

Is There Antagonism between Glyphosate and Glufosinate?

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In North Dakota we now have three crops where both glyphosate (ex. RoundUp Powermax) and glufosinate (ex. Liberty) can be applied in the same season. These crops are corn, soybeans, and canola. Since glyphosate is highly mobile in plants and glufosinate is a contact product, there is potential for antagonism on the plant surface. In 2018, an investigation of the impact of adding glyphosate to glufosinate began. In 2019, combinations were tested in three locations of North Dakota with a variety of weed species. In each of these experiments the application was optimized for glufosinate (ex. >15 GPA spray volume), based on the recommendation. In 2019, combinations of glyphosate and glufosinate with Enlist One and Enlist Duo were also tested.

The weed species response varied. Shepard's purse, common ragweed and redroot pigweed were controlled by all treatment combinations. Green foxtail control was initially good with all treatment combinations, however, by 21 days after application the presence of glufosinate caused a mild reduction in control compared to glyphosate alone. Yellow foxtail control was not affected by the combination of products, it was simply less in treatments without glyphosate. Kochia control was negatively impacted by the combination of products (Table 1). This is the one case where both products applied alone performed better than the combination. In fact, when adding Enlist products, Enlist Duo was better without glufosinate than with. In all other cases Enlist Duo was a neutral or positive addition.

Table 1. Weed species of interest while testing combinations of glyphosate, glufosinate, and Enlist in 2019.

Treatment	Rate		W. buckwheat 7 DAT	W. buckwheat 21 DAT	G. foxtail 21 DAT	Kochia 48 DAT
Check			0.0	0.0	0.0	0
Liberty	32 FL OZ/A		80.0	60.0	60.0	41.7
RoundUp Powermax	28 FL OZ/A		31.3	83.8	93.8	45.0
Liberty + R. Powermax	32 + 28 FL OZ/A		85.0	86.3	75.0	32.7
Liberty + R. Powermax	32 + 21 FL OZ/A		82.5	85.0	87.5	30.0
Liberty + R. Powermax	43 + 21 FL OZ/A		87.5	88.8	72.5	30.0
Liberty + Enlist Duo	32 + 64 FL OZ/A		91.3	91.3	95.0	38.3
Liberty + Enlist One	32 + 32 FL OZ/A		90.0	90.0	37.5	38.3
Enlist Duo	4 PT/A		32.5	75.0	93.8	50.0
Enlist One	2 PT/A		25.0	27.5	0.0	10.0
LSD (0.05)			6.1	6.2	3.5	9.4

Common lambsquarters had a variable response. In 2019, at both locations all treatment combinations were equally effective, achieving high levels of control. In 2018 there was notable antagonism (Table 2). RoundUp Powermax (28 oz) and Liberty (32 oz) alone provided similar levels of control. When combined, control dropped by 10%. Lowering the RoundUp Powermax rate (21 oz) and increasing the Liberty rate (43 oz) overcame this antagonism, but was less economical than either product alone. However, if trying to control glyphosate-resistant weeds, this may have been acceptable.

Table 2. RoundUp and Liberty combinations for controlling common ND weeds in 2018.

2018 Herbicide	Rate oz/a	Adjuvant	Y. Foxtail 14 DAT	Co. Lambqtrs 14 DAT	Redroot Pigweed 14 DAT
Check			0.0	0.0	0.0
Liberty	32	AMS	41.7	81.7	86.7
RoundUp Powermax	28	Class Act NG	63.3	81.7	93.3
Liberty + R. Powermax	32 + 28	Class Act NG	56.7	71.7	85.0
Liberty + R. Powermax	43 + 21	Class Act NG	68.3	88.3	88.3
LSD (0.05)			8.3	7.9	4.6

Wild buckwheat control was enhanced by the combination of the two products. When glufosinate was applied alone, it quickly burned the leaves of wild buckwheat, by the end of the trial the buckwheat had recovered. Glyphosate alone was very slow to control buckwheat, but by the end finished better than glufosinate. When they were added together it was the best of both worlds. The buckwheat was quickly burned back and by the end of the trial the combination performed better than either product alone. Glufosinate with Enlist Duo or Enlist One provided an even larger benefit to buckwheat control at 7 days after application, but was similar to glyphosate plus glufosinate by 21 days.

In short, there was less antagonism than expected when using these combinations, however, each weed species may have a unique response to the products. In fact, this may be a case where every application of this combination may respond in a unique way. When antagonism existed, it was often a reduction of 10 to 20% compared to glyphosate alone. These combinations may be highly effective when used to manage herbicide resistance, but scouting for escapes will be necessary. Generally these escapes were not detectable until two weeks following application.

To avoid potential antagonism and escapes, sequential applications will be most effective. Rarely did combining the products add to herbicide effectiveness (except with buckwheat). In our studies, the added cost of mixing the products rarely would give an advantage. If using a sequential program, glufosinate would be a good early POST product to target the weeds when they are small. A late POST application of glyphosate, with the lower water volume, would maximize the effectiveness of each product that is applied.