LIBERTY APPLIED WITH ADJUVANTS IN LIBERTYLINK SOYBEAN

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BACKGROUND

Liberty (glufosinate) is a broad spectrum grass and broadleaf control herbicide used in combination with LibertyLink soybean. Liberty is applied postemergence at 0.53 to 0.65 lb ai/a (29 to 36 fl oz/A) between soybean emergence and pre bloom when weeds are up to three inches tall. A repeat Liberty application can be made at up to 0.53 lb ai/a. Liberty is applied with ammonium sulfate (AMS) at 3 lb/a in at least 15 gal/a water using nozzles and pressure to produce a medium sized droplet. Using Liberty in LibertyLink crops offers growers herbicide diversity since it has a unique site of action (SOA 10) and controls glyphosate-resistant weeds including kochia, common ragweed, and waterhemp.

Ammonium sulfate should always be added when using Liberty herbicide. Ammonium sulfate enhances Liberty absorption and movement through the leaf cuticle. Calcium magnesium, sodium, and potassium have been reported to reduce the efficacy of weak acid herbicides like Liberty. Ammonium sulfate counteracts the antagonistic effects of hard water salts. As water in the spray droplet evaporates, sulfate from AMS binds with antagonistic salts which prevents them from binding with Liberty. In addition, ammonium from AMS binds with Liberty resulting in greater uptake into the plant and greater resultant weed control.

There are many products, including liquid-based products, that improve herbicide uptake and deactivate antagonistic hard water salts. Liquid-based products tend to be easier to handle and have given consistent performance in trials when used with glyphosate. ET-4000 is an acidic ammonium sulfate replacement. ET-4000 is a sulfuric acid based product that turns to a sulfate when in the presence of water. The objective of this study was to evaluate common lambsquarters and waterhemp control from liquid-based AMS replacements applied with Liberty.

MATERIALS AND METHODS

An experiment was conducted near Moorhead, MN in 2017. The trial site was prepared for planting using a Kongskilde s-tine field cultivator on May 10, 2017. Peterson Farm 'L07-16N' LibertyLink soybean was planted in 22-inch rows at 160,000 seeds per acre on May 11 with a John Deere 1700XP 6-row planter. Postemergence (POST) treatments were applied June 19. All herbicide treatments were applied with a bicycle sprayer in 17 gpa spray solution through 8002 XR flat fan nozzles pressurized with CO_2 at 35 psi to the center four rows of six row plots 30 feet in length. Soybean injury and common lambsquarters and waterhemp control were evaluated June 29 and July 11, 2017.

Table 1. Application 'A' Information – Moorhead, MN 2017

Date	June 19
Time of Day	9:30 AM
Air Temperature (F)	65
Relative Humidity (%)	54
Wind Velocity (mph)	4
Wind Direction	N
Soil Temp. (F at 6")	62
Soil Moisture	Good
Cloud Cover (%)	80
Next Rainfall (amount)	June 28 (0.3 inches)
Soybean Stage	3-trifoliolate
Common lambsquarters	6-in tall
Waterhemp	2-in tall

All soybean injury and weed control evaluations were a visual estimate of percent fresh weight reduction in the four treated rows compared to the adjacent untreated strip. Experimental design was randomized complete block with 4 replications for each trial. Data were analyzed with the ANOVA procedure of ARM, version 2017.4, software package.

RESULTS

Common lambsquarters tends to germinate in late April and early May in western Minnesota and eastern North Dakota. There was a very dense common lambsquarters population at this location even though the first flush was controlled by tillage prior to planting. Waterhemp generally emerges in mid to late May and continues to emerge following precipitation events throughout the summer. Waterhemp density was low to moderate at this location and was clearly impacted by lambsquarters competition and from fewer than normal precipitation events in June and July at Moorhead in 2017.

There was no visual soybean injury from Liberty across adjuvants (Table 2). Lambsquarters was the best indicator species of weed control in this experiment. Lambsquarters control ranged from 84 to 93% across treatments at 10 DAT and from 60 to 74% across treatments at 22 DAT. Applying Moccasin (a soil residual herbicide) with Liberty + AMS or Liberty+ET-4000 gave less lambsquarters control at 10 DAT compared to Liberty+AMS. Liberty+ET-4000+Moccasin gave similar lambsquarters control at 22 DAT compared to Liberty+AMS.

Common lambsquarters control was similar among treatments containing dry or liquid AMS adjuvants with Liberty including ET-4000. No significant differences in lambsquarters control were observed at 10 or 22 DAT from any Liberty alone+adjuvant treatments.

Moccasin was applied with Liberty to provide residual lambsquarters and waterhemp control. However, greater than 0.5 inches of precipitation is recommended to sufficiently activate Moccasin and this precipitation did not occur until August 2, or 44 days after application. Lambsquarters control from Liberty plus Moccasin, 10 DAT was less than from Liberty+AMS, suggesting the tank-mix with Moccasin may have antagonized broadleaf control.

Liberty alone with dry AMS, liquid AMS, or ET-4000, or Liberty tank-mixed with Moccasin provided perfect or near perfect waterhemp control in this experiment.

Table 2. Soybean injury and weed control from adjuvants with Liberty at Moorhead, MN in 2017.

			----------June 29---------			---------July 11---------		
Treatment	Rate	Appl[1]	soyb[2]	colq	wahe	soyb	colq	wahe
	fl oz/A + adjuvant		%inj	%cntl	%cntl	%inj	%cntl	%cntl
Liberty+dry AMS[3]	29 + 3 lb/a	A	0	92	100	0	69	98
Liberty + N-Pak AMS	29 + 5% v/v	A	0	89	100	0	70	100
Liberty + ET-4000	29+ 1.5% v/v	A	0	88	100	0	68	100
Liberty + ET-4000	29 + 3% v/v	A	0	91	98	0	74	100
Liberty + Moccasin[4] + N-Pak AMS	29 + 21 + 5% v/v	A	0	84	100	0	60	100
Liberty + Moccasin + ET-4000	29 + 21 + 1.5% v/v	A	0	85	95	0	70	98
LSD (0.05)			**NS**	**4**	**5**	**NS**	**9**	**NS**

[1]Appl refers to application timing and corresponding information in Table 1.
[2]soyb=soybean; colq=common lambsquarters; wahe=waterhemp
[3]Indicates addition of ammonium sulfate (AMS) at 3 lb/A. N-Pak AMS used at 5 %v/v and provided by Winfield. ET-4000 used at 1.5% v/v and provided by MK Ag Service
[4]S-metolachlor by UPI

CONCLUSIONS

Dry AMS with Liberty provided fair to good lambsquarters control and excellent waterhemp control. N-Pak AMS or ET-4000 with Liberty generally provided similar lambsquarters control. ET-4000 at 3% v/v with Liberty tended to improve lambsquarters control compared to ET-4000 at 1.5% v/v with Liberty. Lambsquarters control from Moccasin plus Liberty, regardless of adjuvant type, was less than from Liberty+adjuvant, especially 10 DAT. The addition of Moccasin did not provide residual control. Waterhemp control from Liberty was similar among the adjuvants and tank mixes tested.