ADJUVANTS TO REDUCE SODIUM BICARBONATE ANTAGONISM OF SETHOXYDIM AND CLETHODIM

A report submitted to:

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SUMMARY

Research was conducted to determine the amount of ammonium sulphate required to overcome sodium bicarbonate antagonism of either clethodim (Select) or sethoxydim (Poast) and to determine the effectiveness of various fluid fertilizers as adjuvants to overcome this herbicide antagonism. Field results indicate that only 1% (v/v) of a 490 g/L formulation of ammonium sulphate (equivalent to 0.49 kg/ha of granular ammonium sulphate at 100 L/ha spray volume) was required to overcome sodium bicarbonate antagonism. The fluid fertilizers 28-0-0, 10-34-0, and 12-0-0-26 were all effective in overcoming this same antagonism. The addition of ammonium sulphate or ammonium-containing fluid fertilizers when the spray carrier contains sodium bicarbonate should minimize any antagonistic effects of sodium bicarbonate on either clethodim or sethoxydim efficacy.

INTRODUCTION

Herbicides must be applied in a carrier, usually water, to ensure distribution onto plant surfaces. However, the water may contain bicarbonate ions, which can reduce the activity of clethodim (Select) and sethoxydim (Poast). Ammonium sulphate and ammonium nitrate have reduced the antagonistic effect of bicarbonate on the efficacy of these two herbicides.

As ammonium sulphate is used most frequently as a granular fertilizer, dissolving the fertilizer in the spray solution can be time consuming. Determination of the amount of ammonium sulphate will minimize the time required to dissolve the fertilizer. Fluid fertilizers are easier to handle than ammonium sulphate and may not be as corrosive. Identification of fluid fertilizers which overcome this antagonism will give producers a readily available source of fertilizer to overcome the herbicide antagonism.

Therefore, the objective of this research is to determine the amount of ammonium sulphate required to overcome sodium bicarbonate antagonism of clethodim or sethoxydim and to determine if other fluid fertilizers can overcome this antagonism.

MATERIALS AND METHODS

Research was initiated for 1995 at two sites, one at the Brandon Research Station and the other at the Kernen Farm of the University of Saskatchewan. Four experiments were conducted at each site, all randomized complete block designs. Experiments 1 and 2 evaluated ammonium sulphate rates at rates indicated in the appropriate tables. Experiments 3 and 4 evaluated fluid fertilizers as adjuvants. The fluid fertilizers were added at equivalent ammonium-nitrogen concentrations, specifically 1% v/v for 28-0-0, 0.64% v/v for 10-34-0, and 0.57% v/v for 12-0-026.

Barley was either broadcast seeded or seeded at right angles to the crop for the weed species. Canola was seed on June 1, 1995 at Brandon and on May 30, 1995 at the Kernen Farm.

Treatments were applied on July 4, 1995 at Brandon and on June 29, 1995 at the University of Saskatchewan site. Plots were evaluated visually at both locations in the period from July 20-28, 1995 and fresh weights were determined at both locations in the period from Aug. 7-19, 1995. Plots were be harvested for canola seed yield using a small-plot combine Aug.. 25 to Aug. 28, 1995.

RESULTS AND DISCUSSION

The amount of antagonism by sodium bicarbonate was not as high as in previous years; however, sodium bicarbonate still did reduce sethoxydim and clethodim efficacy on volunteer barley.

In the ammonium sulphate experiments, only 1% (v/v) of ammonium sulphate was required to overcome sodium bicarbonate antagonism of either clethodim (Table 1) or sethoxydim (Table 2), regardless of the sodium bicarbonate concentration in the spray solution. This is similar to results from previous years. These results indicate that the addition of ammonium sulphate at 1% (v/v) is sufficient to minimize any negative effects of sodium bicarbonate in the spray solution.

Canola seed yield did not always relate to degree of weed control (Table 3). This was due to the high degree of weed control and to shattering losses due to high winds and low rainfall at Brandon.

In the fluid fertilizer experiments, all fluid fertilizers overcame sodium bicarbonate antagonism of either clethodim (Table 4) or sethoxydim (Table 5). This is also similar to results from previous year's research. These results indicate that fluid fertilizer which contain ammonium sources of fertilizer are a suitable and potentially cheaper substitute for ammonium sulphate.

Canola seed yield did not always relate to degree of weed control (Table 6). This was due to the high degree of weed control and to shattering losses due to high winds and low rainfall at Brandon.

Table 1. Effect of ammonium sulphate (AMS) concentration on sodium bicarbonate ($NaHCO_3$) antagonism of clethodim efficacy on barley.

		Brandon		Kernen Farm	
AMS (% v/v)	$NaHCO_3$ (ppm)	Visual (%)	Fresh Wt. (g/m^2)	Visual (%)	Fresh Wt. (g/m^2)
0	0	97	111	95	0
	500	99	64	92	18
	1000	83	209	78	72
	2000	65	279	75	74
1	0	89	99	98	0
	500	98	11	97	0
	1000	99	0	98	0
	2000	95	53	99	0
2	0	99	74	97	0
	500	96	80	99	0
	1000	95	96	97	0
	2000	97	42	98	0
4	0	99	33	95	24
	500	98	63	97	2
	1000	98	0	98	0
	2000	98	106	99	0
Untreated		0	232	0	967
LSD (0.05)		14	104	4	48

Table 2. Effect of ammonium sulphate (AMS) concentration on sodium bicarbonate ($NaHCO_3$) antagonism of sethoxydim efficacy on barley.

		Brandon		Kernen Farm	
AMS (% v/v)	$NaHCO_3$ (ppm)	Visual (%)	Fresh Wt. (g/m^2)	Visual (%)	Fresh Wt. (g/m^2)
0	0	99	0	98	0
	500	99	0	91	11
	1000	92	69	84	54
	2000	89	73	71	188
1	0	99	0	98	0
	500	99	43	97	0
	1000	97	24	98	0
	2000	77	0	99	0
2	0	98	41	99	0
	500	97	14	99	0
	1000	99	0	96	0
	2000	99	19	99	0
4	0	99	45	98	0
	500	99	13	99	0
	1000	99	49	97	0
	2000	99	14	97	0
Untreated		0	123	0	584
LSD (0.05)		18	72	5	105

Table 3. Effect of ammonium sulphate (AMS) on sodium bicarbonate ($NaHCO_3$) antagonism of grass herbicide efficacy on barley as indicated by canola yield.

		Brandon		Kernen Farm	
Fluid fertilizer	$NaHCO_3$ (ppm)	Clethodim (g/m^2)	Sethoxydim (g/m^2)	Clethodim (g/m^2)	Sethoxydim (g/m^2)
None	0	83	28	107	137
	500	70	24	157	167
	1000	87	47	145	163
	2000	84	68	149	146
28-0-0	0	57	24	156	158
	500	68	13	171	158
	1000	57	49	154	183
	2000	70	16	155	175
10-34-0	0	78	32	162	154
	500	87	45	136	166
	1000	83	45	138	153
	2000	79	55	147	157
12-0-0-26	0	66	42	147	150
	500	95	20	144	150
	1000	64	56	149	168
	2000	92	23	141	157
Untreated		56	32	150	177
LSD (0.05)		40	39	26	39

Table 4. Effect of fluid fertilizer on sodium bicarbonate ($NaHCO_3$) antagonism of clethodim efficacy on barley.

		Brandon		Kernen Farm	
Fluid fertilizer	$NaHCO_3$ (ppm)	Visual (%)	Fresh Wt. (g/m^2)	Visual (%)	Fresh Wt. (g/m^2)
None	0	85	242	97	0
	500	82	362	98	0
	1000	55	360	89	33
	2000	70 —	449 ↑	73 ↓	47
28-0-0	0	92	121	97	0
	500	92	304	97	0
	1000	93	199	98	0
	2000	94	255	99	0
10-34-0	0	94	160	98	0
	500	91	296	98	0
	1000	93	235	99	0
	2000	94	266	98	0
12-0-0-26	0	88	303	98	0
	500	94	231	98	0
	1000	93	210	98	0
	2000	91	261	98	0
Untreated		0	516	0	478
LSD (0.05)		16	173	6	75

Table 5. Effect of fluid fertilizer on sodium bicarbonate ($NaHCO_3$) antagonism of sethoxydim efficacy on barley.

		Brandon		Kernen Farm	
Fluid fertilizer	$NaHCO_3$ (ppm)	Visual (%)	Fresh Wt. (g/m^2)	Visual (%)	Fresh Wt. (g/m^2)
None	0	93	135	97	0
	500	84	298	94	0
	1000	83	259	87	28
	2000	89	219	78	64
28-0-0	0	96	305	98	0
	500	90	234	99	0
	1000	89	278	97	0
	2000	91	305	99	0
10-34-0	0	89	193	99	0
	500	93	168	98	0
	1000	89	223	99	0
	2000	88	247	99	0
12-0-0-26	0	92	225	99	0
	500	88	224	98	0
	1000	92	309	97	0
	2000	97	162	97	0
Untreated		0	215	0	644
LSD (0.05)		11	137	6	123

Table 6. Effect of fluid fertilizer on sodium bicarbonate ($NaHCO_3$) antagonism of grass herbicide efficacy on barley as indicated by canola yield.

		Brandon		Kernen Farm	
Fluid fertilizer	$NaHCO_3$ (ppm)	Clethodim (g/m^2)	Sethoxydim (g/m^2)	Clethodim (g/m^2)	Sethoxydim (g/m^2)
None	0	184	185	136	122 L
	500	204	201	164	159
	1000	216	190	164	148
	2000	226	205	153	172
28-0-0	0	212	174	161	179
	500	209	179	151	184
	1000	199	196	161	188 *
	2000	233	195	124 L	178
10-34-0	0	138 L	156 L	167 *	183
	500	260 *	205	153	184
	1000	173	170	157	166
	2000	219	229 *	155	160
12-0-0-26	0	249	202	150	176
	500	207	188	164	168
	1000	191	217	148	171
	2000	200	165	161	173
Untreated		155	205	157	163
LSD (0.05)		70	48	34	29