2021 Annual Report

AGRICULTURAL COMPLEX
FOR
ADVANCED RESEARCH
AND
EXTENSION SYSTEMS
(AG-CARES)

IN COOPERATION WITH

Texas A&M Agrilife Research   Lamesa Cotton Growers   Texas A&M Agrilife Extension Service

Technical Report 22-1

2021 AG-CARES Annual Report

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The dry conditions that ended 2020 continued into 2021 for many areas of the Texas High Plains including the AG-CARES site in Dawson County. Some moisture (0.7”) was received from snowfall in January which allowed land preparation to be done. Listed ground and areas with either wheat stubble or growing cover prevented soil blowing. Essentially no rainfall was received in February, March, or early April. Preplant irrigation began in mid-April to help ensure planting moisture. Activities conducted during the first quarter of 2021 included soil sampling, herbicide applications, and several planning meetings for the upcoming season. Cover crop termination and fertilizer applications began in mid-April. The AG-CARES annual report was prepared and distributed in February and is available on the Lubbock AgriLife website.

The dry conditions with almost no rainfall continued through most of April at the AG-CARES farm near Lamesa, TX. Conditions began to change with over 2.8” rainfall received from April 28-May 1. This rainfall combined with warming temperatures allowed planting to begin on May 6 and most trials were planted by May 18. On May 19, 1.5” rain and significant hail destroyed emerged cotton but fortunately, much of the crop had not emerged. Replanting was completed by May 26. Rainfall for the month of May totaled 6.5”. Above average temperatures most of June resulted in excellent stand establishment and early-season growth. Initial fertilizer applications were made to both pivot and drip irrigated cotton. As of June 25, both irrigated and dryland cotton looked to be the best in years with good stands and no wind/sand damage. This situation changed dramatically on June 26 with 3.9” of rain and severe hail destroying all cotton. From June 26-July 4 a total of 7” of rain was recorded at this site.

The hailstorm destroyed more than 40 research trials conducted by Lubbock personnel (Keeling, Dever, Wheeler, Lewis, and Maeda). Long-term trials were replanted to cotton to maintain crop history. The AG-CARES crop, both irrigated and dryland, looked so promising in late June with abundant subsoil moisture. This is the reality of cotton production in a high-risk environment such as the Texas Southern High Plains. Following the severe hailstorm on June 26, most of the dryland and irrigated acres at AG-CARES were replanted to grain sorghum. Long-term systems plots were replanted to cotton to maintain cropping history even though yield and quality prospects are greatly reduced. After the hail event destroyed the cotton, 10 plants were dug up per plot and the root-knot nematode eggs were extracted from the roots. Even at 42 days after planting, the susceptible variety (DP 1646 B2XF) had significantly higher eggs (4,116 per 5 root systems) than did DP 2141NR B3XF (276 eggs per 5 root systems) or DP 2143NR B3XF (228 eggs per 5 root systems). These two new dicamba tolerant varieties were developed with both reniform nematode and root-knot nematode resistance.

Soil-water neutron probe data and soil health measurements were taken in the long-term tillage study. Soil samples were collected by cropping system and water level to a 48" depth. Samples have been analyzed for bulk density, nitrate, ammonium, organic C, and total N. This has been a very discouraging year at AG-CARES with the good start and above average rainfall throughout the growing season. For producers in the area, above average heat unit accumulation in late August, September, and the first half of October helped late planted cotton. Replanted grain sorghum was harvested in mid-November and cotton November 15-16. Cotton replanted July 6 did surprising well yielding 322 lbs lint/acre and sold for 77¢/lb. Replanted cotton grossed $249/A while replanted sorghum produced 1900 lb/A (sold for $10.90 per cut) and grossed $207/A. Neither of the replanted crops received summer irrigation due to the late planting date and above average rainfall in July and August.

Data from selected trials conducted at AG-CARES in 2021 are included in this report.

Cotton replanted in July at harvest.

Root-knot Nematode Test – Terry Wheeler

Planted on 13 May. Plots were 4 rows wide (40-inch centers) and 35 feet long. Three varieties were used: DP 1646 B2XF (treatments 6-10), DP 2141NR B3XF (treatments 1-5), and DP 2143NR B3XF (treatments 11-15). The infurrow insecticide Admire Pro [AP](8.5 oz/a) banded in the seed furrow, was applied to all treatments except those receiving the granular infurrow AGLOGIC. The non-nematicide check received only Admire Pro. Other treatments included BioST nematicide + AP, Copeo + AP, Velum in the furrow at 6 oz/a + AP, and AGLOGIC at 5 lbs/acre applied in the seed furrow. All 15 treatments were arranged in a randomized complete block design with four replications.

Data collection: Stand and vigor ratings (1 to 6 scale with 6 being the best growth) were made on 15 June. On the 26th of June a hailstorm destroyed the test. Ten roots were dug per plot on 30 June and rated for galling and root-knot nematode eggs were extracted from five of the root systems. No soil samples were taken, due to the roads being under water and the distance we were hiking in to get to the plots.

Environment: Temperature (Fig. 1) and soil moisture (Fig. 2) were adequate at planting. There were several rain events at 2 and 6 days after planting (Fig. 1) which greatly helped in getting good plant stands. Soil moisture was excellent for the entire 44 days after planting (Fig. 2) when the hailstorm occurred.

Results: The stands were adequate for all three varieties (Table 1) and all chemical treatments (Table 2). Plant vigor was lower for DP 1646 B2XF than for DP 2141NR B3XF or DP 2143NR B3XF (Table 1). Eggs per 5 roots, LOG10(Eggs+1), and eggs/gram root were significantly impacted by variety (Table 1), but not by chemical treatment (Table 2). DP 1646 B2XF had more eggs, transformed eggs, and eggs/gram root than the two nematode resistant varieties (Table 1). While the test did not make it to harvest, it did go long enough to verify the resistance in DP 2141NR B3XF and DP 2143NR B3XF against the root-knot nematode population in the field. However, given the good moisture during the first week after planting, it is surprising that the chemical treatments were ineffective at reducing egg production in the roots.

Table 1. Effect of varieties on root-knot nematode egg counts in Lamesa.

Varieties	Plants /ft row	Vigor	Eggs/ 5 roots	LOG_{10} (Eggs+1)	Eggs/ gram root
DP 1646 B2XF	2.71 a	3.80 b	4,116 a	3.39 a	585 a
DP 2141NR B3XF	2.63 ab	4.35 a	276 b	1.59 b	40 b
DP 2143NR B3XF	2.38 b	4.65 a	228 b	1.23 b	31 b
Prob>F	0.074	0.0005	0.0003	0.0001	0.0001

Table 2. Effect of varieties and chemical treatments on root-knot nematode egg counts.

Trt	Variety	Chemical	Plants /ft row	Vigor	Eggs/ 5 roots	LOG (Eggs+1)	Eggs/ Gram root
1	DP 2141NR B3XF	AdmirePro AP(8.5)	2.34	4.25	390	1.82	62
2	DP 2141NR B3XF	AP+CoPeo	3.04	4.50	240	1.83	28
3	DP 2141NR B3XF	AP+BioST Nem.	2.58	3.75	180	1.22	22
4	DP 2141NR B3XF	AP+Velum(6 oz)	2.55	4.50	480	1.97	75
5	DP 2141NR B3XF	AGLOGIC(5 lbs)	2.61	4.75	90	1.12	12
6	DP 1646 B2XF	AP(8.5)	2.70	3.25	3,690	3.40	550
7	DP 1646 B2XF	AP+CoPeo	2.59	4.00	7,680	3.66	1,072
8	DP 1646 B2XF	AP+BioST Nem.	3.20	4.00	1,890	3.26	324
9	DP 1646 B2XF	AP+Velum(6 oz)	2.53	3.50	3,000	3.47	457
10	DP 1646 B2XF	AGLOGIC(5 lbs)	2.54	4.25	4,320	3.15	523
11	DP 2143NR B3XF	AP(8.5)	2.34	4.25	210	1.31	27
12	DP 2143NR B3XF	AP+CoPeo	2.29	5.00	180	1.22	26
13	DP 2143NR B3XF	AP+BioST Nem.	2.41	4.75	510	1.34	71
14	DP 2143NR B3XF	AP+Velum(6 oz)	2.56	4.75	180	1.27	21
15	DP 2143NR B3XF	AGLOGIC(5 lbs)	2.29	4.50	60	1.04	10
	Prob>F		0.287	0.014	0.046	0.003	0.032
	MSD (0.05)			1.10	5,905	1.87	774

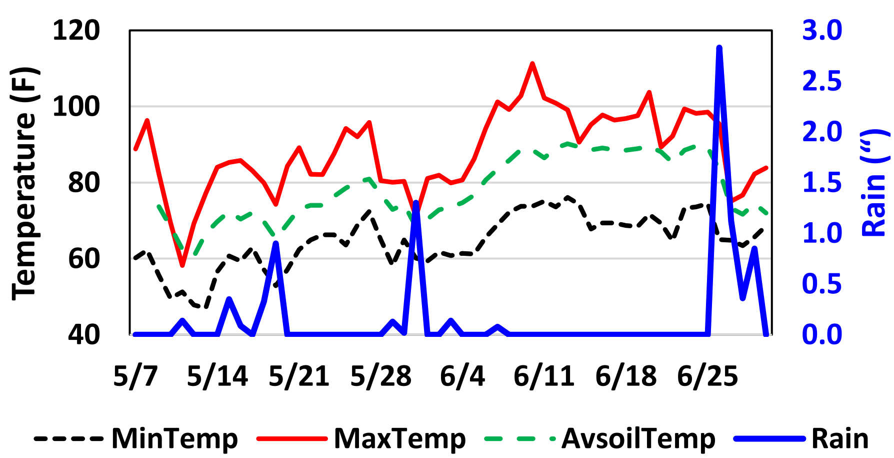

Figure 1. Minimum and maximum air temperature, average soil temperature (5-inch depth), and rain at the AGCARES site in Lamesa in 2021

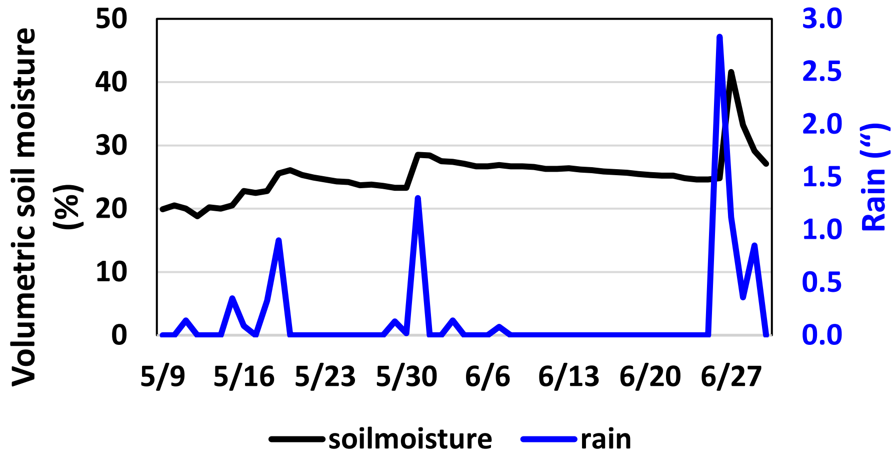

Figure 2. Average volumetric soil moisture and rain at the AG-CARES site in Lamesa, 2021.

Cotton Cropping Systems and Soil Quality - Katie Lewis et al.

Soil Characteristics

Soil organic C (SOC) was generally greater in the no-tillage with cover crops at the 0-6” depth compared to the conventional tillage treatments prior to planting cotton in May 2021 (Table 1). This same trend was also observed at the deeper sampling depth. This is likely the result of greater microbial biomass and activity with the cover crop systems compared to conventionally tilled system.

Nitrate-N was significantly greater under conventional tillage at the 0-6” and 6-12” depth compared to the no-tillage with cover crops (Table 1). Total-N was significantly greater with the cover crop treatments compared to the conventional system at the 12-24” depth. At the 0-6” depth, pH was significantly decreased with conservation management practices compared to the conventional system while sodium concentrations were greatest in the conventional system compared to the no-till cover crop systems. Phosphorus levels were greatest under no-till at the 12-24” depth.

Table 1. Soil pH electrical conductivity (EC), organic C (OC), total N (TN), and extractable macronutrient under conventional tillage (winter fallow), no-till with rye cover, and no-till with mixed cover at depths of 0-6”, 6-12”, and 6-24”. Samples were collected prior to planting cotton in 2021. Means within soil parameter and depth followed by the same letter are not significantly different at $P < 0.05$.

Management Practice	pH	EC	OC	TN	NO_3-N	P	K	Ca	Mg	S	Na
	---	μmhos cm^{-1}	g kg^{-1}	mg kg^{-1}							
	Depth 0-6"										
CT	7.2 a	295	3.0	242	21.4 a	79	327	1116	861	78	161 a
R-NT	6.8 b	213	3.6	313	2.3 b	88	351	966	691	45	93 b
M-NT	6.8 b	231	3.3	214	3.9 b	90	390	940	787	44	105 b
	Depth 6-12"										
CT	7.3	394 a	1.8	125	24.5 a	49	257	1069 a	849	81 a	159
R-NT	7.3	217 b	1.9	97	6.7 b	45	287	823 b	743	56 ab	115
M-NT	7.1	197 b	1.8	84	1.9 c	52	287	818 b	761	40 b	111
	Depth 12-24"										
CT	7.3	368	2.1 b	176 b	15.8 b	13 b	245	1285	1008	74	181
R-NT	7.2	372	3.5 a	344 a	28.3 a	20 a	268	1195	1032	80	199
M-NT	7.2	426	3.3 a	306 a	19.3 b	22 a	258	1155	1088	73	206

Cover Crop Herbage Mass Production and Decomposition

Herbage mass was not significantly different between no-till with rye cover and no-till with mixed cover crop treatments in 2016, 2018, 2020, or 2021 but differences were determined in 2015, 2017, and 2019 with the rye cover crop treatment producing greater above ground biomass compared to the mixed cover crop treatment in 2015 and 2017, while in 2019 the mixed species cover produced significantly greater biomass compared to the rye (Fig. 1). In 2015, 2016, and 2018 the rye cover crop tended to produce more herbage mass than the mixed cover crop treatment. Cover crops harvested in 2016 were seeded about a month earlier than cover crops harvested in 2015 and 2017, which provided adequate time for crop establishment prior to colder temperatures. Cover crops harvested in 2018 had the longest growing season of the years evaluated but due to limited rainfall during the growing season it produced reduced biomass. In 2019, the mixed species cover produced greater herbage mass compared to rye for the first time in the study. This is most likely due to poor rye germination in winter 2018. Herbage production in 2020 was similar to production rates in 2016 and 2017. This was likely a combination of increased heat units in Spring 2020. Herbage production in 2021 was severely limited by reduced winter precipitation and fewer heat units in the 2020-2021 growing seasons. Approximately 60% of the herbage mass decomposed by 4 DAT and ~80% herbage mass decomposed by 128 DAT (Fig. 2). Biomass decomposition was substantially slower in 2020 where ~75% of the herbage mass remained compared to 2021 which was likely caused by differences in overall biomass production between the two years (Fig. 1).

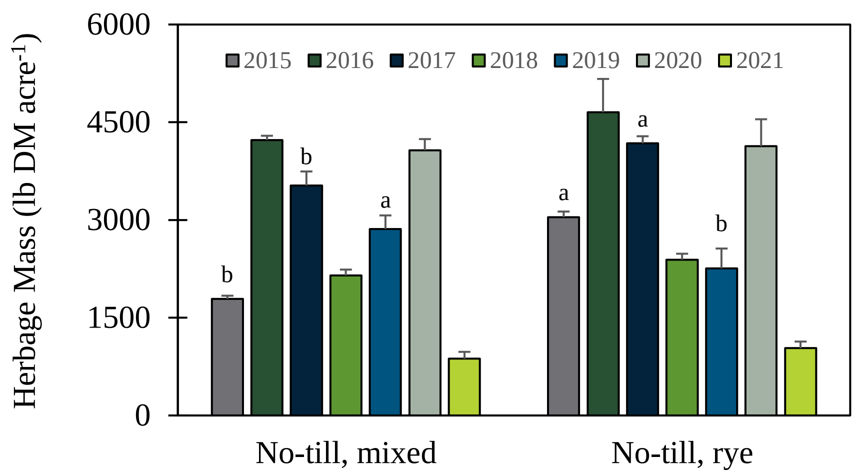

Figure 1. Herbage mass (dry matter, DM) of rye and mixed cover crops harvested in 2015, 2016, 2017, 2018, 2019, 2020, and 2021 with the no-till treatments at Lamesa, TX. Bars represent standard error of the sample mean. Mean values with the same letter within year are not significantly different at $P < 0.05$.

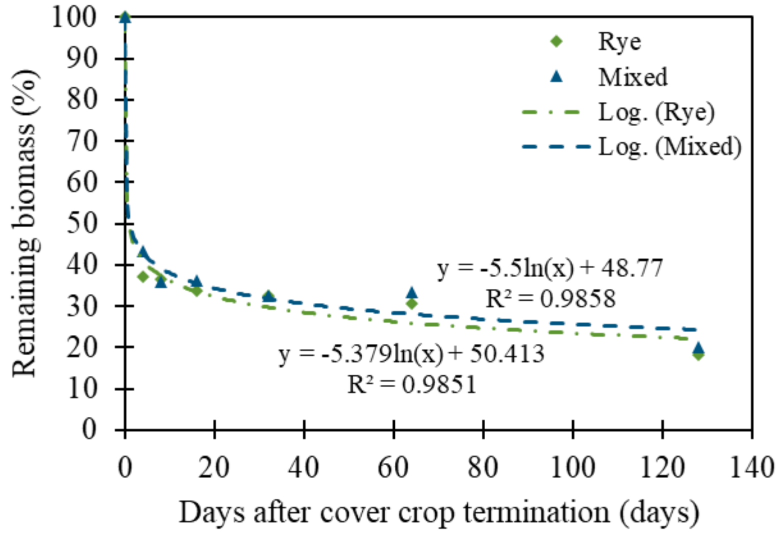

Figure 2. Cover crop biomass decomposition rate over time following termination on 9 April 2021 at AG-CARES, Lamesa, TX. There was no significant difference in decomposition rate between cover crops at any sampling date.

Impact of crop rotation with traditional and non-traditional cover crops on soil health in a transitional organic cropping system, AG-CARES, Lamesa, TX 2021.

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This research is aimed at evaluating soil health during the 3-year transition from conventional to organic production. This includes investigation of crop rotations and traditional and non-traditional cover crops. The crop rotations include: 1) continuous cotton; 2) cotton/peanut; 3) cotton/sesame; and 4) cotton/wheat/forage. Cover crop treatments include: 1) rye at 30 lb/acre; 2) rye/fenugreek/fennel mix at 15 lb/acre; 3) fenugreek/fennel mix at 15 lb/acre; and 4) rye at 15 lb/acre. Soil health parameters evaluated include bulk density, soil nutrient contents, and microbial analyses (PLFA). Weed biomass and abundance, cover crop biomass, and crop yields are planned to be determined.

Cereal rye was drilled on 4 December 2020 at 15 and 30 lb/acre. Preliminary soil samples were collected on 21 January 2021 to establish baseline levels in the study area. Fennel and fenugreek were drilled on 12 March 2021 but experienced poor establishment resulting in low biomass. Soil samples were collected from five depths (0-4", 4-8", 8-12", 12-24", and 24-36") on 31 March 2021 for bulk density, SOC, total carbon and nitrogen, and PLFA analyses. Cover crop biomass (Table 1) was collected on 3 May 2021. Manure compost was applied on 12 May 2021, and cotton cultivar'UA48' was planted on 13 May 2021. A hail event destroyed the cotton on 26 June 2021 and the cotton was replanted on 7 July 2021, resulting in a poor stand.

Table 1. 2021 Cover crop biomass.

Cover Crop Treatment	Biomass (kg/ha)
Rye @ 17 kg/ha	1460
Rye @ 34 kg/ha	1376
Rye/Fennel/Fennugreek @ 34 kg/ha	1400
Fennel/Fennugreek @ 17 kg/ha	22