

WEED MANAGEMENT in the Age of NEW TECHNOLOGY

Sarah Lancaster
Assistant Professor and Extension Specialist – Weed Management

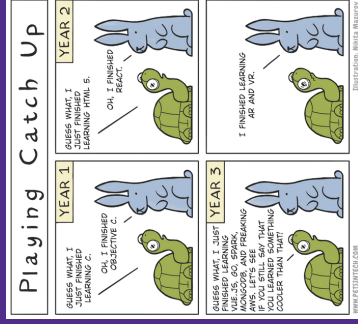
OUTLINE

- 1 SITE-SPECIFIC WEED MANAGEMENT
- 2 TARGETED SPRAYING
- 3 OTHER POSSIBILITIES

WHAT IS SITE-SPECIFIC WEED MANAGEMENT?

“Applying the right input on the right weed at the right time”
Reddy & James 2018

- Environmental benefits for society
- Economic benefits for farmers



TARGETED SPRAYING

Technically, not “spot spraying”
Directed spray application, typically labor intensive

Also not a “prescription” application
Based on map derived from pre-existing information






What targeted spraying system(s) are you aware of?


Targeted Spraying Systems




COMPONENTS



Camera



Processor



Nozzles

TWO TYPES OF TARGETED SPRAYING

Green on Brown

- WeedSeeker
- Weed-It
- See & Spray Select



Green on Green

- Bilberry
- GreenEye
- One Smart Spray
- See & Spray Ultimate & Premium



SENSING TECHNOLOGY (CAMERAS)

Active

- Bilberry
- Weed-It
- Greeneye
- One Smart Spray
- See & Spray Select



Passive

- See & Spray Ultimate and Premium
- Weed Seeker



Dual Booms/Tanks

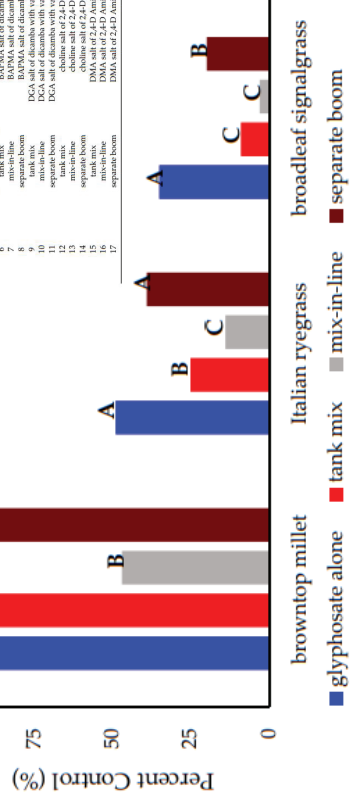
- See & Spray Ultimate and GreenEye
- Spot spray + broadcast
- Avoid some incompatibility/antagonism
- Optimize tank conditions
- pH, adjuvants, etc.



Two-Boom systems might reduce antagonism

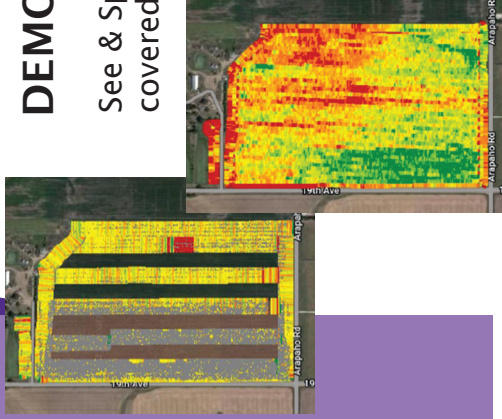
Table 2. Complete Treatment Combination List for the Glyphosate with Synthetic Amino Acid Study.

Treatment	Application Method	Herbicide Active Ingredient(s)
1	single-application	BAPMA salt of dicamba
2	single-application	DCA salt of dicamba
3	single-application	chlorthal salt of 2,4-D
4	single-application	DMA salt of 2,4-D Amine
5	single-application	BAPMA salt of dicamba and glyphosate
6	single-application	DMA salt of 2,4-D Amine and glyphosate
7	mix-in-line	BAPMA salt of dicamba and glyphosate
8	mix-in-line	DMA salt of 2,4-D Amine and glyphosate
9	mix-in-line	DCA salt of dicamba with vapor-grp and glyphosate
10	mix-in-line	chlorthal salt of 2,4-D and glyphosate
11	separate boom	DCA salt of dicamba with vapor-grp and glyphosate
12	separate boom	chlorthal salt of 2,4-D and glyphosate
13	separate boom	DMA salt of 2,4-D Amine and glyphosate
14	separate boom	BAPMA salt of dicamba and glyphosate
15	separate boom	DMA salt of 2,4-D Amine and glyphosate
16	separate boom	DCA salt of dicamba and glyphosate
17	separate boom	DMA salt of 2,4-D Amine and glyphosate



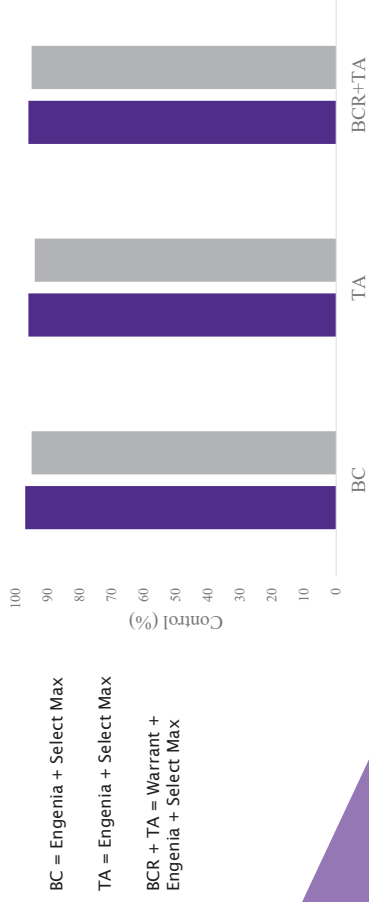
DEMONSTRATION

See & Spray treated 55% of area covered



- Used 350 gallons less spray solution
- Reduced herbicide use by
- 5.9 gallons Liberty
- 1.1 gallons NIS
- 70 lbs AMS

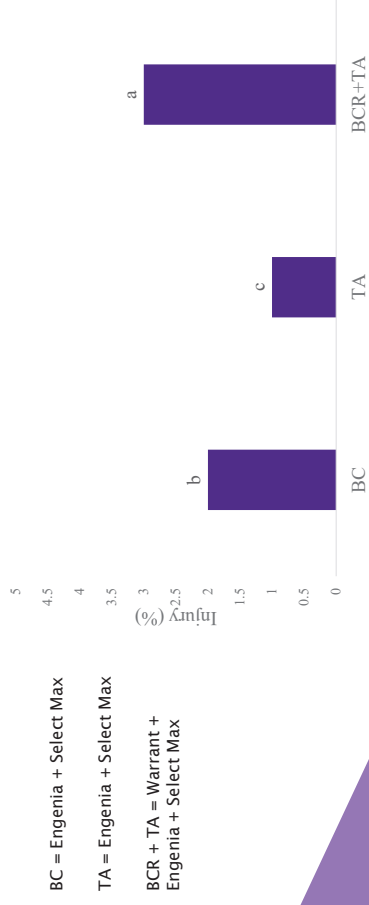
Influence of EPOST Application Method on Weed control 14 DTA



Aveni et al. 2024

13

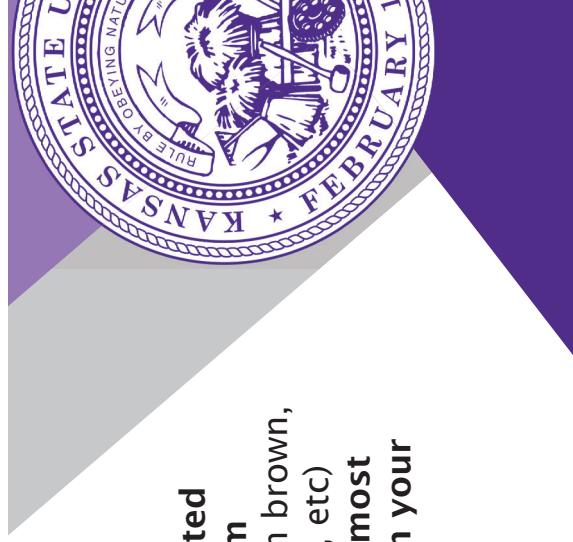
Influence of EPOST Application Method on Soybean Injury 14 DTA



Aveni et al. 2024

14

Which type of targeted application system (Green on green, green on brown, single tank, dual tank, etc) do you think has the most potential usefulness in your operation?



FACTORS INFLUENCING FARMER ADOPTION OF TARGETED SPRAYERS

Collaborators: Haag, Falk, Jones, Hock

STUDY METHODS

Qualitative study based on theory of planned behavior and technology acceptance model¹

Initially identified 7 farmers

Added 10 potential participants based on conversations

Interviewed 11 farmers between May and August
 9 were the primary person making the decision to purchase the sprayer

2 initiated the purchase of the sprayer

¹Mohr and Kuhl 2021



WHAT ARE THE GREATEST BENEFITS OF A SITE-SPECIFIC SPRAYER?

See & Spray™ Ultimate owner

The money savings initially is what it'll be long term, I think it's reducing that weed bank and reducing weed pressure and reducing herbicide expense, not just because you're doing see and spray, but because you have less weed pressure.

See & Spray™ Premium owner

So I think number one is the environmental impact

I think guys are going to be more apt to go out and spray stuff earlier.

See & Spray™ Select owner

Overall efficiencies of your time

21

WHAT ARE THE GREATEST LIMITATIONS OF A SITE-SPECIFIC SPRAYER?

See & Spray™ Ultimate & Premium owners

Well, coverage was one we've talked about that a little bit. It's not bad, it's just it's not as good as being able to shoot it from both sides.

Speed for some guys is probably a limitation

Sometimes the only time we can spray is at night, so that's probably one of the biggest limitations.

Dust and shading a little bit certain times of the day, if the sun's over here on this side, this sides run kind of in the dark, in the shade, and then it gets a little dust, and it makes those cameras not want to read.

Cost is the biggest barrier, or because you gotta buy [the subscription fee].

It's like going over a terrace. When it comes up [over the required height], it sprays that.

And so you're going to spray more [of a terraced field]

See & Spray™ Select and WEED-IT owners

I think we have to cover it at least twice more in a year than we do [with broadcast sprays]

22

WHAT ARE THE GREATEST BENEFITS OF A SITE-SPECIFIC SPRAYER?

See & Spray™ Ultimate owner

The money savings initially is what it'll be long term, I think it's reducing that weed bank and reducing weed pressure and reducing herbicide expense, not just because you're doing see and spray, but because you have less weed pressure.

See & Spray™ Premium owner

So I think number one is the environmental impact

I think guys are going to be more apt to go out and spray stuff earlier.

See & Spray™ Select owner

Overall efficiencies of your time

21

WHAT ARE THE GREATEST LIMITATIONS OF A SITE-SPECIFIC SPRAYER?

See & Spray™ Ultimate & Premium owners

Well, coverage was one we've talked about that a little bit. It's not bad, it's just it's not as good as being able to shoot it from both sides.

Speed for some guys is probably a limitation

Sometimes the only time we can spray is at night, so that's probably one of the biggest limitations.

Dust and shading a little bit certain times of the day, if the sun's over here on this side, this sides run kind of in the dark, in the shade, and then it gets a little dust, and it makes those cameras not want to read.

Cost is the biggest barrier, or because you gotta buy [the subscription fee].

It's like going over a terrace. When it comes up [over the required height], it sprays that.

And so you're going to spray more [of a terraced field]

See & Spray™ Select and WEED-IT owners

I think we have to cover it at least twice more in a year than we do [with broadcast sprays]

22

SUMMARY – OPPORTUNITIES

- Herbicide savings
 - Generally most important
- Time savings
 - More important for fallow/green-on-brown applications
 - Fewer loads either equal to or better than faster driving speed
- Improved weed control
 - Especially long-term
- Reduced crop injury
 - For green-on-green
- Conserve water resources
 - Especially where precipitation <20"

23

SUMMARY – OBSTACLES

- Staying out of fallback mode
 - Dust
 - One participant arranged to have additional cameras mounted on front of machine
 - Shadows/light
 - More important for allowing green-on-green sprayers to run after dark
 - Boom height
 - Uneven terrain
- Coverage
 - One participant addressed by running opposite directions in sequential passes
 - Experimenting with nozzles
- Grain sorghum algorithm
 - Corn will work
- Economics
 - Initial price
 - Used sprayer values
 - Custom applicator
- Trust that cameras will detect small weeds

24

OTHER CONSIDERATIONS

- What portion of acres are suited for targeted application??
- More complicated tendering in dual-tank systems
- Regulatory questions
 - What rate is legal?
 - Mitigation points
- Other uses?

26

PRESCRIPTION HERBICIDE APPLICATIONS

Based residual herbicide applications on:
Soil properties (little variation)
Previous as applied map



Broadcast – 64 fl oz
Based on weed map – 64 or 56 fl oz
Based on soil map – 64 or 60 fl oz
Based on both – 64, 60, or 56 fl oz

27

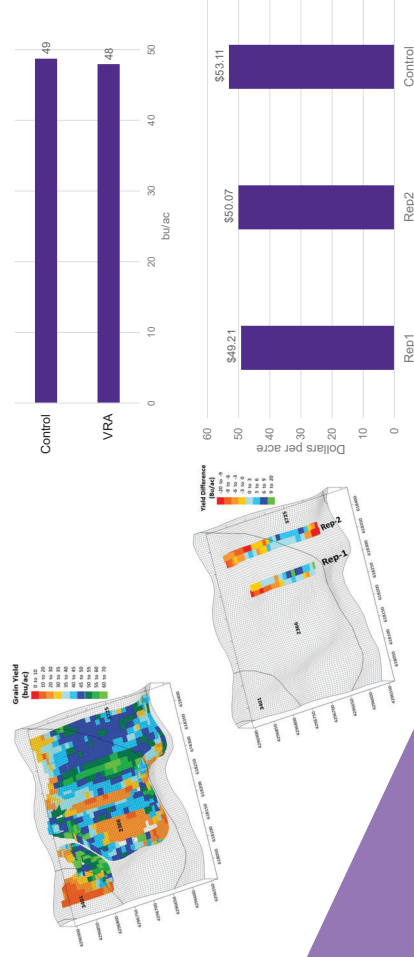
AS APPLIED MAP

Areas of no application correspond with areas with no weeds



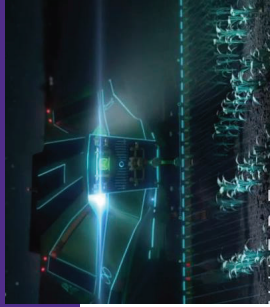
28

Variable-rate residual herbicide application based on weed distribution and soil texture



Calderaro et al 2024

WHAT DOES THE FUTURE HOLD?



LET'S CONNECT

 slancaster@ksu.edu

 [@KStateWeedSci](https://twitter.com/KStateWeedSci)

 K-State Weed Science

 [kstateweedsci](https://www.instagram.com/kstateweedsci)

 War Against Weeds podcast

 eUpdate.agronomy.ksu.edu

