in bold.

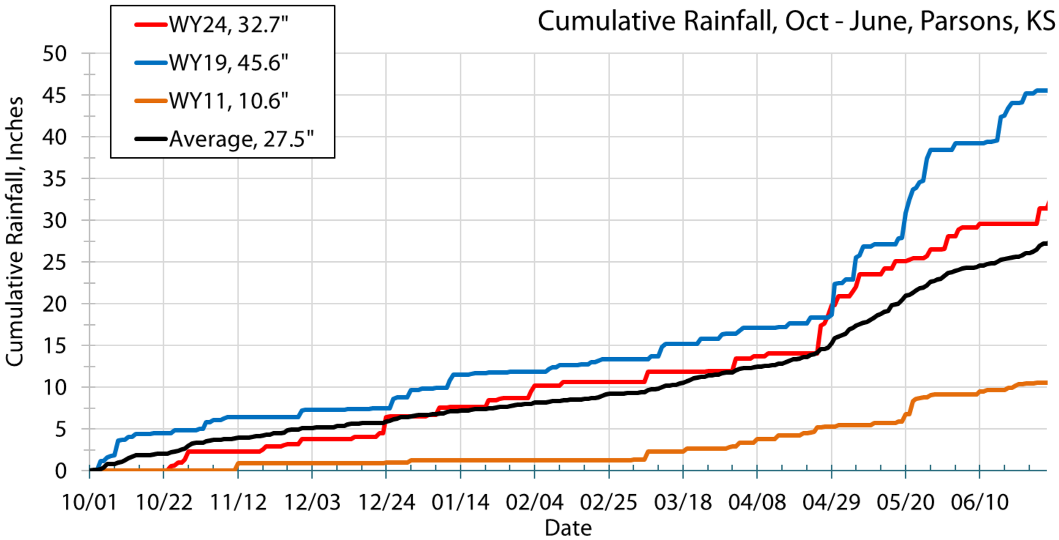

Figure 1. Cumulative rainfall during the winter wheat growing season (October 1 - June 30) for 14-year average, and previous wet (WY19) and dry (WY11) extreme years in comparison to most recent year (WY24). Rainfall totals during this period are given for each year.

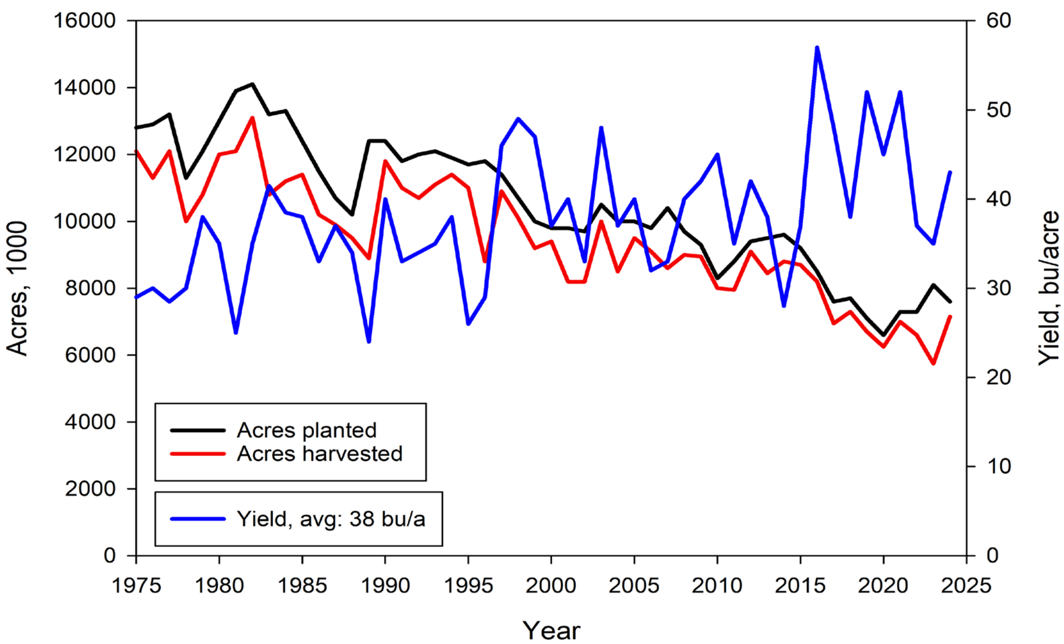

Figure 2. Statewide historical wheat production, (left axis) acres planted (black 1,000), acres harvested (red, 1,000), and (right axis, blue) average statewide winter wheat yield bu/acre for Kansas.

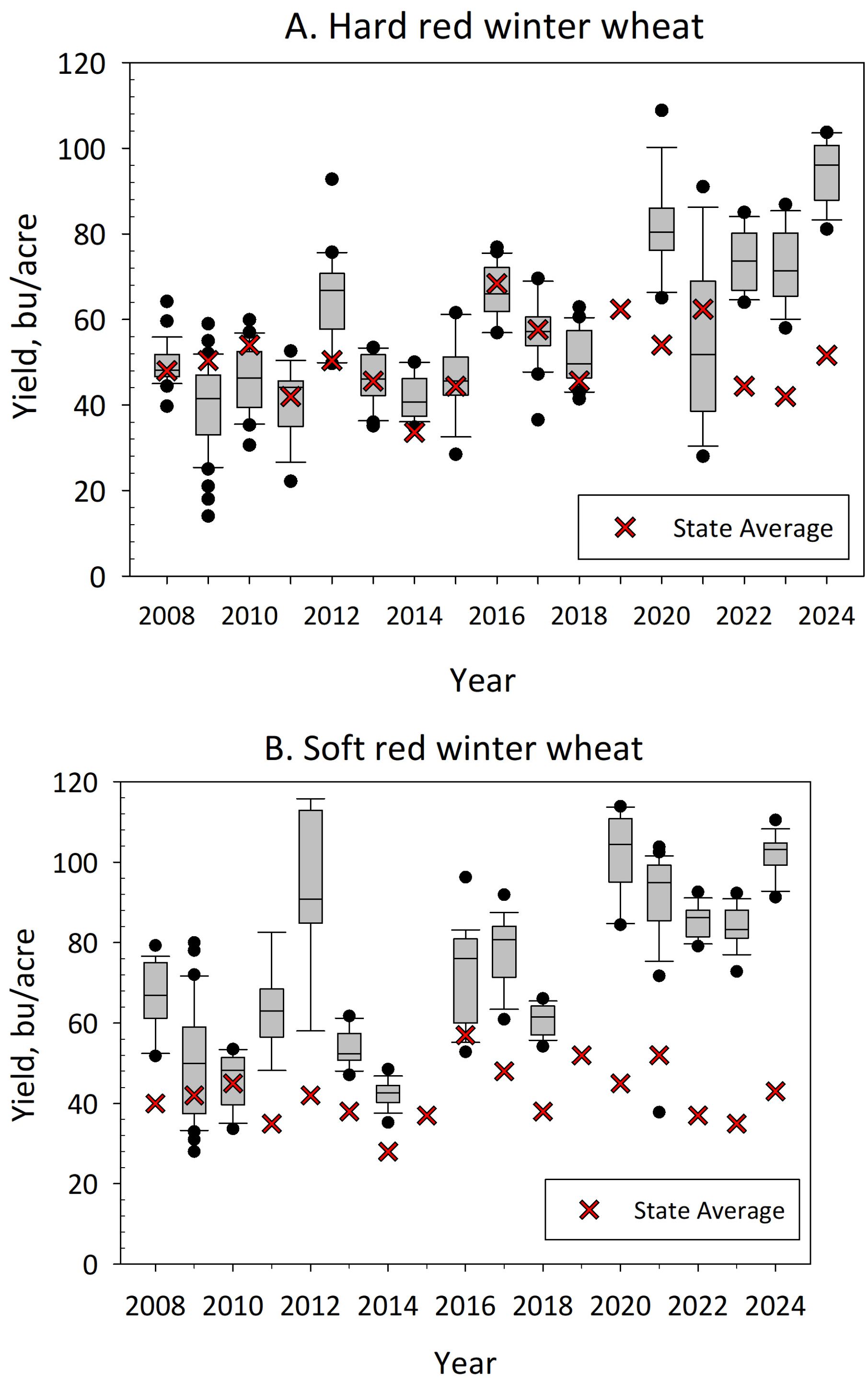

Figure 3. Winter wheat yield for (A) hard red wheat and (B) soft red wheat from variety trials in southeast Kansas from 2008 through 2024. In 2019, variety testing was abandoned due to flooding and poor stands. The line in the middle of the box plots is the median yield of all varieties. The upper and lower quartiles are given by the upper and lower edges of the boxes. The maximum and minimum values are given by the upper and lower "whiskers" extending from the box. Outliers are given as solid circles. For comparison, average reported state yields for hard red winter wheat from Kansas are highlighted as a red X. Statewide average hard red wheat yield is the red X.

Wheat Variety Test Results for South Central Kansas – 2024

J. Seiler, R. Hein, R. Flaming, R. Lollato

Summary
South Central Kansas is a significant wheat production region for the state. Variety selection is an important management decision to maximize profitability that growers face every season. This report summarizes the results of winter wheat variety tests for 2023-2024 in six locations.

Introduction
The success of a wheat crop is affected by several variables. Some of these variables that impact yield are beyond the control of growers (for example, rainfall and temperature conditions) (Lollato et al., 2017). However, growers can control many variables that drive grain yield, such as wheat variety selection (Lollato et al., 2020; Maeoka et al., 2020), population (Bastos et al., 2020; Jaenisch et al., 2019; Lollato et al., 2024) and fertility management (Giordano et al., 2023, 2024; Lollato et al., 2019a), disease control (Cruppe et al., 2021), and the interaction of many of these practices (Jaenisch et al., 2021; Lollato et al., 2019b). Among these decisions, wheat variety selection can lead to increased yields and affect the need for many other decisions such as pest and disease control (de Oliveira Silva et al., 2020; Jaenisch et al., 2022; Raj et al., 2023). A variety's performance varies depending on weather, soil characteristics, pest pressure, management, and timing of yield-impacting events. A variety must withstand a wide range of stressors for success in South Central Kansas, where yield-environment varies considerably even within the same county (Munaro et al., 2020; Sciarresi et al., 2019). Local variety trials are valuable to aid wheat growers in variety selection.

Procedures
The South Central Kansas Extension Wheat Variety Tests were conducted in six replicated trials: Andale, Clearwater, and Haysville in Sedgwick County; Caldwell and Belle Plaine in Sumner County; and Newton in Harvey County. The same 28 varieties were tested at each location.

Tillage practices and chemical applications were consistent with the host field and managed by the cooperating grower. The trials conducted in Clearwater, Newton, and Belle Plaine were no-till, Haysville adopted minimum tillage, and Andale and Caldwell adopted conventional tillage practices. The Andale, Newton, Belle Plaine, and Caldwell trials received a fungicide application between flag leaf emergence and heading, while the trials at Clearwater and Haysville did not receive a fungicide application. All locations were non-irrigated.

Plots, in all locations besides Haysville, consisted of six 9-inch wide rows, were about 30 feet long, and were sown using a Hege plot drill. In Haysville, rows were 7.5 inches wide, 30 feet long, and planted using a Great Plains plot drill. All locations were drilled at 1.2 million seeds per acre, adjusting for variety-specific seed size (Pinto et al., 2019). Trials were planted on the following dates: Andale (10/18/23), Clearwater (10/18/23), Newton (10/18/23), Belle Plaine (10/19/23), Caldwell (10/19/23), and Haysville (10/23/23). Harvest dates were Caldwell (6/10/24), Belle Plaine (6/12/24), Haysville

(6/12/24), Andale (6/14/24), Clearwater (6/14/24), and Newton (6/17/24). A third-party research company was hired to harvest the plots using a small plot combine.

The study was a randomized complete block design with three replications and 28 varieties. All varieties were similarly managed in each location, using standard regional practices. The 28 varieties had a range of yield potentials, maturities, abiotic tolerances, disease resistances/susceptibilities, and other agronomic characteristics that one year of yield data, one planting date, and one fertilizer/fungicide/herbicide management system may not capture.

Grain yield was analyzed within each location through a one-way analysis of variance using Excel. Variety was considered a fixed effect and replications were considered a random effect. A combined analysis of variance across locations considered location and replication nested within location as random effects.

Results

The 2024 south-central Kansas wheat trials benefited significantly from timely rainfall. The three-county trial area was planted in drought conditions after a low rainfall summer. Several rainfall events after planting and into the winter improved soil moisture for green-up, but low precipitation in March and April led to some fields in the area showing symptoms of drought stress. Timely rainfall around flowering and grain fill in May resulted in good yields across most trials. The trial in Haysville did not receive fungicide and experienced an infestation of stripe rust first, then leaf rust as the crop matured. Most varieties in this trial had their leaf area devastated by these diseases, but some were resisting very well (Figure 1). Rock Star showed resistance to the infestation and displayed great leaf health late into the growing season. Other varieties displaying good resistance to stripe rust were AP18 AX, Doublestop CL Plus, LCS Atomic AX, WB4401, WB4523, among several others. Varieties showing more susceptibility to stripe rust than others were AG Radical, KS Hatchett, Kivari AX, LCS Runner, LCS Steel AX, and WB4422. The Clearwater plot also did not receive a fungicide treatment and experienced stripe rust infestation.

The timely rainfall led to an average yield across all locations of 68.8 bushels per acre, which is about 42.7 bushels per acre more than the yields harvested in 2023 (Seiler et al., 2024). The highest-yielding trial was in Newton (88.8 bushels per acre) while the lowest-yielding trial was in Caldwell (47.7 bushels per acre). Wheat yields ranged from 40.8 to 100.6 bushels per acre due to the combination of location and variety. When evaluating the average variety yield across all sites, the lowest-yielding variety was Doublestop CL Plus (61.6 bushels per acre), and the highest-yielding varieties were Rockstar (75.4 bushels per acre), KS Providence (74.8 bushels per acre), KS Bill Snyder (73.6 bushels per acre), WB4523 (73.4 bushels per acre), and LCS Atomic AX (73.4 bushels per acre). The varieties Rockstar, KS Providence, and WB4523 yielded in the top statistical group in all locations.

Conclusions

Overall, wheat yield in south central Kansas significantly benefited from precipitation events during the month of May, which led to good yields across locations. Varieties with susceptibility to stripe rust and leaf rust in Haysville and stripe rust in Clearwater were negatively impacted by disease infestation. The southernmost site, Caldwell, was the lowest-yielding location. The northernmost site, Newton, was the highest-yielding location. This might suggest that the maturity at the time of precipitation events may have played a role in yield potential. Caldwell was the earliest location in maturity, and Newton was the latest. As expected, variety-specific performance was variable across locations, although a few adapted varieties rose toward the top across sites (namely, Rockstar, KS Providence, and WB4523). One option to manage risk is for growers to sow multiple wheat varieties in their operation so that the risks of weather extremes such as spring freeze or grain fill heat stress are more likely avoided, especially considering that no two growing seasons are alike. Each year, several yield-limiting factors can stress the wheat crop, and selecting several varieties can buffer against these risks. The response of wheat to these stressors is dependent on variety.

While the trials provide valuable information for local growers, they should be utilized along with other variety selection resources. When selecting wheat varieties, it is important to use multiple years of yield data, along with information provided by Extension Specialists and seed company representatives.

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Table 1. Wheat grain yield (bushels per acre) results for the 2023-24 winter wheat growing season at Andale, Clearwater, Haysville, Newton, Belle Plaine, and Caldwell, Kansas, as well as the average for all sites

Variety	Source	All	Andale	Clearwater	Haysville	Newton	Belle Plaine	Caldwell
Rock Star	Polansky	75.4	78.7	72.4	85.3	94.4	74.6	47.1
KS Providence	KWA	74.8	77.5	68.7	80.8	98.3	73.7	50.0
KS Bill Snyder	KWA	**73.6**	74.3	**69.8**	**78.5**	**100.5**	**72.3**	45.9
WB4523	WestBred	73.4	77.1	71.5	74.1	91.0	80.3	45.8
LCS Atomic AX	LCS	**73.4**	**79.2**	63.4	**84.9**	**99.3**	64.9	48.6
AP Prolific	AgriPro	73.0	76.7	67.6	76.2	97.4	68.0	52.1
LCS Helix AX	LCS	**71.3**	**84.2**	**71.9**	**77.4**	84.2	61.9	48.5
WB4699	WestBred	70.6	76.5	64.4	62.8	100.6	77.6	41.5
AP24 AX	AgriPro	**70.4**	**81.3**	65.7	66.3	85.2	**71.4**	52.3
High Cotton	OGI	69.9	72.5	75.5	72.6	91.8	58.4	48.4
LCS Warbird AX	LCS	**69.4**	75.0	**68.9**	69.1	**91.2**	61.8	50.5
WB4422	WestBred	69.2	82.1	60.2	61.6	87.9	73.2	50.5
KS Ahearn	KWA	**69.0**	**78.4**	**68.6**	61.0	**88.6**	**70.1**	44.6
AP18 AX	AgriPro	68.8	74.7	57.6	78.2	86.4	65.2	50.4
Showdown	OGI	**68.5**	**78.7**	**71.9**	70.7	79.0	58.1	52.7
Bob Dole	AgriPro	68.3	71.0	66.7	69.8	85.1	68.5	49.0
KS Mako	KWA	**67.6**	67.0	**70.5**	64.1	**93.3**	64.9	46.7
AM Cartwright	AgriMaxx	67.5	70.2	66.6	69.5	92.2	65.5	40.8
Kivari AX	PlainsGold	**67.0**	**76.6**	62.7	60.3	76.0	**73.9**	52.6
WB4401	WestBred	67.0	68.2	62.7	64.1	85.2	77.7	44.2
LCS Steel AX	LCS	**66.8**	**83.1**	49.5	53.0	**97.7**	**67.9**	49.9
Gallagher	OGI	66.6	71.2	62.8	60.3	86.1	71.4	47.9
Canvas	PlainsGold	**66.5**	**77.4**	60.6	63.1	**89.9**	61.5	46.3
KS Hatchett	KWA	66.0	72.6	61.3	64.8	83.7	66.0	47.0
Strad CL+	OGI	64.7	65.6	61.2	**79.7**	83.5	56.8	41.3
AG Radical	AGSECO	63.7	82.0	60.7	49.0	72.4	69.8	47.4
LCS Runner	LCS	62.1	69.8	60.4	50.7	81.9	58.6	50.2
Doublestop CL+	OGI	61.6	68.6	60.0	60.5	84.9	51.2	**44.6**
Average		68.8	75.4	65.1	68.2	88.8	67.3	47.7
Max		75.4	84.2	75.5	85.3	100.6	80.3	52.7
Min		61.6	65.6	49.5	49.0	72.4	51.2	40.8

*Values, highlighted in gray and bold, belong statistically to the highest test weight group. We cannot say values within the group are different from each other.

Figure 1. Detailed canopy photos of wheat varieties with different levels of disease resistance to stripe and leaf rust in Haysville, KS, during the 2023-24 wheat season. The top panel depicts a susceptible variety, and the bottom panel depicts a resistant variety. Note that in this location, most varieties had a large degree of leaf area loss due to early incidence of stripe rust followed by leaf rust and were showing similar levels of incidence and severity as that in the left panel.

Corn, Soybean and Sunflower Production – 2024 Summary

G.F. Sassenrath, G. Blackburn, J. Lingenfelser[1], and X. Lin[1]

Summary
Soybean and corn varieties were tested in replicated field trials at the Southeast Research and Extension Center in Parsons through the Kansas State University variety testing program. In 2024, 16 corn varieties were planted in March 2023. Excess rain led to a very poor stand, and the corn varieties were replanted in mid-June. The late planting led to very poor performance and the test was abandoned. The soybean variety test also failed and was abandoned. Twelve sunflower varieties were tested and harvested. The 2024 growing season was nearly average, but divergent rainfall resulted in flooding early, and long periods of drought in mid- to late summer. Lack of early autumn rains greatly reduced soybean yields. Temperatures throughout the summer were above the 14-year average.

Introduction
Kansas State University performs crop variety testing annually at several locations throughout the state. The Southeast Research and Extension Center tests crop varieties of corn, soybeans, and sunflowers. Variety selection is an important determinant of potential yield. Variety selection is also an important factor in disease and insect management. The crop variety tests performed through the Kansas State University variety testing program allow a comparison of variety performances under common growth conditions and management practices in multiple regions throughout the state.

Environmental conditions are key factors in determining crop success, together with soil characteristics, fertility, and management practices. Of the environmental factors, temperature and moisture (rainfall) are primary determinants of crop performance. Temperature is critical at certain crop developmental stages and plays a role in yield potential. Cumulative Growing Degree Days (GDD) are commonly used to estimate crop growth and developmental stage. Extreme Degree Days (EDD) are an indication of high-temperature exposure during the growing season and can negatively affect crop growth, development, and yield.

This report summarizes corn, soybean, and sunflower variety performance in Parsons, KS, in 2024. Corn varieties were initially planted in April, but excessive rain resulted in a poor stand; corn was replanted in June, but very poor stand establishment led to abandoning the test. Soybean varieties were abandoned because of poor yield due to very low fall rain.

Experimental Procedures
The Kansas State University Crop Performance Tests were conducted in replicated research fields throughout the state. Individual variety results are available at the K-State Crop Performance Test webpage (http://www.agronomy.k-state.edu/services/crop-performance-tests/). This report summarizes crop production for southeast Kansas, focusing on crops grown at Parsons and southeast Kansas. In 2024, crop varieties of corn, soybeans, and sunflowers were planted in 30-inch rows in upland fields (Parsons

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silt loam soil) at the Southeast Research and Extension Center in Parsons using conventional management and fertility. All crop variety trials are managed with conventional tillage. All crops germinated and appeared healthy.

Corn varieties were planted on March 23, 2024, in 30-inch rows at a rate of 23,000 seeds per acre. Excessive rain resulted in very poor stand establishments. Plots were replanted on June 15, 2024. Very poor germination resulted from low rainfall, and plots were abandoned.

Full-season soybeans were planted in 30-inch rows at a seeding rate of 123,000 seeds per acre on June 17, 2024, but abandoned due to poor plant stand.

Double-crop oilseed sunflowers were planted in 30-inch rows following wheat harvest on July 15, 2024, at a seeding rate of 23,000 seeds per acre. Plots were fertilized at a rate of 110-46-60 lb/acre N-P-K. Weeds were controlled with glyphosate (1 qt/acre), 2,4-D LV6 (1.5 pt/acre), Prowl H_2O (50 oz/acre), Spartan charge (8 oz/acre), and Clethodium (10 oz/acre). Sunflowers were harvested on Nov. 22, 2024.

State reported crop yield data were downloaded from the National Agricultural Statistic Service Crop database (*https://quickstats.nass.usda.gov/*). Weather data were collected from the Kansas Mesonet website (*http://mesonet.k-state.edu/agriculture/degreedays/*) for a weather station located at SEREC in Parsons. Cumulative rainfall was calculated throughout the year and during the summer growing season (March – Sept.). Cumulative growing degree days were calculated using base of 50°F during the summer growing season. The number of days of high temperatures (greater than 90°F) were calculated during the summer growing season. Extreme degree days were calculated as temperatures above 86°F.

Results and Discussion

Rainfall during the 2024 summer growing season (beginning with corn planting in March through the end of September) was 28.1 inches, slightly below the 14-year average of 29.4 inches (Figure 1). However, rainfall was unevenly distributed. The early spring rainfall (March 1 – April 25) was near normal. The next 47-day period from April 26 – June 11, however, received more than half of the total growing season rainfall of 15.5 inches, with two major rain events separated by long dry periods. A 3.1-inch rainfall in late June was followed by a long dry period beginning on July 3. No appreciable rain was received until August 13, resulting in the failure of the corn and soybean variety trials at Parsons. Although the total summer growing season rainfall was near-normal, the uneven distribution reduced stand establishment. The usual fall rainfall reduced soybean grain development and yields in the area.

The temperature during the 2024 summer growing season was above average (Figure 2), with total growing degree days (GDD, base 50) of 4295, above the 14-year average (4040). The number of days with temperatures in excess of 90°F was also above the 14-year average, with seven additional high-temperature days (Figure 3). Interestingly, the number of extreme degree days (463, EDD, base 86) was very near the 14-year average (468; Figure 4).

The area planted to corn in Kansas increased to 6.3 million acres in 2024, with 92% of the acreage harvested for grain; 5% of corn was harvested for silage. Grain yield statewide (Figure 5, 129 bu/acre) was slightly above the 50-year average (126 bu/acre).

Soybean acreage increased slightly in 2024, with 4.53 million acres planted. Production across the state was also higher than in 2023, with an average statewide yield of 35 bu/acre in 2024 (Figure 6). Ninety-seven percent of the planted soybean acres were harvested. Reduced fall rainfall limited soybean production in southeast Kansas. Due to very low yields, individual variety results are not reported. The average yield from the variety trials at Parsons was 13.8 bu/acre, well below the 14-year average at the location, and below the overall state average.

The statewide average yield of sunflowers was 1005 lb/acre. The yield from the variety trials at Parsons was slightly above the statewide average, but below the 14-year average at 1280 lb/acre (Figure 7).

Conclusions

The year 2024 was average for rainfall and slightly above normal for temperature. The lack of late-season rainfall reduced some crop yields, especially for soybeans, which usually fill pods with the early autumn rainfall. Corn that was planted timely was able to silk prior to drought and did about average.

Acknowledgments

This data are part of the 2024 Kansas Performance Tests Outreach and Services with Corn, Soybean and Sunflower Hybrids, contribution number 25-160-S.

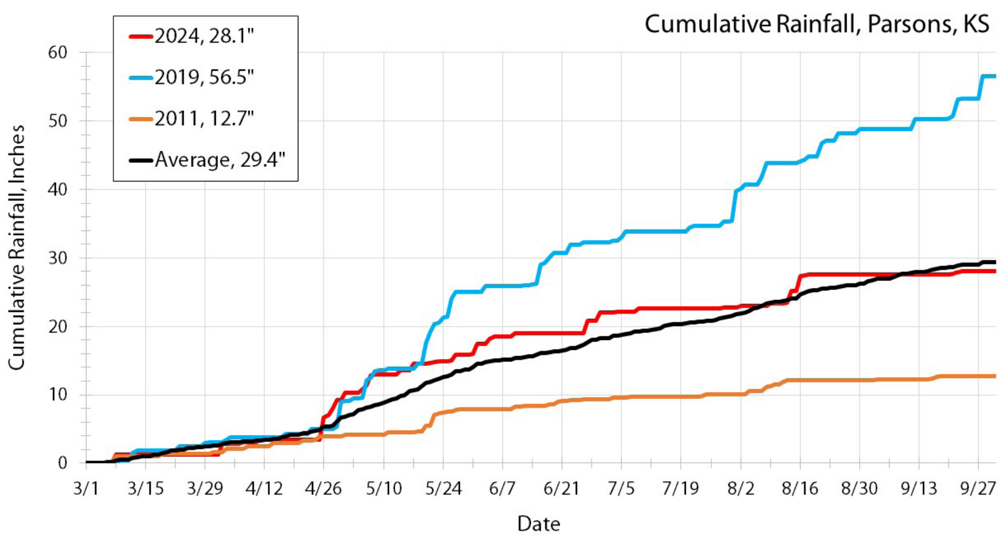

Figure 1. Cumulative rainfall during the summer growing season (March – September) for 2024. Extreme years (2011 and 2019) are shown for comparison with the 14-year average. Total rainfall in inches is given after each year.

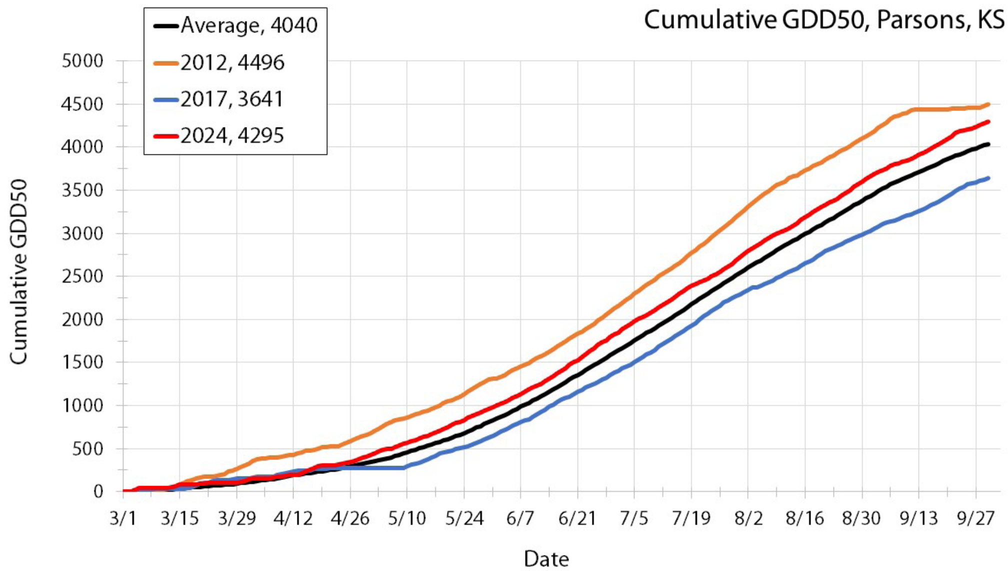

Figure 2. Cumulative growing degree days (GDD, base 50) during the summer growing season (March – September) for 2024. Extreme years (2012 and 2017) are shown for comparison with the 14-year average. Cumulative GDD from March 1 – Sept. 30 are given for each year.

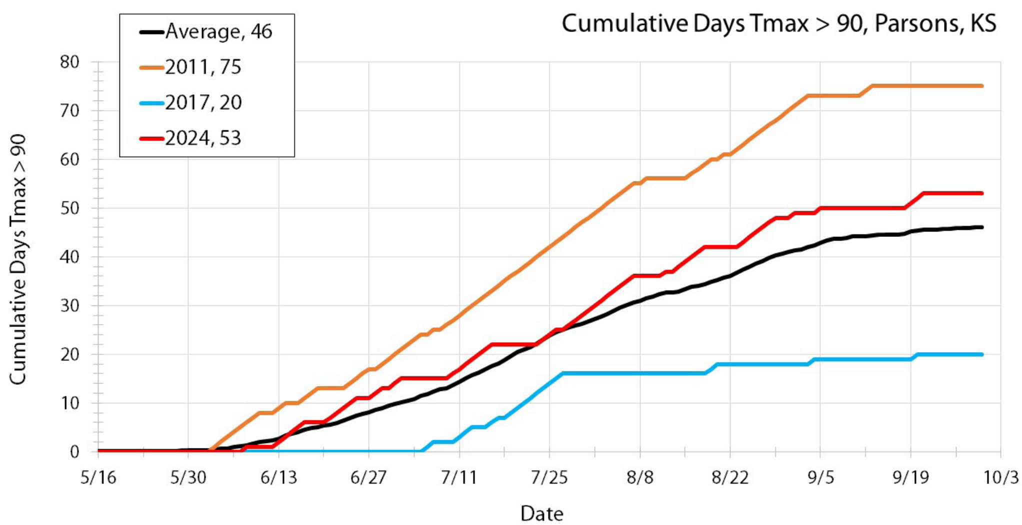

Figure 3. Cumulative number of days with high temperature exceeding 90°F during the summer growing season (March – September) for 2024. Extreme years (2011 and 2017) are shown for comparison with the 14-year average. Total number of days is given after each year.

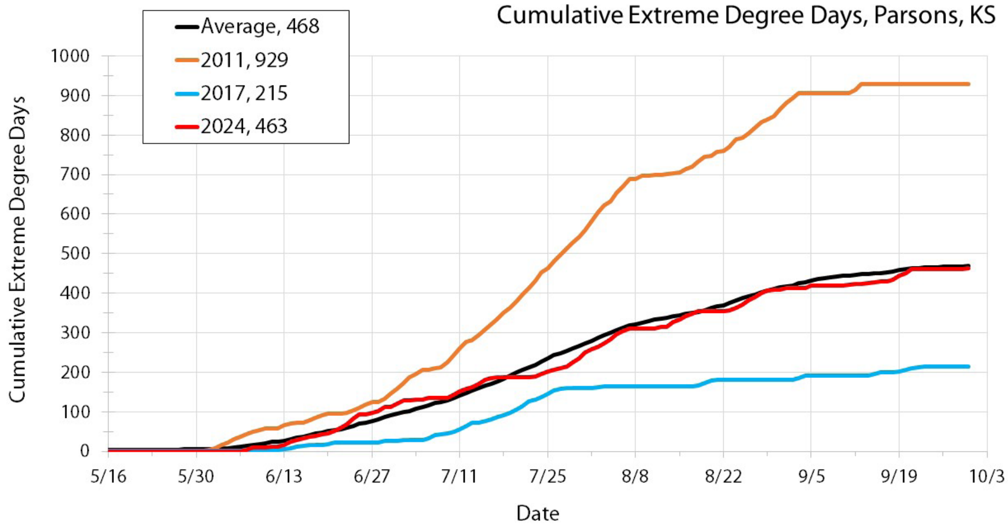

Figure 4. Cumulative extreme degree days (EDD, base 86°F) during the summer growing season (March – September) for 2024. Extreme years (2011 and 2017) are shown in comparison with the 14-year average. Total EDD are given after each year.

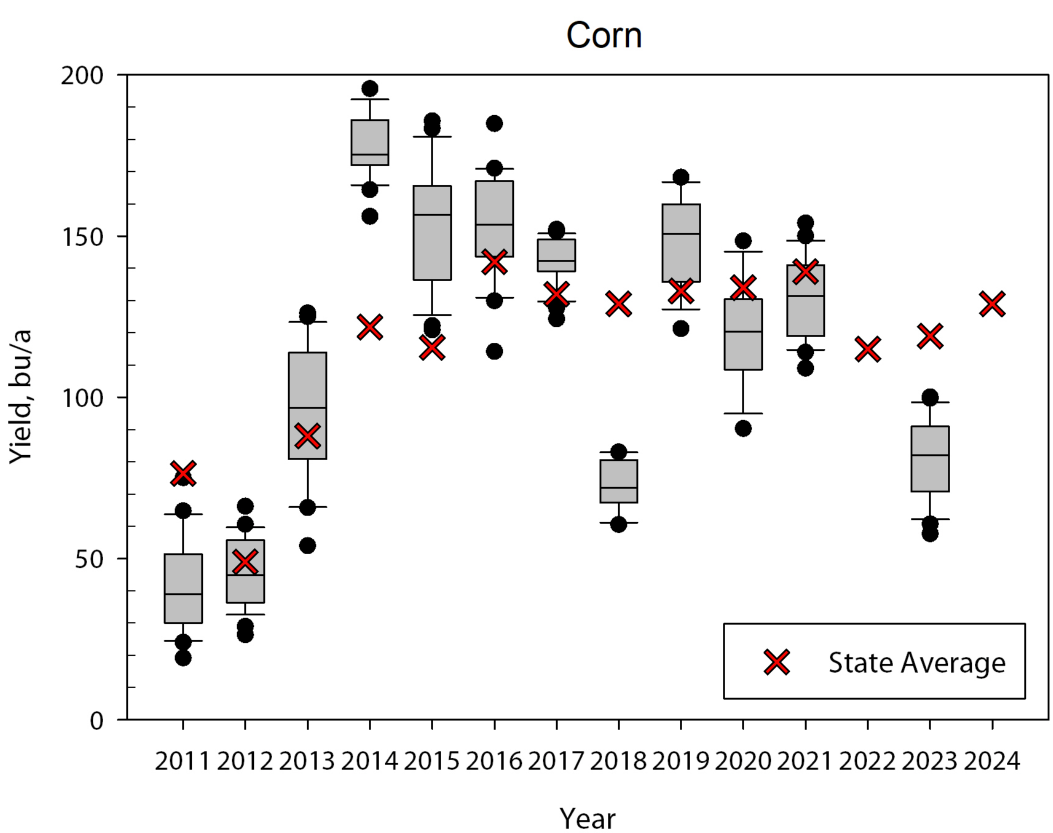

Figure 5. Corn variety test results at Parsons, KS, from 2011 – 2024. The line in the middle of the box plots is the median yield of all varieties. The upper and lower quartiles are given by the upper and lower edges of the boxes. The maximum and minimum values are given by the upper and lower "whiskers" extending from the box. Outliers are given as solid circles. For comparison, average reported yields from Kansas are highlighted as a red X. Corn variety tests were abandoned at Parsons in 2022 and 2024 because of insufficient rainfall.

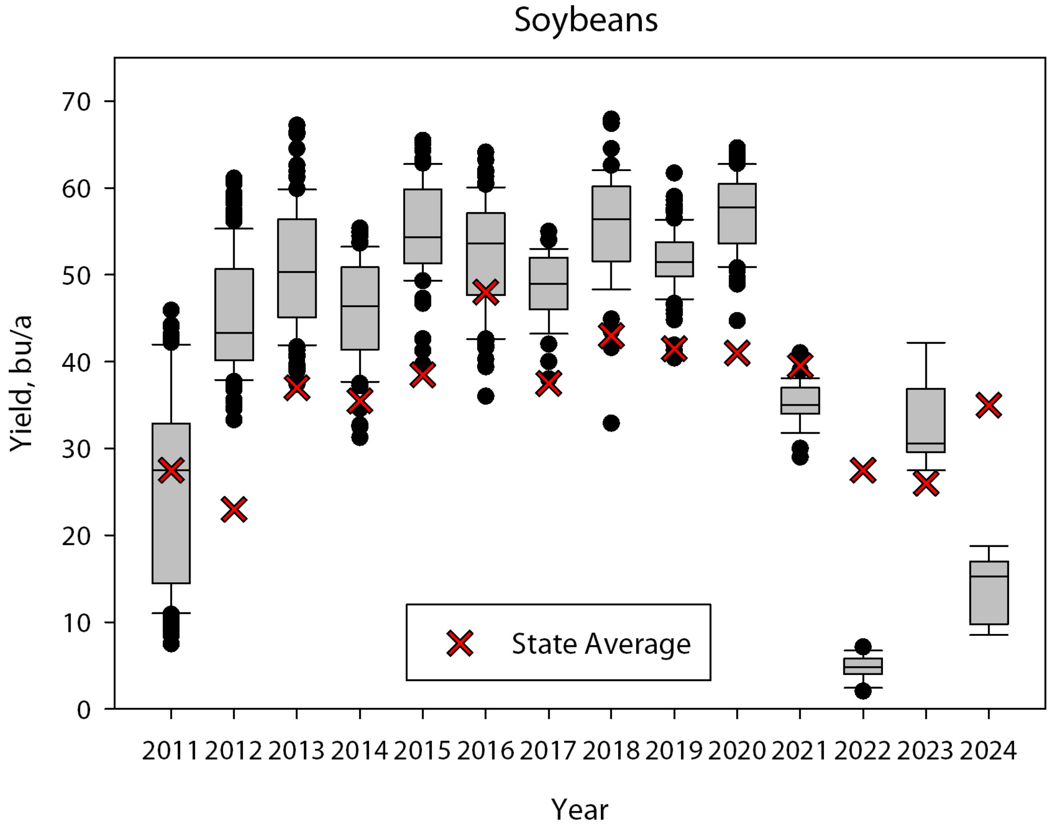

Figure 6. Soybean variety test results at Parsons, KS, from 2011 – 2024. Yields before 2023 are from full-season tests; soybean yields from 2023 are from double-cropped tests. For comparison, average reported Kansas state yields are highlighted as a red X. The variety test from 2024 was harvested, but results for each variety were not released due to poor stand.

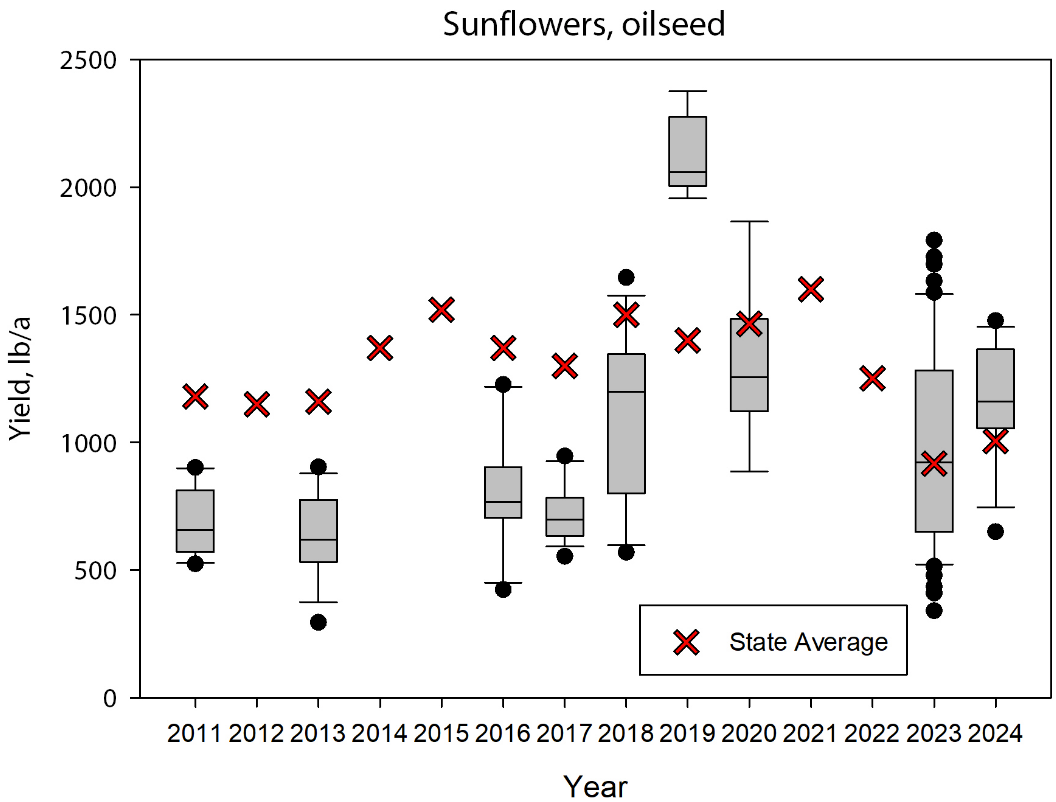

Figure 7. Oilseed sunflower variety test results from Parsons, KS from 2011 – 2023. For years with no bars, the variety tests failed. For comparison, average reported Kansas state yields are highlighted as a red X.

Role of Soil Nutrient Status in Microbial Activity and Disease

G.F. Sassenrath, C. Little,[1] and X. Lin[2]

Summary

The soil supports many living organisms, in addition to plants. Bacteria and fungi are critical components of the soil ecosystem and play fundamental roles in the biochemistry of the soil. This study explores the interdependency of the soil microbiome and soil nutrient status.

Introduction

Soil microbes play a critical role in nutrient cycling in the soil. Microbes break down materials, including plant roots and biomass. The breakdown products of this digestion then become available to support the growth of plants. There is a strong symbiotic interaction between plants and microbes in the nutrient cycling of the soil. Plants release carbohydrates that are then taken up by microbes and used for growth and development. In exchange, the plant microbes deliver nutrients and water to plants, including N, P, and K, as well as micronutrients. This symbiosis is at the heart of nutrient cycling in the soil, and essential for optimal plant growth and productivity. The soil microbiome is very responsive to plants, changing even for different varieties of the same crop.

Some soil microbes can also be harmful, such as disease-causing organisms, including fungi e.g., *Fusarium virguliforme* (cause of sudden death syndrome, SDS), *Macrophomina phaseolina* (cause of charcoal rot), Phytophthora root rot (*Phytophthora sojae*), and nematodes (e.g., soybean cyst nematode, *Heterodera glycines*). Diseases reduce the yield and quality of soybeans and other crops in Kansas and worldwide. Soil-borne diseases are prevalent in crop production fields. Control methods of disease include use of solarization to heat the soil, or chemical fumigation. Some plants have been shown to produce chemicals that act as biofumigants that control or reduce harmful soil microorganisms. These plants can be used to create suppressive soils that inhibit the growth of naturally occurring soil-borne diseases. Alternative management practices, such as the addition of animal manures, have also been used to alter the soil microbiome to improve control of disease organisms. Use of cover crops, such as the high-glucosinolate mustard (*Brassica juncea*), can reduce fungal populations that cause charcoal rot in both soil and soybean plants. Conversely, some management practices increase disease organisms, such as use of corn stover, which is a host of multiple disease organisms, or tillage.

This research tests the hypothesis that improving the overall soil health by supporting healthy soil microbial communities can reduce disease pressure. We are exploring how to create suppressive soils by altering management practices to reduce disease pressure. The research reported here explores the relationship between soil microbial activity and soil nutrients. The research tests the ability of cover crops, animal manure, and solarization to control or reduce charcoal rot in soybean production through improved soil microbial communities.

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Experimental Procedures

Replicated plots were established at the Southeast Research and Extension Center in Parsons in the Spring 2024. Plots included: fallow, mustard cover crop, soybean, corn stubble, cow manure, and plastic sheets. Plastic sheets provide a "solarization" treatment, increasing soil temperature and potentially reducing soil microbes. Plastic sheets were placed on plots and held in place with concrete blocks. Corn stubble was spread to about a 2-inch layer. Corn stubble may increase the soil microbial activity by providing more carbon, but is also a host for *M. phaseolina*, potentially increasing the disease prevalence. Cattle manure was spread to about a 2-inch layer on the plots. Cattle manure adds additional microbes to the soil, increasing the soil microbial diversity and increasing food sources for microbes. The high-glucosinolate mustard, Mighty Mustard Pacific Gold (Johnny's Selected Seeds, Winslow, ME) was broadcast in plots in early April. The use of a mustard cover crop has been shown to reduce the number of CFUs of *M. phaseolina*, while soybeans are a host and increase the colony forming units (CFUs) of *M. phaseolina*. Because of poor plant stand in the mustard, seeds were spread additional times during the growing season. The fallow treatment was left unplanted and served as a control. Five cultivars of soybeans, ranging from MG 3.4 to 4.8, were also planted to test for variation in charcoal rot sensitivity.

Soil samples to a depth of 6 inches were collected at three time periods, in spring prior to implemented treatments, mid-season, and after harvest. Soils were analyzed for nutrients at the K-State Soil testing lab in Manhattan. Soil microbial activity was measured with the 24-hour CO_2- burst test (Solvita, Woods End, ME). Disease prevalence was tested at the Plant Pathology lab in Manhattan.

Results and Discussion

Differences in microbial activity were observed based on management as determined by soil respiration measured with the Solvita CO_2 Burst test (Figure 1). Soybean plots varied from a low of 73.5 to a high of 86.8 ppm, indicative of a medium range in soil microbial activity (Solvita, 2017). The plots with added corn stubble and mustard seed were similar, at 78 and 67 ppm, respectively. The plots with manure were much higher, at 100 ppm. Conversely, the fallow and solarization plots were the lowest, at 52 and 48 ppm, respectively. The corn stubble and manure had much higher microbial activity (note different scale of axis) at 290 and 180 ppm, respectively. This level of activity would be rated high for microbial activity (Solvita, 2017).

Soil microbial activity increased as major and minor soil nutrient levels increased (Figure 2). This pattern was observed for pH and minor nutrients as well, including sulfur, boron, and calcium (data not shown). Much greater rates of increase in soil microbial activity were observed as soil carbon increased (Figure 3). This was apparent for both total organic carbon and organic matter. Increased soil microbial activity has been observed in other studies, and is indicative of the importance of carbon as a food source for microbial growth and production. The only soil nutrient that had a negative impact on soil microbial activity was NH_4.

Conclusions

Soil nutrients are essential for plant growth and development. They are also critical for the soil microbes. The role of soil microbes in plant nutrition is important to maintain the nutrient cycle within the soil. A healthy soil microbial community supports crop production. Here, we demonstrate differences in soil microbial activity with management, and the increase in soil microbial activity with increasing soil nutrient levels.

Acknowledgments

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Solvita. 2017. Guidelines for ranking test results. Tech Memo 0317-3. Solvita.com.

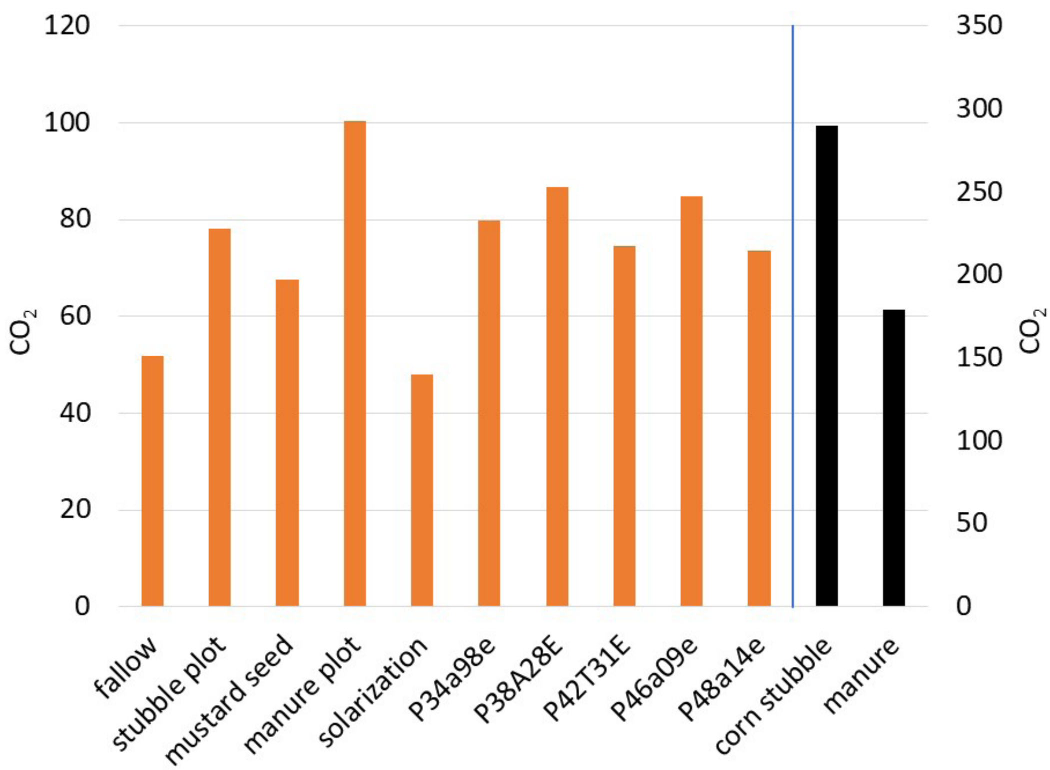


Figure 1. Difference in soil microbial activity as measured by the Solvita Burst test under different management conditions at mid-season. Activity in soils from 5 different soybean cultivars, and plots with added corn stubble, manure, solarization, and mustard seed are in orange, on the left axis. Microbial activity for only corn stubble and manure are in black, with the right-hand axis.

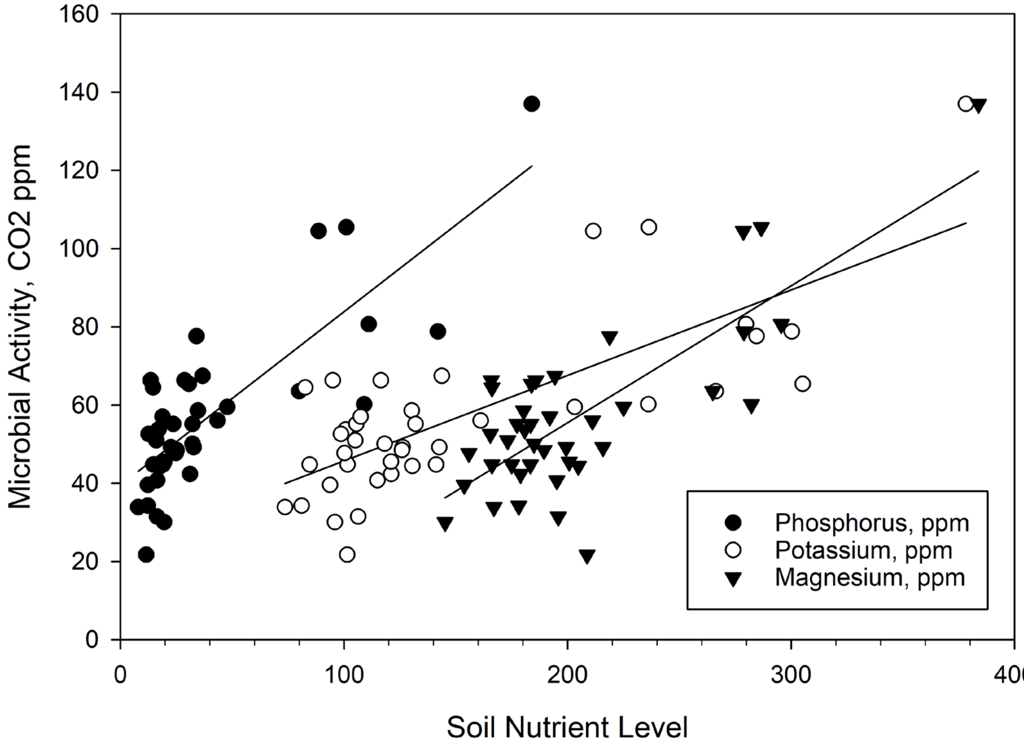


Figure 2. Change in soil microbial activity, measured as soil respiration in CO_2 ppm as soil nutrient level changes for phosphorus ppm (solid circles), potassium ppm (open circles), and magnesium ppm (closed triangles).

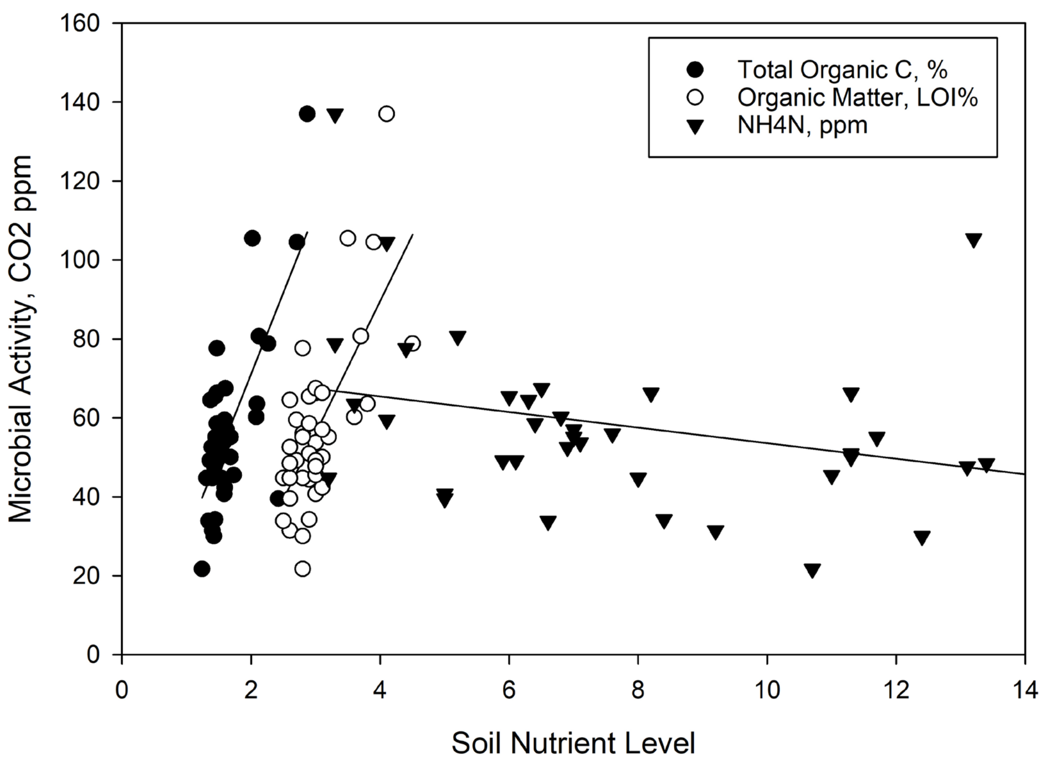


Figure 3. Change in soil microbial activity, measured as soil respiration in CO_2 ppm as soil nutrient level changes for total organic carbon % (solid circles), organic matter loss on ignition % (open circles) and NH_4N ppm (closed triangles).

Southeast Kansas Climate Summary for 2024

Matthew Sittel, Assistant State Climatologist

The divisional data in this report are from the National Centers for Environmental Information (NCEI). The NCEI generated monthly divisional averages based on individual station data from observers within the 14 counties that comprise this division (Fig. 1). The observations come from official reporting sites such as airports, as well as co-operative and citizen observers who measure both temperature and precipitation.

Precipitation was below normal in southeast Kansas in 2024. This was the fifth consecutive year with below normal precipitation. The year ranked as the 66th driest year on record in the division, dating back to the beginning of NCEI records in 1895. More notably, temperatures averaged above normal for the year, and 2024 was the second-warmest year on record in this division; only 2012 was warmer.

Southeast Kansas finished 2024 with a divisional average precipitation total of 37.49 inches, or 3.27 inches below normal. While below normal, this was over 7 inches more than what was received in 2023. Only three months during the year averaged above normal: January, April, and November. While May and June are typically the wettest months, in 2024 the wettest month was November (7.00 inches), followed by April (6.47 inches) (Table 1). December was the driest month (0.33 inch), and July was the most below normal, finishing nearly two and a half inches under the average amount (-2.49 inches). Despite another year with below normal annual precipitation, drought conditions at year's end were better than at the start. There was no D2 or worse drought category anywhere in southeast Kansas in the final US Drought Monitor map of 2024, issued on December 31(Figures 2a-b). The D1 at year's end was limited to parts of Bourbon and Crawford Counties. Much of southeast Kansas was classified as D0, or abnormally dry, a vast improvement from just two months earlier. The worst drought conditions in 2024 were during the month of October, when nearly one-fourth of southeast Kansas was classified as D3, and all areas were at D1 or worse. The very wet November brought dramatic improvements to the area. It was the third wettest November on record, and the wettest since 1992. Totals of 8 to 10 inches for the month were common across southeast Kansas, with a few higher amounts, like 10.55 inches north of Havana in Montgomery County, 10.41 inches at Fredonia in Wilson County, and 10.28 inches south of Peru in Chautauqua County.

The average annual temperature in southeast Kansas in 2024 was 59.9° F, or a departure of +2.8°. Only two months were below normal: January and July, with January the more below normal (-4.7°), thanks to a bitter cold airmass in the middle of that month. Below zero temperatures were recorded across all of southeast Kansas, as low as -10° F in Columbus on January 16. January was followed by the warmest February in 70 years. Over half the days featured highs in the 60s or warmer, with the highest readings at the end of the month, when Sedan reached 86° F on the afternoon of February 27. Record highs for the month of February were set or tied at Winfield (85°), Parsons (85°), and Chanute (84°). Temperatures averaged above normal for summer and the growing season, but there were fewer 100-degree days at most locations, and below normal counts of days where the low temperatures failed to fall below 70 degrees (Table 4).

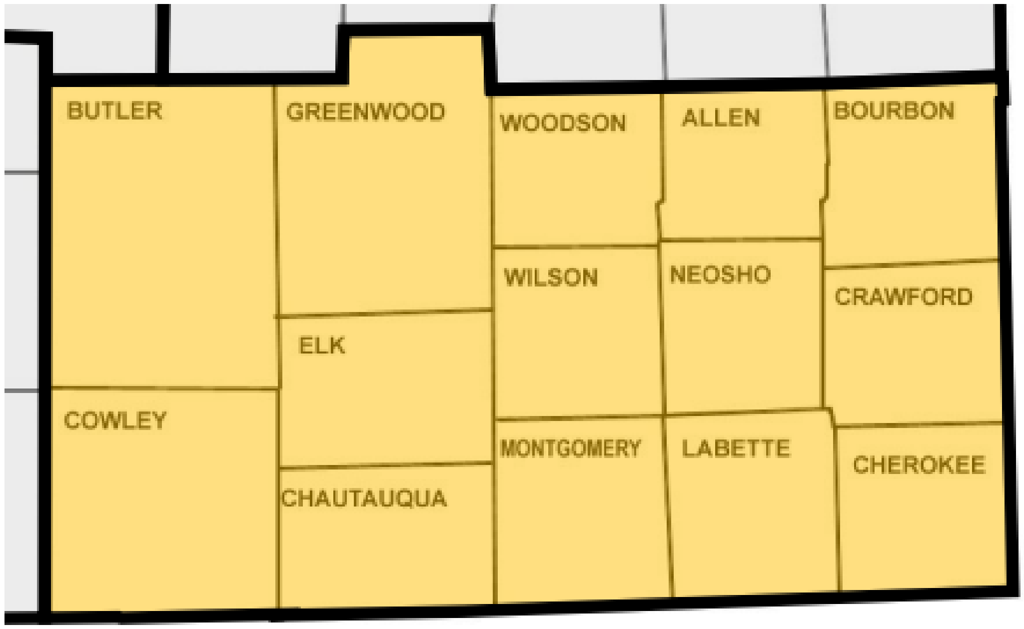
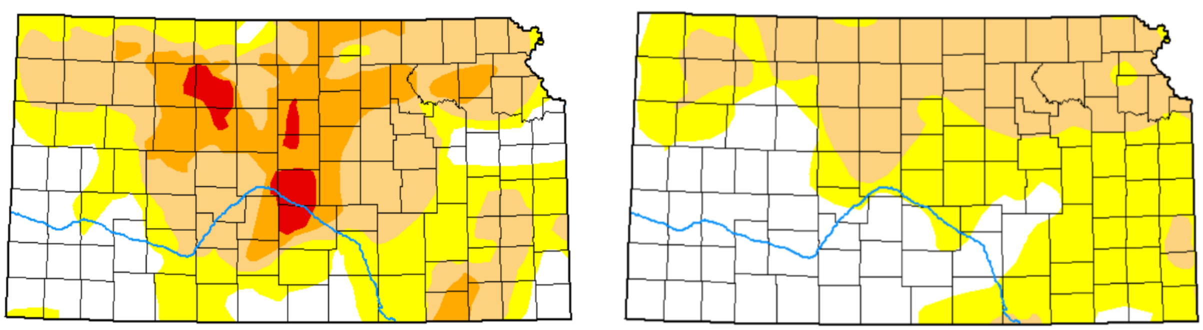


Figure 1. Map of the 14 counties comprising NCEI's southeast Kansas climate division.



Date	None	D0	D1	D2	D3	D4	DSCI
12/31/2024	35.20	36.08	28.72	0.00	0.00	0.00	94
12/26/2023	20.25	26.32	34.00	16.56	2.88	0.00	156

Figures 2a-b, Table 1. US Drought Monitor map for Kansas on December 26, 2023 (left) and December 31, 2024 (right), as well as the percentage of Kansas in each of the drought categories. D4 is the most severe category, while D0 is the least severe. None refers to drought-free conditions. DSCI is the Drought Severity Coverage Index, a composite index of overall drought conditions. Higher DSCI values indicate worse drought. The DSCI can range from a minimum of 0 (entire state drought-free) to 500 (entire state in D4).

Table 2. Total precipitation and daily temperature averages for each month across the southeast Kansas climate division (Source: NCEI).

	Precipitation (in.)			Temperature (°F)		
	Total	Norm.	Dep.	Avg.	Norm.	Dep.
Jan	1.80	1.22	+0.58	28.4	33.1	-4.7
Feb	1.43	1.59	-0.16	47.2	37.6	+9.6
Mar	1.85	2.75	-0.90	51.7	47.3	+4.4
Apr	6.47	4.14	+2.33	60.1	56.7	+3.4
May	5.63	5.96	-0.33	68.0	65.7	+2.3
Jun	4.52	5.45	-0.93	78.0	75.1	+2.9
Jul	1.74	4.23	-2.49	79.2	79.7	-0.5
Aug	3.59	3.92	-0.33	79.3	78.5	+0.8
Sep	1.84	3.93	-2.09	71.9	70.3	+1.6
Oct	1.29	3.48	-2.19	64.8	58.5	+6.3
Nov	7.00	2.13	+4.67	50.0	46.3	+3.7
Dec	0.33	1.77	-1.44	40.3	36.1	+4.2
YEAR	37.49	40.76	-3.27	59.9	57.1	+2.8

Table 3. The five wettest, driest, warmest and coldest years in southeast Kansas since 1895 (Source: NCEI).

Precipitation					Temperature (°F)			
Wettest		Driest			Warmest		Coldest	
Amount	Year	Amount	Year	Rank	Value	Year	Value	Year
57.60”	2019	21.93”	1963	1	60.7°	2012	54.0°	1979
54.09”	2008	22.28”	1956	2	59.9°	2024	54.2°	1895
53.62”	1961	22.60”	1952	3	59.9°	1954	54.3°	1917
52.36”	1985	23.06”	1980	4	59.5°	1946	54.4°	1903
51.95”	1973	23.40”	1917	5	59.4°	1921	54.5°	1993*

Table 4. Number of days in 2024 on which high temperatures were at least 90 and 100 degrees F, and the number of days on which low temperatures were at least 70 degrees, at selected locations across southeast Kansas. The average annual counts are based on 1991-2020 data. BOLD numbers in the 2024 columns indicate above normal totals.

	90°F -Degree Highs		100°F -Degree Highs		70°F -Degree Lows	
Location	**2024**	**Avg.**	**2024**	**Avg.**	**2024**	**Avg.**
Chanute	**81**	49	**8**	5	**57**	40
El Dorado	**75**	53	**11**	6	38	38
Eureka	**64**	50	6	7	36	27
Girard	**69**	52	1	4	42	40
Independence	**73**	54	**7**	6	39	43
Iola	31	40	0	2	31	38
Parsons	**57**	47	0	5	31	35
Sedan	**85**	58	**17**	9	**47**	40
Winfield	**86**	55	**18**	9	**52**	35
Yates Center	**49**	41	3	4	30	30

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Bartlett Co-Op, Bartlett, KS

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East Kansas Agri-Energy, Garnett, KS

Elanco Animal Health, Indianapolis, IN

Rich Falkenstien, Oswego, KS

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Kansas Forage & Grassland Council, Manhattan, KS

Kansas Soil Health Alliance, Esbon, KS

Kansas Soybean Commission, Topeka, KS

Kansas Wheat Alliance, Manhattan, KS

Labette Conservation District, Altamont, KS

McCune Farmers Union Coop, McCune,KS

Merck Animal Health, Summit, NJ

MFA Incorporated, Columbia, MO

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U.S. Department of Agriculture National Institute of Food and Agriculture

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