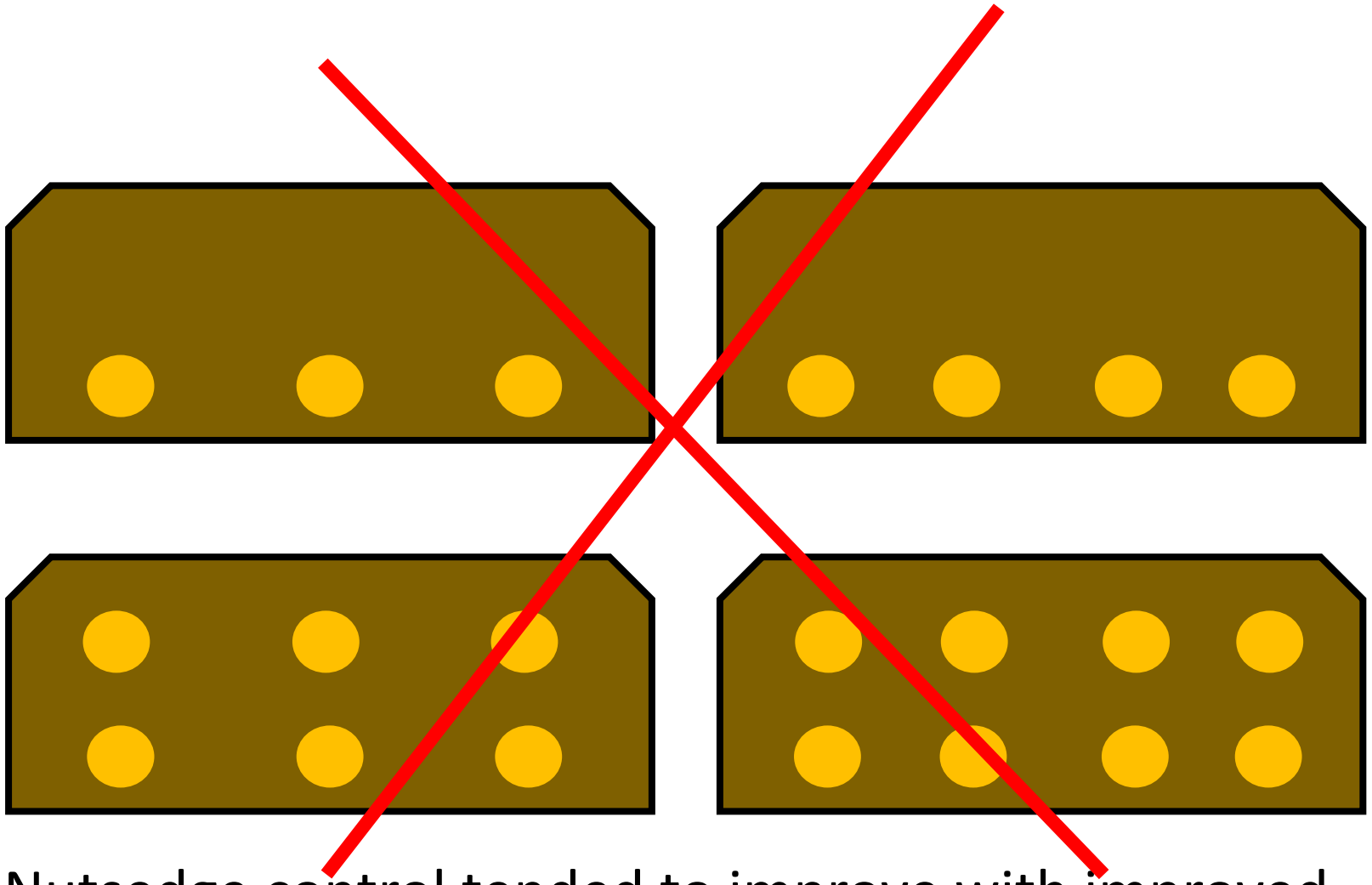
Soil Fumigation for Pest Management in Vegetable Production Systems

Dr. Nathan Boyd

Fumigant Distribution

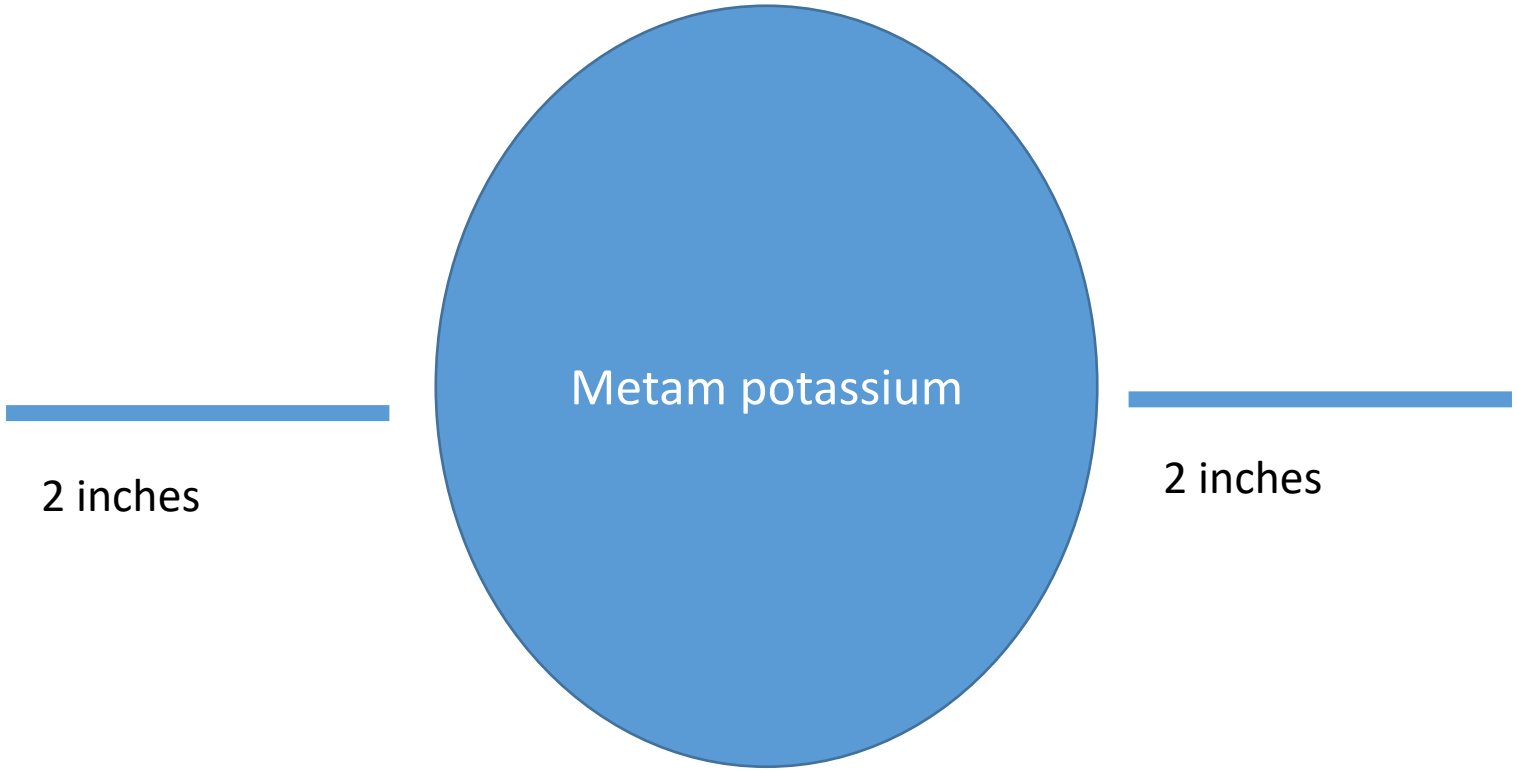
Multi-Port Trials

Enhanced Distribution



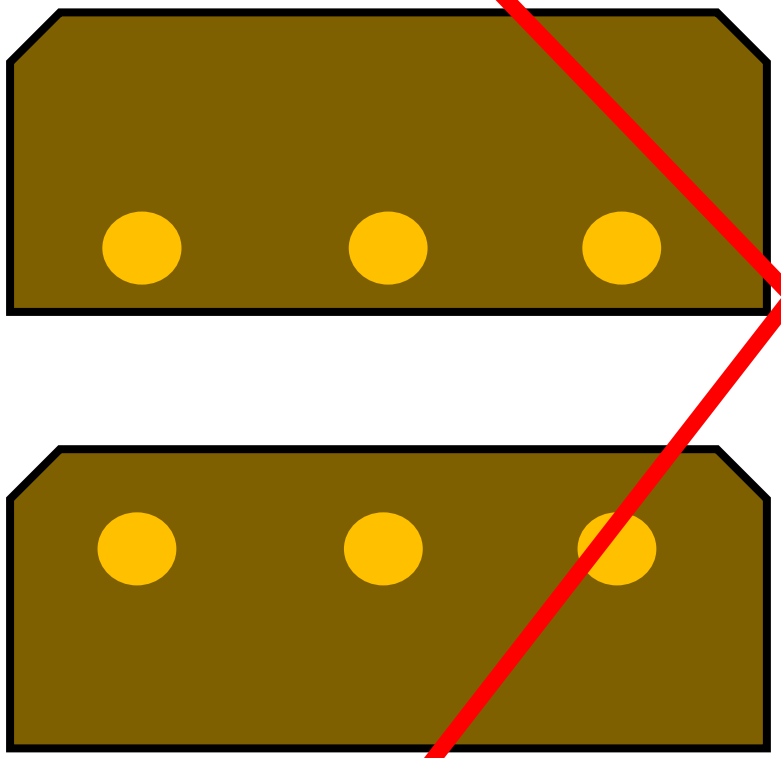
Nutsedge control tended to improve with improved distribution of metam potassium but not other fumigants

Metam potassium or metam sodium distribution in soil



Shallow Injections

Factor 1: Placement



Factor 2: Fumigant

Pic-Clor 60

Paladin Pic-21

Weed Density Following Shallow Applications of Supplemental Fumigants at GCREC

Primary Fumigant	Supplemental Fumigant	June 20 2016	Sept 1 2017	Nov 21 2017
		----------# m^{-2}----------		
None	None	184	26 ab	32
1,3-D + Pic	None	251	30 a	75
1,3-D + Pic	Metam potassium	27	14 ab	103
1,3-D + Pic	**1,3-D**	**7**	**9 ab**	**56**
1,3-D + Pic	**Chloropicrin**	**2**	**1 b**	**38**
1,3-D + Pic	S-Metolachlor	293	12 ab	60
P-Value		0.145	0.027	0.554

Fumigant Placement

Fumigant	Metam Potassium	Fall 2014	Spring 2015
		----nutsedge 10 m^{-2}----	
Nontreated	Nontreated	46 a	99 a
	4”	4 bc	35 bcd
	12”	17 ab	53 ab
	4 & 12”	2 c	37 bc
DMDS	Nontreated	2 c	16 cd
	4”	0 c	1 f
	12”	3 c	2 cde
	4 & 12”	0 c	1 f
1,3-D (39%) + Pic (60%)	Nontreated	3 c	2 ef
	4”	2 c	1 f
	12”	1 c	2 ef
	4 & 12”	0 c	1 f


Supplemental Metam Potassium
For Weed Control

Paladin + K-Pam

Paladin Pic-21

Summary

- increased number of shanks and ports do not appear to improve weed control except for metam potassium or metam sodium
- Shallow placement of metam potassium improved broadleaf and grass weed control
- K-Pam + base fumigant (Florida 3-way) may be used where growers don’t want to apply an herbicide

Plastic Mulch

Plastic Mulch

- Low Density Polyethylene Films (LDPE)
  - Mono-layer polyethylene
- Virtually Impermeable Films (VIF)

- Totally Impermeable Films (TIF)

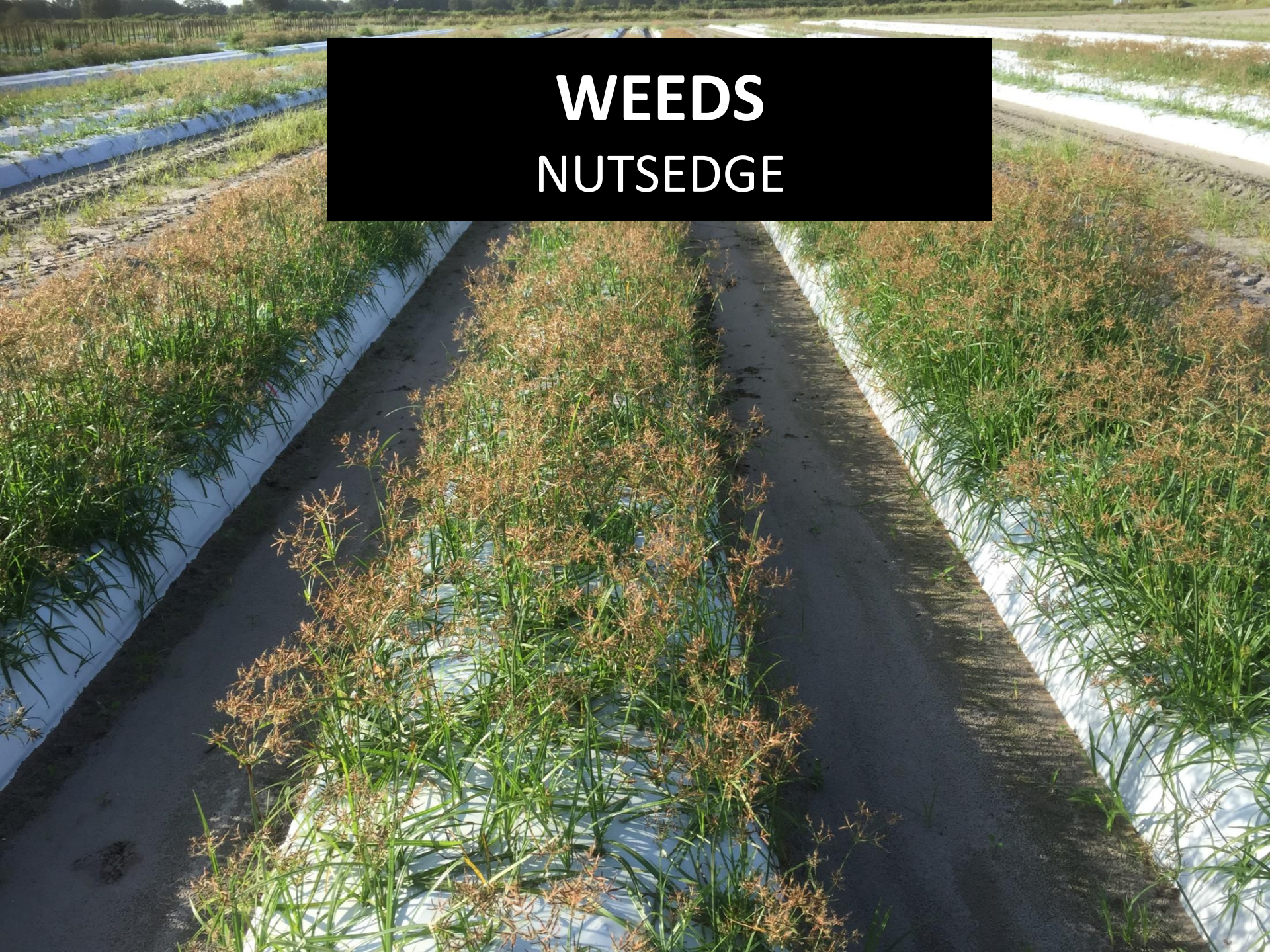
No Mulch

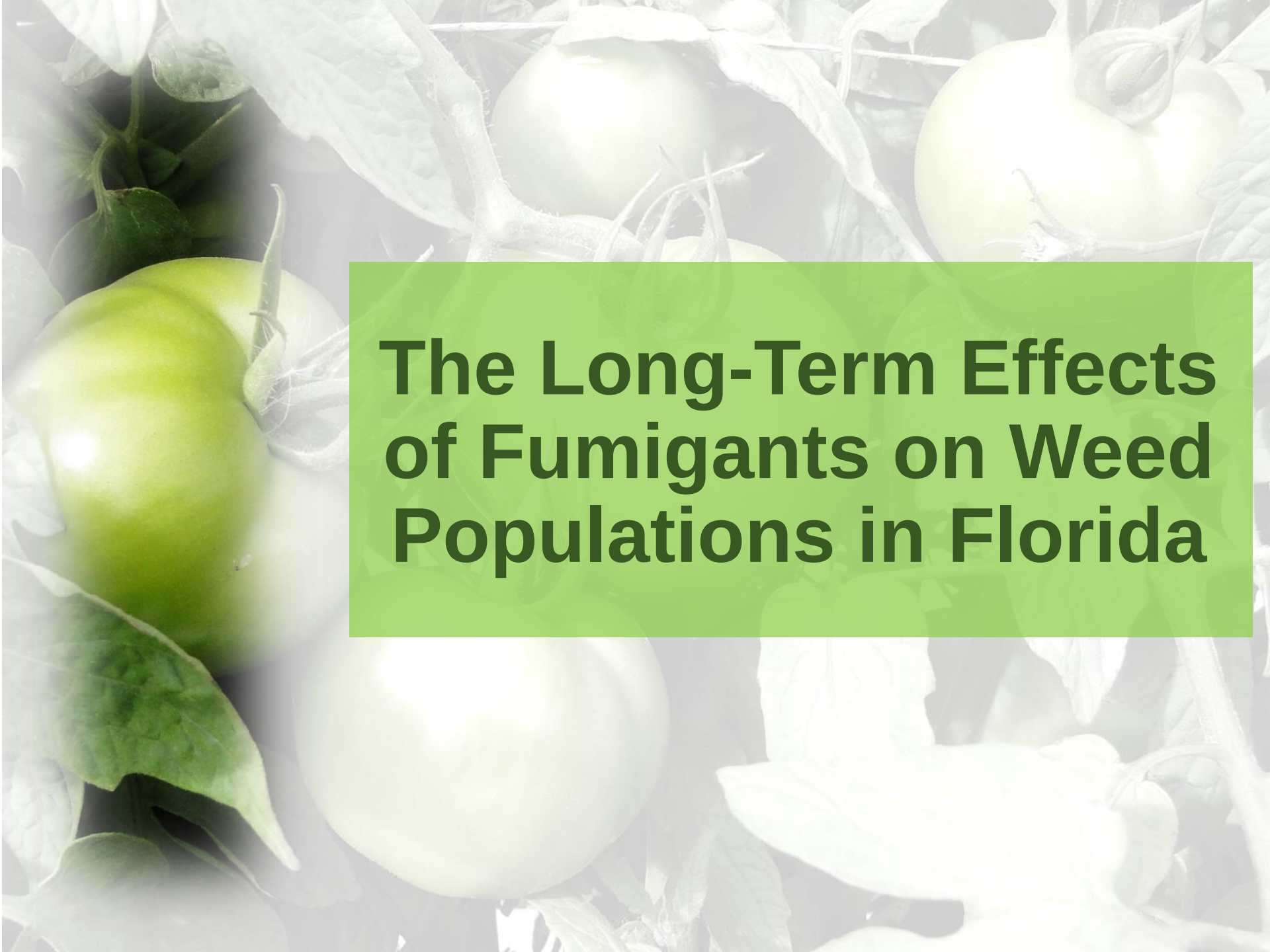
LDPE

TIF

Why Do We Fumigate?

WEED CONTROL


WEEDS
NUTSEDGE



The Long-Term Effects of Fumigants on Weed Populations in Florida

Treatment Name	Rate / Description
NTC	No fumigation
Paladin Pic-21	396 kg/ha
Pic-Clor 60	308 kg/ha
Paladin + K-Pam	396 + 475 kg/ha

Nontreated

Pic-Clor 60

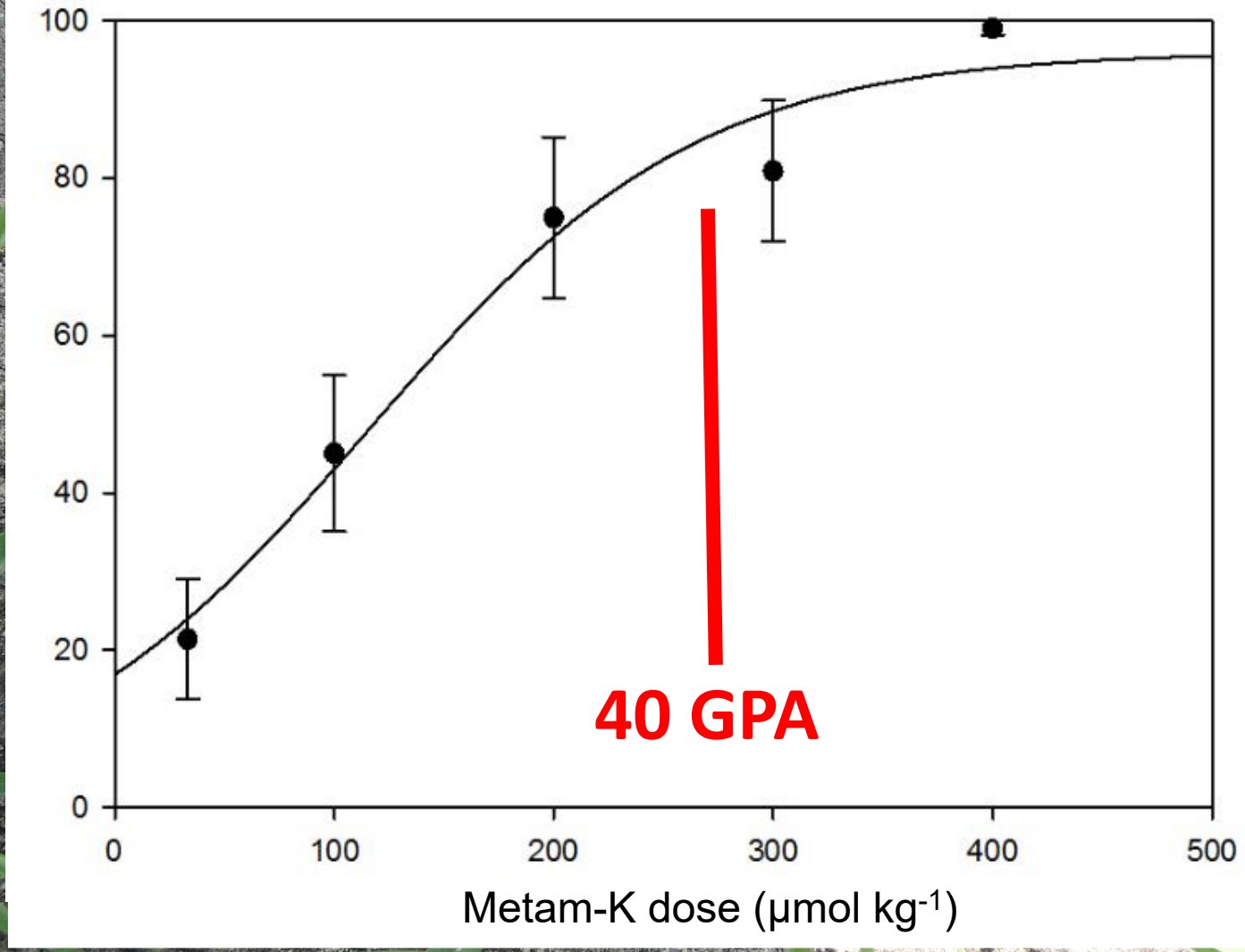
Paladin Pic-21

Paladin + K-Pam

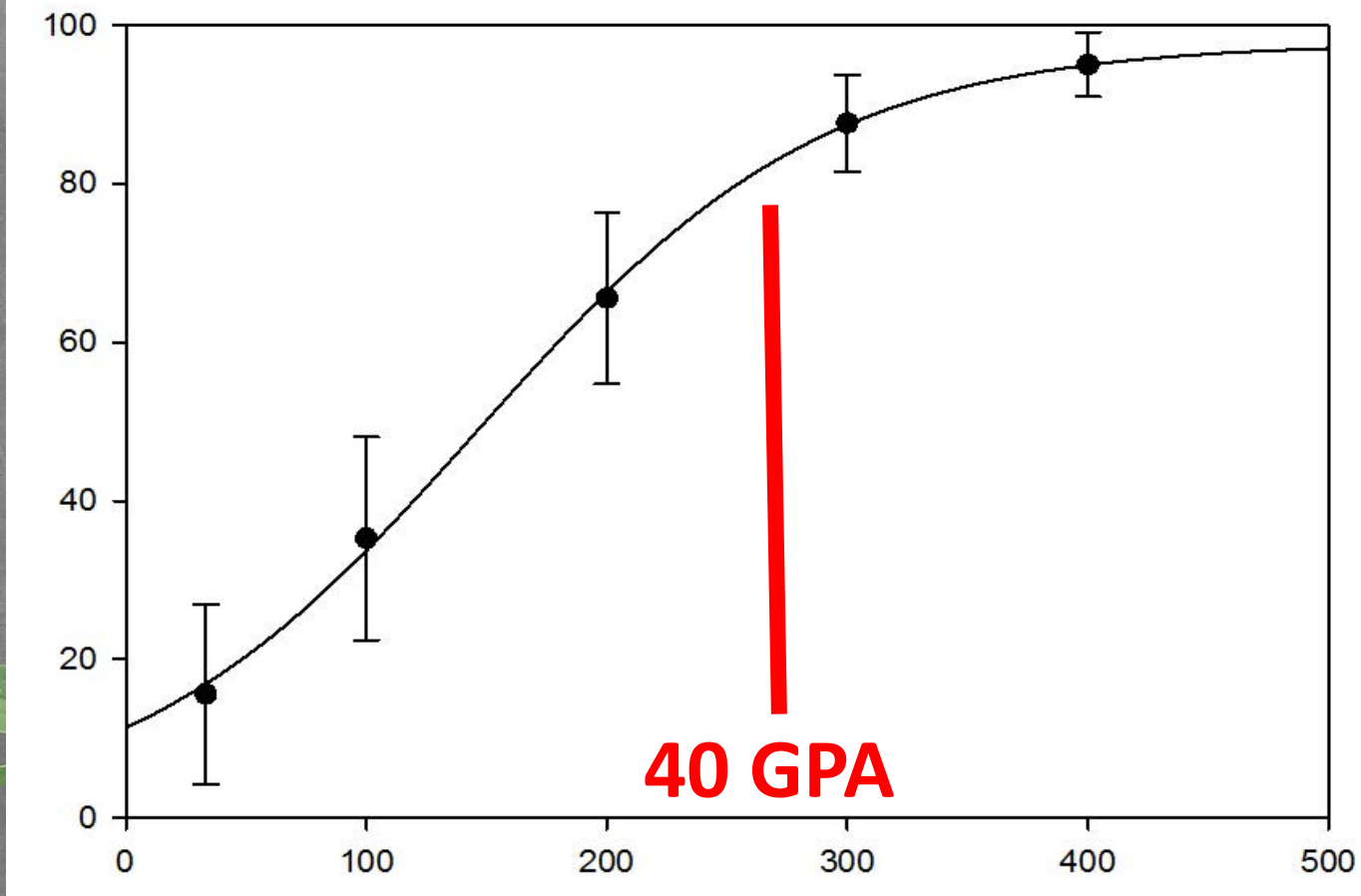
Paladin Pic-21


20
20
20
20
14400 81200
Canning in 3 Easy Steps
1 Prepare your gear
Wash & heat your jars and lids
2 Create your recipe
Use a tested recipe for home canning, see the Ball Blue Book® guide to preserving or FreshPreserving.com
3 Preserve your foods
Fill your clean jars
Boil in Waterbath or Pressure Canner for time specified in recipe
Enjoy your preserved foods within one year!
See bottom panel for complete instructions.
0 14400 81200 2

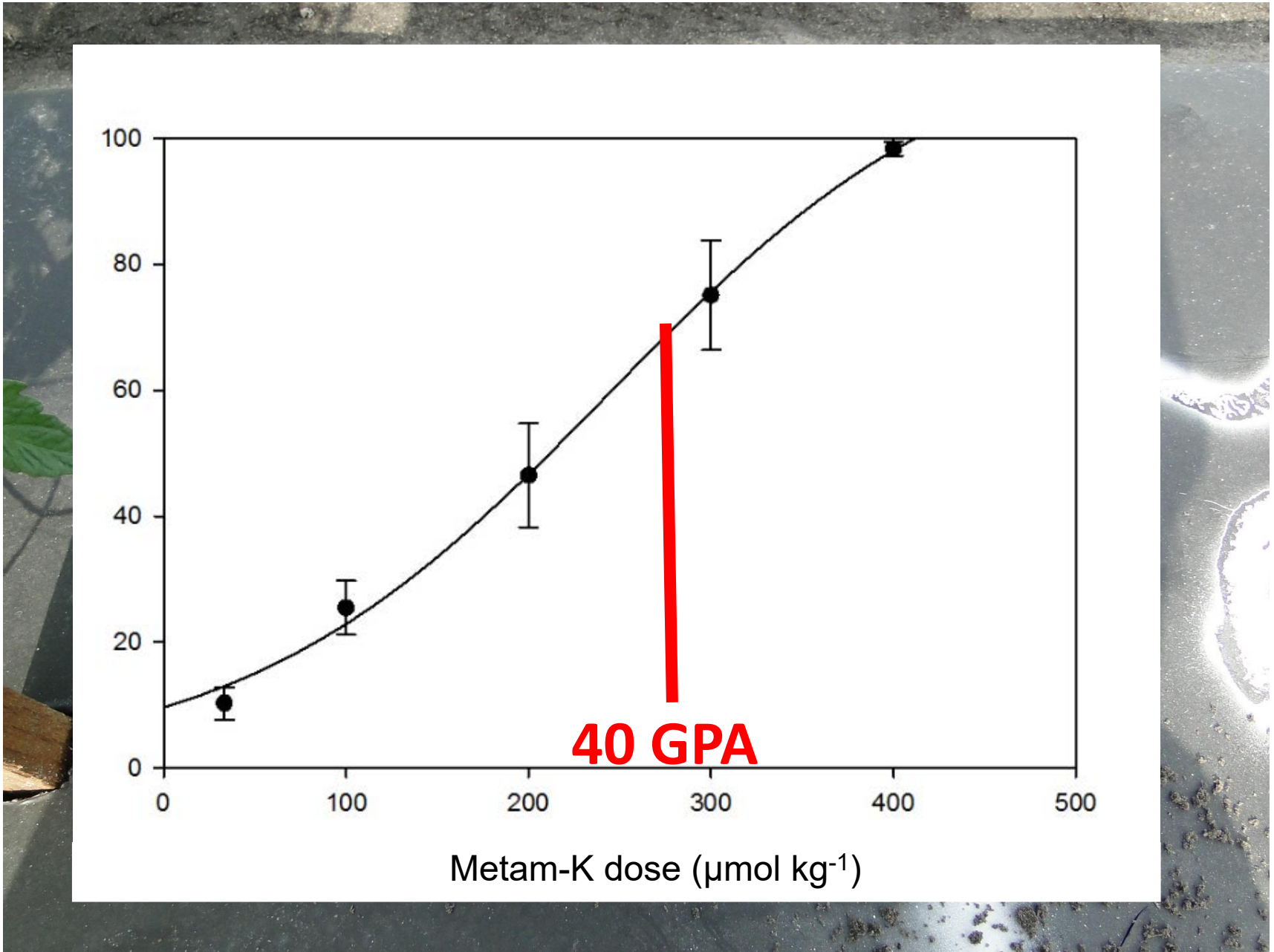
Goosegrass


100
80
60
40
20
0
0
100
200
300
400
500
40 GPA
Metam-K dose (µmol kg-1)

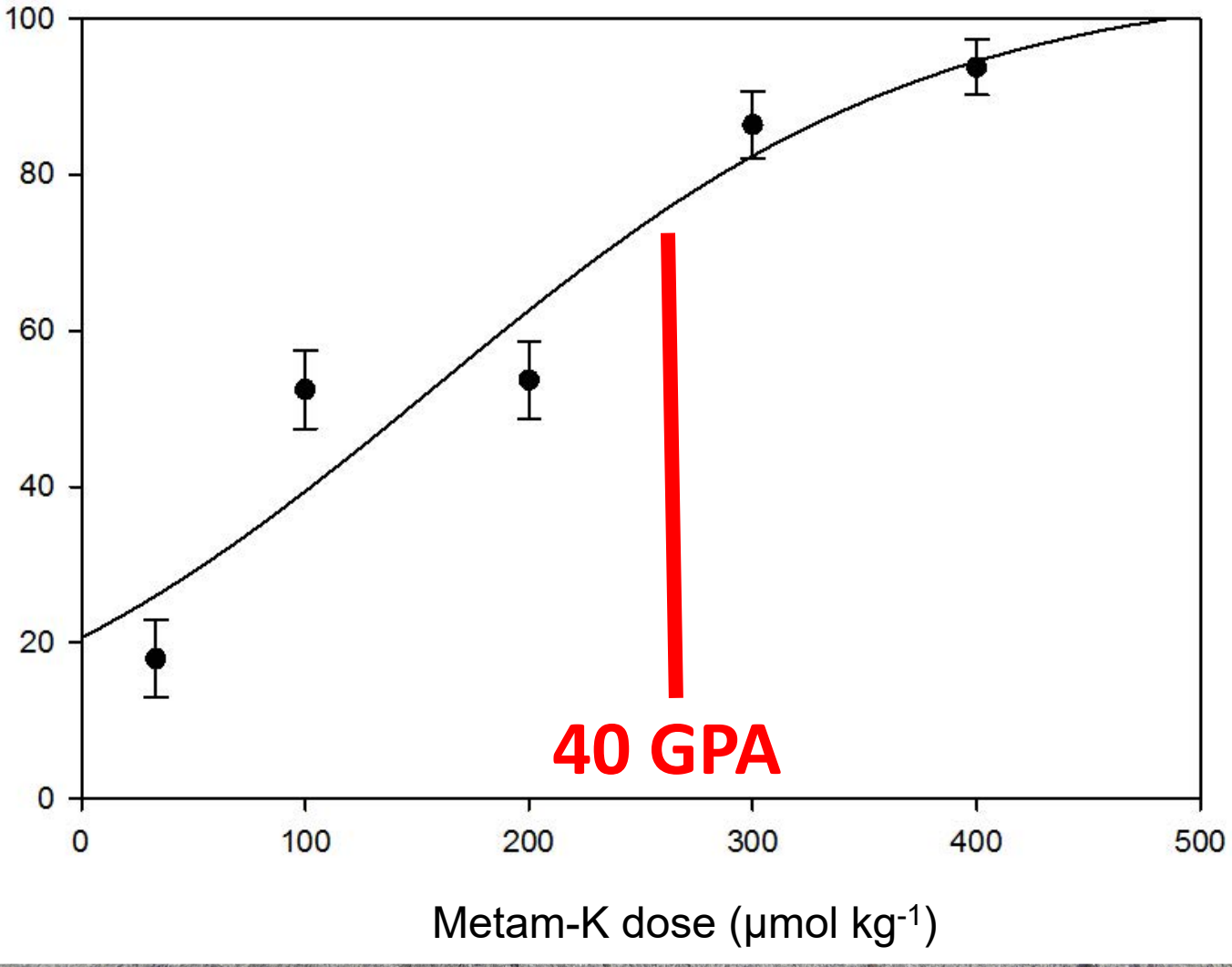
Brazilian Pusley



Black Nightshade



Common Purslane



KEY POINTS

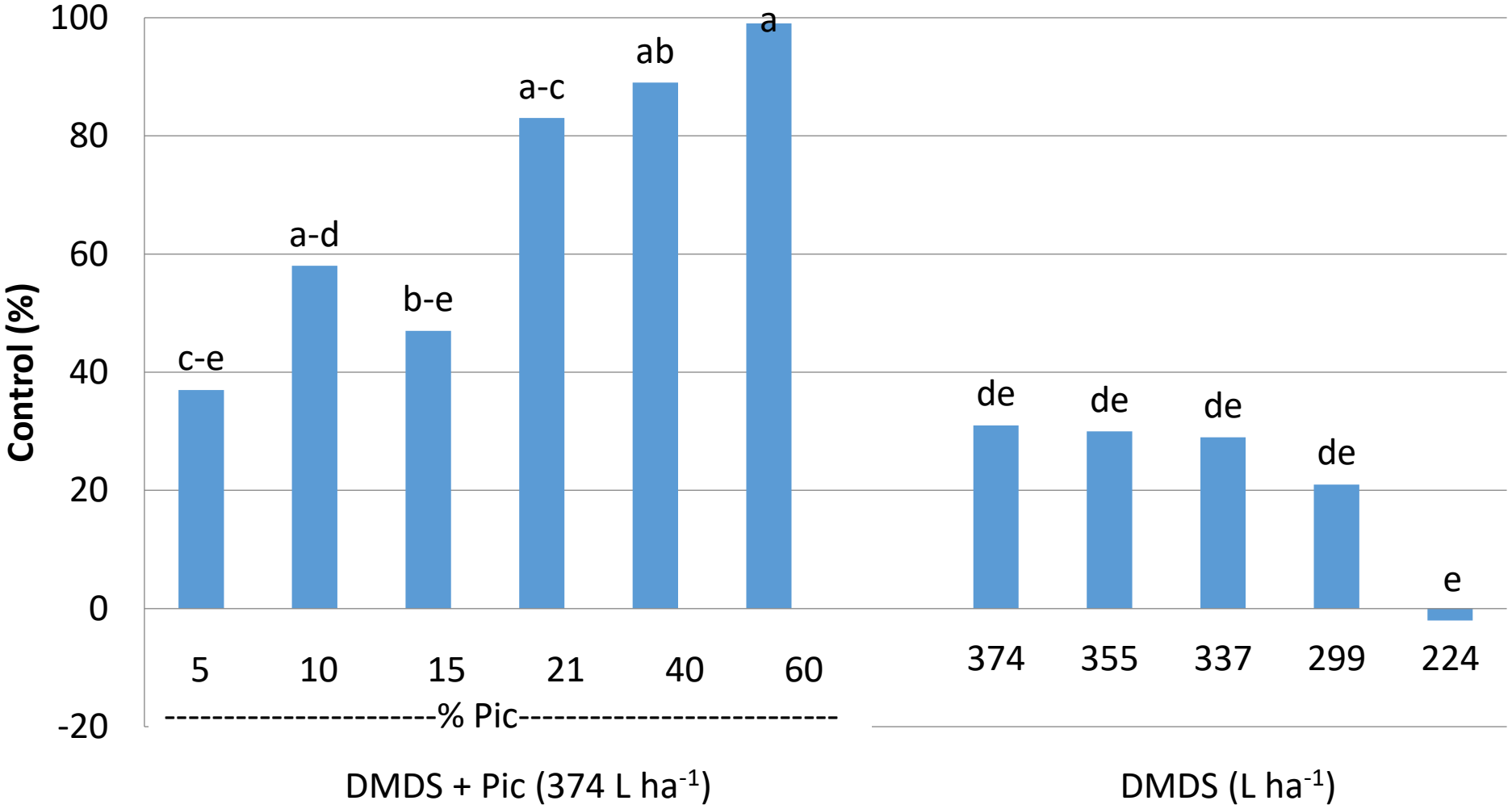
- Fumigants are a critical weed management tool for vegetable growers in the USA.
- K-Pam is probably the most effective fumigant for broadleaf weeds and can kill weed seeds

Chloropicrin and Weed Management

With Pic

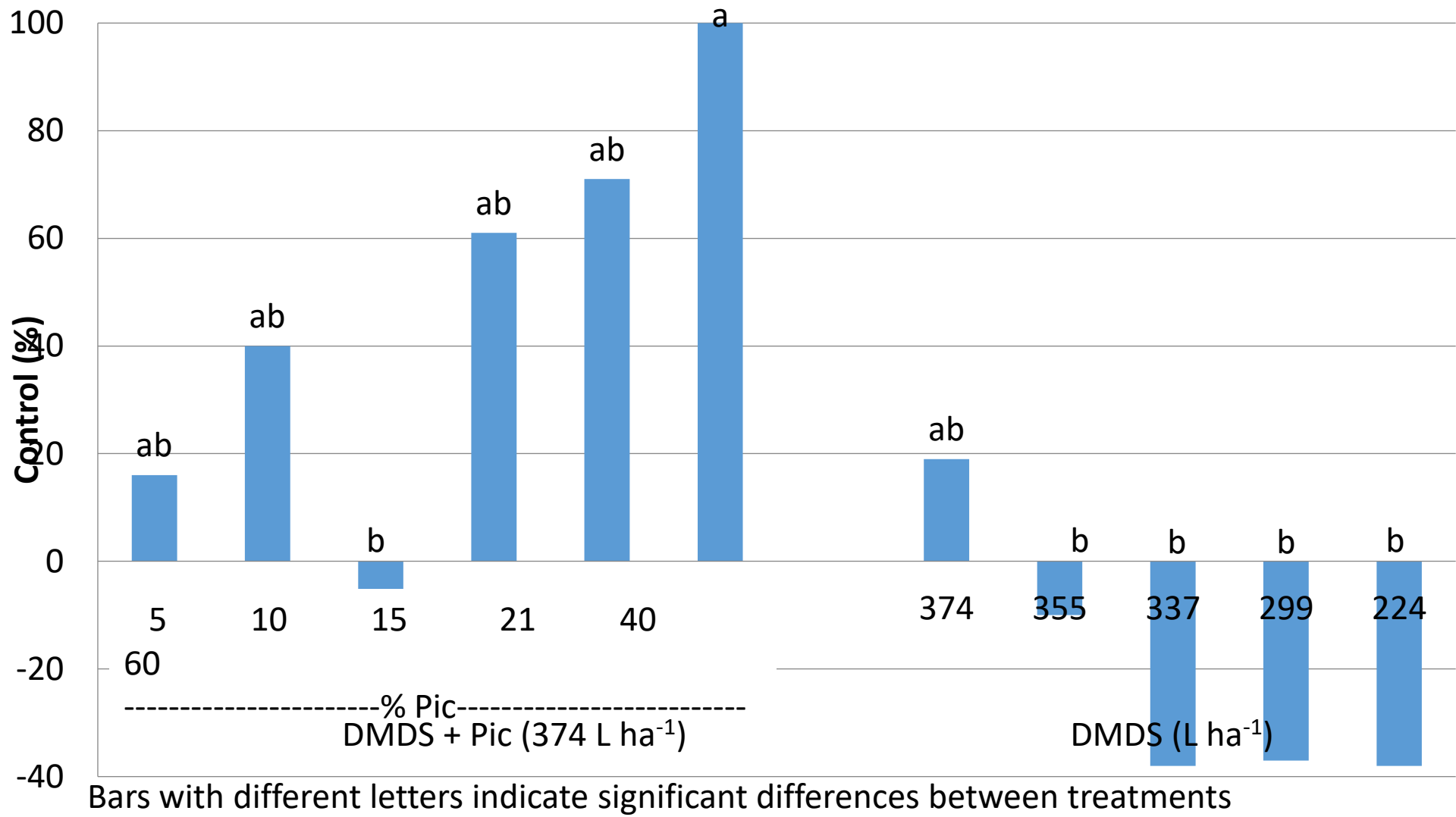
Without Pic

Purple nutsedge, 6 WATP (Fall Experiment)



Bars with different letters indicate significant differences between treatments

Purple nutsedge, 13 WATP (Fall Experiment)



Bars with different letters indicate significant differences between treatments

374 L ha^{-1} (95% DMDS + 5% Pic)

Early season

Middle season

Late season

374 L ha^{-1} (79% DMDS + 21% Pic)

Early season

Middle season

Late season

374 L ha^{-1} (40% DMDS + 60% Pic)

Early season

Middle season

Late season

Nontreated

50 lbs Pic

200 lbs Pic

Nontreated

50 lbs Pic

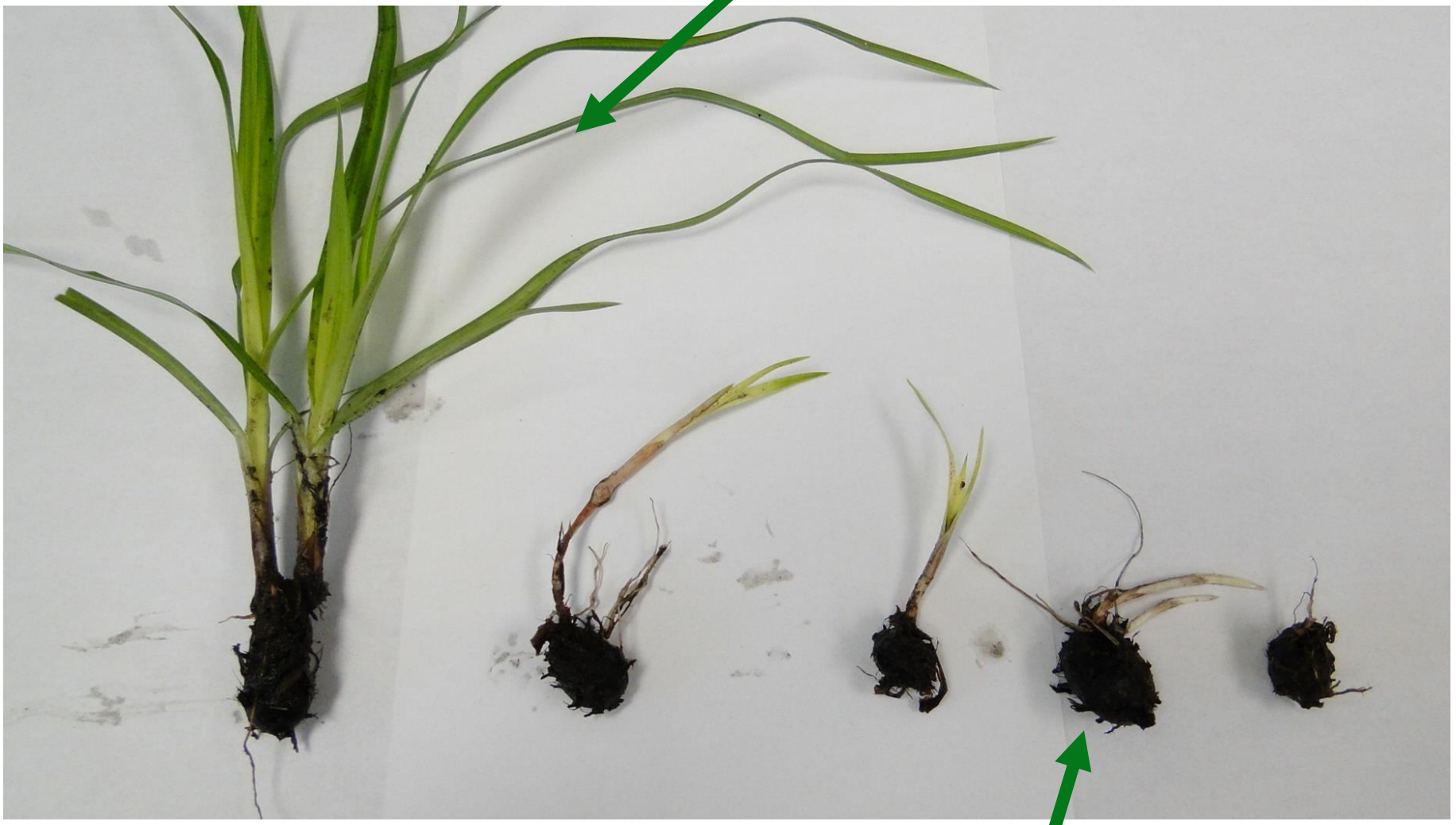
15 GPA 1,3-D

Nontreated

50 lbs Pic

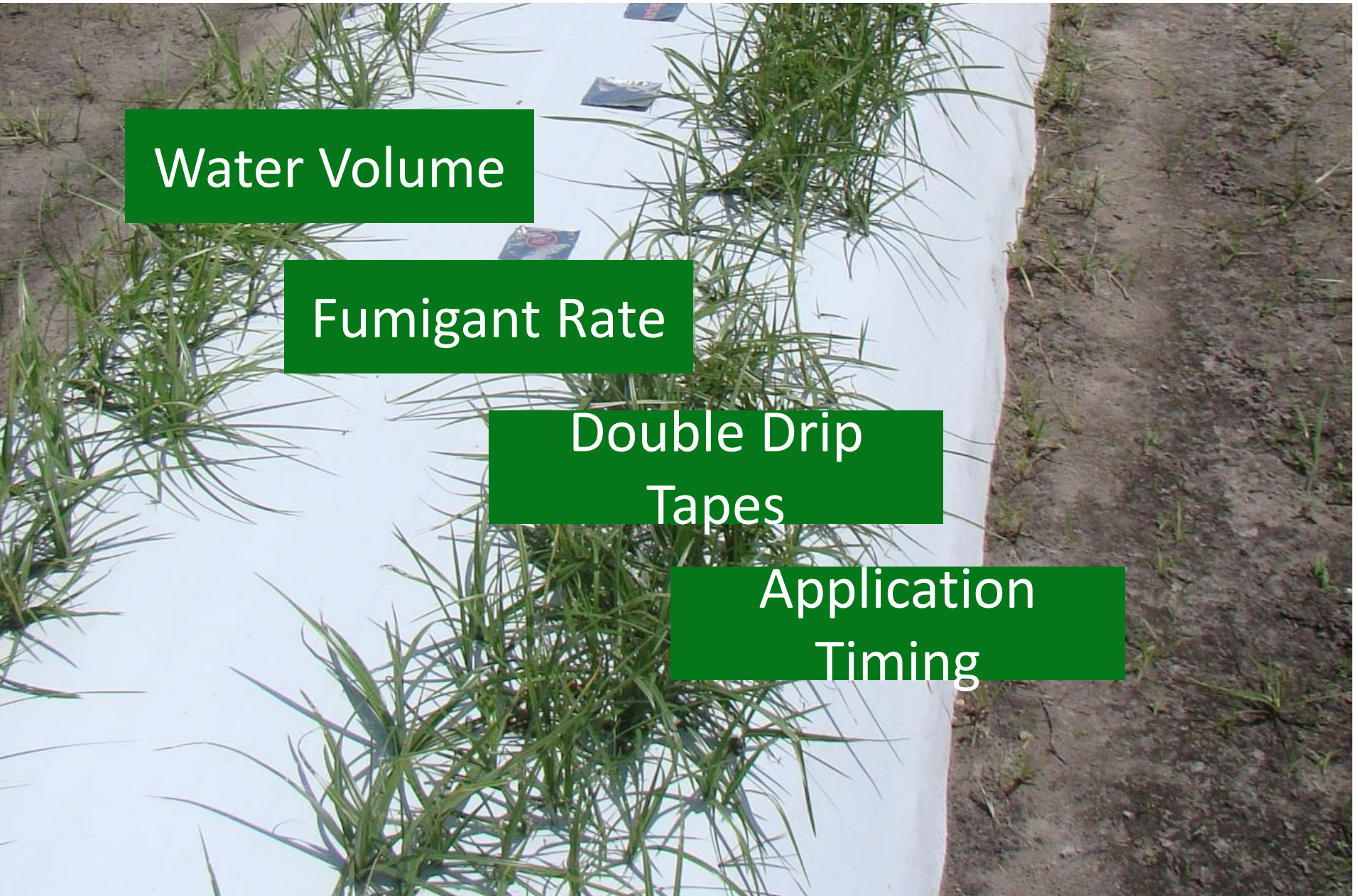
50 lbs Pic + 1,3-D

Sprouted tubers have more surface area to absorb fum



Sprouted tubers are more susceptible to fumigants

Drip Injected Fumigants



How Can We Promote Sprouting?

- Timing of cultivation
- Timing between bed formation and drip injection of fumigants
- Scarification by fumigants (combinations)

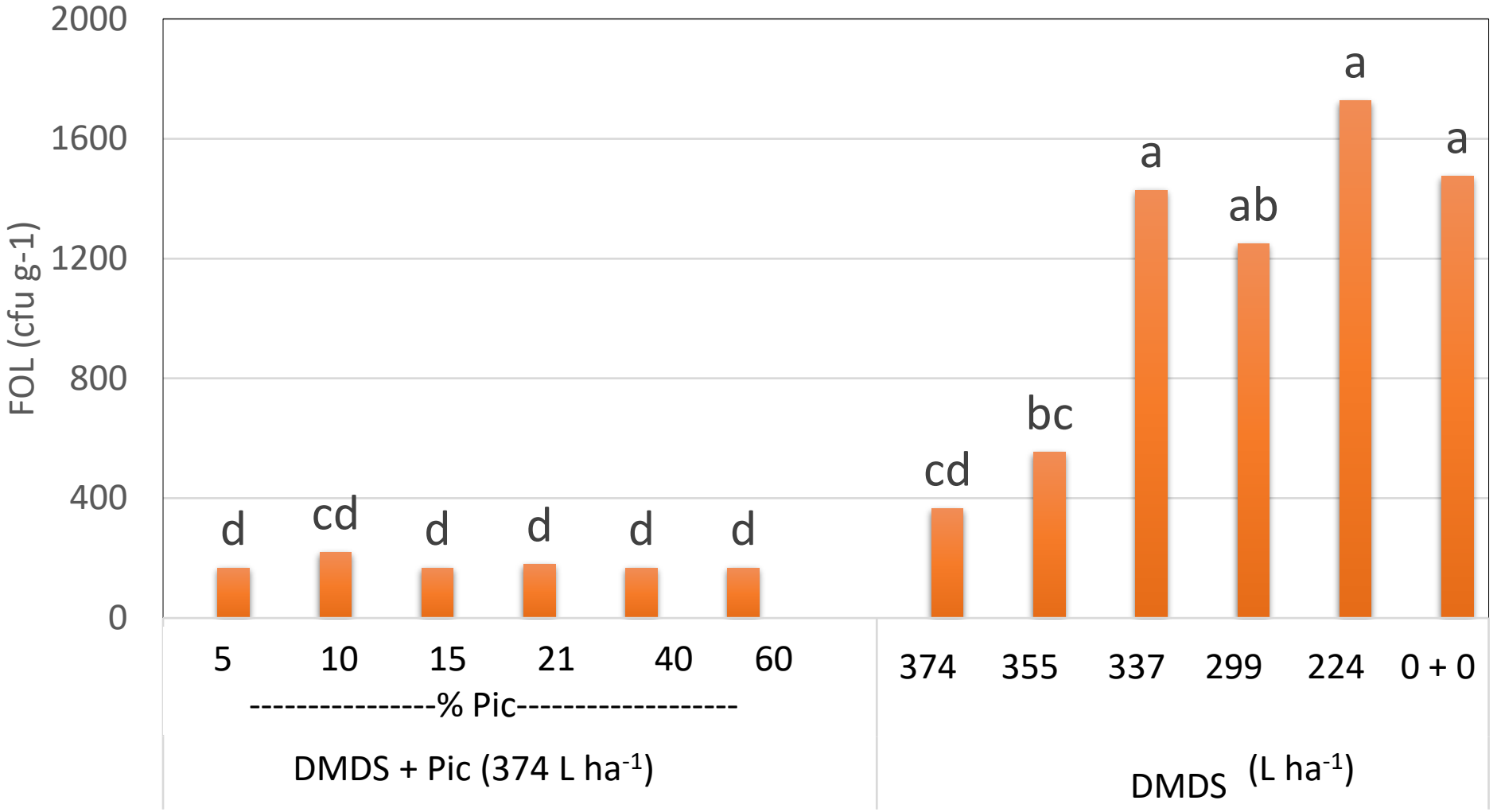
KEY POINTS

- Nutsedge management generally improves when chloropicrin is added to fumigant combinations
- A combination of products generally works better then relying on a single product.

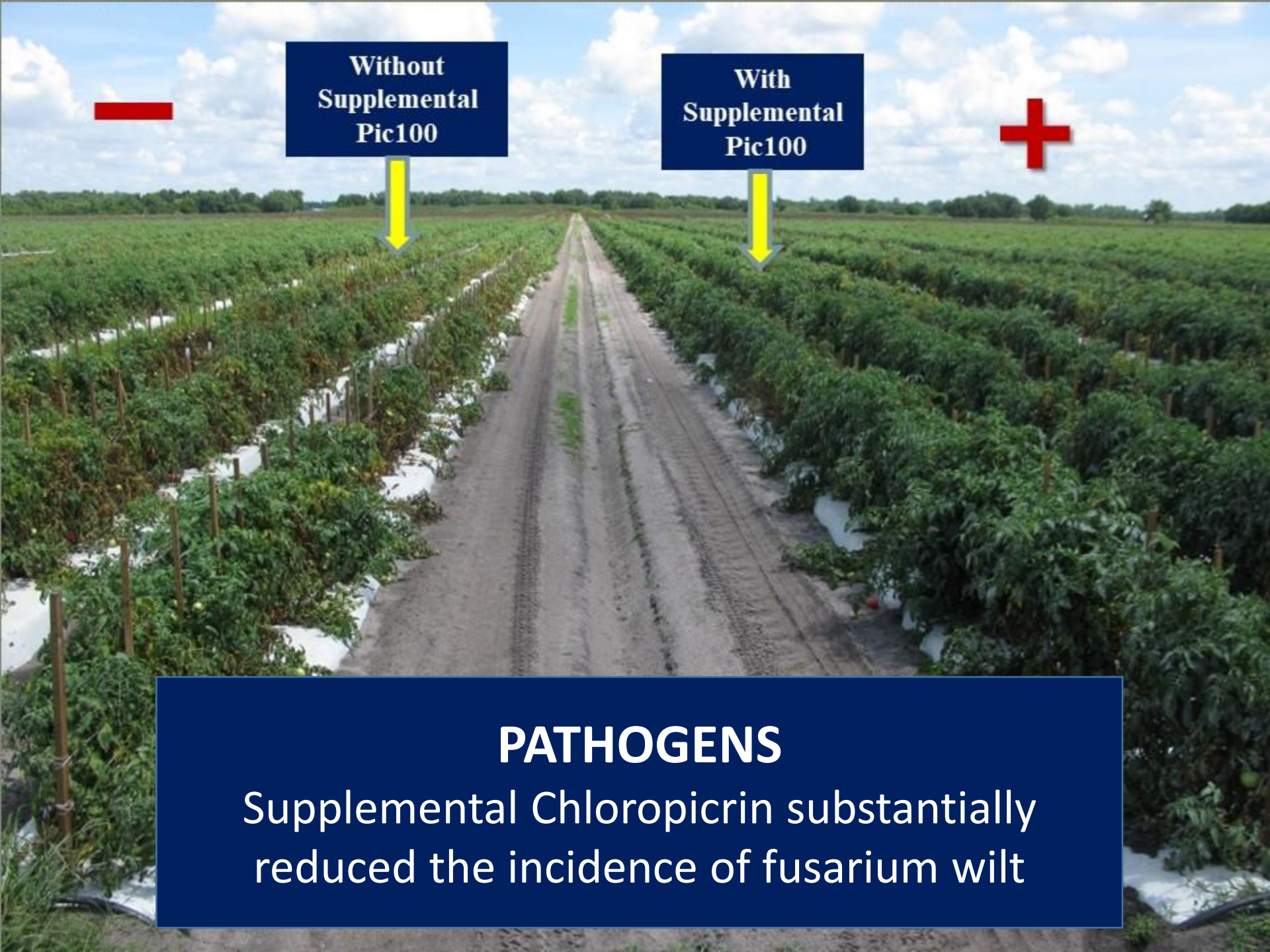
Why Do We Fumigate?

SOIL-BORNE PATHOGENS

Fusarium growth from inoculum



Bars with different letters indicate significant differences between treatments

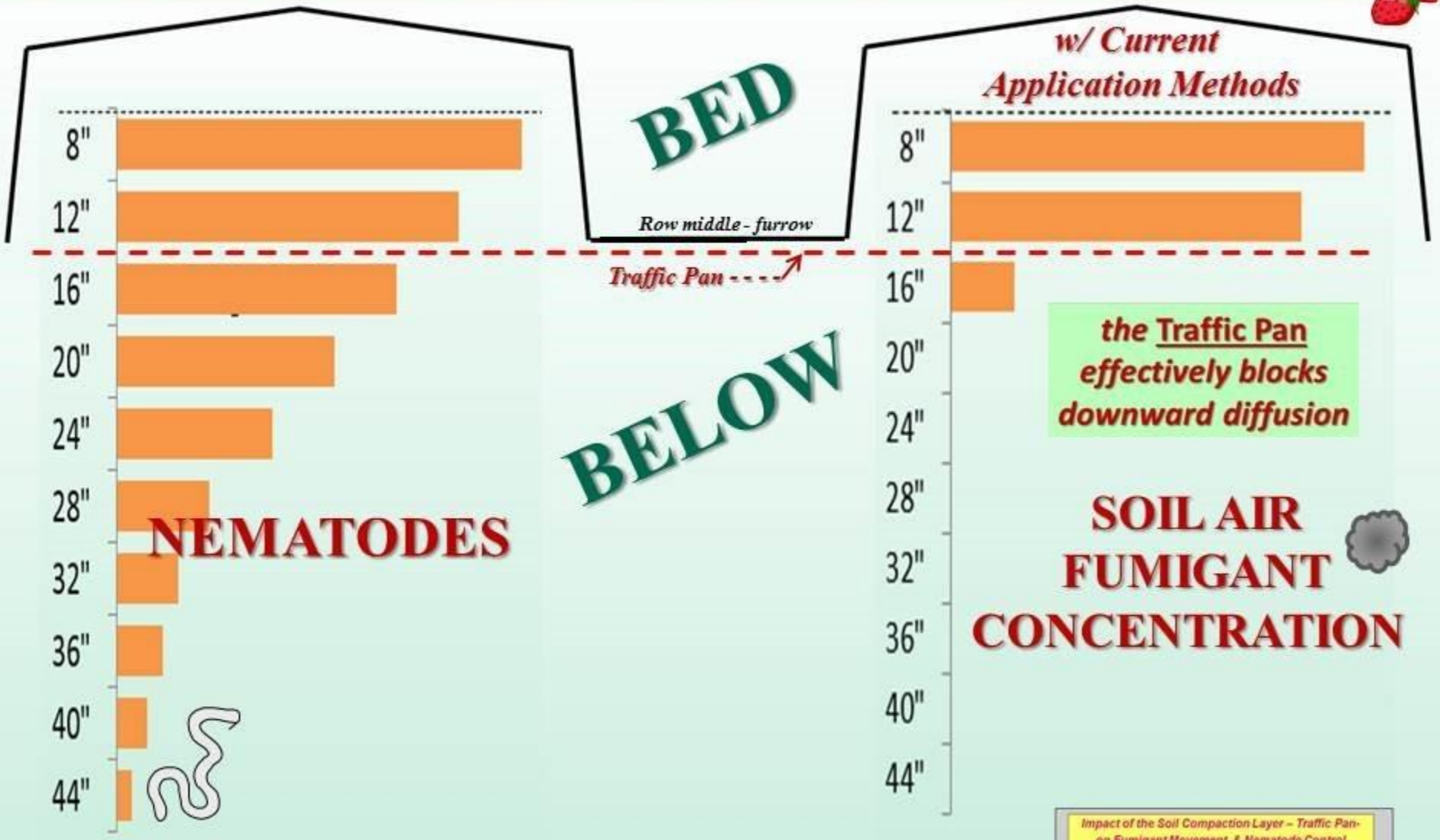

Without Supplemental Pic100
With Supplemental Pic100
PATHOGENS
Supplemental Chloropicrin substantially reduced the incidence of fusarium wilt

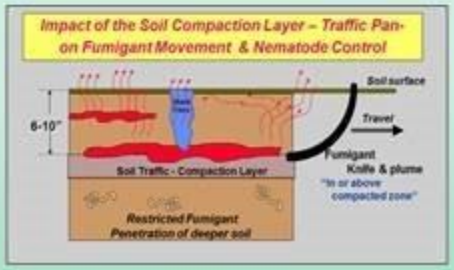
KEY POINTS

- Chloropicrin is considered the key component for the management of soil-borne pathogens.
- Many other fumigants also have efficacy on soil pathogens

Why Do We Fumigate? **Nematodes**

What has the Probinator told us about nematodes & fumigant gases?





SPATIAL DISTRIBUTION

VISUALLIZING NEED FOR NEW FUMIGANT STRATEGIES

Prepared by J.W. Noling

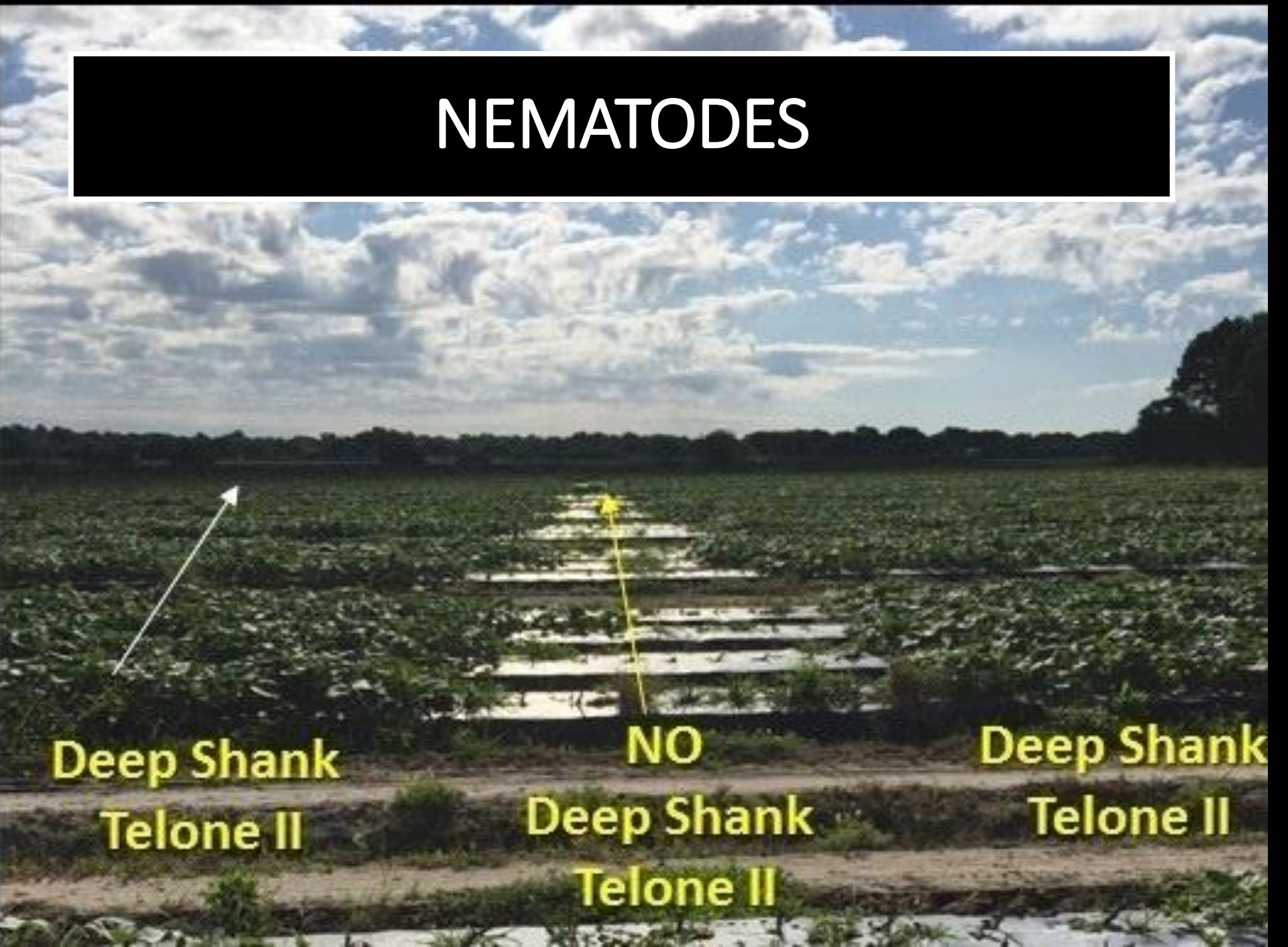
How to deal with the 'uprising' and insurgency.....

What is Needed: NEW TECHNOLOGY for DEEP APPLICATION

Auto Reset – Deep Drip

Auto Reset - Deep Shank w/ Wings

NEMATODES


Deep Shank
Telone II
NO
Deep Shank
Telone II
Deep Shank
Telone II

KEY POINTS

- Growers predominately rely on fumigants for nematode management.
- Many of the alternative management tools have limited efficacy.

Should We Fumigate?

Advantages to Fumigation

- Fewer pesticides are applied directly on the crop.
- Fewer pesticides may be applied overall.
- Control of pests for which there are no non-fumigant alternatives
- Management of pesticide resistant pests
- Improved yields on a per acre basis
- Enhanced ability to grow crops more intensively where land availability is limited.

ACKNOWLEDGMENTS

- The amazing staff at GCREC
- Jialin Yu
- Kshitij Khatri

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THANK YOU!