

# SPIN-AID PROVIDES SELECTIVE WEED CONTROL IN SUGARBEET

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## Summary

1. Kochia approximately 1-inch tall (dime-size), or 6- to 8-lvs, is controlled best with Spin-Aid.
2. Kochia control was greater when ethofumesate was mixed with Spin-Aid. In the field, we recommend Spin-Aid plus ethofumesate and Roundup PowerMAX3 at 4+25 fl oz/A, respectively, plus adjuvant.
3. Kochia control was greater from repeat Spin-Aid applications as compared with Spin-Aid singly.
4. Recommendations for kochia control with Spin-Aid are in the conclusions section of this document.

## Introduction

Some might remember the herbicide, Betanal, or more affectionally, ‘Blue Can.’ Phenmedipham was registered in 1970 and sold under the trade name Betanal from 1970 through 1981. A pre-mix of phenmedipham and desmedipham (1:1 ratio) was registered in 1982 and was sold as Betamix. U.S. registration for Betamix was cancelled in 2014 (EPA 2014). Currently, there is no active phenmedipham registration in sugarbeet in the United States; however, Belchim Crop Protection has been marketing phenmedipham with the trade name ‘Spin-Aid’ on spinach and red beet for six years and has recently completed the acquisition of the registration from Bayer. Phenmedipham is marketed for use in sugarbeet in other world areas. I have evaluated phenmedipham alone and in mixtures in sugarbeet since 2016, including experiments for control of glyphosate resistant (GR) kochia and GR common ragweed and common lambsquarters in 2022. The objective of this greenhouse experiment was to evaluate sugarbeet tolerance and kochia control from single or repeat applications of Spin-Aid alone, Spin-Aid plus ethofumesate, or Spin-Aid plus ethofumesate and Roundup PowerMAX3.

## Materials and Methods

Greenhouse experiments were conducted using a glyphosate sensitive kochia seed source collect at North Dakota State University (NDSU) field research facilities. Kochia was grown in a flat filled with PROMIX general purpose greenhouse media (Premier Horticulture, Inc., Quakertown, PA) to 1-inch and transplanted in 4 × 4-inch pots. Betaseed 8927 sugarbeet were grown in 4 × 4 pots with a 1:1 mixture of Wheatville silt loam from the Northwest Research and Outreach Center, Crookston and PROMIX greenhouse media to the 2-lf stage. Both kochia and sugarbeet were grown at 75°F to 81°F under natural light supplemented with a 16 h photoperiod of artificial light.

Herbicide treatments were applied using a spray booth (Generation III, DeVries Manufacturing, Hollandale, MN) equipped with a TeeJet® 8002 even banding nozzle (TeeJet Technologies, Glendale Heights, IL) calibrated to deliver 15 gpa spray solution at 25 psi and 3 mph when kochia was 6- to 8-lf or ‘dime’ size in diameter (Figure 1) and when sugarbeet was at the 2-lf stage. Visible sugarbeet injury (0% to 100%, 100% indicating complete loss of stand) and kochia control (0% to 100%, 100% indicating complete control) were evaluated approximately 5, 14, and 21 days after treatment (DAT).

### *Spin-Aid rate screen*

Herbicide treatment for control of 1-inch (dime size) kochia and tolerance of 2-lf sugarbeet were a single Spin-Aid application at 48, 72, 96 and 144 fl oz/A and Spin-Aid at 32, 48, and 64 fl oz/A followed by a repeat Spin-Aid application after six days at 32, 48, and 64 fl oz/A, respectfully. All Spin-Aid applications were with Noble methylated seed oil (MSO) (Winfield United, Arden Hills, MN) at 1.5 pt/A (Table 1). Experimental design was randomized complete block with four replications. Data were analyzed with the ANOVA procedure of ARM, version 2022.5 software package.

### *Spin-Aid plus ethofumeste for kochia control; Sugarbeet tolerance from Spin-Aid plus ethofumesate and Roundup PowerMAX3*

Herbicide treatments were a single Spin-Aid application at 64, 80, and 96 fl oz/A or Spin-Aid application at 24, 32, 40, and 48 fl oz/A followed by a repeat Spin-Aid application at 24, 32, 40 and 48 fl oz/A, respectively. Spin-Aid



**Figure 1. One-inch (dime-size) kochia.**

was mixed with ethofumesate and Noble MSO at 1.5 pt/A for kochia control or Spin-Aid with ethofumesate and Roundup PowerMAX3 plus Destiny HC high surfactant methylated seed oil (HSMOC) for sugarbeet tolerance evaluation (Table 2). We elected not to use PowerMAX3 in the kochia experiment since our kochia seed source was segregating for glyphosate resistance. Experimental design was randomized complete block with four replications. Data were analyzed with the ANOVA procedure of ARM, version 2022.5 software package.

**Table 1. Spin-Aid rate and sugarbeet and kochia stage at application, greenhouse, 2023.**

Herbicide treatment <sup>a</sup>	Rate (fl oz/A)	Sugarbeet stage (Num of lvs)	Kochia size (Num of lvs)
Spin-Aid	48	2-4 lvs	6-8 (dime size)
Spin-Aid	72	2-4 lvs	6-8 (dime size)
Spin-Aid	96	2-4 lvs	6-8 (dime size)
Spin-Aid	144	2-4 lvs	6-8 (dime size)
Spin-Aid / Spin-Aid	32/32	2-4 lvs / 6 days	6-8 (dime size) / 6 days
Spin-Aid / Spin-Aid	48/48	2-4 lvs / 6 days	6-8 (dime size) / 6 days
Spin-Aid / Spin-Aid	64/64	2-4 lvs / 6 days	6-8 (dime size) / 6 days
Non Treated Control	-	2-4 lvs	6-8 (dime size)

<sup>a</sup>Spin-Aid with Noble methylated seed oil (MSO) at 1.5 pt/A.

**Table 2. Herbicide treatment and sugarbeet and kochia stage at application, greenhouse, 2023.**

Herbicide treatment <sup>a</sup>	Rate (fl oz/A)	Sugarbeet stage (Num of lvs)	Kochia size (Num of leaves)
Spin-Aid + ethofumesate	64 + 11	2-4 lvs	6-8 (dime size)
Spin-Aid + ethofumesate	80 + 13.8	2-4 lvs	6-8 (dime size)
Spin-Aid + ethofumesate	96 + 16.5	2-4 lvs	6-8 (dime size)
Spin-Aid + etho / Spin-Aid + etho	24 + 4.1 / 24 + 4.1	2-4 lvs	6-8 (dime size)
Spin-Aid + etho / Spin-Aid + etho	32 + 5.5 / 32 + 5.5	2-4 lvs / 7 days	6-8 (dime size) / 7 days
Spin-Aid + etho / Spin-Aid + etho	40 + 6.9 / 40 + 6.9	2-4 lvs / 7 days	6-8 (dime size) / 7 days
Spin-Aid + etho / Spin-Aid + etho	48 + 8.3 / 48 + 8.3	2-4 lvs / 7 days	6-8 (dime size) / 7 days
Non Treated Control	-	2-4 lvs	6-8 (dime size)

<sup>a</sup>Spin-Aid with Noble methylated seed oil (MSO) at 1.5 pt/A mixed with Spin-Aid for kochia control. Roundup PowerMAX at 25 fl oz/A and High Surfactant Methylated Oil Concentrate (HSMOC) at 1.5 pt/A was mixed with Spin-Aid and ethofumesate for sugarbeet tolerance evaluation.

## Results and Discussion

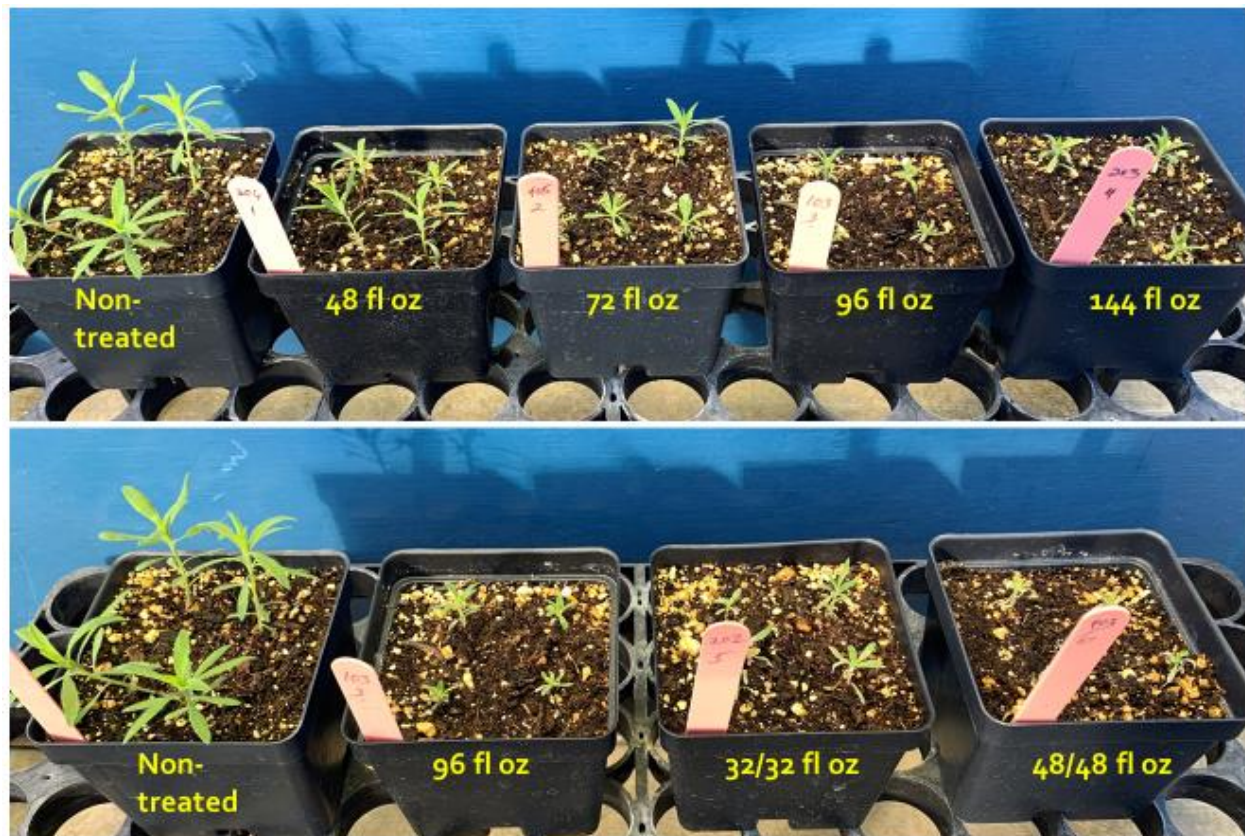
### *Spin-Aid rate screen*

Sugarbeet injury ranged from 18% to 49% from a single Spin-Aid application, 5 days after application A (DAAA). Injury was greatest from Spin-Aid alone at 144 fl oz/A (Table 3). Repeat Spin-Aid applications at 32 or 48 fl oz/A

**Table 3. Sugarbeet injury and kochia control in response to herbicide treatment, greenhouse, 2023.**

Herbicide treatment <sup>a</sup>	Rate --fl oz/A--	Sugarbeet injury			Kochia control		
		5 DAAA	10 DAAA	16 DAAA	10 DAAA	12 DAAA	20 DAAA
		-----%-----			-----%-----		
Spin-Aid	48	20 cd	24 c	3 de	43 e	53 d	23 d
Spin-Aid	72	33 b	20 c	5 de	55 d	65 c	28 d
Spin-Aid	96	33 b	20 c	15 bc	68 bc	68 c	43 c
Spin-Aid	144	49 a	40 b	28 a	78 ab	79 ab	60 ab
Spin-Aid / Spin-Aid	32/32	18 d	23 c	11 cd	58 cd	74 bc	50 bc
Spin-Aid / Spin-Aid	48/48	26 bcd	23 c	15 bc	80 a	81 ab	73 a
Spin-Aid / Spin-Aid	64/64	28 bc	48 a	23 ab	85 a	84 a	71 a
Non-Treated Control	-	0 e	5 d	0 e	0 f	8 e	5 e
LSD (0.10)		10	7	9	11	9	13

<sup>a</sup>Spin-Aid with methylated seed oil (MSO) at 1.5 pt/A for kochia control

**Figure 2. Kochia control in response to Spin-Aid singly or repeat Spin-Aid applications 6 days after Spin-Aid application, greenhouse, 2023.**

did not increase sugarbeet injury as compared with Spin-Aid at 72 or 96 fl oz/A applied singly, 10 DAAA. However, repeat Spin-Aid 64 fl oz/A applications caused more sugarbeet injury than a single 144 fl oz/A Spin-Aid application. Repeat 32 and 48 fl oz/A applications and a single application at 48, 72 and 96 fl oz/A caused less than 20% injury or negligible injury, 16 DAAA.

Kochia control was dependent on Spin-Aid rate and single or repeat Spin-Aid applications (Table 3, Figure 2). Kochia control was greatest from either Spin-Aid at 144 fl oz/A singly or from Spin-Aid at 48 or 64 fl oz/A followed by a repeat Spin-Aid application after six days. Spin-Aid at 48 fl oz/A fb Spin-Aid at 48 fl oz/A provided kochia control superior to a single 96 fl oz/A Spin-Aid application.



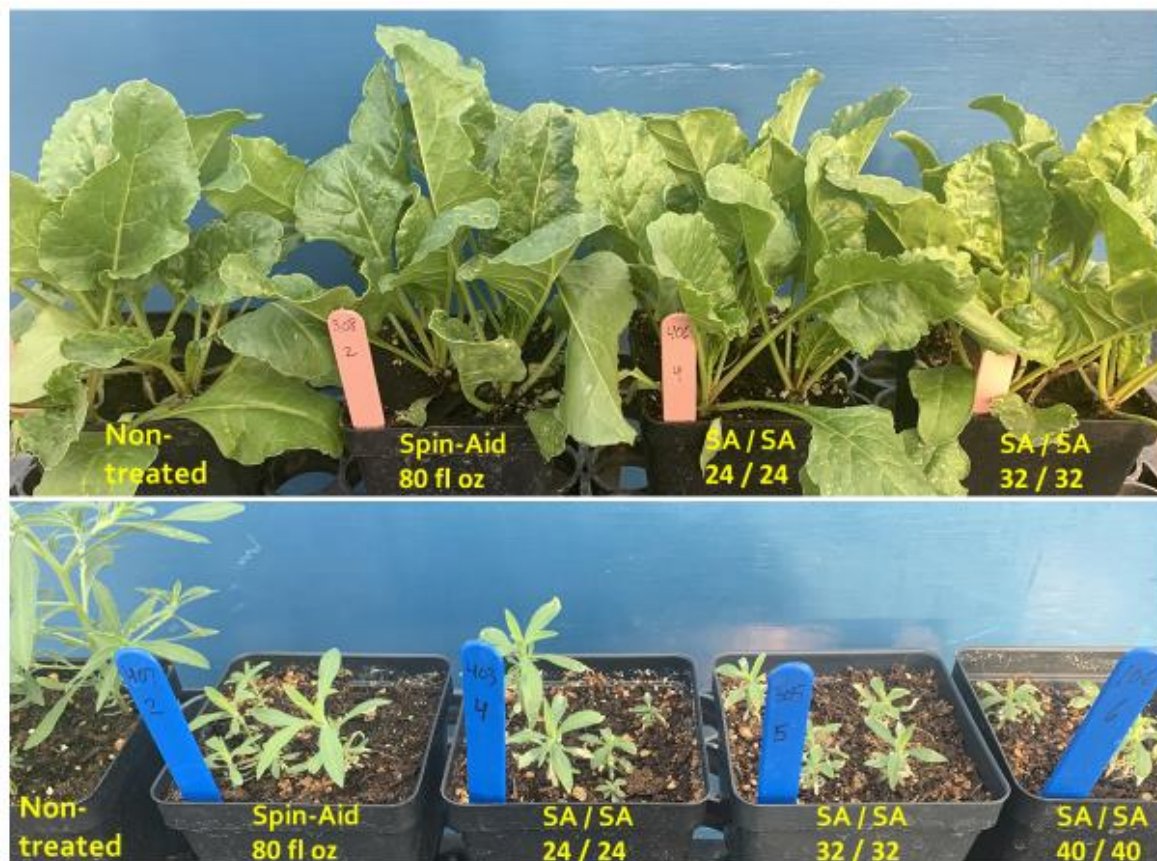
*Spin-Aid plus ethofumeste for kochia control; Sugarbeet tolerance from Spin-Aid plus ethofumesate and Roundup PowerMAX3*

Sugarbeet visible necrosis injury 4 days after application A (DAAA) was greatest with Spin-Aid at 80 and 96 fl oz/A mixed with ethofumesate and Roundup PowerMAX3 (Figure 3 and Table 4). Necrosis injury tended to correlate with Spin-Aid rate; injury was least with Spin-Aid at 24 fl oz/A and most with Spin-Aid at 96 fl oz/A. Necrosis injury was less with repeat Spin-Aid applications at 32 or 48 fl oz/A as compared to Spin-Aid singly at 64 or 96 fl oz/A, respectively. Sugarbeet visible growth reduction injury 15 DAAA was greatest with Spin-Aid singly at 96 fl

**Table 4. Sugarbeet injury and kochia control from single or repeat Spin-Aid applications with ethofumesate (and PowerMAX3), greenhouse, 2023.**

Herbicide treatment <sup>a</sup>	Rate	Sugarbeet injury		Kochia control	
		4 DAAA	15 DAAA	4 DAAA	12 DAAA
	--fl oz/A--	-----%-----		-----%-----	
Spin-Aid + ethofumesate	64 +11	33 b	18 b	70 b	66 d
Spin-Aid + ethofumesate	80 +14	35 ab	14 b	73 b	74 c
Spin-Aid + ethofumesate	96 + 17	40 a	21 ab	86 a	91 a
Spin-Aid+etho / Spin-Aid+etho	24+4 / 24+4	13 e	18 b	33 e	74 c
Spin-Aid+etho / Spin-Aid+etho	32+6 / 32+6	18 de	21 ab	48 d	76 bc
Spin-Aid+etho / Spin-Aid+etho	40+7 / 40+7	20 cd	15 b	58 c	81 b
Spin-Aid+etho / Spin-Aid+etho	48+8 / 48+8	25 c	28 a	60 c	81 b
Non-Treated	-	0 f	4 c	0 f	0 e
LSD (0.10)		6	10	8	7

<sup>a</sup>Spin-Aid + ethofumesate (kochia) or Spin-Aid + ethofumesate + Roundup PowerMAX3 (sugarbeet); treatment contained methylated seed oil (MSO) at 1.5 pt/A for kochia control; treatment contained high surfactant methylated oil concentrate (HSMOC) at 1.5 pt/A for sugarbeet control.



**Figure 3. Sugarbeet tolerance or kochia control in response to Spin-Aid singly or repeat Spin-Aid applications after 7 days (sugarbeet) or after 6 days (kochia), greenhouse, 2023.**

oz/A, or repeat Spin-Aid applications at 32 or 48 fl oz/A with ethofumesate and Roundup PowerMAX3. Sugarbeet injury from other treatments was or tended to be the same.

Kochia control was greatest with Spin-Aid singly at 96 fl oz/A with ethofumesate 8 and 12 DAAA (Table 4, Figure 3). However, in general, repeat Spin-Aid applications with ethofumesate provided kochia control greater than Spin-Aid + ethofumesate singly. For example, Spin-Aid at 32 or 40 fl oz/A with ethofumesate followed by a repeat application 6 days after the first application provided kochia control greater than Spin-Aid singly at 64 or 80 fl oz/A with ethofumesate.

### Conclusions

Target herbicide applications to kochia less than 1-inch tall (dime size) if sugarbeet growth stage will allow. Kochia is a difficult weed to control. These greenhouse experiment and observations from field experiments indicate kochia dime-sized in diameter is easier to control than kochia quarter-sized in diameter or kochia 2 or 3 inches tall. We observed a compromise with kochia control and sugarbeet tolerance from repeat Spin-Aid applications as compared with Spin-Aid singly. Further, mixing Spin-Aid with ethofumesate seemed to improved kochia control as compared to Spin-Aid alone, although Spin-Aid alone or Spin-Aid mixed with ethofumesate were not herbicide treatments in the same experiments. Finally, most producer applications will be a mixture of Spin-Aid with ethofumesate and RoundupPowerMAX3.

Spin-Aid rate will be triggered by sugarbeet growth stage (Table 5) although we prefer dime sized kochia as compared to larger kochia. We favor Spin-Aid at 24 to 32 fl oz/A and sugarbeet at the 2-lf stage and Spin-Aid at 32 or 40 fl oz/A for repeat application.

Field research will be conducted in 2023 to evaluate common lambsquarters and common ragweed control with Spin-Aid or Spin-Aid + ethofumesate.

**Table 5. Dime-sized kochia control with Spin-Aid alone or in mixtures with ethofumesate or Spin-Aid following a soil residual herbicide, based on field and greenhouse research, 2022 and 2023.**

Sugarbeet stage (lf stage)	No Soil Residual Herbicides		Following soil residual herbicides
	Spin-Aid	Spin-Aid + etho	Spin-Aid + etho
	-----fl oz/A-----		---fl oz/A---
Cotyledon	24	16 + 4	12 + 4
2	32	24 + 4	16 + 4
4	48	32 + 4	24 + 4
6	72	40 + 4	32 + 4