

SUGARBEET TOLERANCE AND WEED CONTROL FROM RO-NEET AND EPTAM IN 2023

Thomas J. Peters¹, Alexa L. Lystad², and David C. Mettler³

¹Extension Sugarbeet Agronomist and Weed Control Specialist, ²Research Specialist
North Dakota State University & University of Minnesota, Fargo, ND, and ³Research Agronomist, Southern
Minnesota Beet Sugar Cooperative, Renville, MN

Summary

1. Ro-Neet, Eptam, or Ro-Neet mixed with Eptam at planting caused more sugarbeet injury than ethofumesate at planting.
2. Ro-Neet, Eptam, or Ro-Neet mixed with Eptam provided waterhemp control greater than ethofumesate, 15 and 23 days after planting (DAP).
3. Mixing ethofumesate with either Ro-Neet, Eptam, or Ro-Neet and Eptam might be a way to improve early season waterhemp control, especially when sugarbeet are planted in May or when rainfall is inconsistent.

Introduction

Waterhemp control is our most important weed management challenge in sugarbeet according to the annual growers' survey (Peters et al. 2022). The chloroacetamide herbicides applied at 2- and 6-lf sugarbeet stage are a critical component with our waterhemp control strategy; however, season-long waterhemp control ultimately is dependent on early season control from ethofumesate, Dual Magnum or ethofumesate mixed with Dual Magnum at planting. Some growers are incorporating ethofumesate mostly to ensure activation before waterhemp emergence and to prevent inconsistent waterhemp control (Peters et al. 2022). Ro-Neet, Pyramin, ethofumesate, and Eptam were applied preplant incorporated (PPI) or preemergence (PRE) for weed control in sugarbeet fields in the Red River Valley and Michigan from 1970 to the mid-1980s (Dale et al. 2006). However, use of soil-applied herbicides declined to less than 5% of sugarbeet acres in North Dakota and Minnesota in the mid-1980s because of reliance on POST herbicides and inter-row cultivation (Luecke and Dexter 2003). Stachler and Luecke (2011) reported Ro-Neet, ethofumesate, or Eptam, applied either PPI or PRE, controlled glyphosate-resistant waterhemp; however, they added, sugarbeet growers are reluctant to incorporate herbicides due to detrimental effects of tillage on seed bed moisture and sugarbeet stand.

Sugarbeet growers apply ethofumesate at 3 to 6 pt/A, Dual Magnum at 0.5 to 1 pt/A, or ethofumesate mixed with Dual Magnum at 2 to 3 pt plus 0.5 to 0.75 pt/A, respectively, PRE. These options have provided early season residual control but need to be rainfall activated. Sugarbeet planting was delayed in 2022 and 2023 due to environmental conditions and spring rains have been inconsistent for activating ethofumesate. Thus, growers have opted to incorporate ethofumesate before planting to lessen risk. Incorporating ethofumesate has shifted the mindset and growers are once again asking if Ro-Neet and/or Eptam incorporated might provide more consistent early season waterhemp control than ethofumesate.

Objective

The objective of this experiment was to evaluate weed control and sugarbeet tolerance from Ro-Neet and Eptam alone or in mixtures in comparison with ethofumesate.

Materials and Methods

Experiment was conducted on natural waterhemp populations near Blomkest, MN in 2023. The experimental area was prepared for planting by applying the appropriate fertilizer and tillage. Sugarbeet was planted on May 22, 2023, seeded in 22-inch rows at 60,271 seeds per acre with 4.8 inch spacing between seeds. Herbicide treatments containing Ro-Neet, Eptam, and Ro-Neet + Eptam were two pass incorporated to a 3-inch depth. The first pass was tillage parallel with sugarbeet rows immediately following herbicide application. The second pass was at a shallow angle across the whole trial. Herbicide treatments and rates are described (Table 1). For reasons unknown, Ro-Neet and Eptam rates historically were presented as lb/A rather than pt/A (Table 2).

All treatments were applied with a bicycle sprayer in 17 gpa spray solution through 11002 XR flat fan nozzles pressurized with CO₂ at 40 psi to the center four rows of six row plots 35 feet in length. Herbicides were immediately incorporated for each plot with the rows using a field cultivator set 3 inches deep. A second tillage pass was conducted across the entire trial at a 15-degree angle to the rows.

Table 1. Herbicide treatments, rates, and application timing, Blomkest, MN in 2023.

Herbicide treatment	Rate (pt/A)	Timing of Application
Ro-Neet / Roundup PowerMax3 + etho ^{a,b} /	4.5 / 25 + 6 /	PPI/EPOST/
Roundup PowerMax3 + etho	25 + 6	POST
Ro-Neet/ Roundup PowerMax3 + etho /	5.33 / 25 + 6 /	PPI/EPOST/
Roundup PowerMax3 + etho	25 + 6	POST
Eptam / Roundup PowerMax3 + etho /	2.29 / 25 + 6 /	PPI/EPOST/
Roundup PowerMax3 + etho	25 + 6	POST
Eptam / Roundup PowerMax3 + etho /	2.85 / 25 + 6 /	PPI/EPOST/
Roundup PowerMax3 + etho	25 + 6	POST
Ro-Neet+ Eptam / Roundup PowerMax3 + etho /	3.33 + 1.71 / 25 + 6 /	PPI/EPOST/
Roundup PowerMax3 + etho	25 + 6	POST
Ro-Neet+ Eptam / Roundup PowerMax3 + etho /	2.67 + 2.29 / 25 + 6 /	PPI/EPOST/
Roundup PowerMax3 + etho	25 + 6	POST
Ethofumesate / Roundup PowerMax3 + etho /	6 / 25 + 6 /	PRE/EPOST/
Roundup PowerMax3 + etho	25 + 6	POST
Etho + Dual Magnum ^c / Outlook + Roundup PowerMax3 + etho ^c /	2.5 + 0.75 / 12 + 25 + 6 /	PRE/EPOST/
Warrant + Roundup PowerMax3 + etho	3 + 25 + 6	POST
Ro-Neet+ Eptam + / Warrant + Roundup PowerMax3 + etho /	2.67 + 1.14 / 3 + 25 + 6 /	PPI/EPOST/
Warrant + Roundup PowerMax3 + etho	3 + 25 + 6	POST
Roundup PowerMax3 + etho /	25 + 6 /	EPOST/
Roundup PowerMax3 + Ultra Blazer + Warrant	25 + 16 + 3	POST

^aRoundup PowerMax3 plus ethofumesate, Outlook, or Warrant POST applied with HSMOC at 1.5 pt/A and Amsol Liquid AMS at 2.5% v/v.

^betho = ethofumesate.

^cRoundup PowerMax3, Ultra Blazer, and Warrant POST applied with non-ionic surfactant at 0.25% v/v and Amsol Liquid AMS at 2.5% v/v.

Visible sugarbeet growth reduction injury was evaluated using a 0 to 100% scale (0% representing no visible injury and 100% as complete loss of plant / stand) approximately 7 and 14 days (+/- 3 days) after sugarbeet emergence and 7 and 14 days (+/- 3 days) after early POST (EPOST) application. The combination of two-pass incorporation and dry soils created some gaps in stands. Estimates of stand were collected to separate effects from herbicides and lack of stand associated with dry soils. Visible waterhemp control was evaluated using a 0 to 100% scale (0% indicating no control and 100% indicating complete weed control) 14 and 21 days (+/- 3 days) after PPI/PRE (application A/B) and 7, 14, 21, and 40 days and after EPOST/POST (application C/D). Experimental design was randomized complete block with four replications. Data were analyzed with the ANOVA procedure of ARM, version 2023.5 software package.

Table 2. Eptam and Ro-Neet treatments expressed as pt/A and lb/A.

Treatment	Rate	
	---pt/A---	---lb/A---
Ro-Neet	4.50	3.4
Ro-Neet	5.33	4.0
Eptam	2.29	2.0
Eptam	2.85	2.5
Ro-Neet + Eptam	3.32 + 1.71	2.5 + 1.5
Ro-Neet + Eptam	2.67 + 2.29	2.0 + 2.0
Ro-Neet + Eptam	2.67 + 1.14	1.0 + 1.0
Ethofumesate	6	3.0

Results and Discussion

Sugarbeet growth reduction ranged from 13% to 50%, 16 days after application A (DAAA) and 3% to 20%, 32 DAAA (Table 3). We observed the greatest sugarbeet growth reduction from treatments with Eptam alone and Eptam mixed with Ro-Neet. Sugarbeet injury 24 or 32 DAAA was less than sugarbeet injury 16 DAAA. These results are consistent with Dr. Alan Dexter's observations that Eptam may reduce sugarbeet stands and cause reduced sugarbeet stands and temporary early season growth reduction, especially on coarse textured and low organic matter soils (personal communication).

We observed minor sugarbeet growth reduction with ethofumesate mixed with Dual Magnum, our standard lay-by program (Table 3). However, we attribute observed lack of uniformity in stand to lack of rainfall throughout the growing season. Weekly rainfall totals collected weekly after planting from on-site instrumentation are in Table 4.

Table 3. Sugarbeet growth reduction from herbicide treatments, Blomkest, MN in 2023.^a

Herbicide treatment	Rate	Sugarbeet Growth Reduction		
		16 DAAA ^b	24 DAAA	32 DAAA
	-----pt/A-----	-----%-----		
Ro-Neet / RUPM3 ^c / RUPM3	4.5 / 25 / 25	29 abc	8 abcd	3 a
Ro-Neet/ RUPM3 / RUPM3	5.33 / 25 / 25	25 ab	0 a	5 ab
Eptam / RUPM3 / RUPM3	2.29 / 25 / 25	50 d	10 bcd	14 bcd
Eptam / RUPM3 / RUPM3	2.85 / 25 / 25	48 d	14 cd	20 d
Ro-Neet + Eptam / RUPM3 / RUPM3	3.33 + 1.71 / 25 / 25	36 bcd	3 ab	13 bcd
Ro-Neet + Eptam / RUPM3 / RUPM3	2.67 + 2.29 / 25 / 25	40 bcd	15 d	13 bcd
Ethofumesate / RUPM3 / RUPM3	6 / 25 / 25	24 ab	0 a	5 ab
Ethofumesate + Dual Magnum /	2.5 + 0.75 / 12 + 25 /	13 a	10 bcd	10 abc
Outlook + RUPM3 ^d / Warrant + RUPM3	3 + 25			
Ro-Neet + Eptam / Warrant + RUPM3 /	2.67 + 1.14 / 3 + 25 /	45 cd	13 cd	15 cd
Warrant + RUPM3	3 + 25			
RUPM3 + etho / RUPM3 + Ultra Blazer	25 / 25 + 16 + 3	18 a	6 abc	3 a
+ Warrant ^e				
LSD (0.10)		17	8	9

^aMeans within a rating timing that do not share any letter are significantly different by the LSD at the 10% level of significance.

^bDAAA = Days after application A.

^cRUPM3=Roundup PowerMax3. POST Roundup PowerMax3 applied with ethofumesate at 6 fl oz/A.

^dRoundup PowerMax3 plus ethofumesate, Outlook, or Warrant POST applied with HSMOC and Amsol Liquid AMS at 1.5 pt/A + 2.5% v/v.

^eRoundup PowerMax3, Ultra Blazer, and Warrant POST applied with non-ionic surfactant at 0.25% v/v and Amsol Liquid AMS at 2.5% v/v.

We evaluated sugarbeet stand using a 1 to 9 scale; 1 representing little to no stand and 9 representing a complete stand and sugarbeet canopy on a percent ground cover basis using a 0% to 100% scale in our attempt to discern sugarbeet injury caused by herbicide from stand variation caused by dry moisture conditions. Overall, sugarbeet stands averaged roughly 7, which is classified as a good stand (Table 4). Sugarbeet canopy tended to be less from Eptam alone or Eptam mixtures (Figure 1).

Table 4. Weekly rainfall measurements beginning May 22, 2023, Blomkest, MN.^a

Week	Herbicide Application	Rainfall (inch)
1: May 22	PPI and PRE	0.0
2: May 29		0.2
3: June 5	2-lf sugarbeet stage	1.0
4: June 12		0.3
5: June 19	8-lf sugarbeet stage	0.7
6: June 26		0.0
7: July 3		0.6
8: July 10		1.0
9: July 17		0.0
Cumulative total:		3.8

^aBlomkest precipitation data collected using weather station instrumentation by Campbell Scientific, Inc., Logan, UT.

Waterhemp control from herbicide treatments was observed weekly between June 7 and July 31, 2023, or 15 to 69 days following planting and 0 to 53 days following the first postemergence glyphosate application. This summary will focus on waterhemp and common lambsquarters control 23, 31, and 52 days after planting, or 7, 15, and 36 days after the first postemergence application, when waterhemp control across treatments averaged 81%, 82%, and 66%, respectively (Table 5). Our sugarbeet standard for waterhemp control, ethofumesate followed by (fb) Outlook+RUPM3+etho fb Warrant+RUPM3+etho applied at planting and at the sugarbeet 2- and 6-lf stage fell below the experiment averages. We attribute this to the lack of activating rainfall after planting. In general, waterhemp control was best from treatments containing Ro-Neet, Eptam or Ro-Neet mixed with Eptam, 7 and 15 DAAC. Waterhemp control was similar across treatments 36 DAAC.

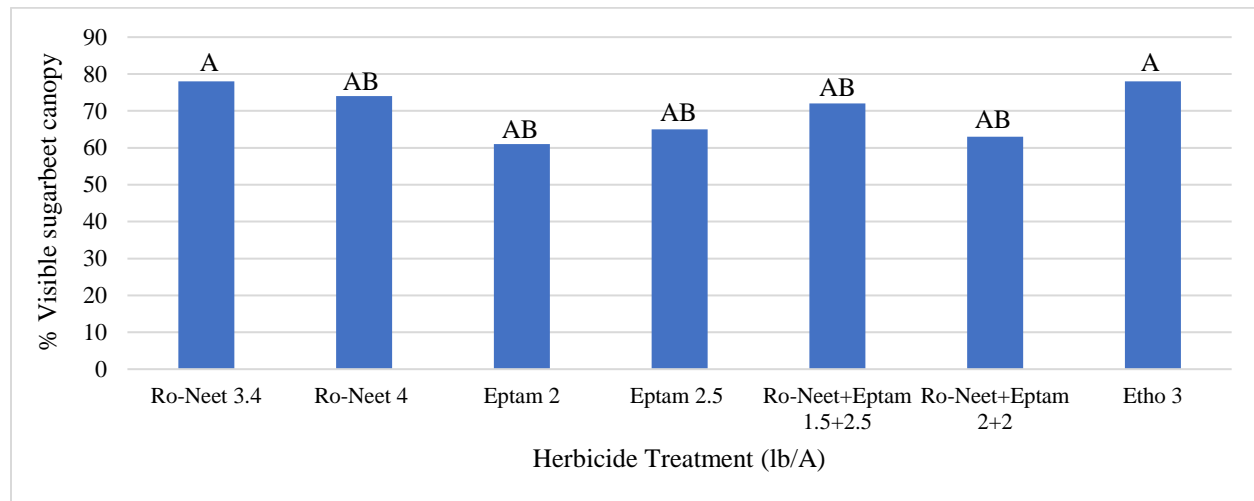


Figure 1. Sugarbeet canopy from selected treatments, 53 days after plant (DAP) or at canopy closure, Blomkest, 2023.

Treatment 9 was Ro-Neet + Eptam followed by Warrant at 3 pt/A applied at the 2-lf sugarbeet stage. Treatment 9 also contained glyphosate + ethofumesate applied at the 2- and 6-lf stage. Although it is difficult to observe benefits from the layby program in a dry year, we intend to continue to evaluate this concept in 2024.

We were able to evaluate common lambsquarters in the experiment; however, Roundup PowerMax3 provided complete control of all common lambsquarters in the POST applications.

Conclusions

We observed the greatest numeric waterhemp control from Eptam at 2.29 and 2.85 pt/A; however, these rates resulted in close to 50% growth reduction, 16 DAAA. Ethofumesate at planting followed by two times Roundup PowerMax3 and ethofumesate or ethofumesate followed by Outlook or Warrant with Roundup PowerMax3 and ethofumesate provided less waterhemp control compared with treatments containing Eptam, Ro-Neet, or both. We

have stated ethofumesate probably did not provide at planting waterhemp control due to the dry conditions at and after planting. However, those are the conditions our growers planted into in 2023 and we need to develop reliable programs, regardless of environmental conditions. For the 2024 growing season, we intend to further evaluate Eptam and/or Ro-Neet mixed with ethofumesate to develop more consistent early season waterhemp control.

Table 5. Waterhemp control from herbicide treatments, Blomkest, MN in 2023.^a

Herbicide treatment	Rate	Waterhemp Control		
		7 DAAC ^b	15 DAAC	36 DAAC
	-----pt/A-----	-----%-----		
Ro-Neet/ RUPM3 ^c / RUPM3	4.5 / 25 / 25	89 a	88 a	68
Ro-Neet/ RUPM3 / RUPM3	5.33 / 25 / 25	79 bc	84 a	65
Eptam / RUPM3 / RUPM3	2.29 / 25 / 25	91 a	88 a	66
Eptam / RUPM3 / RUPM3	2.85 / 25 / 25	89 a	86 a	73
Ro-Neet+ Eptam / RUPM3 / RUPM3	3.33 + 1.71 / 25 / 25	90 a	89 a	68
Ro-Neet+ Eptam / RUPM3 / RUPM3	2.67 + 2.29 / 25 / 25	92 a	89 a	76
Ethofumesate / RUPM3 / RUPM3	6 / 25 / 25	63 d	63 b	49
Ethofumesate + Dual Magnum / Outlook + RUPM3 ^d / Warrant + RUPM3	2.5 + 0.75 / 12 + 25 / 3 + 25	75 c	83 a	61
Ro-Neet+ Eptam / Warrant + RUPM3 / Warrant + RUPM3	2.67 + 1.14 / 3 + 25 / 3 + 25	85 ab	88 a	68
RUPM3 + etho / RUPM3 + Ultra Blazer + Warrant ^e	25 / 25 + 16 + 3	55 d	64 b	68
LSD (0.10)		9	11	NS

^aMeans within a rating timing that do not share any letter are significantly different by the LSD at the 10% level of significance.

^bDAAC = Days after application C.

^cRUPM3=Roundup PowerMax3. POST Roundup PowerMax3 applied with ethofumesate at 6 fl oz/A.

^dRoundup PowerMax3 plus ethofumesate, Outlook, or Warrant POST applied with HSMOC and Amsol Liquid AMS at 1.5 pt/A + 2.5% v/v.

^eRoundup PowerMax3, Ultra Blazer, and Warrant POST applied with non-ionic surfactant at 0.25% v/v and Amsol Liquid AMS at 2.5% v/v.

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