2018 – Progress Report

Dow AgroSciences Mesquite Timing Trial with Sendero Herbicide

Site Locations: Comanche, Jack, Hamilton, Hood and Eastland Counties

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Summary
Sites were established in 2016, 2017 and 2018 to research the efficiency of Sendero Herbicide on mesquite when applied at different phenology stages throughout the growing season. A sample of Mesquite trees were treated every two weeks starting in May through November at sites in Hamilton and Jack County in 2016, Hood and Eastland County in 2017 and Hamilton and Comanche in 2018.

Objective
Mesquite is the most common noxious plant invading Texas Rangelands. Mesquite densities can reach such proportions as to severely limit desirable forage growth by competing for nutrients, water, and sunlight. In addition, large quantities of mesquite bean consumption over a period (several months) can be toxic to grazing animals. The objective of this study is to analyze Sendero herbicide on mesquite trees when applied at different phenology stages of the growing season

Materials and Methods
Mesquite trees were individually sprayed via ground broadcast with an ATV equipped with a CO2 powered spray rig with an evaluated spray boom to simulate aerial application. The boom was equipped with 7 XR8002 nozzles and was emitting a total spray volume of 10 gallon per acre. On each application date the condition of the trees was recorded as well as environmental conditions on that application date. Each treated tree was tagged with an ID number to allow reference to be made as to what condition the trees were in at the time of application. An evaluation was conducted at the end of the season to determine percent defoliation and percent

mortality was evaluated for two years after treatment at the 2016 sites and one year after treatment on the 2017 sites and will continue until all sites are evaluated at 2 years after treatment. Environmental conditions are listed in Table 1 and treatment details are listed in Table 2.

Table 1: Environmental conditions on application dates for the mesquite timing trial locations at Hamilton, Jack, Eastland, Hood and Comanche Counties.

Site	Date	Spray Time	Wind Speed/ Direction	Air Temp.	Soil temp	RH
2016 Sites						
Jack	5/24/16	8:30-9:00	SSE 11 mph	78	69	79
Jack	6/7/16	8:45-9:15	S 1 mph	75	78	67
Jack	6/21/16	8:30-9:00	SSW 7 mph	82	81	68
Jack	7/7/16	8:30-9:00	SSW 10+	81	78	73
Jack	7/19/16	8:00-8:20	Calm	90	82	52
Jack	8/5/16	8:30-8:50	SW 4 mph	84	92	67
Jack	8/16/16	8:38-8:51	Calm	72	75	87
Jack	8/30/16	8:45-9:00	Calm	78	84	85
Jack	9/12/16	9:15-9:34	SSE 9	78	81	79
Jack	9/27/16	9:15-9:34	WNW 2	63	65	68
Jack	10/18/16	8:52-9:10	SSW 6	72	71	79
Jack	11/1/16	9:40-9:50	S 10-12	71	72	86
Jack	11/16/16	10:00-10:30	SSW 8	77	72	37
Hamilton	5/5/16	8:00-8:30	Calm	63	65	76
Hamilton	5/18/16	8:00-8:35	NNE 12	58	64	98
Hamilton	5/31/16	8:00-8:30	S 8	74	74	97
Hamilton	6/14/16	8:00-8:30	ESE 4		78	87
Hamilton	6/30/16	8:00-8:30	Calm	80	79	79
Hamilton	7/14/16	8:00-8:30	S 10 MPH	78	81	81
Hamilton	7/27/16	8:00-830	SSW 6	70	86	80
Hamilton	8/15/16	8:20-8:40	SSE 4	79	80	97
Hamilton	8/29/16	9:00-9:20	NNE 5	75	82	92
Hamilton	9/12/16	8:45-9:00	SSE 2	70	82	95
Hamilton	9/29/16	8:45-9:10	N 8	64	69	71
Hamilton	10/10/16	9:00-9:25	Calm	58	68	73
Hamilton	10/28/16	9:35-10:50	S 7	71		71
Hamilton	11/16/16	2:30-2:50	SSW 12	84	75	56
2017 Sites						
Eastland	4/6/17	9:00-9:20	Calm	62	53	59
Eastland	4/25/17	9:10-9:40	8-11 mph SSW	75	72	55
Eastland	5/8/17	9:00-9:19	13 SSE	75	64	84
Eastland	5/24/17	1:40-1:58	9 West	74	66	34
Eastland	6/7/17	11:25-11:35	6 N	78	74	56
Eastland	6/22/17	9:16-9:30	3 ESE	77	72	66
Eastland	7/5/17	8:50-9:10	Calm	77	76	69
Eastland	7/19/17	9:00-9:15	SSW 9 mph	83	82	60
Eastland	8/3/17	9:30-9:44	Calm	72	74	92
Eastland	8/17/17	9:44-9:59	SSW 9 mph	85	74	61
Eastland	8/28/17	8:30-8:54	NNW 6 mph	69	70	98

Site	Date	Spray Time	Wind Speed/ Direction	Air Temp.	Soil temp	RH
Eastland	9/13/17	9:15-9:30	Calm	67	73	61
Eastland	10/2/17	9:10-9:35	S 13	73	70	74
Eastland	10/17/17	11:10-11:25	S 11 mph	65	68	38
Eastland	11/3/17	11:30-11:45	NW 7	52	60	86
Hood	4/27/17	9:20-9:30	7 SSW	56	62	
Hood	5/9/17	9:00-9:15	8 SE	69	71	
Hood	5/24/17	9:09-9:30	10 WNW	61	60	58
Hood	6/7/17	8:42-9:00	5 N	75	78	66
Hood	6/20/17	8:48-9:03	Calm	79	78	80
Hood	7/3/17	8:30-9:00	8 SE	81	74	70
Hood	7/20/17	8:30-9:00	SSE 6	83	78	67
Hood	8/4/17	8:55-9:06	Calm	79	77	74
Hood	8/18/17	8:28-8:41	2 S	75	77	88
Hood	8/29/17	8:40-8:55	3-10 NW	68	69	84
Hood	9/14/17	9:00-9:17	SE 8	74	76	73
Hood	10/2/17	11:40-12:02	SSE 13	83	75	56
Hood	10/17/17	8:45-9:05	Calm	51	64	75
Hood	11/3/17	8:50-9:05	NNW7	52	63	90
2018 Sites						
Hamilton	4/27/18	12:00-12:30	ENE @ 11 mph	72	66	38
Hamilton	5/14/18	8:30-9:30	S @ 11 mph	74	67	80
Hamilton	5/30/18	9:00-9:15	S @ 10 mph	80	73	63
Hamilton	6/13/18	10:33-10:53	S @ 13 mph	86	77	55
Hamilton	6/26/18	8:15-8:26	S @ 11 mph	79	80	
Hamilton	7/11/18	10:30-10:56	WSW @ 7 mph	89	81	50
Hamilton	7/25/18	8:40-8:55	Calm	81	90	49
Hamilton	8/9/18	10:50-11:15	W @ 8 mph	85	83	53
Hamilton	8/24/18	8:40-8:52	SSW 14 mph	80	80	58
Hamilton	9/13/18	9:10-9:30	S @ 1-3	76	74	85
Hamilton	9/27/18	11:10-11:25	N @4 mph	66	70	55
Comanche	4/27/18	9:30-10:00	N @ 10 mph	65	68	55
Comanche	5/14/18	10:45-11:15	S @ 13 mph	79	71	67
Comanche	5/30/18	11:00-11:20	S @ 10-13	89	76	47
Comanche	6/13/18	8:20-8:50	S @ 9 mph	79	81	73
Comanche	6/26/18	10:30-10:45	South @14	86	90	55
Comanche	7/11/18	8:10-8:36	S @3 mph	78	84	71
Comanche	7/25/18	10:00-10:50	SE 7 mph	91	90	35
Comanche	8/9/18	9:00-9:22	West @ 8 mph	83	89	66
Comanche	8/24/18	10:30-10:40	SSW 14 mph	88	82	42
Comanche	9/13/18	11:30-11:44	SE 7 mph	79	78	74
Comanche	9/27/18	9:00-9:18	Calm	58	70	74

Table 2: Herbicide application rates for mesquite timing trial applications in Jack, Hamilton, Hood, Eastland and Comanche Counties established in 2016, 2017 and 2018.

Date	Herbicide	Rate/A	Material/ plot	TSV	Tag Numbers	Tree Stage
2016 Sites						
Jack						
5/24/16	Sendero	28 oz	88 mL	1 gal	709-729	Early Stage <75
6/7/16	Sendero	28 oz	88 mL	1 gal	750-767	Pre-flower
6/21/16	Sendero	28 oz	88 mL	1 gal	791-800, 501-509	Flower
7/7/16	Sendero	28 oz	88 mL	1 gal	157-172	Bean Elongation
7/19/16	Sendero	28 oz	88 mL	1 gal	188-200, 990-991	Bean Elongation
8/5/16	Sendero	28 oz	88 mL	1 gal	676-690	Post Bean Elongation
8/16/16	Sendero	28 oz	88 mL	1 gal	816-830	Post Bean Elongation
8/30/16	Sendero	28 oz	88 mL	1 gal	851-870	Late Season w/new growth
9/12/16	Sendero	28 oz	88 mL	1 gal	691-700, 891-900	Late Season w/new growth
9/27/16	Sendero	28 oz	88 mL	1 gal	886,887, 890 701-717	Late Season w/new growth
10/18/16	Sendero	28 oz	88 mL	1 gal	758-777	Late season
11/1/16	Sendero	28 oz	88 mL	1 gal	798-800	Late season
11/16/16	Sendero	28 oz	88 mL	1 gal	301-320	Late season
Hamilton						
5/5/16	Sendero	28 oz	88 mL	1 gal	671-684	Early Stage <75
5/18/16	Sendero	28 oz	88 mL	1 gal	685-700, 703-708	Early Stage <75
5/31/16	Sendero	28 oz	88 mL	1 gal	730-749	Early Stage <75
6/14/16	Sendero	28 oz	88 mL	1 gal	768-790	Pre-flower
6/30/16	Sendero	28 oz	88 mL	1 gal	142-156	Flower
7/14/16	Sendero	28 oz	88 mL	1 gal	173-187	Flower
7/27/16	Sendero	28 oz	88 mL	1 gal	661-675	Bean Elongation
8/15/16	Sendero	28 oz	88 mL	1 gal	801-815	Post Bean Elongation
8/29/16	Sendero	28 oz	88 mL	1 gal	831-850	Late Season w/new growth
9/12/16	Sendero	28 oz	88 mL	1 gal	871-875, 889, 891	Late Season w/new growth
9/29/16	Sendero	28 oz	88 mL	1 gal	718-736	Late Season w/new growth
10/10/16	Sendero	28 oz	88 mL	1 gal	738-757	Late Season
10/28/16	Sendero	28 oz	88 mL	1 gal	778-797	Late Season
11/16/16	Sendero	28 oz	88 mL	1 gal	321-340	Late Season
2017 Sites						
Eastland						
4/6/17	Sendero	28 oz	88 mL	1 gal	901-920	Pre-flower <75
4/25/17	Sendero	28 oz	88 mL	1 gal		Pre-flower <75
5/8/17	Sendero	28 oz	88 mL	1 gal	956-975	Flower <75
5/24/17	Sendero	28 oz	88 mL	1 gal	351, 357, 358, 361-375	Flower <75
6/7/17	Sendero	28 oz	88 mL	1 gal	391-405	Flower <75
6/22/17	Sendero	28 oz	88 mL	1 gal	426-446	Flower <75/with Beans
7/5/17	Sendero	28 oz	88 mL	1 gal	468-487	Bean elongation

Table 2: Herbicide application rates for mesquite timing trial applications in Jack, Hamilton, Hood, Eastland and Comanche Counties established in 2016, 2017 and 2018.

Date	Herbicide	Rate/A	Material/ plot	TSV	Tag Numbers	Tree Stage
7/19/17	Sendero	28 oz	88 mL	1 gal	488-500, 991-1000	Bean elongation (still not filled
8/3/17	Sendero	28 oz	88 mL	1 gal	521-540	Post bean elongation
8/17/17	Sendero	28 oz	88 mL	1 gal	562-581	Post bean elongation
8/28/17	Sendero	28 oz	88 mL	1 gal	1-20	Late Season
9/13/17	Sendero	28 oz	88 mL	1 gal	41-60	Late Season
10/2/17	Sendero	28 oz	88 mL	1 gal	81-100	Late Season
10/17/17	Sendero	28 oz	88 mL	1 gal	132-152	Late Season
11/3/17	Sendero	28 oz	88 mL	1 gal	128,172-189	Late Season
Hood						
4/27/17	Sendero	28 oz	88 mL	1 gal	941-955	Early Season Preflower
5/9/17	Sendero	28 oz	88 mL	1 gal	976-990	Early Season Preflower
5/24/17	Sendero	28 oz	88 mL	1 gal	340-355, 359 and 360	Flower Stage
6/7/17	Sendero	28 oz	88 mL	1 gal	376-390	Flower stage
6/20/17	Sendero	28 oz	88 mL	1 gal	406-425	Bean elongation
7/3/17	Sendero	28 oz	88 mL	1 gal	447-467	Bean elongation
7/20/17	Sendero	28 oz	88 mL	1 gal	501-520	Bean elongation
8/4/17	Sendero	28 oz	88 mL	1 gal	542-559	post bean elongation
8/18/17	Sendero	28 oz	88 mL	1 gal	582-600	post bean elongation
8/29/17	Sendero	28 oz	88 mL	1 gal	21-40	late season
9/14/17	Sendero	28 oz	88 mL	1 gal	61-80	late season
10/2/17	Sendero	28 oz	88 mL	1 gal	101-116	Late Season
10/17/17	Sendero	28 oz	88 mL	1 gal	117-131	late season
11/3/17	Sendero	28 oz	88 mL	1 gal	153-171	late season
Hamilton						
4/27/18	Sendero	28 oz	88 mL	1 gal	516-530	Early Season Pre-75 F
5/14/18	Sendero	28 oz	88 mL	1 gal	531-545	Early Season Pre-75 F
5/30/18	Sendero	28 oz	88 mL	1 gal	561-575	Flowering
6/13/18	Sendero	28 oz	88 mL	1 gal	411-430	Flowering
6/26/18	Sendero	28 oz	88 mL	1 gal	491-500	Bean elongation
7/11/18	Sendero	28 oz	88 mL	1 gal	311-328	Bean elongation
7/25/18	Sendero	28 oz	88 mL	1 gal	331-350	Post Bean Elongation
8/9/18	Sendero	28 oz	88 mL	1 gal	391-400, 800-810	Post Bean Elongation
8/24/18	Sendero	28 oz	88 mL	1 gal	811-830	Late Season
9/13/18	Sendero	28 oz	88 mL	1 gal	851-870	Late Season
9/27/18	Sendero	28 oz	88 mL	1 gal	908-928	Late Season
Comanche						
4/27/18	Sendero	28 oz	88 mL	1 gal	500-515	
5/14/18	Sendero	28 oz	88 mL	1 gal	546-560	Early Season Pre-75 F
5/30/18	Sendero	28 oz	88 mL	1 gal	566-590	Early Season Pre-75 F
6/13/18	Sendero	28 oz	88 mL	1 gal	591-600, 400-410	Flowering
6/26/18	Sendero	28 oz	88 mL	1 gal	711-730	Flowering
7/11/18	Sendero	28 oz	88 mL	1 gal	291-310	Bean Elongation
7/25/18	Sendero	28 oz	88 mL	1 gal	351-370	Bean Elongation
8/9/18	Sendero	28 oz	88 mL	1 gal	371-391	Post Bean Elongation
8/24/18	Sendero	28 oz	88 mL	1 gal	831-850	Late Season
9/13/18	Sendero	28 oz	88 mL	1 gal	871-888	Late Season
9/27/18	Sendero	28 oz	88 mL	1 gal	889-907	Late Season

Results and Discussion

Defoliation evaluations were conducted on all sites prior to the first frost while untreated trees still had green leaves present. At this time all treatments and all sites had a very high degree of defoliation except the Comanche sites established in 2018 and the last treatment of 2016 and 2018 trials. The one-year evaluation was conducted in summer of 2017 for both the Jack and Hamilton sites. In the summer of 2018, the two year after treatment evaluation was conducted in Jack County while the one-year evaluations were conducted at Hood and Eastland Counties. The 2016 Hamilton site was grubbed prior to the evaluation and one year after treatment, evaluation data is questionable for that location and no evaluation was able to be conducted at 2 years after treatment. The percent mortality data for all sites is illustrated in Figures 1-4. Figures 5 and 6 are the sites established in 2018 and the graphs represent percent of trees in the treatment that were 100 percent defoliated at the end of season evaluation. The 2018 Hamilton site experienced a high degree of defoliation; however, the Comanche site did not see the same level of defoliation as Hamilton or the other sites conducted in previous year. This is thought to be due to extreme drought that took place in the summer of 2018.

Table 3. Percent mortality at one and two years after treatment for mesquite timing trials established at Jack, Hamilton, Hood, Comanche and Eastland Counties 2016-2017

Date	Herbicide	Rate/A	Tree Stage	Percent Mortality	
2016 Sites				**1 YAT**	**2 YAT**
Jack					
5/24/16	Sendero	28 oz	Early Stage <75	95	100
6/7/16	Sendero	28 oz	Pre-flower	89	83
6/21/16	Sendero	28 oz	Flower	94	94
7/7/16	Sendero	28 oz	Bean Elongation	73	71
7/19/16	Sendero	28 oz	Bean Elongation	57	60
8/5/16	Sendero	28 oz	Post Bean Elongation	87	87
8/16/16	Sendero	28 oz	Post Bean Elongation	93	93
8/30/16	Sendero	28 oz	Late Season w/new growth	25	31
9/12/16	Sendero	28 oz	Late Season w/new growth	75	80
9/27/16	Sendero	28 oz	Late Season w/new growth	15	30
10/18/16	Sendero	28 oz	Late season	20	25
11/1/16	Sendero	28 oz	Late season	0	25
11/16/16	Sendero	28 oz	Late Season	0	0
Hamilton				**1 YAT**	**2 YAT**
5/5/16	Sendero	28 oz	Early Stage <75	80	
5/18/16	Sendero	28 oz	Early Stage <75	69	
5/31/16	Sendero	28 oz	Early Stage <75	93	
6/14/16	Sendero	28 oz	Pre-flower	95	
6/30/16	Sendero	28 oz	Flower	100	
7/14/16	Sendero	28 oz	Flower	100	
7/27/16	Sendero	28 oz	Bean Elongation	100	
8/15/16	Sendero	28 oz	Post Bean Elongation	44	
8/29/16	Sendero	28 oz	Late Season w/new growth	50	
9/12/16	Sendero	28 oz	Late Season w/new growth	91	
9/29/16	Sendero	28 oz	Late Season w/new growth	94	
10/10/16	Sendero	28 oz	Late Season	67	
10/28/16	Sendero	28 oz	Late Season	46	
11/16/16	Sendero	28 oz	Late Season	14	
Eastland				**1 YAT**	**2 YAT**
4/6/17	Sendero	28 oz	Pre-flower <75	16	

Date	Herbicide	Rate/A	Tree Stage	Percent Mortality	
4/25/17	Sendero	28 oz	Pre-flower <75	50	
5/8/17	Sendero	28 oz	Flower <75	94	
5/24/17	Sendero	28 oz	Flower <75	61	
6/7/17	Sendero	28 oz	Flower <75	27	
6/22/17	Sendero	28 oz	Flower <75/with Beans	95	
7/5/17	Sendero	28 oz	Bean elongation	70	
7/19/17	Sendero	28 oz	Bean elongation (still not filled)	80	
8/3/17	Sendero	28 oz	Post bean elongation	90	
8/17/17	Sendero	28 oz	Post bean elongation	80	
8/28/17	Sendero	28 oz	Late Season	33	
9/13/17	Sendero	28 oz	Late Season	11	
10/2/17	Sendero	28 oz	Late Season	0	
10/17/17	Sendero	28 oz	Late Season	0	
11/3/17	Sendero	28 oz	Late Season	0	
Hood				1 YAT	2 YAT
4/27/17	Sendero	28 oz	Early Season Preflower	100	
5/9/17	Sendero	28 oz	Early Season Preflower	100	
5/24/17	Sendero	28 oz	Flower Stage	87	
6/7/17	Sendero	28 oz	Flower stage	76	
6/20/17	Sendero	28 oz	Bean elongation	95	
7/3/17	Sendero	28 oz	Bean elongation	47	
7/20/17	Sendero	28 oz	Bean elongation	78	
8/4/17	Sendero	28 oz	post bean elongation	83	
8/18/17	Sendero	28 oz	post bean elongation	57	
8/29/17	Sendero	28 oz	late season	21	
9/14/17	Sendero	28 oz	late season	5	
10/2/17	Sendero	28 oz	Late Season	0	
10/17/17	Sendero	28 oz	late season	7	
11/3/17	Sendero	28 oz	late season	0	

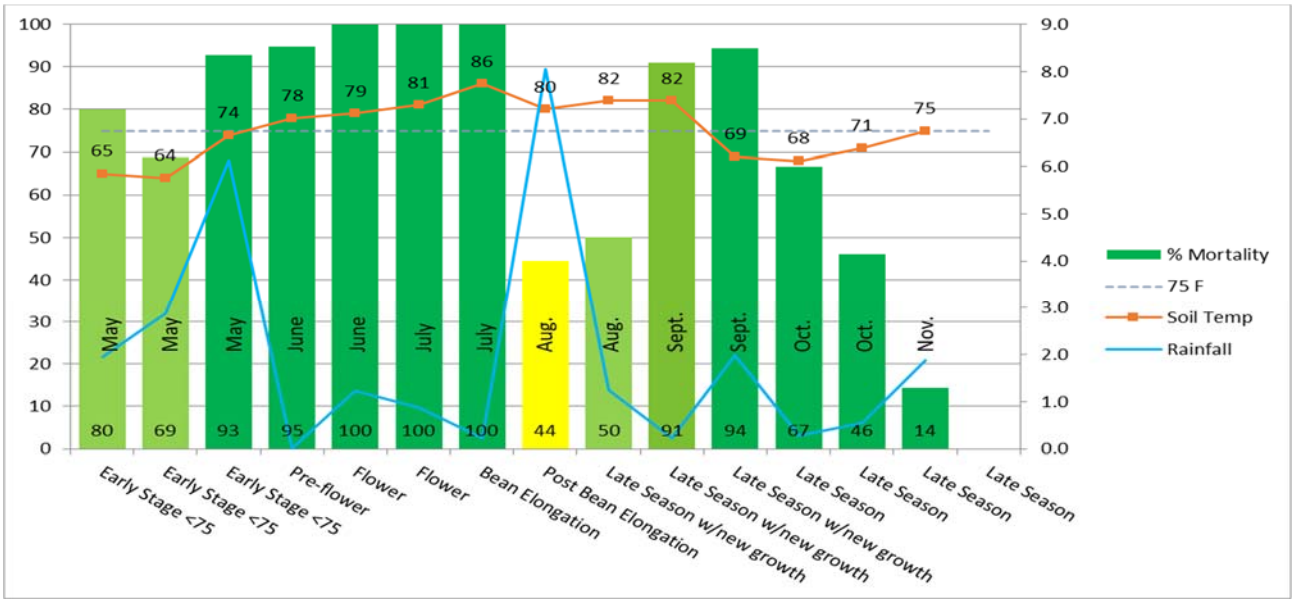

Figure 1. Hamilton County mesquite timing trial established in 2016 at one year after treatment. Unable to collect 2 year after treatment data due to landowner destroying site

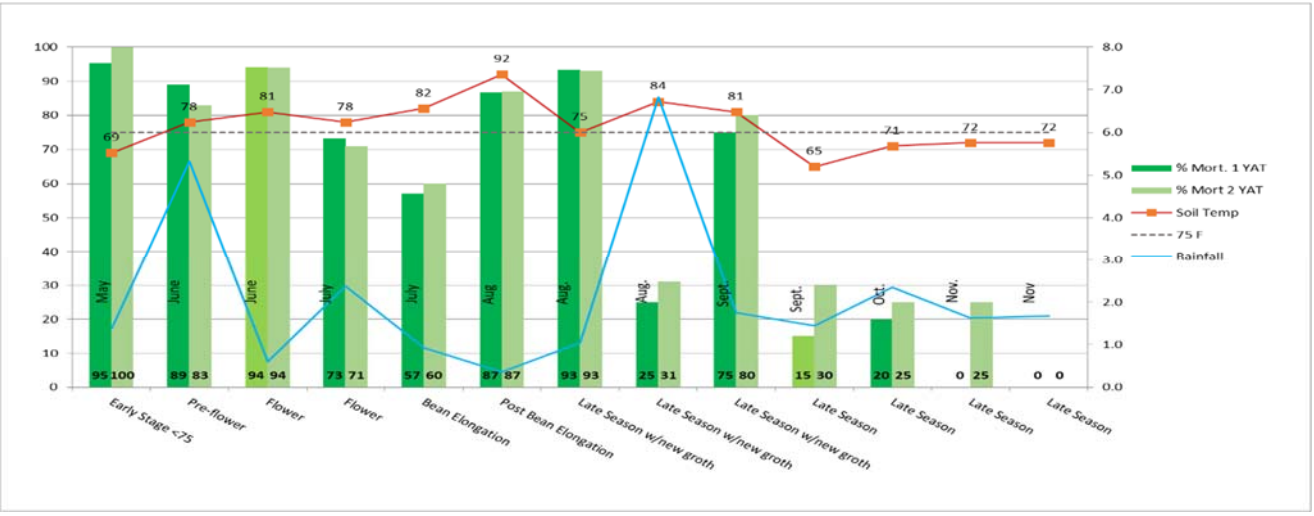

Figure 2. Jack County mesquite timing trial established in 2016 at one and two years after treatment data.

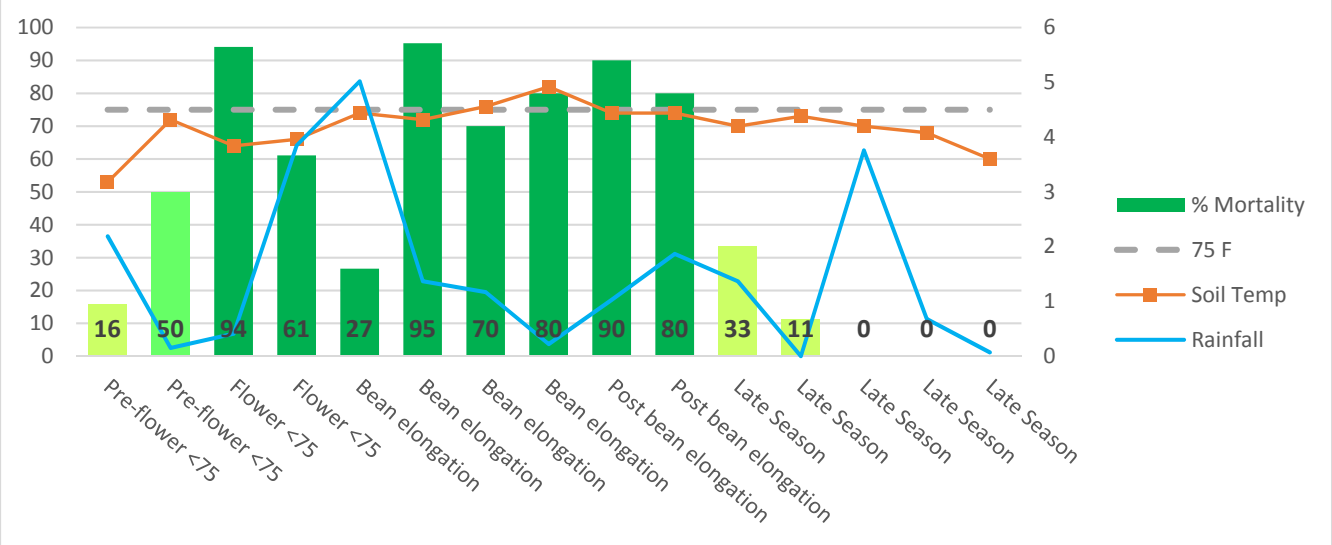

Figure 3. Eastland County Mesquite timing trial established in 2017 at one year after treatment data.

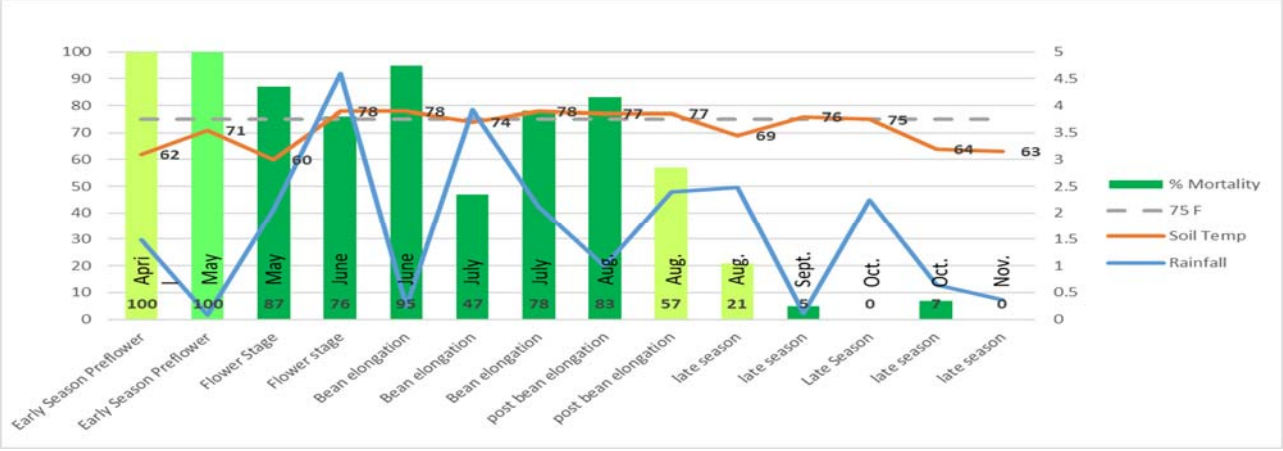

Figure 4. Hood County mesquite timing trial established in 2017 one year after treatment data.

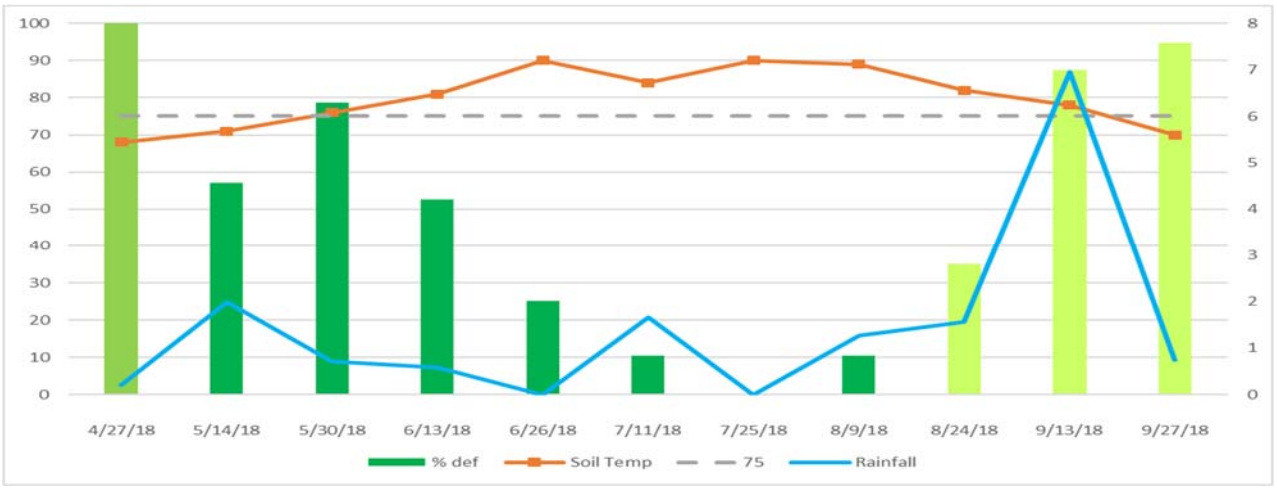

Figure 5. Comanche County mesquite timing trial established in 2018. Data represents percent of treated trees that were defoliated 100 percent in each treatment.

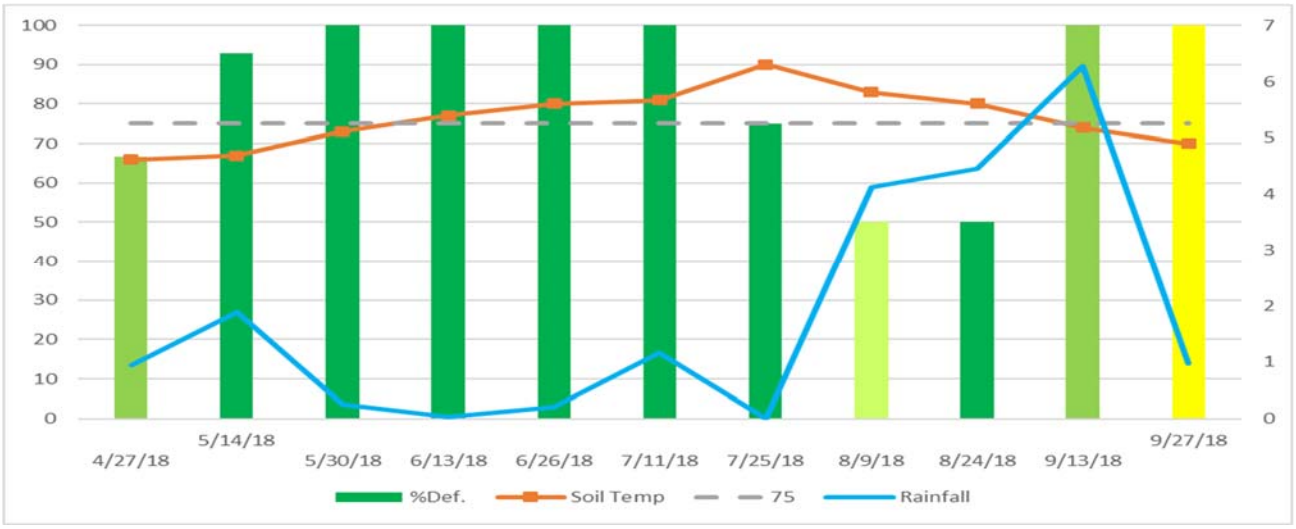

Figure 6. Hamilton County mesquite timing trial established in 2018. Data represented percent of treated trees that were defoliated 100 percent in each treatment.

Acknowledgements

This project was supported by Corteva AgroSciences, Jack, Hamilton, Hood, Eastland and Comanche Counties and the cooperating landowners.