Weed Control in Sugarbeet

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UNIVERSITY OF MINNESOTA EXTENSION

What was your most important production problem in 2022?^a (Multiple Choice)



^aFargo Growers Seminar, February 1, 2023

What was your most troublesome weed control challenge?^a



^aFargo Growers Seminar, February 1, 2023

Outline

- Waterhemp control in sugarbeet
- Complex mixtures
- Spin-Aid for kochia control





nd habitat to



A 155-year-old waterhemp herbarium specimen from the Missouri Botanical Garden Herbarium. Credit: Julia Kreiner, University of British Columbia

Waterhemp Control Program in Sugarbeet

Planting Date	Recommendation				
	Dual Magnum at 0.5 to 1.0 pt/A, ethofumesate at 3 to				
	7.5 pt/A or Dual Magnum at 0.5 to 0.75 pt/A plus				
Sugarbeet plant in	ethofumesate at 2 to 3 pt/A				
April or May	Split lay-by application (early postemergence /				
	postemergence). Chloroacetamide herbicides applied				
	at 2-If sugarbeet fb 6- to 8-If sugarbeet				
June	Continue to scout fields for waterhemp. Control				
	escapes with Ultra Blazer (Section 18ee), Liberty with				
	the Redball™ 915 hooded sprayer (24c), or inter-row				
	cultivation				
July	Electric Discharge Systems (WeedZapper™)				
August / September	Hand remove waterhemp				

Ethofumesate in 2024 Group 15

Ethofumesate products for sugarbeet production

- Nortron, Bayer CropScience
- Ethotron, UPL NA Inc.
- Ethofumesate 4SC, Farm Business Network
- Nektron, Atticus, AG
- Maxtron 4SC (3.78 lb/G), ALBAUGH, LLC

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Chloroacetamides in 2024 Group 15

Dimethenamid

• Outlook, BASF

Acetochlor (encapsulated)

- Warrant, Bayer CropScience
- Enversa, Corteva agriscience

S-metolachlor

- Dual Magnum, Syngenta Crop Protection, LLC
- EverpreX, Corteva agriscience
- Medal, Syngenta Crop Protection, LLC
- Brawl, TENKOZ, Inc.
- Moccasin, UPL NA Inc.
- Charger Basic, WinField United

Why do you make pesticide mixtures?

- Improve weed control
- Broaden spectrum of control
- Save trips





- EC formulations (Outlook and S-metolachlor) speckle sugarbeet
- Asana may be "synergizing" the speckled phenotype
- Speckle is related to a surfactant system "spreading" the droplet

Sugarbeet degrades herbicides by metabolizing herbicides

Challenging environmental conditions slow metabolism

- Cool temperatures
- Excessive moisture conditions
- Overcast days

Multiple herbicides means sugarbeet has to detoxify several active ingredients under stress conditions...at the same time



Etho + Dual Magnum (PRE) at 2 + 0.5 pt/A followed by RUPM3 + etho + S-metolachlor + Stinger HL (2-lf) at 25 + 6 + 16 + 1.5 fl oz/A fb RPM33 + etho + S-metolachlor + Stinger HL (6-lf) at 25 + 6 + 16 + 1.5 fl oz/A, Rothsay, MN, 2022.

Sugarbeet injury, greenhouse, March 2023

Treatment	Rate	GR, 10 DAT	GR, 14 DAT	GR, 17 DAT
	fl oz /A		%	
RUPM3 + ethofumesate (base)	30 + 12	10 C	4 C	3 C
Base + Outlook	21	27 b	12 b	9 C
Base + Outlook and Mustang Maxx	21 + 4	16 c	15 b	18 b
Base + Outlook, Mustang Maxx and Stinger HL	21 + 4 + 3.6	37 a	37 a	43 a
LSD (0.10)		10	9	10

- Injury from Mustang Maxx (or Asana) less than chlorpyrifos.
- Add adjuvant with RUPM, ethofumesate and Outlook. Leave it out with RUPM, ethofumesate, Outlook, insecticide and Stinger



Soil-borne fungicides with herbicides

- Quadris can be mixed with Roundup Power Max and/or Stinger
- Oil based formulations or adjuvants mixed with Quadris may cause necrosis and chlorosis injury to sugarbeet
- What about Excalia?

Quadris mixed with oil-based herbicides may cause bronzing or bleaching damage. Image probably at overlap rate. Photo courtesy of Mike Metzger, Minn-Dak Farmers Coop.



Sugarbeet injury in response to herbicide treatment, greenhouse, 2023

Herbicide treatment		Necrosis	Growth Reduction	
	Rate	4 DAT	4 DAT	14 DAT
	fl oz/A	%	%	
Non-Treated Control	-	0 C	3 C	3 d
RUPM3 + etho + Outlook (base)	28+ 6+ 16	<u>8 b</u>	16 b	1) C
Base + Excalia + Mustang Max + Stinger HL	2 + 4 + 2.4	0 C	19 b	21 b
Base + Quadris + Mustang Max + Stinger HL	14.3 + 4 + 2.4	30 a	60 a	43 a

- Can sugarbeet injury be explained by Excalia or Quadris formulation?
 - Excalia is a suspension concentrate formulation
 - Quadris is a flowable formulation

Pesticide mixtures with Excalia or Quadris, greenhouse, 2023 Images collected on May 1,2023, 11 DAT



*Base = Roundup PowerMAX₃ + Nortron + Outlook with Destiny HC and Amsol Liquid AMS

Excalia

Quadris

Sugarbeet injury in response to herbicide treatment, greenhouse, 2023

Herbicide treatment		Necrosis	Growth Reduction	
	Rate	4 DAT	4 DAT	14 DAT
	fl oz/A	%	%%	
Non-Treated Control	-	o b	3 b	3 b
RUPM3 + etho + Outlook (base)	25+ 12+ 21	0 a	10 a	13 a
Ecalia and Mustang Max	2 + 4	o b	10 ab	o b
Quadris and Mustang Max	14.3 + 4	o b	11 ab	5 ab

Mustang Max mixed with Excalia or Quadris, greenhouse, 2023 Images collected on May 1,2023, 11 DAT





GR weeds dominate the landscape in Minnesota and North Dakota

- GR waterhemp was the most troublesome weed control challenge; on 429,820 acres or 64% of acreage according to 2021 survey
- GR **common ragweed** was 9% overall but 26% in Crookston and EGF factory districts
- GR **kochia** was 22% overall but 57% in Drayton factory district



Kochia

- Life cycle, summer annual
 - One of the first weeds to emerge in spring
- Seed production, 15,000 seeds per plant
- Biology, very deep rooted, tolerate saline soils
- Biology, extremely competitive; a few plants will reduce yield
- Seed viability, 1 to 2 years
- Many document examples of herbicide resistance
 - ALS (SOA 2)
 - 2,4-D, dicamba, and fluroxypyr (SOA 4)
 - Triazines (5)
 - Glyphosate (SOA 9)
 - PPOs (SOA 14)
 - Multiple resistance in ND, 2+4 + 9, 2+4+9+14







March 26th. The surface 1-inch was thawed and below that it was frozen. Photo credit, Lee Briese



Adapted from Werle et al. 2014, Goplen et al. 2017, Weedometer 2008

Kochia

- Life cycle, summer annual
 - One of the first weeds to emerge in spring
- Biology, very deep rooted, tolerate saline soils
- Biology, extremely competitive; a few plants will reduce yield
- Seed production, 20,000 to 30,000 seeds per plant
- Seed viability, 1 to 2 years
 - Many document examples of herbicide resistance
 - ALS (SOA 2)
 - 2,4-D, dicamba, and fluroxypyr (SOA 4)
 - Triazines (5)
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The Crop Sequence in the Red River Valley



Kochia control, 30 days after final application of herbicide treatment





Kochia control in sugarbeet Three options

All options begin with ethofumesate, soil applied

- Paraquat before sugarbeet emerges
 - Use rate depending on vegetation; 1.3 to 2 pt/A (max rate is 2.7 pt/A).
 - Gramoxone alone or in tank mixtures are permitted by ground and by air; a minimum of 10 gal/A by ground and 5 gal/A for aerial application.
 - Use spray nozzles that will produce medium to coarse droplets are recommended.
 - Use an adjuvant, Nonionic-Surfactant (preferred) at 0.25% v/v (2 pt/100 gal). Crop Oil Concentrate or Methylated Seed Oil at 1.0% v/v (1 gal/100 gal).
 - 24 hr re-entry.



Kochia control in sugarbeet Three options

All options begin with ethofumesate, soil applied

- Glyphosate sensitive kochia (fenceline kochia)
- Roundup PowerMax3 (full rates) mixed with a high quality adjuvant and ammonium sulfate
- Roundup PowerMax3 + ethoxylate tallowamine adjuvants + AMS



Kochia control in sugarbeet Three options

All options begin with ethofumesate, soil applied

- Redevelopment of phenmedipham combines historical field and recent greenhouse and field experiments
- Spin-Aid, Betanal, 'Blue Can'
 - Kochia, common lambsquarters and common ragweed control
 - Spin-Aid + ethofumesate; Spin-Aid + ethofumesate + RUMP3
 - Small kochia



4-leaves





quarter-size
6- to 9-leaves

too big
Scout early next year

Response of weeds to Spin-Aid[®] alone or mixtures with ethofumesate

Weeds	Spin-Aid	Spin-Aid + etho
Common lambsquarters	G	G-E
Kochia	G	G-E
Redroot pigweed	P	P
Common ragweed	F	F-G
Wild mustard	G	G-E

E= Excellent (90-99%); G = Good (80-90%); F=Fair (65-80%); P=Poor (40-65%) (ND Weed Control Guide, 1980)

What have we learned about Spin-Aid

- Sugarbeet rapidly metabolize Spin-Aid to less toxic compounds (Hendrick et al. 1974)
- Spin-Aid should be applied over small weeds; rate dependent on sugarbeet growth stage
- Environmental conditions influences PSII inhibitors efficacy
 - Weed control is less with cool temps and low light as compared with direct sunlight conditions (Abbaspoor and Streibig 2007)
 - Risk of injury increases at temperatures greater than 80F and sudden changes from a cool, cloudy environment to a hot, sunny environment (Betamix BMPs).
 - On warm days, wait until late afternoon/early evening or when temperatures start to decrease before making Betamix application (Betamix BMPs).





Injury or control from Spin-Aid, across locations, 2023.^{ab}



^aTreatments included ethofumesate at 4 to 12 fl oz/A plus Noble (MSO) at 1.5 pt/A.

^bMeans within a rating timing that do not share any letter are significantly different by the LSD at the 5% level of significance.



Kochia control from 1-time, 2-time, and 3-time Spin-Aid, across greenhouse runs, 2023-24.^{ab}



^aTreatments included ethofumesate at 4-12 fl oz/A plus Noble (MSO) at 1.5 pt/A.

^bMeans within a rating timing that do not share any letter are significantly different by the LSD at the 5% level of significance.

Kochia control from Spin-Aid, 21 DAT, greenhouse, December/January 22023/24



2-inch LQ control in response to Spin-Aid applied Jan 29 and Feb 2, 7 DAT, Greenhouse.^a



^aglyphosate tolerant source

Spin-Aid as part of an integrated kochia control program

- Roundup PowerMAX3 at 25 fl oz/A with NIS and AMS plus Spin-Aid and etho
 - Spin-Aid rate is dependent on sugarbeet size
 - Spin-Aid rate is dependent on if a soil residual herbicide was used
 - Repeat Spin-aid applications on 5 day intervals for GR kochia control
 - Roundup PowerMax mixed with Spin-Aid and etho on 10 day intervals

Sugarbeet stage	Alone	Following soil residual herbicide
(lf stage)	Spin-Aid + etho (fl oz)	Spin-Aid + etho (fl oz)
Cotyledon	16 + 4	12 + 4
2	24 + 4	16 + 4
4	32 + 4	24 + 4
6	40 + 4	32 + 4

Future Research and Activity

- Spin-Aid[®] alone and mixes with clopyralid for common ragweed control
- Tallowamine adjuvants with glyphosate for kochia control
- Update 24(c) local needs label, cotyledon to 6-lf sugarbeet, tank-mixes with group 4 and group 15 herbicides, adjuvants



See & Spray[™] technology

- Camera system recognizes 'plant' is different from sugarbeet
- Artificial intelligence vs. Machine Learning
- Al is computer software that mimics human cognition to perform complex tasks.
- ML is an application of AI that uses algorithms trained on data to perform a task
- I hear possible field evaluation in sugarbeet in 2024
- I hear the system will be commercially available in sugarbeet in 2026
- What is our goal in sugarbeet?
- What herbicides; selective or nonselective?

		SEE & SPRAY SELECT	SEE & SPRAY ULTIMATE	SEE & SPRAY PREMIUM
	Fallow Use			
	In-Season Use	0		
En all	Traditional Broadcast Spray Application			
	Targeted Spray Application*			
	Single Tank		\bigcirc	
	Dual-Product Solution System/Split Tank	\bigcirc		\bigcirc

Image from the John Deere website

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Thank you for your continued support

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