CULTIVATOR AND SPRAYER BMP'S

Cody Bakker – Ag strategy manager

SMBSC


Hector Vargas
East Grand Forks, MN

ROW CROP CULTIVATION

- Weed control
- Topsoil aeration
- Defoliator and harvester tracking
- BMP #1
  - Hook it up
- Will we commit?


7630
Gordon Crop Culture
Croswell, MI


www.allloway ag.com/cultivators

INTER-ROW CULTIVATION WAS SOMETHING DAD AND GRANDPA DID

How do you cultivate correctly?

- Speed and depth
- Planter / inter-row cultivator match
- Shank configuration, S-tine or sweeps?
- Size of sugarbeet, size of waterhemp

Haugrud Thesis

- Does inter-row cultivation incorporate herbicide?
- Does inter-row cultivation break the herbicide barrier?

Yield

- Root yield, % sucrose and recoverable sugar taking a hit?

WHERE IS YOUR CULTIVATOR?

- Shed?
- Grove?
- Neighbors yard?
- Auction lot?
- Dealership?

Pobeda Collective, Russia
www.alamy.com

WEED CONTROL

- SAG 30 – NDSU Extension Herbicide chart
- No known resistance!
- Levels of control will vary with timing
- Shields down
- Shields up
- Speed down for dirt/dust control

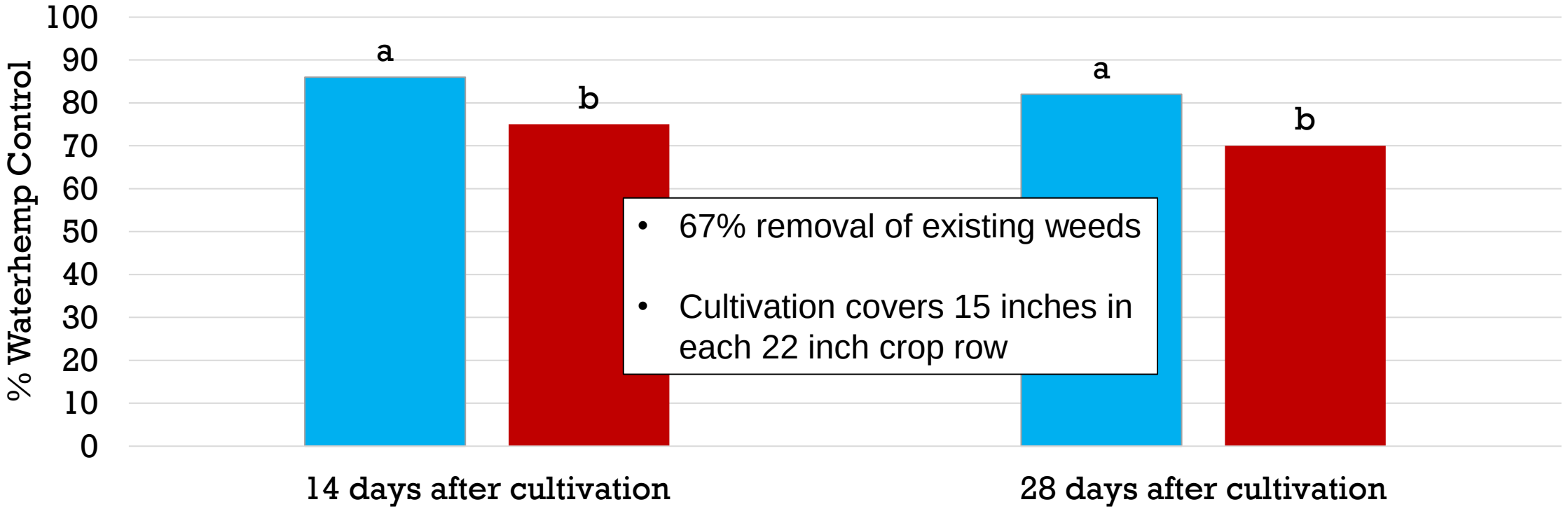
GENERAL CONSIDERATIONS
DO I NEED TO WORRY ABOUT SHOVELS?

- Sweep and s-tine style shovels are effective for weed control
  - Use grandpa or dads equipment and configuration
  - Sweep shovels probably are better at cutting and removing weeds
  - Larger waterhemp might find its way around a three s-tyne shovels
  - Weeds wrap around s-tyne shovels; residue may accumulate between shovels
  - Target waterhemp less than 6-inch; 4-inch is even better
  - Speed is dependent on conditions and crop size
  - Cultivation was not effective at incorporating soil residual herbicides (Haugrud and Peters)

WHEN SHOULD I CULTIVATE?

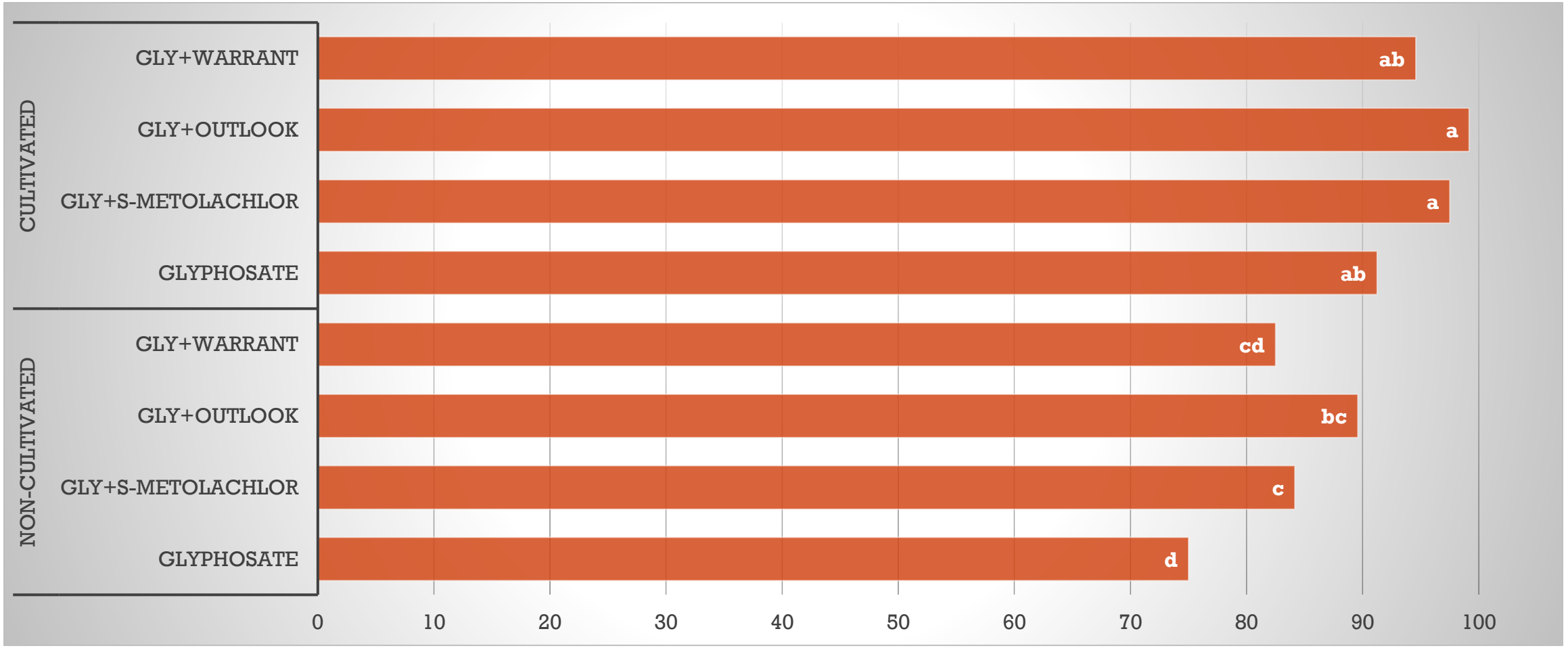
- Consider weed size, target waterhemp less than 4-inch, 4 to 6-inch maximum size
- Cultivate before second lay-by application
  - Be proactive and cultivate to remove GR weed escapes
  - Apply second lay-by after cultivation

DELAYED CULTIVATION TWO WEEKS AFTER POST SPRAY IMPROVED WATERHEMP CONTROL 11-12% ACROSS FOUR ENVIRONMENTS



ANOVA	14 DAT	28 DAT
P-value	0.038	0.030

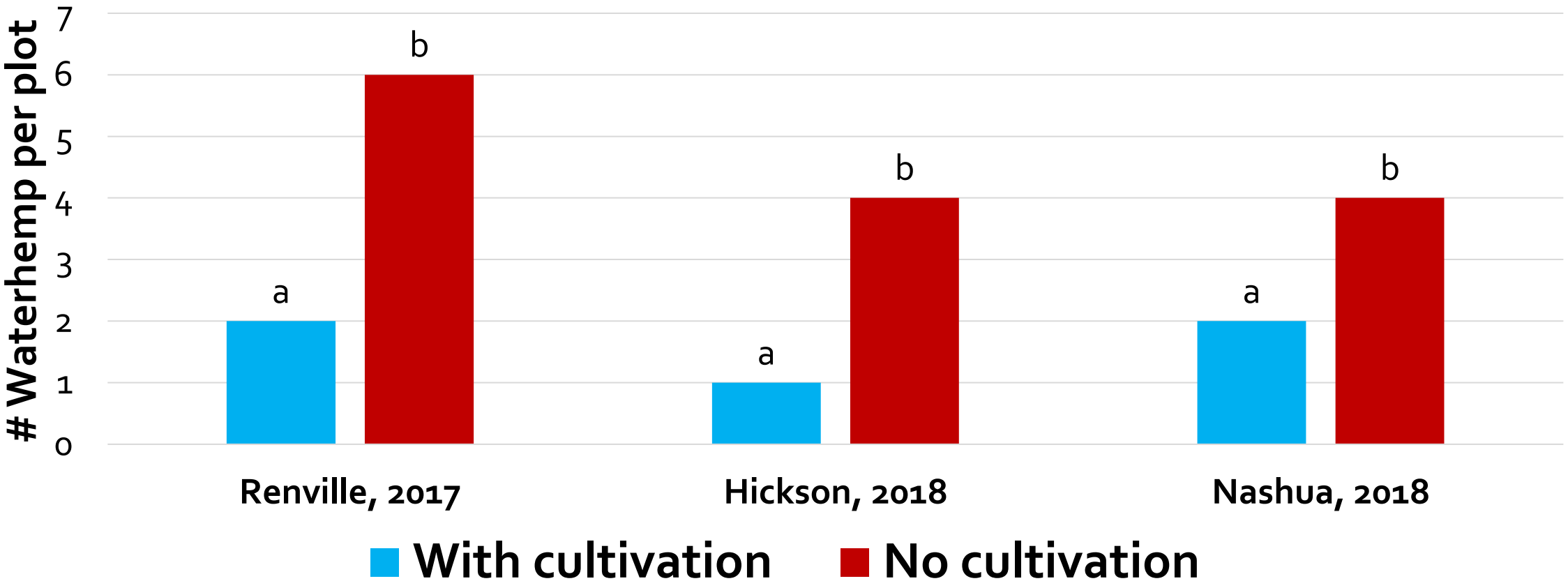
CULTIVATED PLOTS TENDED TO HAVE LESS WEED EMERGENCE 14 DAT, ACROSS LOCATIONS, JULY 24, 2017



% Control of new weed emergence

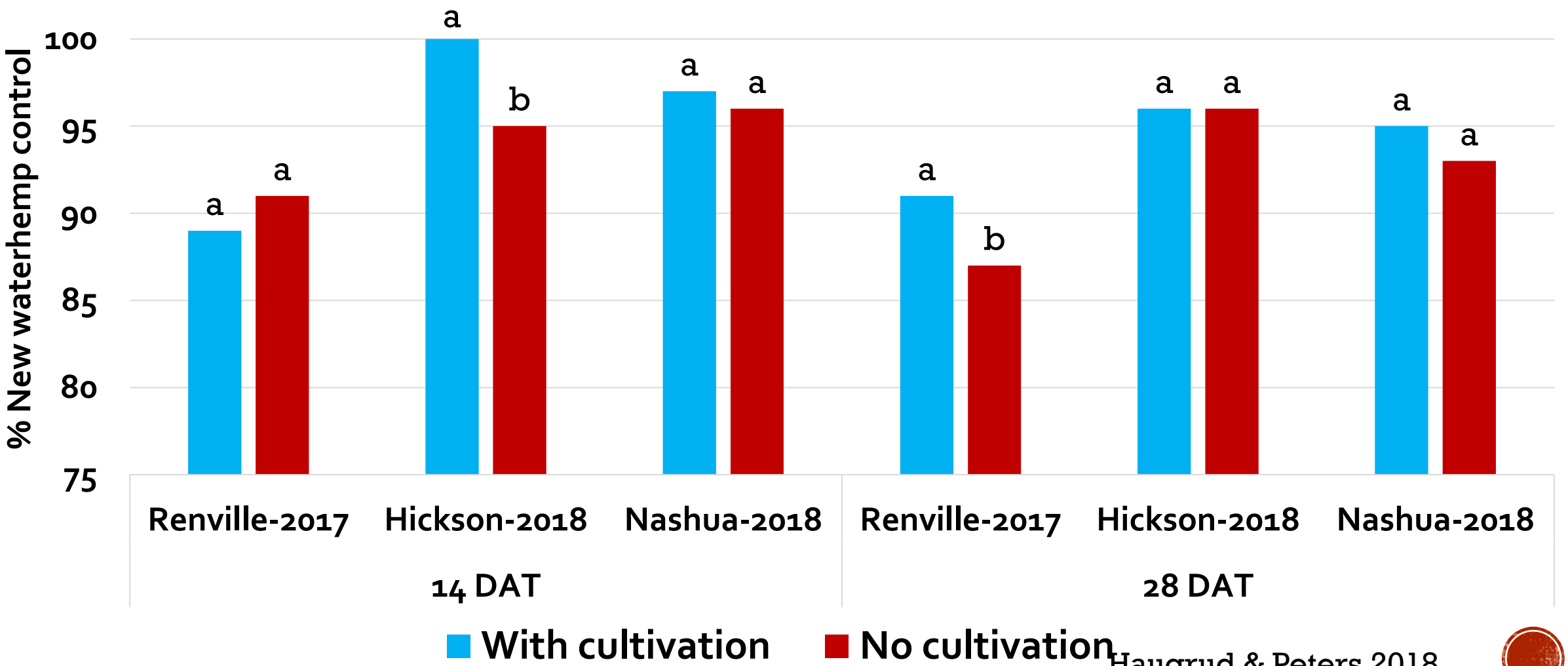
Haugrud & Peters 2017

CULTIVATION IMMEDIATELY AFTER HERBICIDE RESULTED IN 50-75% LESS WATERHEMP, 14 DAT



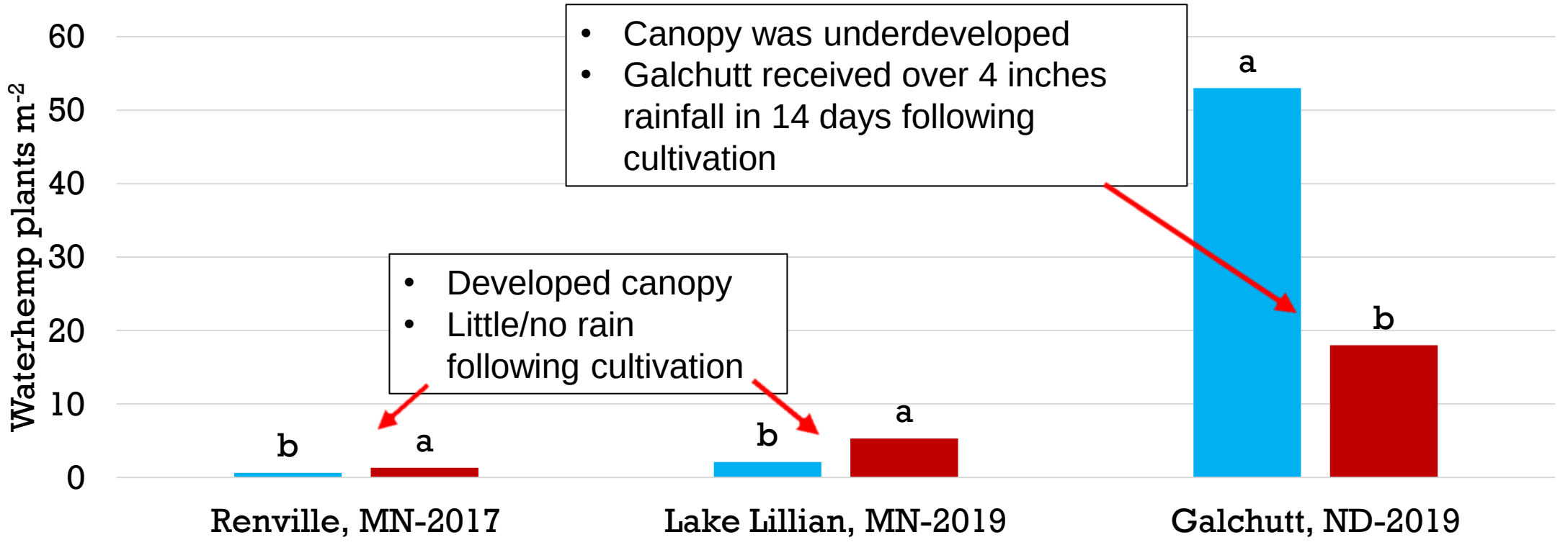
Haugrud & Peters 2018

CULTIVATION GENERALLY HAD NO EFFECT ON "NEW WATERHEMP" EMERGENCE



Haugrud & Peters 2018

DELAYED CANOPY SIGNIFICANTLY INCREASED WATERHEMP DENSITY 28 DAT IN GALCHUTT, ND-2019



ANOVA	Renville, MN-2017	Lake Lillian, MN-2019	Galchutt, ND-2019
P-value	0.01	0.03	0.02

INTEGRATING ROW CULTIVATION WITH SOIL RESIDUAL HERBICIDES

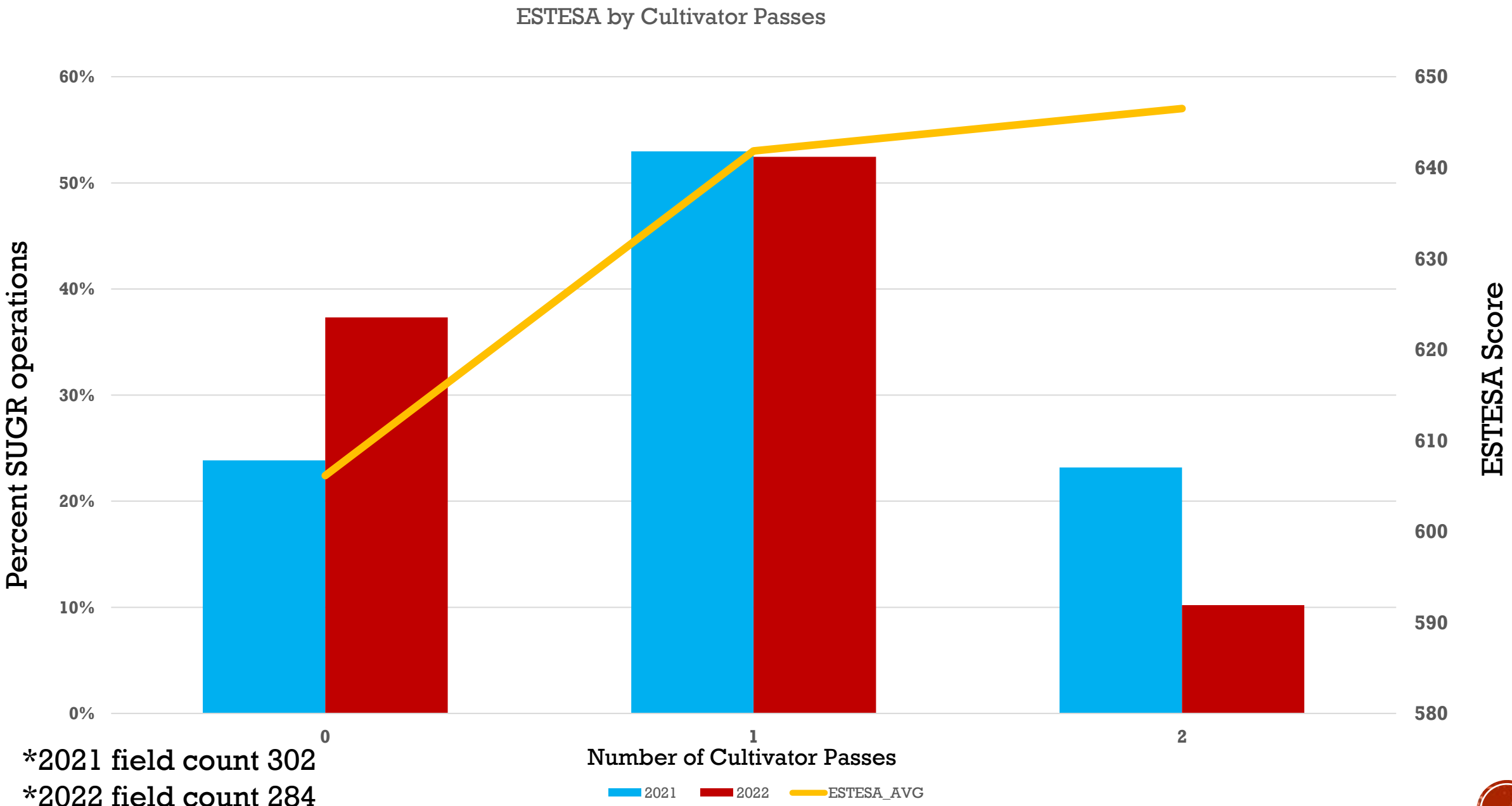
- Cultivate weed escapes before the V8 lay-by application
- The V8 lay by will serve as a barrier for further waterhemp emergence
- Common lambsquarters germination responds to light; exposing soil to red light during cultivation may stimulate further germination and emergence
- Cultivation improved waterhemp control 11-12%
- Density of newly emerging seedlings depends on crop canopy and rainfall after cultivation
- Cultivation remains a valuable tool for sustainable weed management in sugarbeet
- Don’t worry about losing losing that herbicide barrier

YIELD

- Root yield, % sucrose and recoverable sugar
- Rhizoctonia risk?
- One grower stated “I have always been told our best fight against rhizoc was parking the cultivator. So I use it as little as possible.”
- Rhizoctonia management practices and variety rating <4.0

CULTIVATION TIMING HAD NO EFFECT ON SUGARBEET YIELD ACROSS ALL ENVIRONMENTS IN 2018

	Sugarbeet yield components		
Cultivation timing	Root yield	Sucrose content	Recoverable sucrose
	Mg ha^{-1}	%	Kg ha^{-1}
Control	54.4	15.0	7,640
June 21	54.1	14.8	7,591
July 5	55.4	14.9	7,772
July 19	52.8	14.9	7,356
August 2	57.0	14.7	7,733
August 16	54.7	14.5	7,318
June 21 + July 19	54.5	14.5	7,486
July 5 + Aug 2	55.3	14.6	7,507
July 19 + Aug 16	52.6	14.8	7,254
June 21 + July 19 + Aug 16	52.7	14.8	7,330
LSD (0.05)	**NS**	**NS**	**NS**



*2021 field count 302

*2022 field count 284

INTER-ROW CULTIVATION SUMMARY

- Cultivation improved waterhemp control 11-12%
- Density of newly emerging seedlings depends on crop canopy and rainfall
- Time near to crop closure – Single pass or second pass
- Cultivation remains a valuable tool for sustainable weed management in sugarbeet
- No yield hit when using recommended agronomic practices
- There are other questions we can not answer. We appreciate your experiences and opinions


Schmoll Farms
Lake Lillian, MN

INCORPORATING SOIL RESIDUAL HERBICIDES

COMPARISON OF PPI AND PRE ETHOFUMESATE AT 3.75 TO 4.0 LB/A, 1973-1986

Nortron application	4 of 7 locations Redroot pigweed	3 of 7 locations Redroot pigweed
	%	%
PPI	97	91
PRE	79	93
LSD (0.05)	11	NS

Why the difference in control across locations?

WEED CONTROL IN RESPONSE TO HERBICIDE TREATMENT AND INCORPORATION DEPTH[A]

Herbicide Treatment	Incorporation depth	Redroot pigweed	Common Lambsquarters	Mean
	inch	%	%	%
Nortron + Ro-Neet	1	83	91	87
Nortron + Ro-Neet	2	100	100	100
Nortron + Ro-Neet	4	100	100	100
Nortron + TCA	1	93	87	90
Nortron + TCA	2	93	89	91
Nortron + TCA	4	83	73	78

[a]Dexter (1979) Depth of Incorporation, Sgbt. Res. Ext. Repts., 9:81

RESULTS FROM INCORPORATION DEMONSTRATION CONDUCTED SEPTEMBER 1979, COMPARISON OF HERBICIDE INCORPORATION TOOLS (1982), AG DEXTER ET AL., SBREB, 12:49-56.

Tool	Tillage Depth	Speed	Incorporate Depth	Dye left on surface	Uniformity [a]
	inch	MPH	inch	%	0-10
Tandem disk	4	5	3.5	15	2
Field cultivator	4	5	3	30	4
Melroe cultivator	3	8	1.5	20	6
Alloway seedbetter	4	7	1.5	15	9
Koehn field cultivator with crumblers	5	8	2	10	9
Triple K soil condition with crumblers	3	8	2.5	20	7
Spring-tine harrow	2	7	1.5	60	2

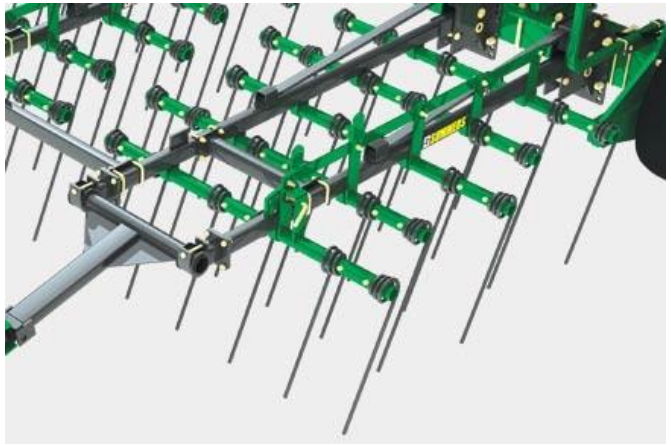
[a] 0 = poor, 10 = excellent

TILLAGE EQUIPMENT IN 2023

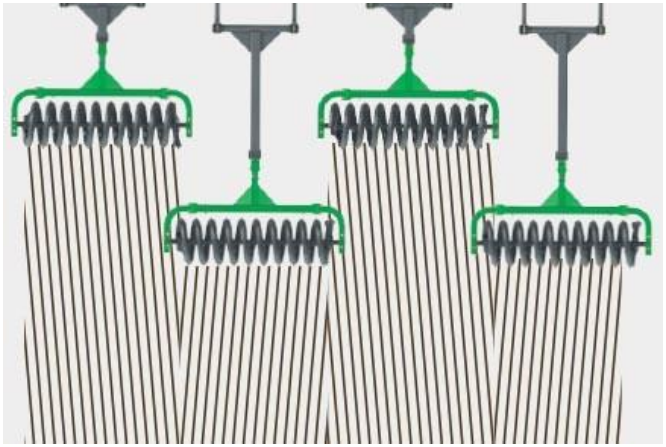
Superharrow with 1/2-inch diameter teeth and eight full rows of harrows, 36-, 48-, 60-, 72- and 84-foot widths

Superweeder combines four ranks of Vibra™ S-tines with a five-bar harrow.

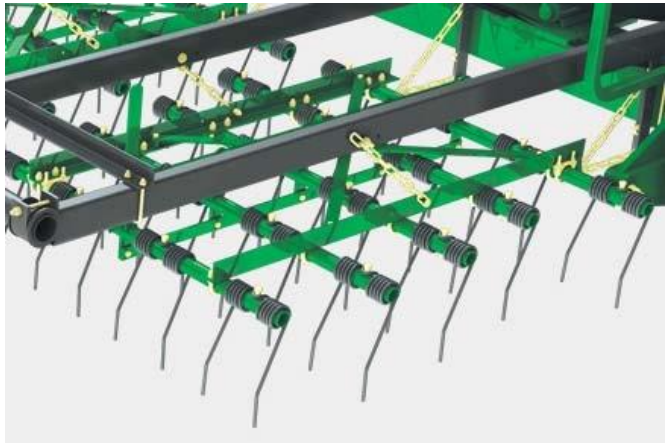
Harrow Packer



Coil Packer

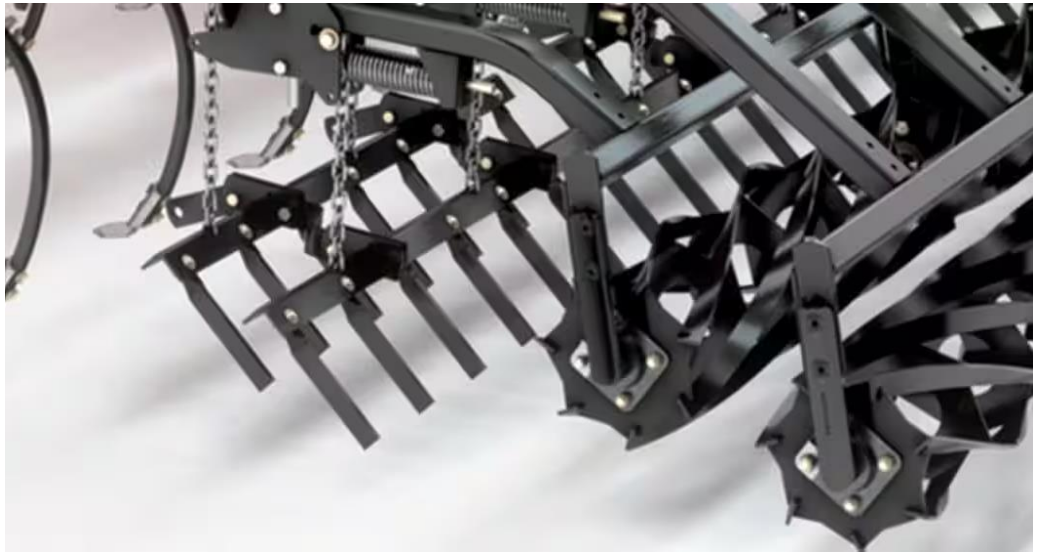


Bent Tine



CASE IH TIGER-MATE
22 TO 60 FT WIDTH

C-shank or Vibra-Tine 265 S-tine field cultivator



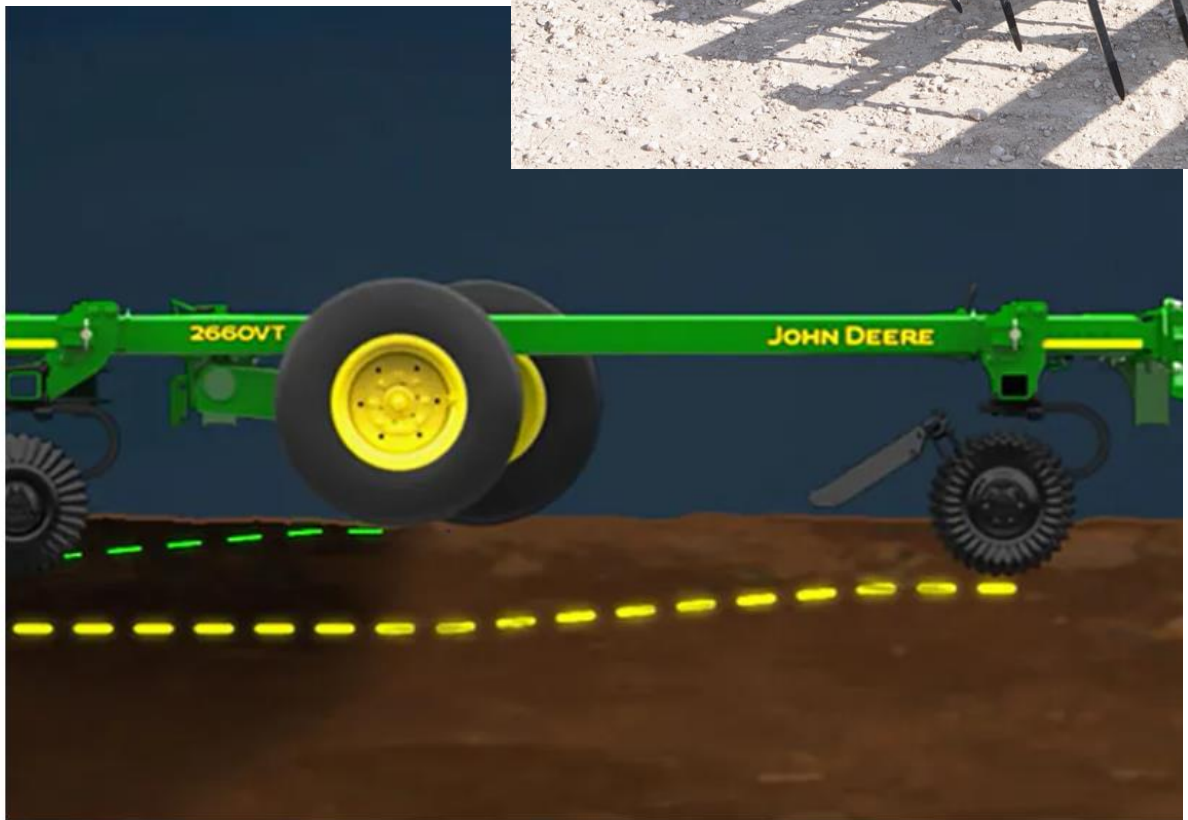
DEERE 2230

Maintain Consistent Depth with TruSet™ Active

Improve depth accuracy with John Deere's industry exclusive TruSet Active. With no need for operator input, TruSet Active adjusts for varying field conditions like residue build up on tires or tire sink in soft soils. This makes the machine smarter, allowing it to adjust itself, paving the way for adoption of future technologies that improve precision and save labor.

Learn More about TruSet Active & TruSet

View Performance Upgrade Kits



WHAT ABOUT VERTICAL TILLAGE TO INCORPORATE ETHOFUMESATE?

- Better ability to size and incorporate higher residue levels
- Is the chemical on the residue or the soil?
- Makes sense with fall/winter cover crop fields
- Less/no experience in conventional tillage
- What other tillage tools should be tried?

SUMMARY

- Set the equipment to a depth from 2 to 3 inch
- Speed is good
- Harrow/crumblers seem to improve mixing
- Spike tooth harrow alone was not sufficient

SPRAYER BEST MANAGEMENT PRACTICES

WHAT AFFECTS MY SPRAY?

- Volume
- Nozzle selection
- Droplet size
- Boom height
- Environment
- Chemistry and Adjuvant selection
- Mixing order
- Cleanout

SPRAY VOLUME

- Speed, nozzle, pressure
- Non-Systemic
- Systemic
- Rate control

K&D Krueger Farms & Sons
East Grand Forks, MN


POWER
ON
OFF
FLOW CONTROL
RATE 1
RATE 2
MAN
INC
DEC
BOOM 1
BOOM 2
BOOM 3
ON
OFF
RATE
DATA
RAVEN SprayerControl

NOZZLE SELECTION

- Flat fan, Twinjet etc.
- Take a look, it's in a book!

	PSI	DROP SIZE 80°	DROP SIZE TIP°	CAPACITY ONE NOZZLE IN GPM	CAPACITY ONE NOZZLE IN OZ./MIN.	20° GPA 4 MPH	5 MPH	6 MPH	8 MPH	10 MPH	12 MPH	15 MPH	20 MPH	GALLONS PER 1000 SQ. FT. 2 MPH	3 MPH	4 MPH	5 MPH
DG80015† DG110015 (100)	30	M	M	0.13	17	9.7	7.7	6.4	4.8	3.9	3.2	2.6	1.9	0.44	0.29	0.22	0.18
	35	M	M	0.14	18	10.4	8.3	6.9	5.2	4.2	3.5	2.8	2.1	0.48	0.32	0.24	0.19
	40	M	F	0.15	19	11.1	8.9	7.4	5.6	4.5	3.7	3.0	2.2	0.51	0.34	0.26	0.20
	50	M	F	0.17	22	12.6	10.1	8.4	6.3	5.0	4.2	3.4	2.5	0.58	0.39	0.29	0.23
	60	F	F	0.18	23	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
DG8002† DG11002 (50)	30	M	M	0.17	22	12.6	10.1	8.4	6.3	5.0	4.2	3.4	2.5	0.58	0.39	0.29	0.23
	35	M	M	0.19	24	14.1	11.3	9.4	7.1	5.6	4.7	3.8	2.8	0.65	0.43	0.32	0.26
	40	M	M	0.20	26	14.9	11.9	9.9	7.4	5.9	5.0	4.0	3.0	0.68	0.45	0.34	0.27
	50	M	M	0.22	28	16.3	13.1	10.9	8.2	6.5	5.4	4.4	3.3	0.75	0.50	0.37	0.30
	60	M	M	0.24	31	17.8	14.3	11.9	8.9	7.1	5.9	4.8	3.6	0.82	0.54	0.41	0.33
DG8003† DG11003 (50)	30	C	C	0.26	33	19.3	15.4	12.9	9.7	7.7	6.4	5.1	3.9	0.88	0.59	0.44	0.35
	35	M	M	0.28	36	21	16.6	13.9	10.4	8.3	6.9	5.5	4.2	0.95	0.63	0.48	0.38
	40	M	M	0.30	38	22	17.8	14.9	11.1	8.9	7.4	5.9	4.5	1.0	0.68	0.51	0.41
	50	M	M	0.34	44	25	20	16.8	12.6	10.1	8.4	6.7	5.0	1.2	0.77	0.58	0.46
	60	M	M	0.37	47	27	22	18.3	13.7	11.0	9.2	7.3	5.5	1.3	0.84	0.63	0.50
DG8004† DG11004 (50)	30	C	C	0.35	45	26	21	17.3	13.0	10.4	8.7	6.9	5.2	1.2	0.79	0.60	0.48
	35	C	C	0.37	47	27	22	18.3	13.7	11.0	9.2	7.3	5.5	1.3	0.84	0.63	0.50
	40	C	M	0.40	51	30	24	19.8	14.9	11.9	9.9	7.9	5.9	1.4	0.91	0.68	0.54
	50	M	M	0.45	58	33	27	22	16.7	13.4	11.1	8.9	6.7	1.5	1.0	0.77	0.61
	60	M	M	0.49	63	36	29	24	18.2	14.6	12.1	9.7	7.3	1.7	1.1	0.83	0.67
DG8005† DG11005 (50)	30	C	C	0.43	55	32	26	21	16.0	12.8	10.6	8.5	6.4	1.5	0.97	0.73	0.58
	35	C	C	0.47	60	35	28	23	17.4	14.0	11.6	9.3	7.0	1.6	1.1	0.80	0.64
	40	C	C	0.50	64	37	30	25	18.6	14.9	12.4	9.9	7.4	1.7	1.1	0.85	0.68
	50	M	M	0.56	72	42	33	28	21	16.6	13.9	11.1	8.3	1.9	1.3	0.95	0.76
	60	M	M	0.61	78	45	36	30	23	18.1	15.1	12.1	9.1	2.1	1.4	1.0	0.83

www.teejet.com


www.sprayers101.com

DROPLET SIZE

- Size does matter
- Droplet spectrum ><
- Small droplets evaporate
- Large droplets can run off
- Don't spray above 90 PSI if the nozzle isn't rated for it!
- Deposition aids

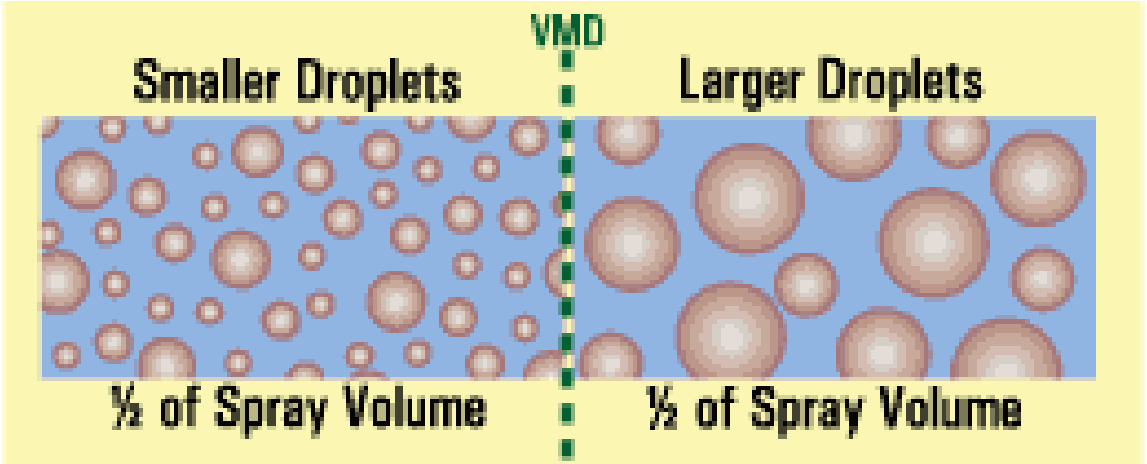
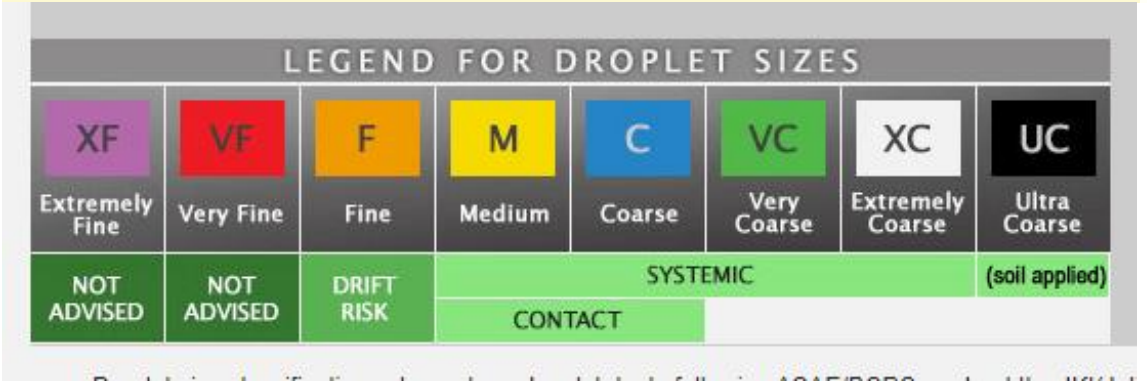


Figure 1: Droplet size is generally given as VMD (Volume Median Diameter).



DROPLET SIZE MAKES A DIFFERENCE

ADVANTAGES AND DISADVANTAGES OF VARIOUS DROPLET SIZES

Equivalent droplet volume in each quadrant*

100 MICRON

ADVANTAGES

+ Excellent coverage
+ Low droplet bounce/shatter

DISADVANTAGES

- Very fast evaporation
- Quick drying time on leaf
- Very high drift potential
- Poor canopy penetration

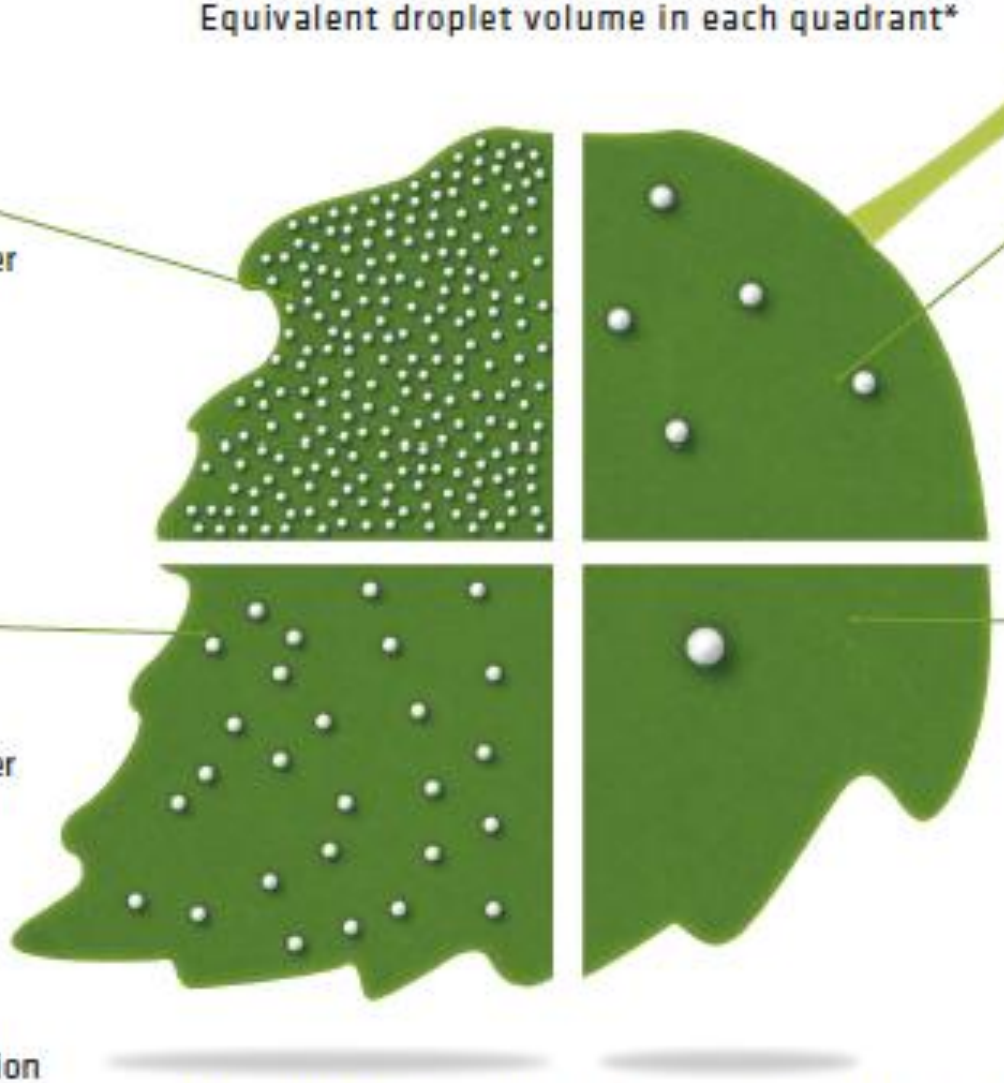
350 MICRON

ADVANTAGES

+ Good coverage
+ Moderate evaporation
+ Low drift potential
+ Good canopy penetration
+ Favorable drying time on leaf
+ Good efficacy for many pesticides

DISADVANTAGES

- Some droplet bounce/shatter



200 MICRON

ADVANTAGES

+ Very good coverage
+ Low droplet bounce/shatter
+ Good efficacy for contact pesticides

DISADVANTAGES

- Fast evaporation
- Fast drying time on leaf
- High drift potential
- Moderate canopy penetration

600 MICRON

ADVANTAGES

+ Long evaporation
+ Very low drift potential
+ Good canopy penetration
+ Long drying time on leaf

DISADVANTAGES

- Low coverage
- High droplet bounce/shatter
- Reduced efficacy for many pesticides

Regardless of which droplet size you need, using the right nozzle and adding InterLock® adjuvant to the tank will increase the number of right-sized droplets you are seeking.

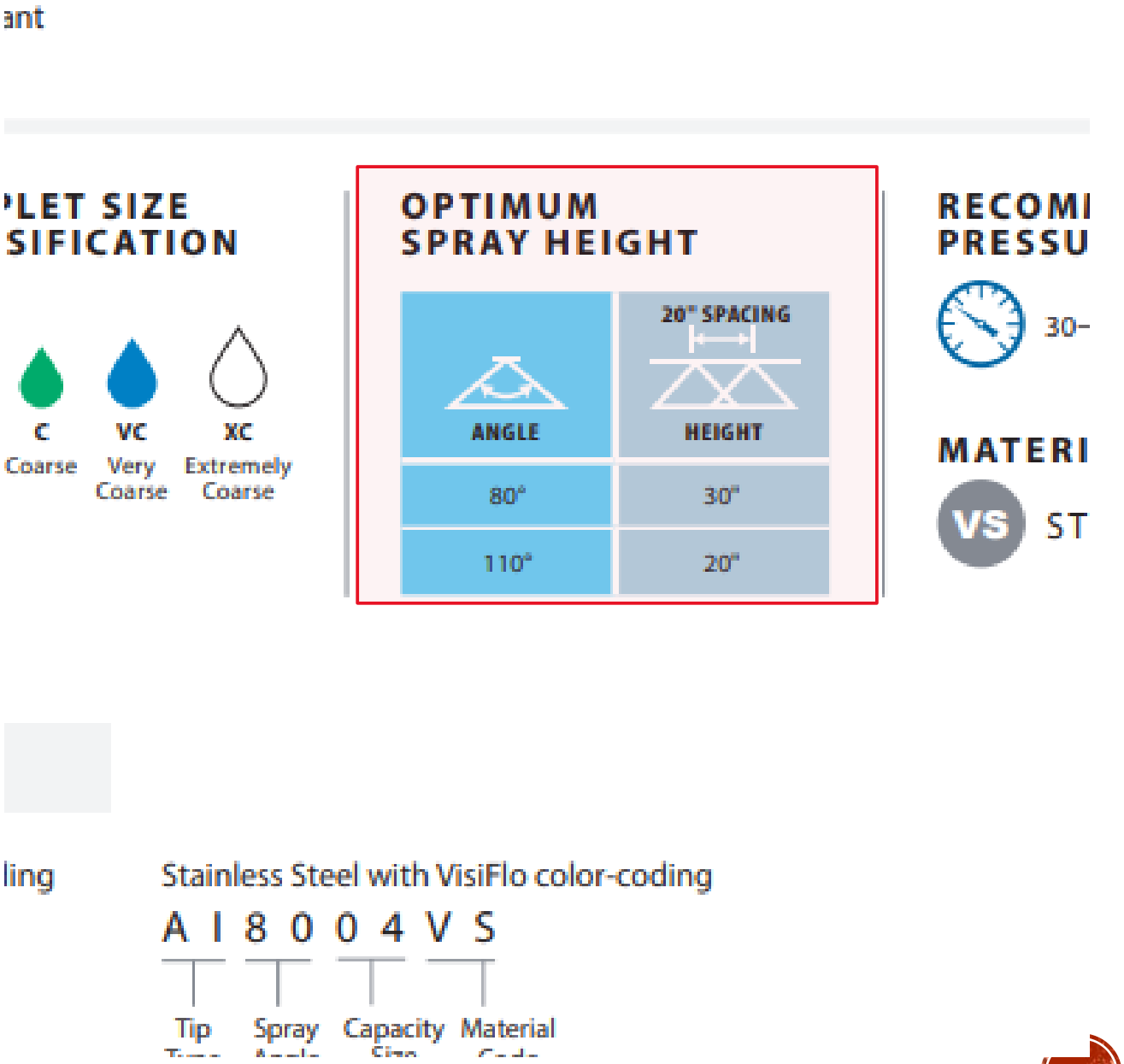
*Relative comparisons. Results vary depending on environment, products included, adjuvants, canopy characteristics and other factors.

WINFIELD Adjuvants

BOOM HEIGHT

OPTIMUM HEIGHT

- It's in the book again!
- Spray angle
- Overlap
- Wind speed



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www.sprayers101.com

ENVIRONMENT

- Wind still blows
- Rainfast time
- Temperature
- Humidity

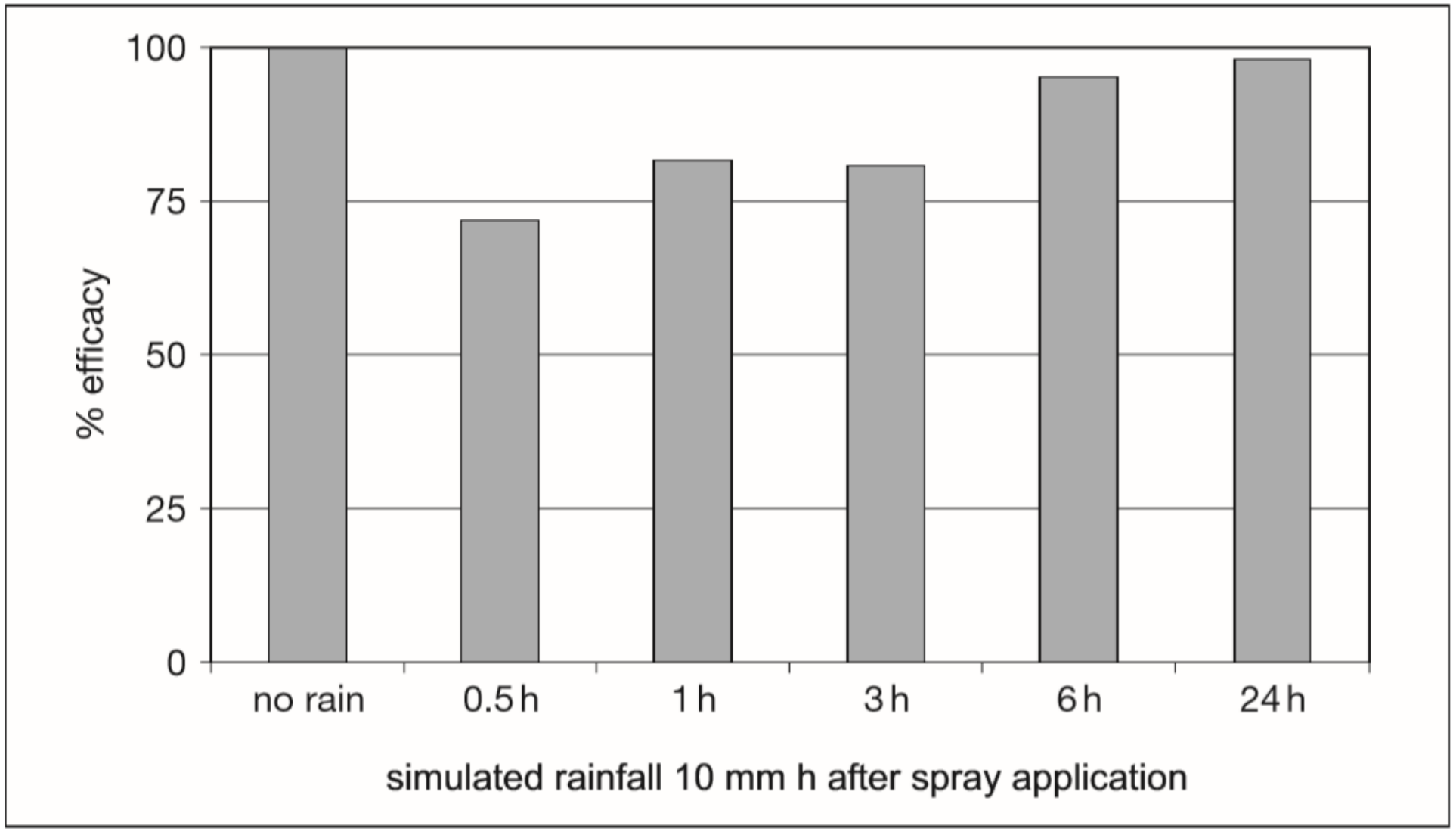

Table 1: Rain fastness of prothioconazole 250 ppm spray application
Simulated rainfall of 10 mm was applied at specific time points and % efficacy (setting of 100 % without rainfall) is shown against different plant pathogens

CHEMISTRY AND ADJUVANT SELECTION

- Right tool for the job
- Stick with the program
- Adjuvants designed to help not hurt

MULTI-SITE FUNGICIDE PROTECTION

MANZATE® PRO-STICK™ FUNGICIDE

DISPERSIBLE GRANULES

ACTIVE INGREDIENTS	BY WEIGHT
Mancozeb: A coordination product of zinc ion and manganese ethylenebisdithiocarbamate	75.0%
in which the ingredients are:	
Manganese++	15.0%
Zinc++	1.9%
Ethylenebisdithiocarbamate ion ($C_4H_6N_2S_4$) – –	58.1%
OTHER INGREDIENTS	25.0%
TOTAL	100.0%

MASTERLOCK®

DEPOSITION AID, CANOPY PENETRATION, SURFACTANT, COVERAGE, SPREADER, STICKER & DRIFT CONTROL AGENT

With

DropTight®Technology

PRINCIPAL FUNCTIONING AGENTS:

Modified vegetable oil, polyoxyethylene sorbitan fatty acid ester, vegetable oil, and soybean oil, ethoxylated 100%

All ingredients are exempt from the requirement of a tolerance in 40 CFR 180.

Patent pending

KEEP OUT OF REACH OF CHILDREN

CAUTION

PRECAUTIONARY STATEMENTS

Harmful if inhaled. Avoid breathing spray mist. Remove and wash contaminated clothing before reuse.

FIRST AID

If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

If on skin: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

If swallowed: Call a poison control center or doctor immediately for treatment advice. Have the person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or

MIXING ORDER

- A.P.P.L.E.S.
- W.A.L.E.S.
- D.A.L.E.S.
- W.A.M.L.E.G.S
- Wear PPE
- Agitation
- Dry formulations
- Agitation

- Microcapsule suspensions
- Liquid Flowables/Soluble Concentrates
- Emulsifiable Concentrates
- Glyphosates
- Surfactants

https://napervilleccgrounds.blogspot.com/2010/06/our-big-jello-mold.html

CLEANOUT

- Wear PPE
- Use the proper cleaner
- Clean the inductor
- Check main and boom section filters
- Check ends of boom sections and nozzles
- Don’t leave a problem for next time

ACKNOWLEDGEMENTS

- SBREB
- Tom Peters
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