

Long-Term Cropping Systems Study – 2019 Yield Results

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The following information provides performance data of the main treatments within the long-term cropping systems study at the CREC during the 2019 growing season. Performance of treatments is represented by crop yield data. As background, the study was initiated in 1987 with three distinct crop rotations, three tillage systems and multiple nitrogen fertility levels. Over the years the crop rotations are modified slightly to reflect changes in crops of interest in the region, however consistency of plant type biology is generally maintained. All system treatments are established each growing season and specific components of treatments may be modified after completing a 4-year cycle.

The 2019 growing season started out with generally dry conditions as surface moisture was limited and subsoil moisture was below average. The beginning of the season was characterized by below normal precipitation from April through June, starting out 2.32 inches below normal. July, August and September had above average precipitation ending the season with 5.05 inches above normal. The end result was a growing season with above-average total precipitation, but with abnormal distribution. Temperatures were significantly lower in April and May and slightly above normal for June and July with the rest of the growing season near normal.

Grain yields from each crop within the three rotations during the 2019 season are shown in table 1. The yields listed represent the crop performance when averaged across nitrogen fertility treatments. Results show that crop performance was not influenced by tillage system that season. Spring wheat and soybean also yielded in a similar manner in each of the rotations they were included.

Table 1. Grain yield of crops among rotations across tillage systems, 2019.

Tillage System	Rotation 1				Rotation 2				Rotation 3			
	Spring Wheat bu/ac	Sunflower lb/ac	Barley bu/ac	Soybean bu/ac	Spring Wheat bu/ac	Field Pea bu/ac	Corn bu/ac	Soybean bu/ac	Winter Wheat bu/ac	Corn bu/ac	Soybean bu/ac	Spring Wheat bu/ac
Minimum	42.8	1679	65.8	64.8	35.3	NA	113.4	62.1	28.5	135.0	62.0	37.5
No-Till	39.5	1846	60.9	62.2	32.8	NA	122.3	65.1	28.1	125.7	61.6	38.8
Conventional	40.9	1933	61.8	62.6	38.3	NA	135.1	65.7	27.1	133.8	61.2	38.7
Average	41.1	1819.5	62.9	63.2	35.5	NA	123.6	64.3	27.9	131.5	61.6	38.4
LSD 0.05	NS	NS	NS	NS	NS	NA	NS	NS	NS	NS	NS	NS

Rotation 1 = Spring Wheat-Sunflower-Barley-Soybean

Rotation 2 = Spring Wheat-Field Pea-Corn-Soybean

Rotation 3 = Winter Wheat-Corn-Soybean-Spring Wheat

NA: Field pea not reported due to herbicide injury.

The influence of N fertilizer treatments on grain yields from 2019 are listed as crop averages across the three tillage systems in table 2. As might be expected, the crop yields generally responded to additions of N as different levels of fertilizer were applied. Only with corn did the 150-pound application result in a trend for yield greater than the 100-pound N fertilizer application. Crop performance across the composted manure N fertility treatments typically resulted in high yields across crops. The 2019 season represents the first year of a new 4-year cycle and manure is only applied at the onset of a cycle.

Yield does tend to decline in the manure treatments as the years progress in the 4-year cycle. The significance of soybean as a legume preceding spring wheat in rotation is reflected in relatively minor response to higher levels of additional N fertilizer.

Table 2. Grain yield of crops among rotations across nitroge fertility treatments, 2019.

Nitrogen Fertility lbs/ac	Rotation 1				Rotation 2				Rotation 3			
	Spring Wheat	Sunflower	Barley	Soybean	Spring Wheat	Field Pea	Corn	Soybean	Winter Wheat	Corn	Soybean	Spring Wheat
	bu/ac	lb/ac	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac	bu/ac
0	35.6	1385	24.4	65.7	31.8	NA	80.1	57.5	21.3	76.8	63.1	36.6
50	36.1	1862	71.7	66.1	33.4	NA	103.9	54.4	28.4	114.7	56.4	34.6
100	43.0	1898	72.0	62.2	35.2	NA	119.8	80.7	22.3	126.3	62.5	38.0
150	45.6	1610	64.9	59.0	34.4	NA	135.8	74.7	31.7	158.5	59.6	39.9
Manure	45.2	2343	81.4	63.0	42.6	NA	178.3	54.1	35.7	181.4	66.4	42.7
Average	41.1	1819.5	62.9	63.2	35.5	NA	123.6	64.3	27.9	131.5	61.6	38.4
LSD 0.05	6.2	398	14.3	NS	6.2	NA	21.2	12.6	5.7	21.2	NS	6.2

** Soybean and field pea as legumes do not receive any N fertilizer application.

NA: Field pea not reported due to herbicide injury.