Yellow Section: Minor Crops **Page #**

Herbicide efficacy study 2021

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Executive Summary
Weeds are constantly competing with potatoes for water, nutrients, and light. Previous research has reported pests causing up to 40% yield loss in potatoes and weeds can cause 34% loss in yield when weeds are not controlled. Managing hard-to-kill weeds is important for successful potato production. The focus of this project was to evaluate various herbicide combinations on weed control and potato tuber yield. A focus was put on tank mixture that have lower water solubility and have a longer residual. These herbicides included Linex, Zidua, and Matrix.

Materials and Methods
Plots were planted with Russet Burbank near Verndale, MN in a commercial potato field managed by RDO farms on May 7, 2021. Weeds growth was prolific in this field. Preemergent herbicide treatments occurred on May 20, 2021, and postemergence applications were completed on June 17, 2021. Plots were visually evaluated for crop injury at 14 and 28 days after treatment using a scale from 0 to 100, with 0 indicating complete plant death and 100 indicating no injury to the crop. Weed control was rated at 14 and 28 days after treatment using a scale from 0 to 100 with 0 indicating no weed control and 100 representing 100% weed control. Plots were harvested on September 8, 2021, with a single row plot harvest and subsequently graded for size on September 10, 2021. Data were analyzed using Proc Mixed in SAS to account for uneven replicate number in some treatments. Means were separated by Tukey pair-wise comparison at p=0.05.

Results
This field was not fumigated prior to planting potatoes. Weed pressure was high and many species were present. No crop injury was observed (Table 1). Weed control varied by treatment and weed species (Table 1). Preemergent herbicides that were tank mixed with another herbicide tended to perform well. Metribuzin at 0.6 lb/a performed well for a single herbicide. Interestingly, the two postemergence treatments had good weed control at 28 days after treatment. The higher dose of Prowl H2O (3 pt/a) + metribuzin (0.75 lb/a) + Matrix (1.5 oz/a) + K-tone 0.5% v/v had great weed control and the highest yield (Table 2). One explanation for the higher yield may have been that the intense weed pressure (Figure 1) kept the soil cooler and subsequent weed control allowed tubers to bulk more. Weed pressure was much lower on other treated plots (Figure 2). Tuber count was numerically lower compared to all the treated plots causing the percentage of tubers over 6 and 10oz to be the highest from the treatment of Prowl H2O (3 pt/a) + metribuzin (0.75 lb/a) + Matrix (1.5 oz/a) + K-tone 0.5% v/v applied postemergence (Table 3).

Figure 1. Weed pressure in postemergence plots treated 4 days prior to this picture in Verndale, MN.

Table 1. Crop injury and weed control at 14 days after treatment from various preemergent and postemergence herbicides in Verndale, MN, 2021.

	Treatment name	Rate	Timing	Crop injury	Common lambsquarters		Wild buckwheat		Barnyard grass		Redroot pigweed		Eastern black nightshade	
				%	% efficacy									
1	Non-treated check	--	--	100	0	b	0	b	0	c	0	b	0	c
2	Metribuzin	0.6 lb/a	PRE	100	90	a	55	ab	74	ab	99	a	95	a
3	Linex	2 pt/a	PRE	100	81	a	63	ab	70	ab	98	a	100	a
4	Linex	2 pt/a	PRE	100	96	a	70	a	84	ab	98	a	100	a
	Zidua	3 fl oz/a	PRE											
5	Metribuzin	0.6 lb/a	PRE	100	97	a	63	ab	84	ab	98	a	100	a
	Zidua	3 fl oz/a	PRE											
6	Metribuzin	0.6 lb/a	PRE	100	91	a	75	a	81	ab	100	a	100	a
	Linex	2 pt/a	PRE											
7	Metribuzin	0.6 lb/a	PRE	100	93	a	63	ab	78	ab	100	a	100	a
	Linex	2 pt/a	PRE											
	Sulfentrazone	3 oz/a	PRE											
8	Linex	2 pt/a	PRE	100	100	a	74	a	74	ab	99	a	100	a
	Zidua	3 fl oz/a	PRE											
	Sulfentrazone	3 oz/a	PRE											
9	Linex	2 pt/a	PRE	100	89	a	55	ab	83	ab	88	a	100	a
	Zidua	3 fl oz/a	PRE											
	Prowl H2O	1.5 pt/a	PRE											
	Matrix	1.5 oz/a	PRE											
10	Linex	2 pta	PRE	100	86	a	63	ab	84	ab	100	a	100	a
	Zidua	3 fl oz/a	PRE											
	Matrix	1.5 oz/a	PRE											
11	Linex	2 pt/a	PRE	100	94	a	50	ab	79	ab	100	a	100	a
	Dual	1 pt/a	PRE											
12	Zidua	3 fl oz/a	PRE	100	85	a	60	ab	85	ab	100	a	94	a
	Dual	1 pt/a	PRE											
	Metribuzin	0.6 lb/a	PRE											
13	Zidua	3 fl oz/a	PRE	100	92	a	70	a	84	ab	100	a	100	a
	Metribuzin	0.6 lb/a	PRE											
	Matrix	1.5 oz/a	PRE											
14	Linex	2 pt/a	PRE	100	95	a	60	ab	89	a	100	a	100	a
	Zidua	3 fl oz/a	PRE											
	Prowl H2O	3 pt/a	PRE											
15	Linex	2 pt/a	PRE	100	99	a	89	a	88	a	100	a	100	a
	Zidua	3 fl oz/a	PRE											
	Metribuzin	0.6 lb/a	PRE											
16	Linex	2 pt/a	PRE	100	97	a	80	a	89	a	100	a	100	a
	Metribuzin	0.6 lb/a	PRE											
	Matrix	1.5 oz/a	PRE											
	Sulfentrazone	3 oz/a	PRE											
17	Prowl H2O	3 pt/a	POST	100	65	a	67	ab	42	bc	65	a	35	b
	Metribuzin	0.75 lb/a	POST											
	Matrix	1.5 oz/a	POST											
	K-Tone	0.5% v/v	POST											
18	Prowl H2O	1.5 pt/a	POST	100	55	a	75	ab	49	ab	73	a	14	bc
	Metribuzin	0.5 lb/a	POST											
	Matrix	1.25 oz/a	POST											
	K-Tone	0.5% v/v	POST											

Figure 2. June 15, 2021 pictures of each treatment.

Table 2. Crop injury and weed control at 28 days after treatment from various preemergent and postemergence herbicides in Verndale, MN, 2021.

	Treatment name	Rate	Timing	Crop injury %	Common lambsquarters		Wild buckwheat		Barnyard grass		Redroot pigweed		Eastern black nightshade		Hairy nightshade		Common ragweed	
					% efficacy													
1	Non-treated check	--	--	100	0	c	0	c	0	b	0	b	0	c	0	b	0	b
2	Metribuzin	0.6 lb/a	PRE	100	75	ab	28	abc	71	a	93	a	35	bc	73	ab	75	a
3	Linex	2 pt/a	PRE	100	48	abc	13	bc	40	ab	80	a	75	ab	40	ab	39	ab
4	Linex Zidua	2 pt/a 3 fl oz/a	PRE PRE	100	76	ab	48	abc	70	a	83	a	90	ab	91	a	89	a
5	Metribuzin Zidua	0.6 lb/a 3 fl oz/a	PRE PRE	100	96	a	70	abc	85	a	100	a	87	ab	92	a	80	a
6	Metribuzin Linex	0.6 lb/a 2 pt/a	PRE PRE	100	73	ab	64	abc	65	a	74	a	73	ab	60	ab	74	a
7	Metribuzin Linex Sulfentrazone	0.6 lb/a 2 pt/a 3 oz/a	PRE PRE PRE	100	94	a	40	abc	79	a	73	a	90	ab	44	ab	88	a
8	Linex Zidua Sulfentrazone	2 pt/a 3 fl oz/a 3 oz/a	PRE PRE PRE	100	88	a	63	abc	82	a	91	a	98	a	85	a	94	a
9	Linex Zidua Prowl H2O Matrix	2 pt/a 3 fl oz/a 1.5 pt/a 1.5 oz/a	PRE PRE PRE PRE	100	55	ab	13	bc	75	a	90	a	100	a	79	a	81	a
10	Linex Zidua Matrix	2 pta 3 fl oz/a 1.5 oz/a	PRE PRE PRE	100	36	bc	46	abc	63	a	70	a	73	ab	70	ab	75	a
11	Linex Dual	2 pt/a 1 pt/a	PRE PRE	100	62	ab	0	c	63	a	87	a	100	a	73	ab	100	a
12	Zidua Dual Metribuzin	3 fl oz/a 1 pt/a 0.6 lb/a	PRE PRE PRE	100	59	ab	41	abc	83	a	98	a	88	ab	85	a	80	a
13	Zidua Metribuzin Matrix	3 fl oz/a 0.6 lb/a 1.5 oz/a	PRE PRE PRE	100	77	ab	23	abc	78	a	92	a	90	ab	100	a	83	a
14	Linex Zidua Prowl H2O	2 pt/a 3 fl oz/a 3 pt/a	PRE PRE PRE	100	92	a	13	abc	88	a	100	a	100	a	92	a	83	a
15	Linex Zidua Metribuzin	2 pt/a 3 fl oz/a 0.6 lb/a	PRE PRE PRE	100	91	a	65	abc	76	a	83	a	100	a	86	a	100	a
16	Linex Metribuzin Matrix Sulfentrazone	2 pt/a 0.6 lb/a 1.5 oz/a 3 oz/a	PRE PRE PRE PRE	100	90	a	49	abc	86	a	99	a	93	ab	55	ab	95	a
17	Prowl H2O Metribuzin Matrix K-Tone	3 pt/a 0.75 lb/a 1.5 oz/a 0.5% v/v	POST POST POST POST	100	100	a	100	ab	88	a	100	a	100	a	100	a	100	a
18	Prowl H2O Metribuzin Matrix K-Tone	1.5 pt/a 0.5 lb/a 1.25 oz/a 0.5% v/v	POST POST POST POST	100	92	a	100	a	80	a	100	a	95	ab	95	a	100	a

Table 3. Graded yield of Russet Burbank potato tubers (cwt/a) following herbicide treatments near Verndale, MN in 2021.

	Treatment name	Rate	Timing	<3 oz	3-6 oz		6-10 oz		10-14 oz		>14 oz		Total yield		Marketable yield		Pct >6oz		Pct >10 oz	
				---------- cwt/a ----------													-------- % --------			
1	Non-treated check	--	--	55	74	b	32	b	3	b	0	b	164	c	109	c	17	c	1	b
2	Metribuzin	0.6 lb/a	PRE	57	162	ab	119	ab	24	b	11	b	373	ab	316	abc	38	bc	9	b
3	Linex	2 pt/a	PRE	48	136	ab	68	ab	16	b	1	b	270	bc	221	bc	31	bc	6	b
4	Linex Zidua	2 pt/a 3 fl oz/a	PRE PRE	38	135	ab	178	ab	52	b	20	b	423	ab	385	ab	57	abc	16	b
5	Metribuzin Zidua	0.6 lb/a 3 fl oz/a	PRE PRE	30	126	ab	177	ab	89	ab	38	ab	461	ab	431	ab	66	ab	28	ab
6	Metribuzin Linex	0.6 lb/a 2 pt/a	PRE PRE	37	143	ab	179	ab	73	ab	21	b	454	ab	417	ab	60	ab	21	ab
7	Metribuzin Linex Sulfentrazone	0.6 lb/a 2 pt/a 3 oz/a	PRE PRE PRE	28	126	ab	157	ab	67	ab	34	ab	412	ab	384	ab	63	ab	25	ab
8	Linex Zidua Sulfentrazone	2 pt/a 3 fl oz/a 3 oz/a	PRE PRE PRE	34	143	ab	159	ab	56	b	23	b	414	ab	380	ab	53	abc	17	b
9	Linex Zidua Prowl H2O Matrix	2 pt/a 3 fl oz/a 1.5 pt/a 1.5 oz/a	PRE PRE PRE PRE	31	145	ab	169	ab	60	b	24	b	429	ab	398	ab	59	ab	19	b
10	Linex Zidua Matrix	2 pta 3 fl oz/a 1.5 oz/a	PRE PRE PRE	48	149	ab	147	ab	22	b	10	b	376	abc	328	abc	42	abc	6	b
11	Linex Dual	2 pt/a 1 pt/a	PRE PRE	41	142	ab	108	ab	28	b	4	b	322	abc	282	abc	42	abc	10	b
12	Zidua Dual Metribuzin	3 fl oz/a 1 pt/a 0.6 lb/a	PRE PRE PRE	49	126	ab	122	ab	47	b	9	b	353	abc	304	abc	49	abc	15	b
13	Zidua Metribuzin Matrix	3 fl oz/a 0.6 lb/a 1.5 oz/a	PRE PRE PRE	23	131	ab	167	ab	81	ab	36	ab	439	ab	416	ab	64	ab	26	ab
14	Linex Zidua Prowl H2O	2 pt/a 3 fl oz/a 3 pt/a	PRE PRE PRE	37	152	ab	138	ab	58	ab	29	b	444	ab	407	ab	56	abc	20	b
15	Linex Zidua Metribuzin	2 pt/a 3 fl oz/a 0.6 lb/a	PRE PRE PRE	37	180	a	176	a	51	b	19	b	463	ab	426	ab	53	abc	15	b
16	Linex Metribuzin Matrix Sulfentrazone	2 pt/a 0.6 lb/a 1.5 oz/a 3 oz/a	PRE PRE PRE PRE	41	158	ab	195	a	83	ab	35	ab	512	a	471	a	60	ab	23	ab
17	Prowl H2O Metribuzin Matrix K-Tone	3 pt/a 0.75 lb/a 1.5 oz/a 0.5% v/v	POST POST POST POST	14	80	b	182	a	144	a	106	a	525	a	511	a	82	a	48	a
18	Prowl H2O Metribuzin Matrix K-Tone	1.5 pt/a 0.5 lb/a 1.25 oz/a 0.5% v/v	POST POST POST POST	29	113	ab	162	ab	78	ab	55	ab	437	ab	408	ab	64	ab	26	ab

Table 4. Graded yield of Russet Burbank potato tuber (tuber number/acre) following herbicide treatments near Verndale, MN in 2021.

	Treatment name	Rate	Timing	<3 oz		3-6 oz		6-10 oz	10-14 oz		>14 oz		Total yield	Marketable yield		Pct >6oz		Pct >10 oz	
				---------- Tuber number/a ----------												-------- % --------			
1	Non-treated check	--	--	44,286	a	32,912	ab	8,228	484	b	0	b	85,910	41,624	b	9	c	0	b
2	Metribuzin	0.6 lb/a	PRE	44,831	a	63,525	ab	27,407	3,449	b	1,089	b	140,300	95,469	ab	21	bc	3	b
3	Linex	2 pt/a	PRE	40,293	ab	57,536	ab	17,424	2,723	b	182	b	118,157	77,864	ab	17	bc	2	b
4	Linex Zidua	2 pt/a 3 fl oz/a	PRE PRE	29,766	ab	51,062	ab	38,962	7,502	b	2,178	b	129,470	99,704	ab	36	abc	7	b
5	Metribuzin Zidua	0.6 lb/a 3 fl oz/a	PRE PRE	23,958	ab	49,852	ab	40,656	13,068	ab	4,356	ab	131,890	107,932	ab	44	abc	14	ab
6	Metribuzin Linex	0.6 lb/a 2 pt/a	PRE PRE	33,396	ab	61,710	ab	45,012	12,100	ab	2,662	ab	154,880	121,484	a	38	abc	10	b
7	Metribuzin Linex Sulfentrazone	0.6 lb/a 2 pt/a 3 oz/a	PRE PRE PRE	21,296	ab	48,884	ab	34,848	10,406	ab	3,146	ab	118,580	97,284	ab	41	abc	11	b
8	Linex Zidua Sulfentrazone	2 pt/a 3 fl oz/a 3 oz/a	PRE PRE PRE	29,585	ab	58,806	ab	35,574	8,531	b	2,541	b	135,036	105,452	a	34	abc	8	b
9	Linex Zidua Prowl H2O Matrix	2 pt/a 3 fl oz/a 1.5 pt/a 1.5 oz/a	PRE PRE PRE PRE	26,681	ab	59,351	ab	41,201	9,801	ab	2,723	b	139,755	113,075	a	39	abc	9	b
10	Linex Zidua Matrix	2 pta 3 fl oz/a 1.5 oz/a	PRE PRE PRE	36,784	ab	58,564	ab	33,638	3,388	b	1,210	b	133,584	96,800	ab	26	bc	3	b
11	Linex Dual	2 pt/a 1 pt/a	PRE PRE	33,880	ab	57,112	ab	25,410	4,356	b	484	b	121,242	87,362	ab	24	bc	4	b
12	Zidua Dual Metribuzin	3 fl oz/a 1 pt/a 0.6 lb/a	PRE PRE PRE	37,026	ab	51,062	ab	28,556	7,502	b	1,210	b	125,356	88,330	ab	30	abc	7	b
13	Zidua Metribuzin Matrix	3 fl oz/a 0.6 lb/a 1.5 oz/a	PRE PRE PRE	17,908	ab	50,820	ab	37,268	12,342	ab	3,872	ab	122,210	104,302	ab	44	abc	13	ab
14	Linex Zidua Prowl H2O	2 pt/a 3 fl oz/a 3 pt/a	PRE PRE PRE	31,702	ab	63,404	ab	40,898	9,196	ab	2,904	ab	147,862	116,402	a	36	abc	9	b
15	Linex Zidua Metribuzin	2 pt/a 3 fl oz/a 0.6 lb/a	PRE PRE PRE	29,948	ab	72,237	a	42,834	7,805	b	2,178	b	155,001	125,054	a	34	abc	7	b
16	Linex Metribuzin Matrix Sulfentrazone	2 pt/a 0.6 lb/a 1.5 oz/a 3 oz/a	PRE PRE PRE PRE	30,129	ab	55,176	ab	41,382	11,798	ab	3,449	ab	141,933	111,804	a	40	abc	11	b
17	Prowl H2O Metribuzin Matrix K-Tone	3 pt/a 0.75 lb/a 1.5 oz/a 0.5% v/v	POST POST POST POST	11,616	b	30,492	b	41,140	22,022	a	10,648	a	115,918	104,302	ab	64	a	28	a
18	Prowl H2O Metribuzin Matrix K-Tone	1.5 pt/a 0.5 lb/a 1.25 oz/a 0.5% v/v	POST POST POST POST	21,054	ab	40,414	ab	35,574	11,616	ab	6,050	ab	114,466	93,654	ab	46	ab	15	ab

Broadleaf crop response to preplant, low-dose rate of dicamba, Carrington, 2021.
(Greg Endres and Mike Ostlie)

The field study is being conducted at the NDSU Carrington Research Extension Center with support from the ND Soybean Council and Northarvest Bean Growers Association. Study objective is to evaluate soybean, pinto bean and sunflower plant growth and seed yield response based on timing of planting following application of preplant, low-dose soil rate of dicamba with or without water activation. Experimental design was a randomized complete block with a split-plot arrangement (main plot=crop; split plot=herbicide; and split-split plot=planting date) and four replications. The irrigated trial was established with field pea as prior crop on conventional-till Heimdal-Emrick loam soil with 3.9% organic matter, 7.6 pH, 41 ppm P, 312 ppm K, 2.01 ppm Zn, and 0.45 mmho/cm soluble salts (0- to 6-inch depth). Dicamba (Clarity at 4 fl oz/A [0.125 lb ai/A]) was soil applied with a CO_2-hand-boom plot sprayer delivering 17 gal/A at 35 psi through TJ Turbo 02 nozzles to the center 6.7 ft of 10- by 25-ft plots on May 13 with 44 F, 63% RH and 5 mph wind to wet soil surface. Planting dates were May 19 and June 1; 6 and 19 days, respectively, following application of dicamba. Crop cultivar and targeted stands: soybean - Peterson Farms Seed '19B04' and 150,000 plants/A; pinto bean - 'ND Palomino' pinto bean and 70,000 plants/A; and sunflower - Mycogen '8N270CLDM' and 20,000 plants/A. Crops were planted in 30-inch rows. Irrigation and rainfall totaled 0.08 inch between application of dicamba and the first planting date; and 2.16 inches between application of dicamba and the second planting date; and 22.5 inches June 1-Sept. 29. Seed harvest with a plot combine occurred on the following dates: pinto bean=Sept. 9 (plants hand-pulled and placed in swathes Sept. 7); soybean=Oct. 4; and sunflower=Nov. 1.

Soybean plant stand (trial average=119,500 plants/A) was similar among treatments (Table 1), though the density tended to be reduced with early planting following application of dicamba. Plant development, height and canopy closure generally were not impacted by dicamba. Plant injury with early planting after application of dicamba was 32-43% when evaluated during the first 4 weeks after plant emergence but declined over time. Minimal (4-5%) or no plant injury was observed with the late planting date following application of dicamba. Seed yield was excellent and did not differ among treatments. Seed test weight and count also were not negatively impacted by dicamba.

Table 1. Soybean response to preplant dicamba, Carrington, 2021.

Treatment		Plant													
		Stand	Development			Injury (%)[1]			Height (cm)[2]		Canopy closure (%)		Seed		
					Physiological	WAE[3]									
Planting		plt/A	Emergence	Flower	maturity (R8)						Visual	Canopeo	Yield	TW	Count
date	Herbicide	20-Jun	Day of year			1 to 2	3 to 4	6 to 8	3 to 4	6 to 8	28-Jun	2-Aug	bu/A	lb/bu	no./lb
	untreated check	133,470	155	194	263	0	0	0	31	66	26	98	77.2	56.4	2,920
19-May	dicamba	110,890	156	197	265	43	32	14	27	60	16	94	72.9	56.2	2,920
	untreated check	116,200	160	200	267	0	0	0	26	58	20	94	76.2	55.9	2,800
1-Jun	dicamba	116,870	160	199	266	4	5	0	24	59	16	95	71.5	56.2	2,800
CV (%)[4]		11.4	0.3	0.7	0.5	51.7	63.4	125.2	8.2	11.8	11.1	3.7	7.40	0.8	2.2
LSD (0.05)[4]		NS	NS	2	NS	6	4	4	NS	NS	NS	NS	NS	NS	NS

[1]Biomass reduction. Dates of injury notes: first planting=14-Jun, 28-Jun and 12-Jul; second planting=20-Jun, 6-Jul and 19-Jul.

[2]Dates of height notes: 2-Jul and 21-Jul.

[3]WAE=weeks after plant emergence.

[4]Statistics include all three crops in analysis.

Pinto bean plant stand, averaging 77,500 plants/A, was similar among treatments (Table 2). Plant development, height and canopy closure were not impacted by dicamba. Plant injury with early planting after application of dicamba was 14-28% when evaluated during the first 4 weeks after plant emergence but declined over time. Minimal (7%) or no plant injury was observed with the late planting date following application of dicamba. Seed yield, test weight and count were not negatively impacted by dicamba.

Table 2. Pinto bean response to preplant dicamba, Carrington, 2021.

Treatment		Plant													
		Stand	Development			Injury (%)[1]			Height (cm)[2]		Canopy closure (%)		Seed		
						WAE[3]									
Planting date	Herbicide	plt/A	Emergence	Flower	Physiological maturity (R8)	1 to 2	3 to 4	6 to 8	3 to 4	6 to 8	Visual	Canopeo	Yield	TW	Count
		20-Jun	Day of year								28-Jun	2-Aug	cwt/A	lb/bu	no./lb
19-May	untreated check	72,380	155	192	237	0	0	0	31	59	27	91	31.31	59.3	1,210
	dicamba	71,720	156	192	240	28	14	9	28	55	22	96	29.90	59.1	1,260
1-Jun	untreated check	83,000	159	193	239	0	0	0	29	60	25	95	30.67	59.0	1,270
	dicamba	83,000	160	193	241	7	0	0	30	57	23	98	30.44	59.1	1,270
CV (%)[4]		11.4	0.3	0.7	0.5	51.7	63.4	125.2	8.2	11.8	11.1	3.7	7.4	0.8	2.2
LSD (0.05)[4]		NS	NS	NS	NS	6	4	4	NS	NS	NS	NS	NS	NS	NS

[1]Biomass reduction. Dates of injury notes: first planting=14-Jun, 28-Jun and 12-Jul; second planting=20-Jun, 6-Jul and 19-Jul.

[2]Dates of height notes: 2-Jul and 21-Jul.

[3]WAE=weeks after plant emergence.

[4]Statistics include all three crops in analysis.

Sunflower plant stand, averaging 25,900 plants/A, was similar among treatments (Table 3). Plant development, height and canopy closure generally were similar among treatments. Plant injury was essentially absent following application of dicamba. Also, seed yield and test weight were similar among treatments.

Table 3. Sunflower response to preplant dicamba, Carrington, 2021.

Treatment		Plant											
		Stand	Development			Injury (%)[1]			Height (cm)[2]		Canopy closure (%)	Seed	
Planting date	Herbicide	plt/A	Emergence	Flower	Physiological maturity (R8)	WAE[3]					Visual	Yield	TW
		20-Jun	Day of year			1 to 2	3 to 4	6 to 8	3 to 4	6 to 8	28-Jun	cwt/A	lb/bu
19-May	untreated check	24,570	152	204	247	0	0	0	63	158	54	25.80	29.9
	dicamba	29,880	153	203	249	0	0	0	60	144	57	30.00	30.3
1-Jun	untreated check	23,910	161	211	252	0	0	0	44	142	32	25.21	27.9
	dicamba	25,230	162	211	251	5	0	0	37	144	26	24.14	29.9
CV (%)[4]		11.4	0.3	0.7	0.5	51.7	63.4	125.2	8.2	11.8	11.1	7.4	0.8
LSD (0.05)[4]		NS	NS	2	NS	NS	NS	NS	NS	NS	NS	NS	NS

[1]Biomass reduction. Dates of injury notes: first planting=14-Jun, 28-Jun and 12-Jul; second planting=20-Jun, 6-Jul and 19-Jul.

[2]Dates of height notes: 2-Jul and 21-Jul.

[3]WAE=weeks after plant emergence.

[4]Statistics include all 3 crops in analysis.

Pinto bean response following winter rye cover crop, Carrington, 2021.
(Greg Endres and Mike Ostlie)

The final (fifth) year of the study was conducted at the NDSU Carrington Research Extension Center with support from Northarvest Bean Growers Association to examine soil cover and moisture, weed management, and pinto bean production with winter rye grown as a preplant cover crop. Experimental design was a randomized complete block with four replications. The dryland trial was established on a conventionally tilled Heimdal-Emrick loam soil with 3.9% organic matter, 6.8 buffer pH, 0.22 dS/m soluble salt (0-6-inch depth), 24 ppm P, 400 ppm K, and 0.99 ppm Zn. 'ND Dylan' rye was direct seeded in 7-inch rows at targeted rate of 65 lb/A (98% germination and 19,100 seeds/lb=1,216,700 PLS/A) on September 17, 2020. Rye was not emerged at soil freeze-up due to dry topsoil during fall. Rye stand averaged 354,000 plants/A across the trial on April 17, 2021. 'ND Palomino' pinto bean was planted at 94,000 seeds/A in 30-inch rows with a JD Flex planter into tilled soil, rye residue or living rye in moderately dry topsoil on June 2. NDAWN monthly rain (inches): May=1.4; June=1.8; July=0.1; August=2.6; September=2.0; October=3.7; and 6-month total=11.6.

Rye treatments (trts) were designated by termination method and timing based on crop planting date:

1. Conventional production system check: Preplant (PP) Roundup PowerMax (glyphosate; 28.4 fl oz/A) plus adjuvant on May 4, 2021 (29 days before bean planting [DBBP]; 2- to 3-leaf [3- to 4-inch height] rye). Tillage (field cultivator plus harrow) on May 5. Preemergence (PRE) Spartan Elite (sulfentrazone+S-metolachlor; 20 fl oz/A) on June 2 (0.39 inch of rain received during June 8-11 and 0.55 inch on June 20).
2. PP Roundup PowerMax on May 4.
3. PP Roundup PowerMax on May 4 followed by PRE Spartan Elite on June 2.
4. PP Roundup PowerMax on May 17 (16 DBBP; 3-leaf [tillering; 3- to 8-inch height] rye).
5. PRE Roundup PowerMax on June 2 (day of bean planting; flag-stage [≤18-inch height] rye).
6. PRE Roundup PowerMax on June 2 followed by ground rolling on June 3.
7. PRE Roundup PowerMax on June 11 (9 days after bean planting [DABP]; flag- to flower-stage [<30-inch height] rye).
8. Non-terminated rye.

Herbicide trts were applied with a CO_2-pressurized hand-boom sprayer delivering 14 gpa through TJ Turbo 02 flat-fan nozzles at 35 psi. Raptor (imazamox) plus Trizenta (clethodim) plus MSO was post-emergence (POST) applied on June 28 at V1-2 bean growth stages, and Trizenta plus MSO was applied on July 19 at prebloom to R2 bean stages for general weed control. A killing frost occurred on October 20 (low of 25 degrees F; NDAWN). Plants were hand-pulled for field drying on November 4 and seed harvested with a plot combine on November 8.

Delaying rye termination until or after bean planting (trts 5-7) delayed bean plant emergence 4-6 days; flowering 12-19 days; and maturity 0-20 days compared to the conventional production check and earlier rye termination trts (Table 1). Topsoil moisture (measured 1 DABP) needed for bean plant establishment was depleted by the extended rye growth in trts 5-8 and delay in adequate rainfall to replenish soil moisture (0.39 inch June 6-11 and 1.38 inches June 20-25; NDAWN). Bean plant stands generally were greater when rye was terminated with glyphosate about one month before planting (trts 2-3) compared to other treatments (Table 1). However, the trial stand was poor, averaging 22,000 plants/A, versus the target of establishing at least 70,000 plants/A. Plant canopy closure was greatest with trts 1 and 3, and greatly reduced with trt 8. Late-season rain (Aug 20 to Oct 20=7.86 inches) stimulated new plant growth and extended time to reach plant maturity. Bean seed yield was poor, averaging 550 lb/A, due to dry soil and high temperatures during the first half of the growing season. Seed yield was greatest with early rye termination and PRE herbicide (trt 3). Yield generally was similar among other trts including with late-terminated rye except with the non-terminated rye (no yield). Test weight was greatest with trts 4-7.

Table 1. Pinto bean response to rye cover crop, Carrington, 2021.

	Plant[a]						Seed			
Trt no.	Emergence	Stand (2-Jul; V2-4)	Chlorosis[b]	Flower (R1)	Canopy closure (30-Aug)	Maturity (R9)	Yield	Test weight	Count	Protein
	DOY	plt/A	0-9	DOY	%	DOY	lb/A	lb/bu	no./lb	%
1	164	21,910	2	200	38	280	546	55.2	1,225	21.8
2	165	24,570	2	199	32	276	480	55.6	1,230	21.5
3	164	29,880	2	201	39	266	726	54.6	1,224	21.7
4	165	22,580	3	202	30	281	434	56.1	1,270	20.9
5	170	20,590	2	215	31	280	585	56.2	1,166	20.9
6	169	22,580	1	218	30	286	531	56.9	1,186	21.0
7	169	19,260	1	214	32	276	543	56.6	1,171	21.0
8	170	15,270	2	225	7	293	0	x	x	x
Mean	167	22,080	2	209	30	279	549	55.9	1,210	21.3
CV (%)	0.6	16.8	26.4	2.0	12.1	3.0	21.0	1.4	3.9	2.2
LSD (0.10)	1	4,510	1	5	4	10	141	1.0	57	0.6

[a]DOY (day of year): 167=June 16; 209=July 28; 279=Oct 6.

[b]0=green and 9=yellow.

Table 2. Ground cover, soil moisture, and weed control with rye cover crop for pinto bean, Carrington, 2021.

	Ground cover (%)[a]				Weed Control[c]		
	Line transect	Canopeo	Topsoil moisture[b]		Fota	Piwe	Rye
Trt no.	3-Jun		3-Jun	2-Jul	25-Jun		
	%						
1	39	1	14.1	17.5	71	81	99
2	52	1	15.7	18.6	65	59	98
3	49	1	17.1	20.4	77	78	99
4	60	1	16.1	19.7	70	54	99
5	69	19	12.7	20.0	74	73	72
6	66	25	13.6	19.1	70	63	73
7	61	19	13.7	20.1	76	73	99
8	62	17	14.3	14.2	76	75	0
Mean	57	10	14.6	18.7	72	69	80
CV (%)	25.0	50.8	12.9	6.7	11.0	13.1	2.1
LSD (0.10)	NS	6	2.3	1.5	NS	11	2

[a]Line transect measured plant residue and live plants (primarily rye). Canopeo measured green plant material.

[b]Measured with Extech Instruments MO750 soil moisture meter at 4-inch soil depth.

[c]Visual evaluation: Fota=green and yellow foxtail; Piwe=redroot and prostrate pigweed.

Ground cover ranged from 39-69% after bean planting (Table 2). Rye ground cover was greatest with trts 5-8. Foxtail control visually evaluated on June 25 (before POST herbicide application across the trial) was similar among trts, ranging from 65-77%. Pigweed control (73-81%) was greatest with PRE herbicide and generally with late termination of rye. Ground rolling following PRE glyphosate (trt 6) generally provided similar trial results as trt 5.

In summary, the adverse soil and weather conditions starting fall 2020 and continuing until late August 2021 resulted in low rye and pinto bean plant densities, and poor bean seed yield. As in previous years of the study, delaying rye termination until or after bean planting generally extended bean plant development due to rye depleting topsoil soil moisture that was needed for establishment of bean plants. However, bean seed yield generally was similar among trts, except if rye was not terminated. Also, as in past years of the study, delaying rye termination until or after bean planting generally provided similar weed suppression as the PRE herbicide.

North Dakota State University

PPI and PRE Herbicides for Residual control of AMAPA and AMATA in Dry bean

Trial ID: 21S-NW22-DRY-08 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-08 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

General Trial Information
Study Director: Dr. Joe Ikley

Trial Status: E established
ARM Trial Created On: Apr-29-2021

Conducted Under GLP: No
Conducted Under GEP: No

Contacts
Role: STYDIR study director
Study Director: Dr. Joe Ikley
Role: SPONSR sponsor
Sponsor: Northharvest

Site and Design
Treated Plot Width: 6.67 FT
Treated Plot Length: 30 FT
Treated Plot Area: 200.1 FT2 **Treatments:** 16
Replications: 4 **Study Design:** RACOBL Randomized Complete Block (RCB)

Application Description

	A	B
Application Date	May-10-2021	May-10-2021
Appl. Start Time	12:35 PM	4:45 AM
Appl. Stop Time	1:00 PM	5:20 AM
Application Method	SPRAY	SPRAY
Application Timing	PSINCR	PREEM
Application Placement	BROSOI	BROSOI
Applied By	Stith, J	Stith, J
Appl. Entry Date	May-20-2021	May-20-2021
Air Temperature Start, Stop	57, 57 F	60, 60 F
% Relative Humidity Start, Stop	33, 33	25, 25
Wind Velocity+Dir. Start	7 MPH, ENE	5 MPH, W
Wind Velocity+Dir. Stop	7 MPH, ENE	5 MPH, W
Wind Velocity+Dir. Max	9 MPH, ENE	7 MPH, W
Wet Leaves (Y/N)	N, no	N, no
Soil Temperature	50 F	52 F
Soil Moisture	DRY	DRY
Soil Surface Condition	CLODDY	CLODDY
% Cloud Cover	0	0

North Dakota State University

PPI and PRE Herbicides for Residual control of AMAPA and AMATA in Dry bean

Trial ID: 21S-NW22-DRY-08 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-08 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Application Equipment

	A	B
Appl. Equipment	Walter	Walter
Equipment Type	BACCAI	BACCAI
Operation Pressure	28 PSI	28 PSI
Nozzle Model	11002	11002
Nozzle Type	TEEJAI	TEEJAI
Nozzle Spacing	20 IN	20 IN
Boom Length	6.67 FT	6.67 FT
Boom Height	20 IN	20 IN
Ground Speed	3 MPH	3 MPH
Carrier	WATER	WATER
Application Amount	15 GAL/AC	15 GAL/AC
Mix Size	1119 mL	1119 mL
Propellant	COMCO2	COMCO2

Notes

Context	Date	By	Notes
STATUS	Apr-29-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'S' during trial creation.
STATUS	May-20-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'E' when Application Date entered.

North Dakota State University

PPI and PRE Herbicides for Residual control of AMAPA and AMATA in Dry bean

Trial ID: 21S-NW22-DRY-08 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-08 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	1*	2*	3*	4*	5*
	Pest Type					W, Weed		W, Weed	W, Weed
	Pest Code					AMATA		AMATA	AMATA
	Pest Name					common water hemp		common water hemp	common water hemp
	Crop Type, Code				C, PHSVX		C, PHSVX		
	Crop Name				dry bean		dry bean		
	Rating Date				Jun-7-2021	Jun-7-2021	Jun-24-2021	Jun-24-2021	Jul-7-2021
	Rating Type				PHYGEN	CONTRO	PHYGEN	CONTRO	CONTRO
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100
	Number of Subsamples				1	1	1	1	1
	Assessed By				Ikley, J	Ikley, J	Ikley, J	Ikley, J	Ikley, J
	Data Entry Date				Aug-11-2021	Aug-12-2021	Aug-12-2021	Aug-12-2021	Aug-12-2021
	Days After First/Last Applic.				28, 28	28, 28	45, 45	45, 45	58, 58
	Days After Emergence				19 DE-1	19 DE-1	36 DE-1	36 DE-1	49 DE-1
1	Untreated Check				0.0 -	0.0 c	0.0 -	0.0 e	0.0 e
2	EPTAM	4	pt/a	A	0.0 -	97.0 ab	0.0 -	93.8 a-d	91.3 ab
3	SONALAN HFP	3	pt/a	A	0.8 -	98.5 a	0.0 -	95.0 abc	93.8 ab
4	TREFLAN HFP	1.5	pt/a	A	0.0 -	95.0 ab	0.0 -	93.5 a-d	88.8 abc
5	PROWL H20	3	pt/a	A	0.8 -	90.0 b	0.0 -	91.0 a-d	85.0 abc
6	EPTAM	3	pt/a	A	0.8 -	96.0 ab	0.0 -	91.0 a-d	85.0 abc
	SONALAN HFP	2	pt/a	A					
7	EPTAM	3	pt/a	A	0.0 -	99.0 a	0.0 -	99.0 a	99.0 a
	TREFLAN HFP	1.5	pt/a	A					
8	DUAL II MAGNUM	2	pt/a	B	0.8 -	95.8 ab	0.0 -	87.5 a-d	81.3 abc
9	OUTLOOK	14	fl oz/a	B	3.8 -	97.0 ab	0.0 -	81.0 cd	72.5 bc
10	OUTLOOK	21	fl oz/a	B	0.0 -	98.5 a	0.0 -	82.5 bcd	65.0 c
11	SPARTAN CHARGE	5	fl oz/a	A	2.8 -	94.8 ab	0.0 -	91.3 a-d	80.0 abc
12	SPARTAN CHARGE	5	fl oz/a	B	2.0 -	92.5 ab	0.0 -	78.8 d	47.5 d
13	AUTHORITY ELITE	25	fl oz/a	A	0.8 -	99.0 a	0.0 -	98.0 ab	94.0 ab
14	AUTHORITY ELITE	25	fl oz/a	B	1.3 -	98.0 a	0.0 -	85.0 a-d	72.5 bc
15	SPARTAN CHARGE	4	fl oz/a	A	0.8 -	92.3 ab	0.0 -	87.5 a-d	80.0 abc
	PROWL H20	1.5	pt/a	A					
16	SPARTAN CHARGE	4	fl oz/a	B	1.3 -	99.0 a	0.0 -	90.0 a-d	82.5 abc
	OUTLOOK	14	fl oz/a	B					
	LSD P=.05				2.29	4.71	.	9.25	14.67
	Standard Deviation				1.61	3.31	0.00	6.50	10.30
	CV				165.69	3.67	0.0	7.73	13.53
	Levene's F^				0.665	1.536	.	1.549	2.008
	Levene's Prob(F)				0.804	0.13	.	0.126	0.035*
	Skewness^				0.6344*	-0.9192*	.	0.0658	-0.5708
	Kurtosis^				1.0056	1.6771*	.	0.393	1.2099*
	Replicate F				1.496	1.137	0.000	4.239	2.887
	Replicate Prob(F)				0.2285	0.3443	1.0000	0.0101	0.0459
	Treatment F				1.771	214.097	0.000	50.757	21.525
	Treatment Prob(F)				0.0705	0.0001	1.0000	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
Could not calculate LSD (% mean diff) for columns 3 because error mean square = 0.
^Calculated from residual.

North Dakota State University

PPI and PRE Herbicides for Residual control of AMAPA and AMATA in Dry bean

Trial ID: 21S-NW22-DRY-08 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-08 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	6*	7*
	Pest Type				W, Weed	W, Weed
	Pest Code				AMATA	AMATA
	Pest Name				common water hemp	common water hemp
	Crop Type, Code					
	Crop Name					
	Rating Date				Jul-8-2021	Jul-8-2021
	Rating Type				COUNT	BIOMAS
	Rating Unit/Min/Max				0.5 M2, -, -	G, -, -
	Number of Subsamples				2	1
	Assessed By					
	Data Entry Date				Aug-12-2021	Aug-12-2021
	Days After First/Last Applic.				59, 59	59, 59
	Days After Emergence				50 DE-1	50 DE-1
1	Untreated Check				22.5 a	47.7003 a
2	EPTAM	4	pt/a	A	2.4 b	9.7358 bc
3	SONALAN HFP	3	pt/a	A	0.5 b	0.7298 c
4	TREFLAN HFP	1.5	pt/a	A	1.3 b	6.2485 bc
5	PROWL H20	3	pt/a	A	2.1 b	14.2420 bc
6	EPTAM	3	pt/a	A	1.8 b	7.4575 bc
	SONALAN HFP	2	pt/a	A		
7	EPTAM	3	pt/a	A	0.1 b	0.0900 c
	TREFLAN HFP	1.5	pt/a	A		
8	DUAL II MAGNUM	2	pt/a	B	1.3 b	6.3848 bc
9	OUTLOOK	14	fl oz/a	B	2.0 b	16.6713 bc
10	OUTLOOK	21	fl oz/a	B	1.8 b	16.4448 bc
11	SPARTAN CHARGE	5	fl oz/a	A	2.5 b	6.6703 bc
12	SPARTAN CHARGE	5	fl oz/a	B	5.4 b	41.2290 ab
13	AUTHORITY ELITE	25	fl oz/a	A	0.3 b	2.3810 bc
14	AUTHORITY ELITE	25	fl oz/a	B	1.3 b	11.0790 bc
15	SPARTAN CHARGE	4	fl oz/a	A	2.6 b	10.5335 bc
	PROWL H20	1.5	pt/a	A		
16	SPARTAN CHARGE	4	fl oz/a	B	0.8 b	6.5783 bc
	OUTLOOK	14	fl oz/a	B		
	LSD P=.05				5.55	22.53465
	Standard Deviation				3.90	15.82283
	CV				128.98	123.99
	Levene's F^				6.08	2.79
	Levene's Prob(F)				0.00*	0.004*
	Skewness^				0.2935	1.2657*
	Kurtosis^				19.1548*	7.7581*
	Replicate F				0.906	1.406
	Replicate Prob(F)				0.4458	0.2535
	Treatment F				7.503	2.853
	Treatment Prob(F)				0.0001	0.0033

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
Could not calculate LSD (% mean diff) for columns 3 because error mean square = 0.
^Calculated from residual.

North Dakota State University

PPI and PRE Herbicides for Residual control of AMAPA and AMATA in Dry bean

Trial ID: 21S-NW22-DRY-08 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-08 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Pest Type
W, Weed = Weed or volunteer crop
Pest Code
AMATA, Amaranthus x tamariscinus, common water hemp = US
Crop Type, Code
C = EPPO species (Bayer) codes
PHSVX, BVBE, Phaseolus vulgaris, dry bean = US
Rating Type
PHYGEN = phytotoxicity - general / injury
CONTRO = control / burndown or knockdown
COUNT = count
BIOMAS = biomas
Rating Unit/Min/Max
%, 0, 100 = percent
G, , = gram
Assessed By
Ikley, J = Extension Agent

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-NW22-DRY-09 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-09 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

General Trial Information
Study Director: Dr. Joe Ikley

Trial Status: E established
ARM Trial Created On: Apr-29-2021

Conducted Under GLP: No
Conducted Under GEP: No

Contacts
Role: STYDIR study director
Study Director: Dr. Joe Ikley
Role: SPONSR sponsor
Sponsor: Northharvest

Site and Design
Treated Plot Width: 6.67 FT
Treated Plot Length: 30 FT
Treated Plot Area: 200.1 FT2 **Treatments:** 12
Replications: 4 **Study Design:** RACOBL Randomized Complete Block (RCB)

Application Description

	A	B	C
Application Date	May-10-2021	Jul-9-2021	
Appl. Start Time	1:05 PM	11:40 AM	
Appl. Stop Time	1:30 PM	12:10 PM	
Interval to Prev. Appl.		60 DAYS	
Application Method	SPRAY	SPRAY	
Application Timing	PSINCR	POEMCR	
Application Placement	BROSOI	BROFOL	
Applied By	Stith, J	Haugrud, N	
Appl. Entry Date	May-20-2021	Jul-15-2021	
Air Temperature Start, Stop	58, 58 F	76, 79 F	
% Relative Humidity Start, Stop	31, 31	51, 51	
Wind Velocity+Dir. Start	7 MPH, ENE	4 MPH, SE	
Wind Velocity+Dir. Stop	7 MPH, ENE	5 MPH, SE	
Wind Velocity+Dir. Max	11 MPH, ENE	6 MPH, SE	
Wet Leaves (Y/N)	N, no	N, no	
Soil Temperature	51 F	70 F	
Soil Moisture	DRY	DRY	
Soil Surface Condition	CLODDY	CLODDY	
% Cloud Cover	10	80	

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-NW22-DRY-09 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-09 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Application Equipment

	A	B	C
Appl. Equipment	Stormbreaker	Narsil	
Equipment Type	BACCAI	BACCAI	
Operation Pressure	29 PSI	28 PSI	
Nozzle Model	11002	11002	
Nozzle Type	TEEJAI	TT	
Nozzle Spacing	20 IN	20 IN	
Boom Length	10 FT	6.67 FT	
Boom Height	20 IN	20 IN	
Ground Speed	3 MPH	3 MPH	
Carrier	WATER	WATER	
Application Amount	15 GAL/AC	15 GAL/AC	
Mix Size	1800 mL	1119 mL	
Propellant	COMCO2	COMCO2	

Notes

Context	Date	By	Notes
STATUS	Apr-29-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'S' during trial creation.
STATUS	May-20-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'E' when Application Date entered.

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-NW22-DRY-09 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-09 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	1*	2*	3*	4*	5*	6*
	Pest Type					W, Weed	W, Weed		W, Weed	W, Weed
	Pest Code					AMATA	HIBTR		AMATA	HIBTR
	Pest Name					common water hemp	hibiscus		common water hemp	hibiscus
	Crop Type, Code				C, PHSVX			C, PHSVX		
	Crop Name				dry bean			dry bean		
	Rating Date				Jul-15-2021	Jul-15-2021	Jul-15-2021	Jul-21-2021	Jul-21-2021	Jul-21-2021
	Part Rated				PLOT, C	PLOT, P	PLOT, P	PLOT, C	PLOT, P	PLOT, P
	Rating Type				PHYGEN	CONTRO	CONTRO	PHYGEN	CONTRO	CONTRO
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100
	Number of Subsamples				1	1	1	1	1	1
	Data Entry Date				Aug-26-2021	Aug-26-2021	Aug-26-2021	Aug-26-2021	Aug-26-2021	Aug-26-2021
	Days After First/Last Applic.				66, 6	66, 6	66, 6	72, 12	72, 12	72, 12
	Number of Decimals				0	0	0	0	0	0
1	EPTAM	3	pt/a	A	0 e	0 d	0 g	0 c	0 d	0 d
	SONALAN HFP	2	pt/a	A						
2	EPTAM	3	pt/a	A	4 cde	13 c	75 b-e	0 c	10 c	91 a
	SONALAN HFP	2	pt/a	A						
	BASAGRAN	1.6	pt/a	B						
	MSO ULTRA	1	% v/v	B						
	N-PAK AMS	2.5	% v/v	B						
3	EPTAM	3	pt/a	A	4 cde	18 c	68 de	0 c	10 c	97 a
	SONALAN HFP	2	pt/a	A						
	BASAGRAN	0.8	pt/a	B						
	MSO ULTRA	1	% v/v	B						
	N-PAK AMS	2.5	% v/v	B						
	BASAGRAN	0.8	pt/a	C						
	MSO ULTRA	1	% v/v	C						
	N-PAK AMS	2.5	% v/v	C						
4	EPTAM	3	pt/a	A	11 b	85 a	78 b-e	3 c	94 a	38 c
	SONALAN HFP	2	pt/a	A						
	REFLEX	12	fl oz/a	B						
	MSO ULTRA	1	% v/v	B						
5	EPTAM	3	pt/a	A	8 bcd	65 b	63 e	4 bc	86 b	65 b
	SONALAN HFP	2	pt/a	A						
	REFLEX	6	fl oz/a	B						
	MSO ULTRA	1	% v/v	B						
	REFLEX	6	fl oz/a	C						
	MSO ULTRA	1	% v/v	C						
6	EPTAM	3	pt/a	A	8 bcd	18 c	73 cde	5 bc	13 c	89 a
	SONALAN HFP	2	pt/a	A						
	BASAGRAN	1.6	pt/a	B						
	RAPTOR	4	fl oz/a	B						
	MSO ULTRA	1	% v/v	B						
	N-PAK AMS	2.5	% v/v	B						
7	EPTAM	3	pt/a	A	1 de	13 c	75 b-e	0 c	10 c	96 a
	SONALAN HFP	2	pt/a	A						
	BASAGRAN	0.8	pt/a	B						
	RAPTOR	2	fl oz/a	B						
	MSO ULTRA	1	% v/v	B						
	N-PAK AMS	2.5	% v/v	B						
	BASAGRAN	0.8	pt/a	C						
	RAPTOR	2	fl oz/a	C						
	MSO ULTRA	1	% v/v	C						
	N-PAK AMS	2.5	% v/v	C						
8	EPTAM	3	pt/a	A	20 a	91 a	93 a	10 a	97 a	94 a
	SONALAN HFP	2	pt/a	A						
	BASAGRAN	1.6	pt/a	B						
	REFLEX	12	fl oz/a	B						
	MSO ULTRA	1	% v/v	B						
	N-PAK AMS	2.5	% v/v	B						

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 10=2.6
* Adjusted means
^Calculated from residual.

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-NW22-DRY-09 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-09 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	1*	2*	3*	4*	5*	6*
	Pest Type					W, Weed	W, Weed		W, Weed	W, Weed
	Pest Code					AMATA	HIBTR		AMATA	HIBTR
	Pest Name					common water hemp	hibiscus		common water hemp	hibiscus
	Crop Type, Code				C, PHSVX			C, PHSVX		
	Crop Name				dry bean			dry bean		
	Rating Date				Jul-15-2021	Jul-15-2021	Jul-15-2021	Jul-21-2021	Jul-21-2021	Jul-21-2021
	Part Rated				PLOT, C	PLOT, P	PLOT, P	PLOT, C	PLOT, P	PLOT, P
	Rating Type				PHYGEN	CONTRO	CONTRO	PHYGEN	CONTRO	CONTRO
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100
	Number of Subsamples				1	1	1	1	1	1
	Data Entry Date				Aug-26-2021	Aug-26-2021	Aug-26-2021	Aug-26-2021	Aug-26-2021	Aug-26-2021
	Days After First/Last Applic.				66, 6	66, 6	66, 6	72, 12	72, 12	72, 12
	Number of Decimals				0	0	0	0	0	0
9	EPTAM	3	pt/a	A	11 b	85 a	90 ab	9 ab	98 a	99 a
	SONALAN HFP	2	pt/a	A						
	BASAGRAN	0.8	pt/a	B						
	REFLEX	6	fl oz/a	B						
	MSO ULTRA	1	% v/v	B						
	N-PAK AMS	2.5	% v/v	B						
	BASAGRAN	0.8	pt/a	C						
	REFLEX	6	fl oz/a	C						
	MSO ULTRA	1	% v/v	C						
	N-PAK AMS	2.5	% v/v	C						
10	EPTAM	3	pt/a	A	6 b-e	85 a	83 a-d	1 c	84 b	85 a
	SONALAN HFP	2	pt/a	A						
	BASAGRAN	0.56	pt/a	B						
	RAPTOR	2	fl oz/a	B						
	REFLEX	4	fl oz/a	B						
	MSO ULTRA	1	% v/v	B						
	N-PAK AMS	2.5	% v/v	B						
11	EPTAM	3	pt/a	A	9 bc	84 a	84 abc	4 bc	94 a	96 a
	SONALAN HFP	2	pt/a	A						
	BASAGRAN	0.56	pt/a	B						
	RAPTOR	2	fl oz/a	B						
	REFLEX	4	fl oz/a	B						
	MSO ULTRA	1	% v/v	B						
	N-PAK AMS	2.5	% v/v	B						
	BASAGRAN	0.56	pt/a	C						
	RAPTOR	2	fl oz/a	C						
	REFLEX	4	fl oz/a	C						
	MSO ULTRA	1	% v/v	C						
	N-PAK AMS	2.5	% v/v	C						
12	EPTAM	3	pt/a	A	1 de	18 c	18 f	0 c	8 c	8 d
	SONALAN HFP	2	pt/a	A						
	RAPTOR	4	fl oz/a	B						
	MSO ULTRA	1	% v/v	B						
	28% UAN	2.5	% v/v	B						
	LSD P=.05				4.3	9.5	10.2	4.1	6.0	10.2
	Standard Deviation				3.0	6.6	7.1	2.8	4.2	7.1
	CV				43.4	13.9	10.7	96.7	8.33	9.95
	Levene's F^				2.654	1.617	0.847	2.132	1.681	1.039
	Levene's Prob(F)				0.013*	0.135	0.597	0.043*	0.118	0.434
	Skewness^				0.3922	0.5192	-0.1827	0.3154	0.7495*	0.8846*
	Kurtosis^				0.7356	-0.3776	0.0772	0.7493	2.2463*	2.0158*
	Replicate F				2.106	0.836	0.534	1.571	0.281	1.424
	Replicate Prob(F)				0.1183	0.4836	0.6622	0.2148	0.8387	0.2533
	Treatment F				14.106	125.273	64.389	6.190	443.027	103.381
	Treatment Prob(F)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
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Due to missing data, the effective replicates used for mean comparisons are: col. 10=2.6
* Adjusted means
^Calculated from residual.

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-NW22-DRY-09 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-09 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	7*	8*	9*	10*
	Pest Type				W, Weed	W, Weed		
	Pest Code				AMATA	HIBTR		
	Pest Name				common water hemp	hibiscus		
	Crop Type, Code						C, PHSVN	C, PHSVN
	Crop Name						Kidney bean	Kidney bean
	Rating Date				Aug-2-2021	Aug-2-2021	Sep-21-2021	Sep-21-2021
	Part Rated				PLOT, P	PLOT, P		
	Rating Type				CONTRO	CONTRO	YIELD	MOICON
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	g, -, -	%, 0, 100
	Number of Subsamples				1	1	1	1
	Data Entry Date				Aug-26-2021	Aug-26-2021	Oct-12-2021	Oct-12-2021
	Days After First/Last Applic.				84, 24	84, 24	134, 74	134, 74
	Number of Decimals				0	0		
1	EPTAM	3	pt/a	A	0 d	0 d	647.0 -	5.83 -
	SONALAN HFP	2	pt/a	A				
2	EPTAM	3	pt/a	A	10 c	86 a	1155.0 -	5.42 -
	SONALAN HFP	2	pt/a	A				
	BASAGRAN	1.6	pt/a	B				
	MSO ULTRA	1	% v/v	B				
	N-PAK AMS	2.5	% v/v	B				
3	EPTAM	3	pt/a	A	10 c	94 a	1027.0 -	6.52 -
	SONALAN HFP	2	pt/a	A				
	BASAGRAN	0.8	pt/a	B				
	MSO ULTRA	1	% v/v	B				
	N-PAK AMS	2.5	% v/v	B				
	BASAGRAN	0.8	pt/a	C				
	MSO ULTRA	1	% v/v	C				
	N-PAK AMS	2.5	% v/v	C				
4	EPTAM	3	pt/a	A	94 a	33 c	1079.5 -	6.13 -
	SONALAN HFP	2	pt/a	A				
	REFLEX	12	fl oz/a	B				
	MSO ULTRA	1	% v/v	B				
5	EPTAM	3	pt/a	A	80 b	49 b	1222.8 -	5.91 -
	SONALAN HFP	2	pt/a	A				
	REFLEX	6	fl oz/a	B				
	MSO ULTRA	1	% v/v	B				
	REFLEX	6	fl oz/a	C				
	MSO ULTRA	1	% v/v	C				
6	EPTAM	3	pt/a	A	10 c	79 a	1032.3 -	6.31 -
	SONALAN HFP	2	pt/a	A				
	BASAGRAN	1.6	pt/a	B				
	RAPTOR	4	fl oz/a	B				
	MSO ULTRA	1	% v/v	B				
	N-PAK AMS	2.5	% v/v	B				
7	EPTAM	3	pt/a	A	10 c	91 a	970.3 -	5.99 -
	SONALAN HFP	2	pt/a	A				
	BASAGRAN	0.8	pt/a	B				
	RAPTOR	2	fl oz/a	B				
	MSO ULTRA	1	% v/v	B				
	N-PAK AMS	2.5	% v/v	B				
	BASAGRAN	0.8	pt/a	C				
	RAPTOR	2	fl oz/a	C				
	MSO ULTRA	1	% v/v	C				
	N-PAK AMS	2.5	% v/v	C				
8	EPTAM	3	pt/a	A	95 a	90 a	969.5 -	5.55 -
	SONALAN HFP	2	pt/a	A				
	BASAGRAN	1.6	pt/a	B				
	REFLEX	12	fl oz/a	B				
	MSO ULTRA	1	% v/v	B				
	N-PAK AMS	2.5	% v/v	B				

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Due to missing data, the effective replicates used for mean comparisons are: col. 10=2.6
* Adjusted means
^Calculated from residual.

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-NW22-DRY-09 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-09 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	7*	8*	9*	10*
	Pest Type				W, Weed	W, Weed		
	Pest Code				AMATA	HIBTR		
	Pest Name				common water hemp	hibiscus		
	Crop Type, Code						C, PHSVN	C, PHSVN
	Crop Name						Kidney bean	Kidney bean
	Rating Date				Aug-2-2021	Aug-2-2021	Sep-21-2021	Sep-21-2021
	Part Rated				PLOT, P	PLOT, P		
	Rating Type				CONTRO	CONTRO	YIELD	MOICON
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	g, -, -	%, 0, 100
	Number of Subsamples				1	1	1	1
	Data Entry Date				Aug-26-2021	Aug-26-2021	Oct-12-2021	Oct-12-2021
	Days After First/Last Applic.				84, 24	84, 24	134, 74	134, 74
	Number of Decimals				0	0		
9	EPTAM	3	pt/a	A	98 a	97 a	993.3 -	5.83 -
	SONALAN HFP	2	pt/a	A				
	BASAGRAN	0.8	pt/a	B				
	REFLEX	6	fl oz/a	B				
	MSO ULTRA	1	% v/v	B				
	N-PAK AMS	2.5	% v/v	B				
	BASAGRAN	0.8	pt/a	C				
	REFLEX	6	fl oz/a	C				
	MSO ULTRA	1	% v/v	C				
	N-PAK AMS	2.5	% v/v	C				
10	EPTAM	3	pt/a	A	84 b	75 a	1047.8 -	5.94 -
	SONALAN HFP	2	pt/a	A				
	BASAGRAN	0.56	pt/a	B				
	RAPTOR	2	fl oz/a	B				
	REFLEX	4	fl oz/a	B				
	MSO ULTRA	1	% v/v	B				
	N-PAK AMS	2.5	% v/v	B				
11	EPTAM	3	pt/a	A	94 a	94 a	1000.3 -	7.08 -
	SONALAN HFP	2	pt/a	A				
	BASAGRAN	0.56	pt/a	B				
	RAPTOR	2	fl oz/a	B				
	REFLEX	4	fl oz/a	B				
	MSO ULTRA	1	% v/v	B				
	N-PAK AMS	2.5	% v/v	B				
	BASAGRAN	0.56	pt/a	C				
	RAPTOR	2	fl oz/a	C				
	REFLEX	4	fl oz/a	C				
	MSO ULTRA	1	% v/v	C				
	N-PAK AMS	2.5	% v/v	C				
12	EPTAM	3	pt/a	A	8 c	8 d	683.5 -	5.50 -
	SONALAN HFP	2	pt/a	A				
	RAPTOR	4	fl oz/a	B				
	MSO ULTRA	1	% v/v	B				
	28% UAN	2.5	% v/v	B				
	LSD P=.05				5.5	13.9	373.11	0.958
	Standard Deviation				3.8	9.7	259.35	0.645
	CV				7.76	14.6	26.31	10.7
	Levene's F^				1.005	1.829	0.748	0.665
	Levene's Prob(F)				0.461	0.085	0.687	0.755
	Skewness^				0.0524	0.3764	-0.0827	0.9499*
	Kurtosis^				2.7059*	2.1421*	-0.2631	3.9578*
	Replicate F				0.893	0.251	1.197	0.461
	Replicate Prob(F)				0.4548	0.8601	0.3260	0.7129
	Treatment F				518.035	52.695	1.666	1.248
	Treatment Prob(F)				0.0001	0.0001	0.1258	0.3265

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
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Due to missing data, the effective replicates used for mean comparisons are: col. 10=2.6
* Adjusted means
^Calculated from residual.

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-NW22-DRY-09 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-09 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Pest Type
W, Weed = Weed or volunteer crop
Pest Code
AMATA, Amaranthus x tamariscinus, common water hemp = US
HIBTR, Hibiscus trionum, hibiscus = US
Crop Type, Code
C = EPPO species (Bayer) codes
PHSVX, BVBE, Phaseolus vulgaris, dry bean = US
PHSVN, BVBE, Phaseolus vulgaris nanus, Kidney bean = US
Part Rated
PLOT = plot
C = Crop is Part Rated
P = Pest is Part Rated
Rating Type
PHYGEN = phytotoxicity - general / injury
CONTRO = control / burndown or knockdown
YIELD = yield
MOICON = moisture content
Rating Unit/Min/Max
%, 0, 100 = percent
g, , = gram

North Dakota State University

Layered Residual Approach in Dry Bean for Control of AMAPA and AMATA

Trial ID: 21S-NW22-DRY-10 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-10 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

General Trial Information
Study Director: Dr. Joe Ikley

Trial Status: E established
ARM Trial Created On: Apr-29-2021

Conducted Under GLP: No
Conducted Under GEP: No

Contacts
Role: STYDIR study director
Study Director: Dr. Joe Ikley
Role: SPONSR sponsor
Sponsor: Northharvest

Site and Design
Treated Plot Width: 6.67 FT
Treated Plot Length: 30 FT
Treated Plot Area: 200.1 FT2 **Treatments:** 12
Replications: 4 **Study Design:** RACOBL Randomized Complete Block (RCB)

Application Description

	A	B	C
Application Date	May-10-2021	Jun-14-2021	Jun-22-2021
Appl. Start Time	1:30 PM	11:20 AM	2:00 PM
Appl. Stop Time	1:50 PM	11:45 AM	2:15 PM
Application Method	SPRAY	SPRAY	SPRAY
Application Timing	PSINCR	POST	POEMCR
Application Placement	BANSOI	BROFOL	BROFOL
Applied By	Stith, J	Stith, J	Stith, J
Appl. Entry Date	May-20-2021	Jun-16-2021	Jun-28-2021
Air Temperature Start, Stop	59, 59 F	87, 91 F	81, 80 F
% Relative Humidity Start, Stop	36, 36	23, 23	27, 27
Wind Velocity+Dir. Start	7 MPH, NE	2 MPH, N	5 MPH, SW
Wind Velocity+Dir. Stop	7 MPH, NE	3 MPH, N	7 MPH, SW
Wind Velocity+Dir. Max	9 MPH, NE	6 MPH, N	9 MPH, SW
Wet Leaves (Y/N)	N, no	N, no	N, no
Soil Temperature	51 F	80 F	72 F
Soil Moisture	DRY	NORMAL	NORMAL
Soil Surface Condition	CLODDY	CLODDY	CLODDY
% Cloud Cover	10	0	0

North Dakota State University

Layered Residual Approach in Dry Bean for Control of AMAPA and AMATA

Trial ID: 21S-NW22-DRY-10 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-10 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Application Equipment

	A	B	C
Appl. Equipment	Stormbreaker	Mjolnir	Walter
Equipment Type	BACCAI	BACCAI	BACCAI
Operation Pressure	29 PSI	28 PSI	28 PSI
Nozzle Model	11002	11002	11002
Nozzle Type	TEEJAI	TEEJTU	TT
Nozzle Spacing	20 IN	20 IN	20 IN
Boom Length	10 FT	6.67 FT	6.67 FT
Boom Height	20 IN	20 IN	20 IN
Ground Speed	3 MPH	3 MPH	3 MPH
Carrier	WATER	WATER	WATER
Application Amount	15 GAL/AC	15 GAL/AC	15 GAL/AC
Mix Size	1800 mL	1119 mL	1119 mL
Propellant	COMCO2	COMCO2	COMCO2

Notes

Context	Date	By	Notes
STATUS	Apr-29-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'S' during trial creation.
STATUS	May-20-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'E' when Application Date entered.

North Dakota State University

Layered Residual Approach in Dry Bean for Control of AMAPA and AMATA

Trial ID: 21S-NW22-DRY-10 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-10 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	1*	2*	3*	4*	5*
	Pest Type					W, Weed		W, Weed	W, Weed
	Pest Code					AMATA		AMATA	AMATA
	Pest Name					common water hemp		common water hemp	common water hemp
	Crop Type, Code				C, PHSVX		C, PHSVX		
	Crop Name				dry bean		dry bean		
	Rating Date				Jul-7-2021	Jul-7-2021	Jul-21-2021	Jul-21-2021	Aug-2-2021
	Part Rated				PLOT, C	PLOT, P	PLOT, C	PLOT, P	PLOT, P
	Rating Type				PHYGEN	CONTRO	PHYGEN	CONTRO	CONTRO
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100
	Number of Subsamples				1	1	1	1	1
	Data Entry Date				Aug-26-2021	Aug-26-2021	Aug-26-2021	Aug-26-2021	Aug-26-2021
	Days After First/Last Applic.				58, 15	58, 15	72, 29	72, 29	84, 41
	Number of Decimals				0	0	0	0	0
1	EPTAM	3	pt/a	A	1 -	94 ab	0 -	90 bc	90 bc
	SONALAN HFP	2	pt/a	A					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
2	EPTAM	3	pt/a	A	3 -	91 b	0 -	88 c	88 c
	SONALAN HFP	2	pt/a	A					
	OUTLOOK	10	fl oz/a	B					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
3	EPTAM	3	pt/a	A	4 -	96 ab	0 -	93 abc	93 abc
	SONALAN HFP	2	pt/a	A					
	DUAL II MAGNUM	1	pt/a	B					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
4	EPTAM	3	pt/a	A	4 -	96 ab	1 -	98 ab	97 ab
	SONALAN HFP	2	pt/a	A					
	REFLEX	12	fl oz/a	B					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
5	EPTAM	3	pt/a	A	4 -	99 a	0 -	100 a	100 a
	SONALAN HFP	2	pt/a	A					
	OUTLOOK	10	fl oz/a	B					
	REFLEX	12	fl oz/a	B					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
6	EPTAM	3	pt/a	A	8 -	99 a	5 -	99 a	99 ab
	SONALAN HFP	2	pt/a	A					
	DUAL II MAGNUM	1	pt/a	B					
	REFLEX	12	fl oz/a	B					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
7	EPTAM	3	pt/a	A	5 -	97 ab	4 -	94 abc	94 abc
	SONALAN HFP	2	pt/a	A					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					
8	EPTAM	3	pt/a	A	5 -	97 ab	4 -	95 abc	95 abc
	SONALAN HFP	2	pt/a	A					
	OUTLOOK	10	fl oz/a	C					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 8=1.9
* Adjusted means
^Calculated from residual.

North Dakota State University

Layered Residual Approach in Dry Bean for Control of AMAPA and AMATA

Trial ID: 21S-NW22-DRY-10 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-10 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	1*	2*	3*	4*	5*
	Pest Type					W, Weed		W, Weed	W, Weed
	Pest Code					AMATA		AMATA	AMATA
	Pest Name					common water hemp		common water hemp	common water hemp
	Crop Type, Code				C, PHSVX		C, PHSVX		
	Crop Name				dry bean		dry bean		
	Rating Date				Jul-7-2021	Jul-7-2021	Jul-21-2021	Jul-21-2021	Aug-2-2021
	Part Rated				PLOT, C	PLOT, P	PLOT, C	PLOT, P	PLOT, P
	Rating Type				PHYGEN	CONTRO	PHYGEN	CONTRO	CONTRO
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100
	Number of Subsamples				1	1	1	1	1
	Data Entry Date				Aug-26-2021	Aug-26-2021	Aug-26-2021	Aug-26-2021	Aug-26-2021
	Days After First/Last Applic.				58, 15	58, 15	72, 29	72, 29	84, 41
	Number of Decimals				0	0	0	0	0
9	EPTAM	3	pt/a	A	6 -	97 ab	6 -	97 ab	96 ab
	SONALAN HFP	2	pt/a	A					
	DUAL II MAGNUM	1	pt/a	C					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					
10	EPTAM	3	pt/a	A	6 -	99 a	5 -	99 a	99 ab
	SONALAN HFP	2	pt/a	A					
	REFLEX	12	fl oz/a	C					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					
11	EPTAM	3	pt/a	A	3 -	99 a	3 -	100 a	97 ab
	SONALAN HFP	2	pt/a	A					
	OUTLOOK	10	fl oz/a	C					
	REFLEX	12	fl oz/a	C					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					
12	EPTAM	3	pt/a	A	6 -	99 a	5 -	100 a	100 a
	SONALAN HFP	2	pt/a	A					
	DUAL II MAGNUM	1	pt/a	C					
	REFLEX	12	fl oz/a	C					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					
	LSD P=.05				6.0	4.3	5.3	5.4	5.4
	Standard Deviation				4.2	3.0	3.6	3.7	3.8
	CV				93.23	3.07	134.76	3.89	3.93
	Levene's F^				0.708	1.967	1.688	1.145	1.03
	Levene's Prob(F)				0.723	0.062	0.116	0.358	0.442
	Skewness^				0.2702	-0.5408	0.194	-0.3256	-0.1747
	Kurtosis^				-0.8915	-0.0041	-0.9663	0.34	-0.0012
	Replicate F				3.454	1.235	2.763	0.988	0.967
	Replicate Prob(F)				0.0274	0.3126	0.0575	0.4104	0.4201
	Treatment F				0.812	2.810	1.692	5.021	4.421
	Treatment Prob(F)				0.6286	0.0106	0.1190	0.0001	0.0004

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 8=1.9
* Adjusted means
^Calculated from residual.

North Dakota State University

Layered Residual Approach in Dry Bean for Control of AMAPA and AMATA

Trial ID: 21S-NW22-DRY-10 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-10 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	6*	7*	8*	9*	10*
	Pest Type				W, Weed	W, Weed	W, Weed		
	Pest Code				AMATA	AMATA	AMATA		
	Pest Name				common water hemp	common water hemp	common water hemp		
	Crop Type, Code							C, PHSVN	C, PHSVN
	Crop Name							dry bean	dry bean
	Rating Date				Aug-18-2021	Sep-16-2021	Sep-21-2021	Sep-21-2021	Sep-21-2021
	Part Rated				PLOT, P				
	Rating Type				CONTRO	DENSIT	WEIGHT	MOICON	YIELD
	Rating Unit/Min/Max				%, 0, 100	m2, -, -	g, -, -	%, 0, 100	g, -, -
	Number of Subsamples				1	2	1	1	1
	Data Entry Date				Aug-26-2021	Oct-12-2021	Oct-12-2021	Oct-12-2021	Oct-12-2021
	Days After First/Last Applic.				100, 57	129, 86	134, 91	134, 91	134, 91
	Number of Decimals				0				
1	EPTAM	3	pt/a	A	89 ab	0.9 ab	280.8 -	5.70 -	1276.8 -
	SONALAN HFP	2	pt/a	A					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
2	EPTAM	3	pt/a	A	85 b	1.1 a	133.3 -	5.40 -	1302.3 -
	SONALAN HFP	2	pt/a	A					
	OUTLOOK	10	fl oz/a	B					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
3	EPTAM	3	pt/a	A	92 ab	0.5 bc	50.1 -	5.83 -	999.5 -
	SONALAN HFP	2	pt/a	A					
	DUAL II MAGNUM	1	pt/a	B					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
4	EPTAM	3	pt/a	A	97 a	0.1 c	71.3 -	5.88 -	1110.5 -
	SONALAN HFP	2	pt/a	A					
	REFLEX	12	fl oz/a	B					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
5	EPTAM	3	pt/a	A	100 a	0.0 c		5.70 -	1069.5 -
	SONALAN HFP	2	pt/a	A					
	OUTLOOK	10	fl oz/a	B					
	REFLEX	12	fl oz/a	B					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
6	EPTAM	3	pt/a	A	100 a	0.0 c		5.83 -	1005.0 -
	SONALAN HFP	2	pt/a	A					
	DUAL II MAGNUM	1	pt/a	B					
	REFLEX	12	fl oz/a	B					
	VARISTO	1	pt/a	B					
	MSO ULTRA	1	% v/v	B					
	N-PAK AMS	2.5	% v/v	B					
7	EPTAM	3	pt/a	A	93 ab	0.4 bc	140.3 -	6.35 -	805.3 -
	SONALAN HFP	2	pt/a	A					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					
8	EPTAM	3	pt/a	A	94 ab	0.3 bc	111.0 -	5.68 -	750.0 -
	SONALAN HFP	2	pt/a	A					
	OUTLOOK	10	fl oz/a	C					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 8=1.9
* Adjusted means
^Calculated from residual.

North Dakota State University

Layered Residual Approach in Dry Bean for Control of AMAPA and AMATA

Trial ID: 21S-NW22-DRY-10 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-10 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Pest Type					W, Weed	W, Weed	W, Weed		
Pest Code					AMATA	AMATA	AMATA		
Pest Name					common water hemp	common water hemp	common water hemp		
Crop Type, Code								C, PHSVN	C, PHSVN
Crop Name								dry bean	dry bean
Rating Date					Aug-18-2021	Sep-16-2021	Sep-21-2021	Sep-21-2021	Sep-21-2021
Part Rated					PLOT, P				
Rating Type					CONTRO	DENSIT	WEIGHT	MOICON	YIELD
Rating Unit/Min/Max					%, 0, 100	m2, -, -	g, -, -	%, 0, 100	g, -, -
Number of Subsamples					1	2	1	1	1
Data Entry Date					Aug-26-2021	Oct-12-2021	Oct-12-2021	Oct-12-2021	Oct-12-2021
Days After First/Last Applic.					100, 57	129, 86	134, 91	134, 91	134, 91
Number of Decimals					0				
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	6*	7*	8*	9*	10*
9	EPTAM	3	pt/a	A	95 ab	0.4 bc	171.9 -	5.68 -	970.5 -
	SONALAN HFP	2	pt/a	A					
	DUAL II MAGNUM	1	pt/a	C					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					
10	EPTAM	3	pt/a	A	99 a	0.1 c	-117.8 -	5.83 -	1073.8 -
	SONALAN HFP	2	pt/a	A					
	REFLEX	12	fl oz/a	C					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					
11	EPTAM	3	pt/a	A	98 a	0.0 c		5.98 -	1163.3 -
	SONALAN HFP	2	pt/a	A					
	OUTLOOK	10	fl oz/a	C					
	REFLEX	12	fl oz/a	C					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					
12	EPTAM	3	pt/a	A	100 a	0.0 c		5.88 -	1079.3 -
	SONALAN HFP	2	pt/a	A					
	DUAL II MAGNUM	1	pt/a	C					
	REFLEX	12	fl oz/a	C					
	VARISTO	1	pt/a	C					
	MSO ULTRA	1	% v/v	C					
	N-PAK AMS	2.5	% v/v	C					
LSD P=.05					7.8	0.46	287.53	0.558	359.29
Standard Deviation					5.4	0.32	179.75	0.388	249.75
CV					5.67	103.28	120.27	6.68	23.78
Levene's F^					2.121	0.904	1.209	0.975	0.744
Levene's Prob(F)					0.044*	0.546	0.368	0.485	0.69
Skewness^					-0.6653	0.5905	0.7438	0.036	0.7706*
Kurtosis^					1.5207*	1.1006	1.1061	-0.0584	2.1659*
Replicate F					1.091	1.400	1.299	0.853	4.426
Replicate Prob(F)					0.3665	0.2602	0.3333	0.4751	0.0101
Treatment F					3.161	5.182	0.602	1.345	1.715
Treatment Prob(F)					0.0051	0.0001	0.7418	0.2446	0.1134

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 8=1.9
* Adjusted means
^Calculated from residual.

North Dakota State University

Layered Residual Approach in Dry Bean for Control of AMAPA and AMATA

Trial ID: 21S-NW22-DRY-10 Location: NW22, Reed Township, Fargo, ND Trial Year: 2021
Protocol ID: 21S-NW22-DRY-10 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Pest Type
W, Weed = Weed or volunteer crop
Pest Code
AMATA, Amaranthus x tamariscinus, common water hemp = US
Crop Type, Code
C = EPPO species (Bayer) codes
PHSVX, BVBE, Phaseolus vulgaris, dry bean = US
PHSVN, BVBE, Phaseolus vulgaris nanus, dry bean = US
Part Rated
PLOT = plot
C = Crop is Part Rated
P = Pest is Part Rated
Rating Type
PHYGEN = phytotoxicity - general / injury
CONTRO = control / burndown or knockdown
DENSIT = density
WEIGHT = weight
MOICON = moisture content
YIELD = yield
Rating Unit/Min/Max
%, 0, 100 = percent
m2, , = square meter
g, , = gram

North Dakota State University

Sonalan, Eptam, and Permit in Dry Bean

Trial ID: 21S-PALM-DRY-03 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-03 Investigator (Creator): Dr. Joe Ikley
Project ID: ETH-21-01 Study Director: Dr. Joe Ikley
Sponsor Contact: Alan Helm, Gowan

General Trial Information
Study Director: Dr. Joe Ikley

Trial Status: E established
ARM Trial Created On: May-3-2021

Conducted Under GLP: No
Conducted Under GEP: No

Contacts
Role: STYDIR study director
Study Director: Dr. Joe Ikley
Role: SPONSR sponsor
Sponsor: Alan Helm, Gowan

Site and Design
Treated Plot Width: 6.67 FT
Treated Plot Length: 30 FT
Treated Plot Area: 200.1 FT2 **Treatments:** 9
Replications: 4 **Study Design:** RACOBL Randomized Complete Block (RCB)

Application Description

	A	B	C	D
Application Date	Jun-2-2021	Jun-2-2021	Jun-29-2021	Jul-7-2021
Appl. Start Time	10:20 AM	1:25 PM	11:05 AM	11:45 AM
Appl. Stop Time	10:30 AM	1:30 PM	11:10 AM	11:50 AM
Interval to Prev. Appl.		3 HOURS	27 DAYS	8 DAYS
Application Method	SPRAY	SPRAY	SPRAY	SPRAY
Application Timing	PREINC	PREEM	POEMCR	POEMCR
Application Placement	BROSOI	BROSOI	BROFOL	BROFOL
Applied By	Stith, J	Stith, J	Stith, J	Stith, J
Appl. Entry Date	Jun-16-2021	Jun-16-2021	Jun-30-2021	Jul-16-2021
Air Temperature Start, Stop	80, 81 F	91, 91 F	73, 73 F	77, 71 F
% Relative Humidity Start, Stop	49, 49	26, 26	54, 54	41, 52
Wind Velocity+Dir. Start	4.4 MPH, W	3 MPH, NW	4 MPH, N	2 MPH, NE
Wind Velocity+Dir. Stop	4.8 MPH, W	3.7 MPH, NW	3 MPH, N	1 MPH, NE
Wind Velocity+Dir. Max	6.7 MPH, W	10 MPH, NW	5 MPH, N	3 MPH, NE
Wet Leaves (Y/N)	N, no	N, no	N, no	N, no
Soil Temperature	62 F	71 F	72 F	74 F
Soil Moisture	DRY	DRY	WET	DRY
Soil Surface Condition	CLOTRA	CLOTRA	CLOTRA	CLODDY
% Cloud Cover	10	10	10	40

North Dakota State University

Sonalan, Eptam, and Permit in Dry Bean

Trial ID: 21S-PALM-DRY-03 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-03 Investigator (Creator): Dr. Joe Ikley
Project ID: ETH-21-01 Study Director: Dr. Joe Ikley
Sponsor Contact: Alan Helm, Gowan

Application Equipment

	A	B	C	D
Appl. Equipment	Walter	Walter	Walter	Walter
Equipment Type	BACCAI	BACCAI	BACCAI	BACCAI
Operation Pressure	28 PSI	28 PSI	28 PSI	28 PSI
Nozzle Model	11002	11002	8002	8002
Nozzle Type	TTI	TTI	XR	XR
Nozzle Spacing	20 IN	20 IN	20 IN	20 IN
Boom Length	6.67 FT	6.67 FT	6.67 FT	6.67 FT
Boom Height	20 IN	20 IN	20 IN	20 IN
Ground Speed	3 MPH	3 MPH	3 MPH	3 MPH
Carrier	WATER	WATER	WATER	WATER
Application Amount	15 GAL/AC	15 GAL/AC	15 GAL/AC	15 GAL/AC
Mix Size	1119 mL	1119 mL	1119 mL	1119 mL
Propellant	COMCO2	COMCO2	COMCO2	COMCO2

Notes

Context	Date	By	Notes
STATUS	May-3-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'S' during trial creation.
STATUS	Jun-16-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'E' when Application Date entered.

North Dakota State University

Sonalan, Eptam, and Permit in Dry Bean

Trial ID: 21S-PALM-DRY-03 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-03 Investigator (Creator): Dr. Joe Ikley
Project ID: ETH-21-01 Study Director: Dr. Joe Ikley
Sponsor Contact: Alan Helm, Gowan

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	1*	2*	3*	4*	5*
	Pest Type					W, Weed	W, Weed	W, Weed	W, Weed
	Pest Code					AMAPA	AMAPA	AMAPA	AMAPA
	Pest Scientific Name					Amaranthus palmeri	Amaranthus palmeri	Amaranthus palmeri	Amaranthus palmeri
	Pest Name					Palmer amaranth	Palmer amaranth	Palmer amaranth	Palmer amaranth
	Crop Type, Code				C, PHSVX				
	BBCH Scale				BVBE				
	Crop Scientific Name				Phaseolus vulgaris				
	Crop Name				dry bean				
	Rating Date				Jun-16-2021	Jun-28-2021	Jul-5-2021	Jul-12-2021	Jul-20-2021
	Rating Type				PHYGEN	CONTRO	CONTRO	CONTRO	CONTRO
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100
	Number of Subsamples				1	1	1	1	1
	Assessed By				Ikley, J	Ikley, J	Ikley, J	Ikley, J	Ikley, J
	Data Entry Date				Aug-17-2021	Aug-17-2021	Aug-17-2021	Aug-17-2021	Aug-17-2021
	Days After First/Last Applic.				14, 14	26, 26	33, 6	40, 5	48, 13
	Plant-Eval Interval				14 DP-1	26 DP-1	33 DP-1	40 DP-1	48 DP-1
	Days After Emergence				7 DE-1	19 DE-1	26 DE-1	33 DE-1	41 DE-1
1	Untreated				0.0 -	0.0 c	0.0 c	0.0 c	0.0 c
2	SONALAN HFP	3	pt/a	A	0.0 -	93.3 a	82.5 a	80.0 a	72.5 a
3	EPTAM	4	pt/a	A	0.0 -	91.3 a	77.5 a	75.0 a	63.8 a
4	EPTAM	3	pt/a	A	3.8 -	98.0 a	90.0 a	85.0 a	77.5 a
	SONALAN HFP	2	pt/a	A					
	PERMIT	0.67	oz/a	B					
5	EPTAM	3	pt/a	A	2.5 -	94.8 a	91.3 a	85.0 a	72.5 a
	SONALAN HFP	2	pt/a	A					
	PERMIT	0.67	oz/a	C					
	PRIME OIL	1	% v/v	C					
6	EPTAM	3	pt/a	A	0.0 -	96.0 a	90.0 a	90.0 a	85.0 a
	SONALAN HFP	2	pt/a	A					
	PERMIT	0.67	oz/a	B					
	BASAGRAN	1	pt/a	D					
	RAPTOR	4	fl oz/a	D					
	PRIME OIL	1	% v/v	D					
7	EPTAM	3	pt/a	A	2.5 -	92.0 a	86.8 a	85.5 a	81.3 a
	SONALAN HFP	2	pt/a	A					
	PERMIT	0.67	oz/a	C					
	PRIME OIL	1	% v/v	C					
	BASAGRAN	1	pt/a	D					
	RAPTOR	4	fl oz/a	D					
	PRIME OIL	1	% v/v	D					
8	SONALAN HFP	2	pt/a	A	1.3 -	95.8 a	88.5 a	89.0 a	82.5 a
	EPTAM	3	pt/a	A					
	REFLEX	1	pt/a	B					
	PERMIT	0.67	oz/a	D					
	BASAGRAN	1	pt/a	D					
	PRIME OIL	1	% v/v	D					
9	DUAL II MAGNUM	1.33	pt/a	B	0.0 -	70.0 b	41.3 b	31.3 b	30.0 b
	REFLEX	1	pt/a	B					
	BASAGRAN	1	pt/a	D					
	RAPTOR	4	fl oz/a	D					
	PRIME OIL	1	% v/v	D					
	LSD P=.05				3.42	10.60	16.05	17.06	20.30
	Standard Deviation				2.34	7.26	11.00	11.69	13.91
	CV				211.02	8.94	15.28	16.95	22.16
	Levene's F^				7.298	2.044	1.934	0.619	0.921
	Levene's Prob(F)				0.00*	0.079	0.096	0.754	0.515
	Skewness^				0.4305	-0.8115*	-0.4436	-0.9303*	-0.5663
	Kurtosis^				1.3238	1.3977	0.0275	1.05	0.6812
	Replicate F				0.337	1.344	0.240	0.381	0.163
	Replicate Prob(F)				0.7988	0.2838	0.8674	0.7675	0.9204
	Treatment F				1.547	75.604	32.142	29.140	17.177
	Treatment Prob(F)				0.1934	0.0001	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
^Calculated from residual.

North Dakota State University

Sonalan, Eptam, and Permit in Dry Bean

Trial ID: 21S-PALM-DRY-03 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-03 Investigator (Creator): Dr. Joe Ikley
Project ID: ETH-21-01 Study Director: Dr. Joe Ikley
Sponsor Contact: Alan Helm, Gowan

Pest Type
W, Weed = Weed or volunteer crop
Pest Code
AMAPA, Amaranthus palmeri, Palmer amaranth = US
Crop Type, Code
C = EPPO species (Bayer) codes
PHSVX, BVBE, Phaseolus vulgaris, dry bean = US
Rating Type
PHYGEN = phytotoxicity - general / injury
CONTRO = control / burndown or knockdown
Rating Unit/Min/Max
%, 0, 100 = percent
Assessed By
Ikley, J = Extension Agent
Plant-Eval Interval
14 DP-1 = 1 PHSVX Jun-2-2021
26 DP-1 = 1 PHSVX Jun-2-2021
33 DP-1 = 1 PHSVX Jun-2-2021
40 DP-1 = 1 PHSVX Jun-2-2021
48 DP-1 = 1 PHSVX Jun-2-2021

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
^Calculated from residual.

North Dakota State University

PPI and PRE Herbicides for Residual control of AMAPA and AMATA in Dry bean

Trial ID: 21S-PALM-DRY-04 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-04 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

General Trial Information
Study Director: Dr. Joe Ikley

Trial Status: E established
ARM Trial Created On: May-3-2021

Conducted Under GLP: No
Conducted Under GEP: No

Contacts
Role: STYDIR study director
Study Director: Dr. Joe Ikley
Role: SPONSR sponsor
Sponsor: Northharvest

Site and Design
Treated Plot Width: 6.67 FT
Treated Plot Length: 30 FT
Treated Plot Area: 200.1 FT2 **Treatments:** 16
Replications: 4 **Study Design:** RACOBL Randomized Complete Block (RCB)

Application Description

	A	B
Application Date	Jun-2-2021	Jun-2-2021
Appl. Start Time	9:55 AM	1:35 PM
Appl. Stop Time	10:15 AM	1:40 PM
Interval to Prev. Appl.		3 HOURS
Application Method	SPRAY	SPRAY
Application Timing	PREINC	PREEM
Application Placement	BROSOI	BROSOI
Applied By	Stith, J	Stith, J
Appl. Entry Date	Jun-16-2021	Jun-16-2021
Air Temperature Start, Stop	76, 80 F	90, 91 F
% Relative Humidity Start, Stop	38, 38	26, 26
Wind Velocity+Dir. Start	7.4 MPH, W	4 MPH, SW
Wind Velocity+Dir. Stop	5.3 MPH, W	3.2 MPH, SW
Wind Velocity+Dir. Max	7.9 MPH, W	10 MPH, SW
Wet Leaves (Y/N)	N, no	N, no
Soil Temperature	62 F	71 F
Soil Moisture	DRY	DRY
Soil Surface Condition	CLOTRA	CLOTRA
% Cloud Cover	15	10

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Trial ID: 21S-PALM-DRY-04 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-04 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Application Equipment

	A	B
Appl. Equipment	Walter	Walter
Equipment Type	BACCAI	BACCAI
Operation Pressure	28 PSI	28 PSI
Nozzle Model	11002	11002
Nozzle Type	TTI	TTI
Nozzle Spacing	20 IN	20 IN
Boom Length	6.67 FT	6.67 FT
Boom Height	20 IN	20 IN
Ground Speed	3 MPH	3 MPH
Carrier	WATER	WATER
Application Amount	15 GAL/AC	15 GAL/AC
Mix Size	1119 mL	1119 mL
Propellant	COMCO2	COMCO2

Notes

Context	Date	By	Notes
STATUS	May-3-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'S' during trial creation.
STATUS	Jun-16-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'E' when Application Date entered.

North Dakota State University

PPI and PRE Herbicides for Residual control of AMAPA and AMATA in Dry bean

Trial ID: 21S-PALM-DRY-04 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-04 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	1*	2*	3*	4*
	Pest Type					W, Weed	W, Weed	W, Weed
	Pest Code					AMAPA	AMAPA	AMAPA
	Pest Scientific Name				Amaranthus palmeri	Amaranthus palmeri	Amaranthus palmeri	Amaranthus palmeri
	Pest Name					Palmer amaranth	Palmer amaranth	Palmer amaranth
	Crop Type, Code				C, PHSVX			
	BBCH Scale				BVBE			
	Crop Scientific Name				Phaseolus vulgaris			
	Crop Name				dry bean			
	Rating Date				Jun-16-2021	Jun-28-2021	Jul-12-2021	Jul-26-2021
	Rating Type				PHYGEN	CONTRO	CONTRO	CONTRO
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	%, 0, 100	%, 0, 100
	Number of Subsamples				1	1	1	1
	Assessed By				Ikley, J	Ikley, J	Ikley, J	Ikley, J
	Data Entry Date				Aug-23-2021	Aug-23-2021	Aug-23-2021	Aug-23-2021
	Days After First/Last Applic.				14, 14	26, 26	40, 40	54, 54
	Plant-Eval Interval				14 DP-1	26 DP-1	40 DP-1	54 DP-1
	Days After Emergence				7 DE-1	19 DE-1	33 DE-1	47 DE-1
1	Untreated Check				0.0 -	0.0 c	0.0 c	0.0 c
2	EPTAM	4	pt/a	A	0.0 -	92.0 ab	80.0 ab	70.0 ab
3	SONALAN HFP	3	pt/a	A	1.3 -	91.8 ab	81.3 ab	73.8 ab
4	TREFLAN HFP	1.5	pt/a	A	3.8 -	77.5 ab	63.8 ab	51.3 ab
5	PROWL H20	3	pt/a	A	1.3 -	87.5 ab	70.0 ab	67.5 ab
6	EPTAM	3	pt/a	A	2.5 -	96.5 a	86.3 a	85.0 a
	SONALAN HFP	2	pt/a	A				
7	EPTAM	3	pt/a	A	0.0 -	91.0 ab	68.8 ab	55.0 ab
	TREFLAN HFP	1.5	pt/a	A				
8	DUAL II MAGNUM	2	pt/a	B	0.0 -	58.8 b	42.5 b	37.5 b
9	OUTLOOK	14	fl oz/a	B	1.3 -	73.8 ab	50.0 ab	43.8 ab
10	OUTLOOK	21	fl oz/a	B	1.3 -	75.0 ab	63.8 ab	51.5 ab
11	SPARTAN CHARGE	5	fl oz/a	A	0.0 -	78.8 ab	52.5 ab	47.5 ab
12	SPARTAN CHARGE	5	fl oz/a	B	1.3 -	79.8 ab	66.3 ab	57.5 ab
13	AUTHORITY ELITE	25	fl oz/a	A	1.3 -	96.0 a	83.8 a	72.5 ab
14	AUTHORITY ELITE	25	fl oz/a	B	2.5 -	71.3 ab	61.3 ab	55.0 ab
15	SPARTAN CHARGE	4	fl oz/a	A	0.0 -	72.5 ab	60.0 ab	60.0 ab
	PROWL H20	1.5	pt/a	A				
16	SPARTAN CHARGE	4	fl oz/a	B	2.5 -	83.8 ab	66.3 ab	55.0 ab
	OUTLOOK	14	fl oz/a	B				
	LSD P=.05				3.04	20.46	23.02	25.59
	Standard Deviation				2.13	14.36	16.16	17.97
	CV				182.17	18.75	25.96	32.57
	Levene's F^				1.25	1.271	0.762	1.234
	Levene's Prob(F)				0.27	0.257	0.711	0.281
	Skewness^				0.6937*	-0.6891*	0.0236	0.3515
	Kurtosis^				-0.0264	1.7777*	-0.2712	-0.6142
	Replicate F				0.086	1.040	0.719	0.959
	Replicate Prob(F)				0.9675	0.3839	0.5457	0.4204
	Treatment F				1.183	10.176	6.502	4.551
	Treatment Prob(F)				0.3190	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 5,6=3.9
* Adjusted means
^Calculated from residual.

North Dakota State University

PPI and PRE Herbicides for Residual control of AMAPA and AMATA in Dry bean

Trial ID: 21S-PALM-DRY-04 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-04 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	5*	6*
	Pest Type				W, Weed	W, Weed
	Pest Code				AMAPA	AMAPA
	Pest Scientific Name				Amaranthus palmeri	Amaranthus palmeri
	Pest Name				Palmer amaranth	Palmer amaranth
	Crop Type, Code					
	BBCH Scale					
	Crop Scientific Name					
	Crop Name					
	Rating Date				Aug-5-2021	Aug-5-2021
	Rating Type				BIOMAS	DENSTY
	Rating Unit/Min/Max				g, -, -	m2, -, -
	Number of Subsamples				1	1
	Assessed By				DeSimini, S	DeSimini, S
	Data Entry Date				Aug-23-2021	Aug-23-2021
	Days After First/Last Applic.				64, 64	64, 64
	Plant-Eval Interval				64 DP-1	64 DP-1
	Days After Emergence				57 DE-1	57 DE-1
1	Untreated Check				134.692 -	11.9 -
2	EPTAM	4	pt/a	A	36.460 -	7.0 -
3	SONALAN HFP	3	pt/a	A	26.165 -	4.0 -
4	TREFLAN HFP	1.5	pt/a	A	18.243 -	5.5 -
5	PROWL H20	3	pt/a	A	3.080 -	2.0 -
6	EPTAM	3	pt/a	A	15.770 -	5.5 -
	SONALAN HFP	2	pt/a	A		
7	EPTAM	3	pt/a	A	15.813 -	6.0 -
	TREFLAN HFP	1.5	pt/a	A		
8	DUAL II MAGNUM	2	pt/a	B	129.783 -	8.0 -
9	OUTLOOK	14	fl oz/a	B	15.720 -	2.5 -
10	OUTLOOK	21	fl oz/a	B	39.530 -	4.0 -
11	SPARTAN CHARGE	5	fl oz/a	A	55.258 -	5.0 -
12	SPARTAN CHARGE	5	fl oz/a	B	19.465 -	3.0 -
13	AUTHORITY ELITE	25	fl oz/a	A	26.940 -	3.0 -
14	AUTHORITY ELITE	25	fl oz/a	B	67.528 -	7.5 -
15	SPARTAN CHARGE	4	fl oz/a	A	34.823 -	3.5 -
	PROWL H20	1.5	pt/a	A		
16	SPARTAN CHARGE	4	fl oz/a	B	40.810 -	2.5 -
	OUTLOOK	14	fl oz/a	B		
	LSD P=.05				96.2590	5.44
	Standard Deviation				67.5464	3.82
	CV				166.13	77.54
	Levene's F^				0.718	0.842
	Levene's Prob(F)				0.754	0.628
	Skewness^				2.6763*	0.3415
	Kurtosis^				14.9089*	0.0073
	Replicate F				0.925	2.657
	Replicate Prob(F)				0.4364	0.0600
	Treatment F				1.116	1.547
	Treatment Prob(F)				0.3708	0.1300

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 5,6=3.9
* Adjusted means
^Calculated from residual.

North Dakota State University

PPI and PRE Herbicides for Residual control of AMAPA and AMATA in Dry bean

Trial ID: 21S-PALM-DRY-04 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-04 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Pest Type
W, Weed = Weed or volunteer crop
Pest Code
AMAPA, Amaranthus palmeri, Palmer amaranth = US
Crop Type, Code
C = EPPO species (Bayer) codes
PHSVX, BVBE, Phaseolus vulgaris, dry bean = US
Rating Type
PHYGEN = phytotoxicity - general / injury
CONTRO = control / burndown or knockdown
BIOMAS = biomas
DENSTY = density
Rating Unit/Min/Max
%, 0, 100 = percent
g, , = gram
m2, , = square meter
Assessed By
Ikley, J = Extension Agent
DeSimini, S = Research Specialist
Plant-Eval Interval
14 DP-1 = 1 PHSVX Jun-2-2021
26 DP-1 = 1 PHSVX Jun-2-2021
40 DP-1 = 1 PHSVX Jun-2-2021
54 DP-1 = 1 PHSVX Jun-2-2021
64 DP-1 = 1 PHSVX Jun-2-2021

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-PALM-DRY-05 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-05 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

General Trial Information
Study Director: Dr. Joe Ikley

Trial Status: E established
ARM Trial Created On: May-3-2021

Conducted Under GLP: No
Conducted Under GEP: No

Contacts
Role: STYDIR study director
Study Director: Dr. Joe Ikley
Role: SPONSR sponsor
Sponsor: Northharvest

Site and Design
Treated Plot Width: 6.67 FT
Treated Plot Length: 30 FT
Treated Plot Area: 200.1 FT2 **Treatments:** 12
Replications: 4 **Study Design:** RACOBL Randomized Complete Block (RCB)

Application Description

	B	C
Application Date	Jul-13-2021	Jul-20-2021
Appl. Start Time	10:40 AM	4:45 PM
Appl. Stop Time	11:05 AM	4:55 PM
Application Method	SPRAY	SPRAY
Application Timing	POEMCR	POEMCR
Application Placement	BROFOL	BROFOL
Applied By	Stith, J	Stith, J
Appl. Entry Date	Jul-16-2021	Jul-22-2021
Air Temperature Start, Stop	77, 78 F	83, 84 F
% Relative Humidity Start, Stop	58, 51	56, 54
Wind Velocity+Dir. Start	2 MPH, N	3 MPH, S
Wind Velocity+Dir. Stop	3 MPH, N	2 MPH, S
Wind Velocity+Dir. Max	5 MPH, N	5 MPH, S
Wet Leaves (Y/N)	N, no	N, no
Soil Temperature	76 F	76 F
Soil Moisture	DRY	DRY
Soil Surface Condition	CLODDY	CLODDY
% Cloud Cover	0	100

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-PALM-DRY-05 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-05 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Application Equipment

	B	C
Appl. Equipment	Walter	Walter
Equipment Type	BACCAI	BACCAI
Operation Pressure	28 PSI	28 PSI
Nozzle Model	8002	11002
Nozzle Type	XR	TT
Nozzle Spacing	20 IN	20 IN
Boom Length	6.67 FT	6.67 FT
Boom Height	20 IN	20 IN
Ground Speed	3 MPH	3 MPH
Carrier	WATER	WATER
Application Amount	15 GAL/AC	15 GAL/AC
Mix Size	1119 mL	1119 mL
Propellant	COMCO2	COMCO2

Notes

Context	Date	By	Notes
STATUS	May-3-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'S' during trial creation.
STATUS	Jul-16-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'E' when Application Date entered.

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-PALM-DRY-05 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-05 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	1*	2*	3*
	Pest Type				W, Weed	W, Weed	W, Weed
	Pest Code				AMAPA	AMAPA	AMAPA
	Pest Name				Palmer amaranth	Palmer amaranth	Palmer amaranth
	Rating Date				Jul-20-2021	Jul-26-2021	Aug-2-2021
	Rating Type				CONTRO	CONTRO	CONTRO
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	%, 0, 100
	Number of Subsamples				1	1	1
	Assessed By				Ikley, J	Ikley, J	Ikley, J
	Data Entry Date				Aug-17-2021	Aug-17-2021	Aug-17-2021
	Days After First/Last Applic.				-, 7	-, 6	-, 13
	Days After Emergence				41 DE-1	47 DE-1	54 DE-1
1	EPTAM	3	pt/a	A	0.0 c	0.0 b	0.0 ab
	SONALAN HFP	2	pt/a	A			
2	EPTAM	3	pt/a	A	9.6 c	1.4 b	-1.7 b
	SONALAN HFP	2	pt/a	A			
	BASAGRAN	1.6	pt/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
3	EPTAM	3	pt/a	A	6.6 c	4.9 b	6.0 ab
	SONALAN HFP	2	pt/a	A			
	BASAGRAN	0.8	pt/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
	BASAGRAN	0.8	pt/a	C			
	MSO ULTRA	1	% v/v	C			
	N-PAK AMS	2.5	% v/v	C			
4	EPTAM	3	pt/a	A	80.1 a	70.8 a	57.3 ab
	SONALAN HFP	2	pt/a	A			
	REFLEX	12	fl oz/a	B			
	MSO ULTRA	1	% v/v	B			
5	EPTAM	3	pt/a	A	66.3 ab	58.1 a	48.3 ab
	SONALAN HFP	2	pt/a	A			
	REFLEX	6	fl oz/a	B			
	MSO ULTRA	1	% v/v	B			
	REFLEX	6	fl oz/a	C			
	MSO ULTRA	1	% v/v	C			
6	EPTAM	3	pt/a	A	16.3 c	11.4 b	8.3 ab
	SONALAN HFP	2	pt/a	A			
	BASAGRAN	1.6	pt/a	B			
	RAPTOR	4	fl oz/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
7	EPTAM	3	pt/a	A	10.3 c	12.8 b	5.0 ab
	SONALAN HFP	2	pt/a	A			
	BASAGRAN	0.8	pt/a	B			
	RAPTOR	2	fl oz/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
	BASAGRAN	0.8	pt/a	C			
	RAPTOR	2	fl oz/a	C			
	MSO ULTRA	1	% v/v	C			
	N-PAK AMS	2.5	% v/v	C			
8	EPTAM	3	pt/a	A	73.4 a	62.5 a	53.9 ab
	SONALAN HFP	2	pt/a	A			
	BASAGRAN	1.6	pt/a	B			
	REFLEX	12	fl oz/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 1-3=3.1
* Adjusted means
^Calculated from residual.

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-PALM-DRY-05 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-05 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	1*	2*	3*
	Pest Type				W, Weed	W, Weed	W, Weed
	Pest Code				AMAPA	AMAPA	AMAPA
	Pest Name				Palmer amaranth	Palmer amaranth	Palmer amaranth
	Rating Date				Jul-20-2021	Jul-26-2021	Aug-2-2021
	Rating Type				CONTRO	CONTRO	CONTRO
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	%, 0, 100
	Number of Subsamples				1	1	1
	Assessed By				Ikley, J	Ikley, J	Ikley, J
	Data Entry Date				Aug-17-2021	Aug-17-2021	Aug-17-2021
	Days After First/Last Applic.				-, 7	-, 6	-, 13
	Days After Emergence				41 DE-1	47 DE-1	54 DE-1
9	EPTAM	3	pt/a	A	65.0 ab	76.0 a	69.8 a
	SONALAN HFP	2	pt/a	A			
	BASAGRAN	0.8	pt/a	B			
	REFLEX	6	fl oz/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
	BASAGRAN	0.8	pt/a	C			
	REFLEX	6	fl oz/a	C			
	MSO ULTRA	1	% v/v	C			
	N-PAK AMS	2.5	% v/v	C			
10	EPTAM	3	pt/a	A	70.1 ab	59.1 a	63.9 ab
	SONALAN HFP	2	pt/a	A			
	BASAGRAN	0.56	pt/a	B			
	RAPTOR	2	fl oz/a	B			
	REFLEX	4	fl oz/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
11	EPTAM	3	pt/a	A	49.6 b	74.4 a	55.0 ab
	SONALAN HFP	2	pt/a	A			
	BASAGRAN	0.56	pt/a	B			
	RAPTOR	2	fl oz/a	B			
	REFLEX	4	fl oz/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
	BASAGRAN	0.56	pt/a	C			
	RAPTOR	2	fl oz/a	C			
	REFLEX	4	fl oz/a	C			
	MSO ULTRA	1	% v/v	C			
	N-PAK AMS	2.5	% v/v	C			
12	EPTAM	3	pt/a	A	13.3 c	8.3 b	12.7 ab
	SONALAN HFP	2	pt/a	A			
	RAPTOR	4	fl oz/a	B			
	MSO ULTRA	1	% v/v	B			
	28% UAN	2.5	% v/v	B			
	LSD P=.05				14.36	30.20	35.96
	Standard Deviation				9.82	20.65	24.58
	CV				25.72	55.92	77.27
	Levene's F^				0.574	0.571	0.807
	Levene's Prob(F)				0.833	0.834	0.633
	Skewness^				0.9436*	-0.3835	-0.02
	Kurtosis^				0.5369	0.7272	0.1754
	Replicate F				0.059	0.395	0.574
	Replicate Prob(F)				0.9806	0.7580	0.6377
	Treatment F				32.586	7.926	4.377
	Treatment Prob(F)				0.0001	0.0001	0.0014

Pest Type
W, Weed = Weed or volunteer crop
Pest Code
AMAPA, Amaranthus palmeri, Palmer amaranth = US
Rating Type
CONTRO = control / burndown or knockdown
Rating Unit/Min/Max

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 1-3=3.1
* Adjusted means
^Calculated from residual.

North Dakota State University

POST Herbicides for AMAPA and AMATA Control in Dry Bean

Trial ID: 21S-PALM-DRY-05 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-05 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

%, 0, 100 = percent
Assessed By
Ikley, J = Extension Agent

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 1-3=3.1
* Adjusted means
^Calculated from residual.

North Dakota State University

Layered Residual Approach in Dry Bean for Control of AMAPA and AMATA

Trial ID: 21S-PALM-DRY-06 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-06 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

General Trial Information
Study Director: Dr. Joe Ikley

Trial Status: E established
ARM Trial Created On: May-3-2021

Conducted Under GLP: No
Conducted Under GEP: No

Contacts
Role: STYDIR study director
Study Director: Dr. Joe Ikley
Role: SPONSR sponsor
Sponsor: Northharvest

Site and Design
Treated Plot Width: 6.67 FT
Treated Plot Length: 30 FT
Treated Plot Area: 200.1 FT2 **Treatments:** 12
Replications: 4 **Study Design:** RACOBL Randomized Complete Block (RCB)

Application Description

		B	C
Application Date		Jun-29-2021	Jul-7-2021
Appl. Start Time		10:45 AM	11:55 AM
Appl. Stop Time		11:00 AM	12:10 PM
Application Method		SPRAY	SPRAY
Application Timing		POEMCR	POEMCR
Application Placement		BROFOL	BROFOL
Applied By		Stith, J	Stith, J
Appl. Entry Date		Jun-30-2021	Jul-16-2021
Air Temperature Start, Stop		73, 74 F	74, 77 F
% Relative Humidity Start, Stop		56, 56	48, 41
Wind Velocity+Dir. Start		3 MPH, N	1 MPH, NE
Wind Velocity+Dir. Stop		4 MPH, N	3 MPH, NE
Wind Velocity+Dir. Max		5 MPH, N	5 MPH, NE
Wet Leaves (Y/N)		N, no	N, no
Soil Temperature		72 F	74 F
Soil Moisture		WET	DRY
Soil Surface Condition		CLODDY	CLODDY
% Cloud Cover		10	90

North Dakota State University

Layered Residual Approach in Dry Bean for Control of AMAPA and AMATA

Trial ID: 21S-PALM-DRY-06 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-06 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Application Equipment

	A	B	C
Appl. Equipment	Walter	Walter	Walter
Equipment Type	BACCAI	BACCAI	BACCAI
Operation Pressure	28 PSI	28 PSI	28 PSI
Nozzle Model	8002	8002	8002
Nozzle Type	XR	XR	XR
Nozzle Spacing	20 IN	20 IN	20 IN
Boom Length	6.67 FT	6.67 FT	6.67 FT
Boom Height	20 IN	20 IN	20 IN
Ground Speed	3 MPH	3 MPH	3 MPH
Carrier	WATER	WATER	WATER
Application Amount	15 GAL/AC	15 GAL/AC	15 GAL/AC
Mix Size	1119 mL	1119 mL	1119 mL
Propellant	COMCO2	COMCO2	COMCO2

Notes

Context	Date	By	Notes
STATUS	May-3-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'S' during trial creation.
STATUS	Jun-30-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'E' when Application Date entered.

North Dakota State University

Layered Residual Approach in Dry Bean for Control of AMAPA and AMATA

Trial ID: 21S-PALM-DRY-06 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-06 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Pest Type						W, Weed	W, Weed
Pest Code						AMAPA	AMAPA
Pest Name						Palmer amaranth	Palmer amaranth
Rating Date						Jul-20-2021	Aug-2-2021
Rating Type						CONTRO	CONTRO
Rating Unit/Min/Max						%, 0, 100	%, 0, 100
Number of Subsamples						1	1
Assessed By						Ikley, J	Ikley, J
Data Entry Date						Aug-17-2021	Aug-17-2021
Days After First/Last Applic.						-, 13	-, 26
Days After Emergence						41 DE-1	54 DE-1
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code		1*	2*
1	EPTAM	3	pt/a	A		72.5 -	71.3 -
	SONALAN HFP	2	pt/a	A			
	VARISTO	1	pt/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
2	EPTAM	3	pt/a	A		63.8 -	61.3 -
	SONALAN HFP	2	pt/a	A			
	OUTLOOK	10	fl oz/a	B			
	VARISTO	1	pt/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
3	EPTAM	3	pt/a	A		66.8 -	68.8 -
	SONALAN HFP	2	pt/a	A			
	DUAL II MAGNUM	1	pt/a	B			
	VARISTO	1	pt/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
4	EPTAM	3	pt/a	A		80.5 -	81.3 -
	SONALAN HFP	2	pt/a	A			
	REFLEX	12	fl oz/a	B			
	VARISTO	1	pt/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
5	EPTAM	3	pt/a	A		81.0 -	79.8 -
	SONALAN HFP	2	pt/a	A			
	OUTLOOK	10	fl oz/a	B			
	REFLEX	12	fl oz/a	B			
	VARISTO	1	pt/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
6	EPTAM	3	pt/a	A		72.5 -	62.5 -
	SONALAN HFP	2	pt/a	A			
	DUAL II MAGNUM	1	pt/a	B			
	REFLEX	12	fl oz/a	B			
	VARISTO	1	pt/a	B			
	MSO ULTRA	1	% v/v	B			
	N-PAK AMS	2.5	% v/v	B			
7	EPTAM	3	pt/a	A		86.0 -	77.5 -
	SONALAN HFP	2	pt/a	A			
	VARISTO	1	pt/a	C			
	MSO ULTRA	1	% v/v	C			
	N-PAK AMS	2.5	% v/v	C			
8	EPTAM	3	pt/a	A		72.5 -	62.5 -
	SONALAN HFP	2	pt/a	A			
	OUTLOOK	10	fl oz/a	C			
	VARISTO	1	pt/a	C			
	MSO ULTRA	1	% v/v	C			
	N-PAK AMS	2.5	% v/v	C			

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
^Calculated from residual.

North Dakota State University

Layered Residual Approach in Dry Bean for Control of AMAPA and AMATA

Trial ID: 21S-PALM-DRY-06 Location: Palmerville, ND Trial Year: 2021
Protocol ID: 21S-PALM-DRY-06 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Northharvest

Pest Type						W, Weed	W, Weed
Pest Code						AMAPA	AMAPA
Pest Name						Palmer amaranth	Palmer amaranth
Rating Date						Jul-20-2021	Aug-2-2021
Rating Type						CONTRO	CONTRO
Rating Unit/Min/Max						%, 0, 100	%, 0, 100
Number of Subsamples						1	1
Assessed By						Ikley, J	Ikley, J
Data Entry Date						Aug-17-2021	Aug-17-2021
Days After First/Last Applic.						-, 13	-, 26
Days After Emergence						41 DE-1	54 DE-1
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code		1*	2*
9	EPTAM	3	pt/a	A		77.3 -	76.0 -
	SONALAN HFP	2	pt/a	A			
	DUAL II MAGNUM	1	pt/a	C			
	VARISTO	1	pt/a	C			
	MSO ULTRA	1	% v/v	C			
	N-PAK AMS	2.5	% v/v	C			
10	EPTAM	3	pt/a	A		89.8 -	83.5 -
	SONALAN HFP	2	pt/a	A			
	REFLEX	12	fl oz/a	C			
	VARISTO	1	pt/a	C			
	MSO ULTRA	1	% v/v	C			
	N-PAK AMS	2.5	% v/v	C			
11	EPTAM	3	pt/a	A		94.8 -	88.5 -
	SONALAN HFP	2	pt/a	A			
	OUTLOOK	10	fl oz/a	C			
	REFLEX	12	fl oz/a	C			
	VARISTO	1	pt/a	C			
	MSO ULTRA	1	% v/v	C			
	N-PAK AMS	2.5	% v/v	C			
12	EPTAM	3	pt/a	A		96.0 -	94.5 -
	SONALAN HFP	2	pt/a	A			
	DUAL II MAGNUM	1	pt/a	C			
	REFLEX	12	fl oz/a	C			
	VARISTO	1	pt/a	C			
	MSO ULTRA	1	% v/v	C			
	N-PAK AMS	2.5	% v/v	C			
LSD P=.05						20.47	24.44
Standard Deviation						14.23	16.99
CV						17.92	22.47
Levene's F^						0.802	0.286
Levene's Prob(F)						0.638	0.985
Skewness^						-0.31	-0.5956
Kurtosis^						-0.4044	-0.3718
Replicate F						4.604	3.261
Replicate Prob(F)						0.0085	0.0337
Treatment F						2.187	1.580
Treatment Prob(F)						0.0408	0.1510

Pest Type
W, Weed = Weed or volunteer crop
Pest Code
AMAPA, Amaranthus palmeri, Palmer amaranth = US
Rating Type
CONTRO = control / burndown or knockdown
Rating Unit/Min/Max
%, 0, 100 = percent
Assessed By
Ikley, J = Extension Agent

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
* Adjusted means
^Calculated from residual.

North Dakota State University

Broadleaf Crop Tolerance of Preplant Dicamba

Trial ID: 21S-PROSPER-MS-23 Location: Prosper, ND Trial Year: 2021
Protocol ID: 21S-PROSPER-MS-23 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Greg Endres, CREC

General Trial Information
Study Director: Dr. Joe Ikley

Trial Status: E established
ARM Trial Created On: May-4-2021

Conducted Under GLP: No
Conducted Under GEP: No

Contacts
Role: STYDIR study director
Study Director: Dr. Joe Ikley
Role: SPONSR sponsor
Sponsor: Greg Endres, CREC

Site and Design
Treated Plot Width: 6.67 FT
Treated Plot Length: 30 FT
Treated Plot Area: 200.1 FT2 **Treatments:** 12
Replications: 4 **Study Design:** SPLPLO Split-Plot

Application Description

	A
Application Date	May-17-2021
Appl. Start Time	10:20 AM
Appl. Stop Time	10:35 AM
Application Method	SPRAY
Application Timing	PREEM
Application Placement	BROSOI
Applied By	Stith, J
Appl. Entry Date	May-20-2021
Air Temperature Start, Stop	86.1, 86.1 F
% Relative Humidity Start, Stop	33.7, 33.7
Wind Velocity+Dir. Start	1 MPH, SW
Wind Velocity+Dir. Stop	1 MPH, SW
Wind Velocity+Dir. Max	1.3 MPH, SW
Wet Leaves (Y/N)	N, no
Soil Temperature	60 F
Soil Moisture	DRY
Soil Surface Condition	COARSE
% Cloud Cover	0

North Dakota State University

Broadleaf Crop Tolerance of Preplant Dicamba

Trial ID: 21S-PROSPER-MS-23 Location: Prosper, ND Trial Year: 2021
Protocol ID: 21S-PROSPER-MS-23 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Greg Endres, CREC

Application Equipment

	A
Appl. Equipment	Walter
Equipment Type	BACCAI
Operation Pressure	28 PSI
Nozzle Model	11002
Nozzle Type	TEEJAI
Nozzle Spacing	20 IN
Boom Length	6.67 FT
Boom Height	20 IN
Ground Speed	3 MPH
Carrier	WATER
Application Amount	15 GAL/AC
Mix Size	1119 mL
Propellant	COMCO2

Notes

Context	Date	By	Notes
STATUS	May-4-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'S' during trial creation.
STATUS	May-20-2021	Dr. Joe Ikley	Automatically added by ARM: Trial Status updated to 'E' when Application Date entered.

North Dakota State University

Broadleaf Crop Tolerance of Preplant Dicamba

Trial ID: 21S-PROSPER-MS-23 Location: Prosper, ND Trial Year: 2021
Protocol ID: 21S-PROSPER-MS-23 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Greg Endres, CREC

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	1*	2*	3*	4*	5*
	Crop Name								
	Rating Date				Jun-28-2021	Jun-28-2021	Jul-2-2021	Jul-2-2021	Jul-12-2021
	Rating Type				STAOBJ	HEIGHT	STAOBJ	HEIGHT	HEIGHT
	Rating Unit/Min/Max				10 FT, -, -	INCH, -, -	10 FT, -, -	INCH, -, -	INCH, -, -
	Number of Subsamples				2	5	2	5	5
	Assessed By								
	Data Entry Date				Aug-11-2021	Aug-11-2021	Aug-11-2021	Aug-11-2021	Aug-11-2021
	Days After First/Last Applic.				42, 42	42, 42	46, 46	46, 46	56, 56
	Trt-Eval Interval				42 DA-A	42 DA-A	46 DA-A	46 DA-A	56 DA-A
1	7-10 DAYS AFTER SPRAY SOYBEAN Untreated				58.6 a	7.85 b			12.5 d
2	7-10 DAYS AFTER SPRAY SOYBEAN CLARITY	4	fl oz/a	A A	36.4 b	4.65 b			9.5 d
3	7-10 DAYS AFTER SPRAY PINTO BEAN Untreated				31.5 b	7.85 b			12.0 d
4	7-10 DAYS AFTER SPRAY PINTO BEAN CLARITY	4	fl oz/a	A A	15.4 c	5.45 b			10.0 d
5	7-10 DAYS AFTER SPRAY SUNFLOWER Untreated				10.5 c	17.60 a			41.0 b
6	7-10 DAYS AFTER SPRAY SUNFLOWER CLARITY	4	fl oz/a	A A	11.4 c	19.25 a			48.5 a
7	14+ DAYS AFTER SPRAY/1 IN RAIN SOYBEAN Untreated						45.3 b	5.5 b	10.4 d
8	14+ DAYS AFTER SPRAY/1 IN RAIN SOYBEAN CLARITY	4	fl oz/a	A A			62.0 a	5.4 b	9.2 d
9	14+ DAYS AFTER SPRAY/1 IN RAIN PINTO BEAN Untreated						25.9 c	7.9 b	12.1 d
10	14+ DAYS AFTER SPRAY/1 IN RAIN PINTO BEAN CLARITY	4	fl oz/a	A A			22.4 c	5.6 b	9.2 d
11	14+ DAYS AFTER SPRAY/1 IN RAIN SUNFLOWER Untreated						10.9 c	15.2 a	35.9 c
12	14+ DAYS AFTER SPRAY/1 IN RAIN SUNFLOWER CLARITY	4	fl oz/a	A A			9.8 c	14.8 a	34.5 c
	LSD P=.05				11.35	2.445	14.06	2.60	3.97
	Standard Deviation				7.53	1.623	9.27	1.72	2.76
	CV				27.59	15.54	30.56	19.04	13.53
	Levene's F^				0.879	0.957	8.857	1.159	1.067
	Levene's Prob(F)				0.515	0.47	0.001*	0.367	0.414
	Skewness^				-0.532	1.1768*	0.7865	0.6865	-0.9415*
	Kurtosis^				1.8206	3.2287*	-0.9486	-1.0536	1.9586*
	Analyzed as				RCB	RCB	RCB	RCB	RCB
	Replicate F				0.459	1.663	2.480	2.989	2.428
	Replicate Prob(F)				0.7148	0.2173	0.1038	0.0644	0.0829
	Treatment F				24.819	60.992	18.415	29.322	116.463
	Treatment Prob(F)				0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean separations are based on the complete error term.
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 3=3.8; 7=3.1
* Adjusted means
^Calculated from residual.

North Dakota State University

Broadleaf Crop Tolerance of Preplant Dicamba

Trial ID: 21S-PROSPER-MS-23 Location: Prosper, ND Trial Year: 2021
Protocol ID: 21S-PROSPER-MS-23 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Greg Endres, CREC

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	6*	7*	8*
	Crop Name				MULTIPLE SPECIES	MULTIPLE SPECIES	MULTIPLE SPECIES
	Rating Date				Jun-2-2021	Jun-9-2021	Jun-15-2021
	Rating Type				PHYGEN	PHYGEN	PHYGEN
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	%, 0, 100
	Number of Subsamples				1	1	1
	Assessed By				Haugrud, N	Haugrud, N	Haugrud, N
	Data Entry Date				Aug-17-2021	Aug-17-2021	Aug-17-2021
	Days After First/Last Applic.				16, 16	23, 23	29, 29
	Trt-Eval Interval				16 DA-A	23 DA-A	29 DA-A
1	7-10 DAYS AFTER SPRAY SOYBEAN Untreated				0.0 b	0.0 b	0.0 d
2	7-10 DAYS AFTER SPRAY SOYBEAN CLARITY	4 fl oz/a 4 fl oz/a	A A		55.0 a	72.5 a	72.5 a
3	7-10 DAYS AFTER SPRAY PINTO BEAN Untreated				0.0 b	0.0 b	0.0 d
4	7-10 DAYS AFTER SPRAY PINTO BEAN CLARITY	4 fl oz/a 4 fl oz/a	A A		65.0 a	62.5 a	61.3 b
5	7-10 DAYS AFTER SPRAY SUNFLOWER Untreated				0.0 b	0.0 b	0.0 d
6	7-10 DAYS AFTER SPRAY SUNFLOWER CLARITY	4 fl oz/a 4 fl oz/a	A A		8.8 b	10.0 b	3.8 d
7	14+ DAYS AFTER SPRAY/1 IN RAIN SOYBEAN Untreated					0.0 b	0.0 d
8	14+ DAYS AFTER SPRAY/1 IN RAIN SOYBEAN CLARITY	4 fl oz/a 4 fl oz/a	A A			17.5 b	42.5 c
9	14+ DAYS AFTER SPRAY/1 IN RAIN PINTO BEAN Untreated					-0.8 b	0.0 d
10	14+ DAYS AFTER SPRAY/1 IN RAIN PINTO BEAN CLARITY	4 fl oz/a 4 fl oz/a	A A				57.5 b
11	14+ DAYS AFTER SPRAY/1 IN RAIN SUNFLOWER Untreated					0.0 b	0.0 d
12	14+ DAYS AFTER SPRAY/1 IN RAIN SUNFLOWER CLARITY	4 fl oz/a 4 fl oz/a	A A			5.3 b	8.8 d
	LSD P=.05				15.64	10.02	9.29
	Standard Deviation				10.38	6.90	6.46
	CV				48.36	41.48	31.46
	Levene's F^				1.05	2.026	2.684
	Levene's Prob(F)				0.419	0.067	0.013*
	Skewness^				0.0751	-0.2304	-0.9123*
	Kurtosis^				0.0611	2.2283*	7.8662*
	Analyzed as				RCB	RCB	RCB
	Replicate F				2.176	2.721	1.645
	Replicate Prob(F)				0.1334	0.0649	0.1978
	Treatment F				33.897	57.384	79.891
	Treatment Prob(F)				0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean separations are based on the complete error term.
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 3=3.8; 7=3.1
* Adjusted means
^Calculated from residual.

North Dakota State University

Broadleaf Crop Tolerance of Preplant Dicamba

Trial ID: 21S-PROSPER-MS-23 Location: Prosper, ND Trial Year: 2021
Protocol ID: 21S-PROSPER-MS-23 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Greg Endres, CREC

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	9*	10*	11*
	Crop Name				MULTIPLE SPECIES	MULTIPLE SPECIES	MULTIPLE SPECIES
	Rating Date				Jun-24-2021	Jul-7-2021	Jul-20-2021
	Rating Type				PHYGEN	PHYGEN	PHYGEN
	Rating Unit/Min/Max				%, 0, 100	%, 0, 100	%, 0, 100
	Number of Subsamples				1	1	1
	Assessed By				Haugrud, N	Haugrud, N	Haugrud, N
	Data Entry Date				Aug-17-2021	Aug-17-2021	Aug-17-2021
	Days After First/Last Applic.				38, 38	51, 51	64, 64
	Trt-Eval Interval				38 DA-A	51 DA-A	64 DA-A
1	7-10 DAYS AFTER SPRAY SOYBEAN Untreated				0.0 d	0.0 b	0.0 c
2	7-10 DAYS AFTER SPRAY SOYBEAN CLARITY	4 fl oz/a 4 fl oz/a	A A		70.0 a	57.5 a	52.5 a
3	7-10 DAYS AFTER SPRAY PINTO BEAN Untreated				0.0 d	0.0 b	0.0 c
4	7-10 DAYS AFTER SPRAY PINTO BEAN CLARITY	4 fl oz/a 4 fl oz/a	A A		65.0 ab	52.5 a	50.0 a
5	7-10 DAYS AFTER SPRAY SUNFLOWER Untreated				0.0 d	0.0 b	0.0 c
6	7-10 DAYS AFTER SPRAY SUNFLOWER CLARITY	4 fl oz/a 4 fl oz/a	A A		3.8 d	1.3 b	0.0 c
7	14+ DAYS AFTER SPRAY/1 IN RAIN SOYBEAN Untreated				0.0 d	0.0 b	0.0 c
8	14+ DAYS AFTER SPRAY/1 IN RAIN SOYBEAN CLARITY	4 fl oz/a 4 fl oz/a	A A		45.0 c	42.5 a	22.5 bc
9	14+ DAYS AFTER SPRAY/1 IN RAIN PINTO BEAN Untreated				0.0 d	0.0 b	0.0 c
10	14+ DAYS AFTER SPRAY/1 IN RAIN PINTO BEAN CLARITY	4 fl oz/a 4 fl oz/a	A A		52.5 bc	46.3 a	30.0 b
11	14+ DAYS AFTER SPRAY/1 IN RAIN SUNFLOWER Untreated				0.0 d	0.0 b	0.0 c
12	14+ DAYS AFTER SPRAY/1 IN RAIN SUNFLOWER CLARITY	4 fl oz/a 4 fl oz/a	A A		10.0 d	8.8 b	5.0 c
	LSD P=.05				13.09	13.34	14.99
	Standard Deviation				9.10	9.27	10.42
	CV				44.35	53.31	78.15
	Levene's F^				1.113	3.526	3.078
	Levene's Prob(F)				0.38	0.002*	0.005*
	Skewness^				-0.8464*	0.1759	-0.1001
	Kurtosis^				5.9446*	3.1466*	2.5942*
	Analyzed as				RCB	RCB	RCB
	Replicate F				1.448	1.524	2.660
	Replicate Prob(F)				0.2466	0.2265	0.0643
	Treatment F				39.360	27.292	15.251
	Treatment Prob(F)				0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean separations are based on the complete error term.
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 3=3.8; 7=3.1
* Adjusted means
^Calculated from residual.

North Dakota State University

Broadleaf Crop Tolerance of Preplant Dicamba

Trial ID: 21S-PROSPER-MS-23 Location: Prosper, ND Trial Year: 2021
Protocol ID: 21S-PROSPER-MS-23 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Greg Endres, CREC

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	12*
	Crop Name				MULTIPLE SPECIES
	Rating Date				Jun-16-2021
	Rating Type				STAOBJ
	Rating Unit/Min/Max				
	Number of Subsamples				2
	Assessed By				Haugrud, N
	Data Entry Date				Aug-31-2021
	Days After First/Last Applic.				30, 30
	Trt-Eval Interval				30 DA-A
1	7-10 DAYS AFTER SPRAY SOYBEAN Untreated				61.6 a
2	7-10 DAYS AFTER SPRAY SOYBEAN CLARITY	4 4	fl oz/a fl oz/a	A A	27.9 b
3	7-10 DAYS AFTER SPRAY PINTO BEAN Untreated				29.1 b
4	7-10 DAYS AFTER SPRAY PINTO BEAN CLARITY	4 4	fl oz/a fl oz/a	A A	18.8 bc
5	7-10 DAYS AFTER SPRAY SUNFLOWER Untreated				10.5 c
6	7-10 DAYS AFTER SPRAY SUNFLOWER CLARITY	4 4	fl oz/a fl oz/a	A A	11.4 c
7	14+ DAYS AFTER SPRAY/1 IN RAIN SOYBEAN Untreated				
8	14+ DAYS AFTER SPRAY/1 IN RAIN SOYBEAN CLARITY	4 4	fl oz/a fl oz/a	A A	
9	14+ DAYS AFTER SPRAY/1 IN RAIN PINTO BEAN Untreated				
10	14+ DAYS AFTER SPRAY/1 IN RAIN PINTO BEAN CLARITY	4 4	fl oz/a fl oz/a	A A	
11	14+ DAYS AFTER SPRAY/1 IN RAIN SUNFLOWER Untreated				
12	14+ DAYS AFTER SPRAY/1 IN RAIN SUNFLOWER CLARITY	4 4	fl oz/a fl oz/a	A A	
	LSD P=.05				8.71
	Standard Deviation				5.78
	CV				21.77
	Levene's F^				0.558
	Levene's Prob(F)				0.731
	Skewness^				-0.8924
	Kurtosis^				1.7245
	Analyzed as				RCB
	Replicate F				1.350
	Replicate Prob(F)				0.2958
	Treatment F				42.829
	Treatment Prob(F)				0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean separations are based on the complete error term.
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Due to missing data, the effective replicates used for mean comparisons are: col. 3=3.8; 7=3.1
* Adjusted means
^Calculated from residual.

North Dakota State University

Broadleaf Crop Tolerance of Preplant Dicamba

Trial ID: 21S-PROSPER-MS-23 Location: Prosper, ND Trial Year: 2021
Protocol ID: 21S-PROSPER-MS-23 Investigator (Creator): Dr. Joe Ikley
Project ID: Study Director: Dr. Joe Ikley
Sponsor Contact: Greg Endres, CREC

Rating Type
STAOBJ = stand - objective (based on counts)
HEIGHT = height
PHYGEN = phytotoxicity - general / injury
Rating Unit/Min/Max
%, 0, 100 = percent
Assessed By
Haugrud, N = Research Specailist