SCREENING OF HERBICIDES FOR SELECTIVE WEED CONTROL IN BRASSICACEOUS CROPS

ED PEACHEY
HORTICULTURE DEPARTMENT

Oregon State University

Brassicaceae vegetable food and seed

Rhapanus sativa: common radish

B. oleracea: broccoli, cabbage, cauliflower, kale, collards

B. rapa: turnip, napa cab, bok choi, rapini

B. napus: rutabaga, Russian kale

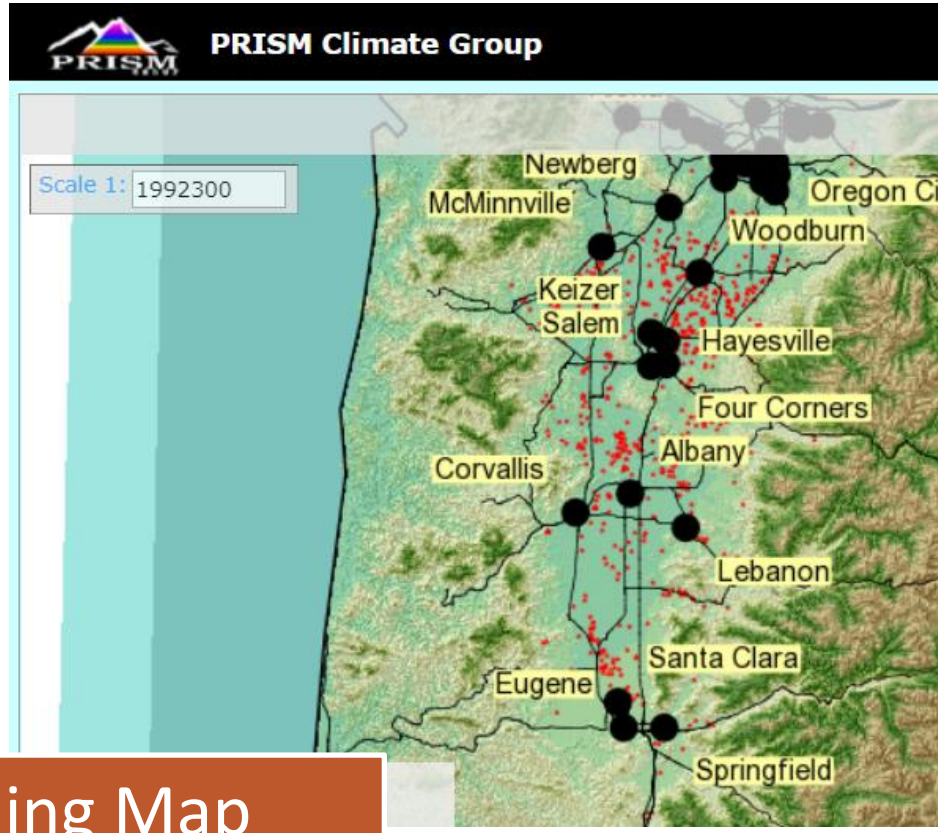
Eruca vesicaria: arugula

Willamette Valley, Western Oregon

~8,000 acres of vegetable seeds

$50 million value

- 225 fields pinned in 2012
- 156 fields in 2017



Pinning Map

Brassica+ Seed Production in PNW

Western Washington and Oregon

- >90% of the European cabbage, Brussels sprouts, rutabaga and turnip seed for the world
- 20 – 30 % of radish, Chinese cabbage and other oriental *Brassica* vegetable crops.

Brassica seed production- small acreage but high value crop.

Special Seed Exclusion Labeling, Oregon

"This seed was produced using one or more products for which the United States Environmental Protection Agency has not established pesticide residue tolerances.

This seed, in whole, ***as sprouts****, or in any form,* ***may not be used*** *for human consumption or animal feed.*

Failure to comply with this condition may violate the requirements of the Federal Food and Drug Administration, the Oregon Department of Agriculture, and other regulatory agencies."

Weed Control Challenges

CROPS AND ROTATION CROPS

In radish

- Shepherdspurse curse
- Any wild mustard or radish
- Dogfennel
- Bedstraw
- Nightshades (trifluralin result)


Squash (seed crop) in Radish
Radish in Squash

Crops and Their Weedy Relatives

Mustards, Shepherdspurse in Radish!

Radish in Radish!!

Alternatives to herbicides?

Cultivation technologies


Hybrid radish seed with 2 male rows

Research focus

Dimethenamid-P (1993) *R. sativa*

Fluroxypyr (1997) *R. sativa*

Sulfentrazone (1991)

- *B rapa, B. napus, B. oleraceae, R. sativa*

Tolpyralate and other Gr 27 herbicides

Dimethenamid-P

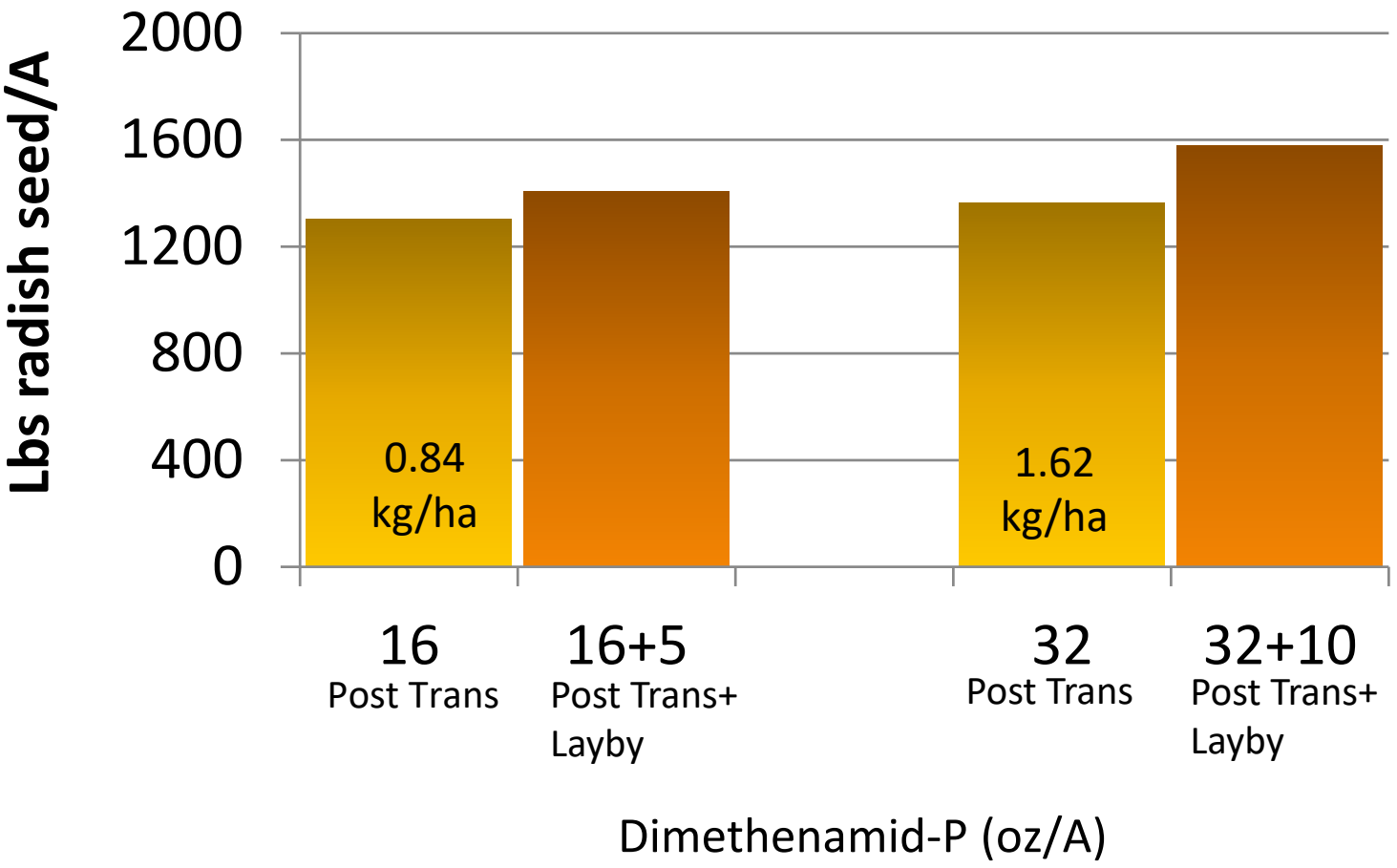
Outlook

Transplanted radish for seed

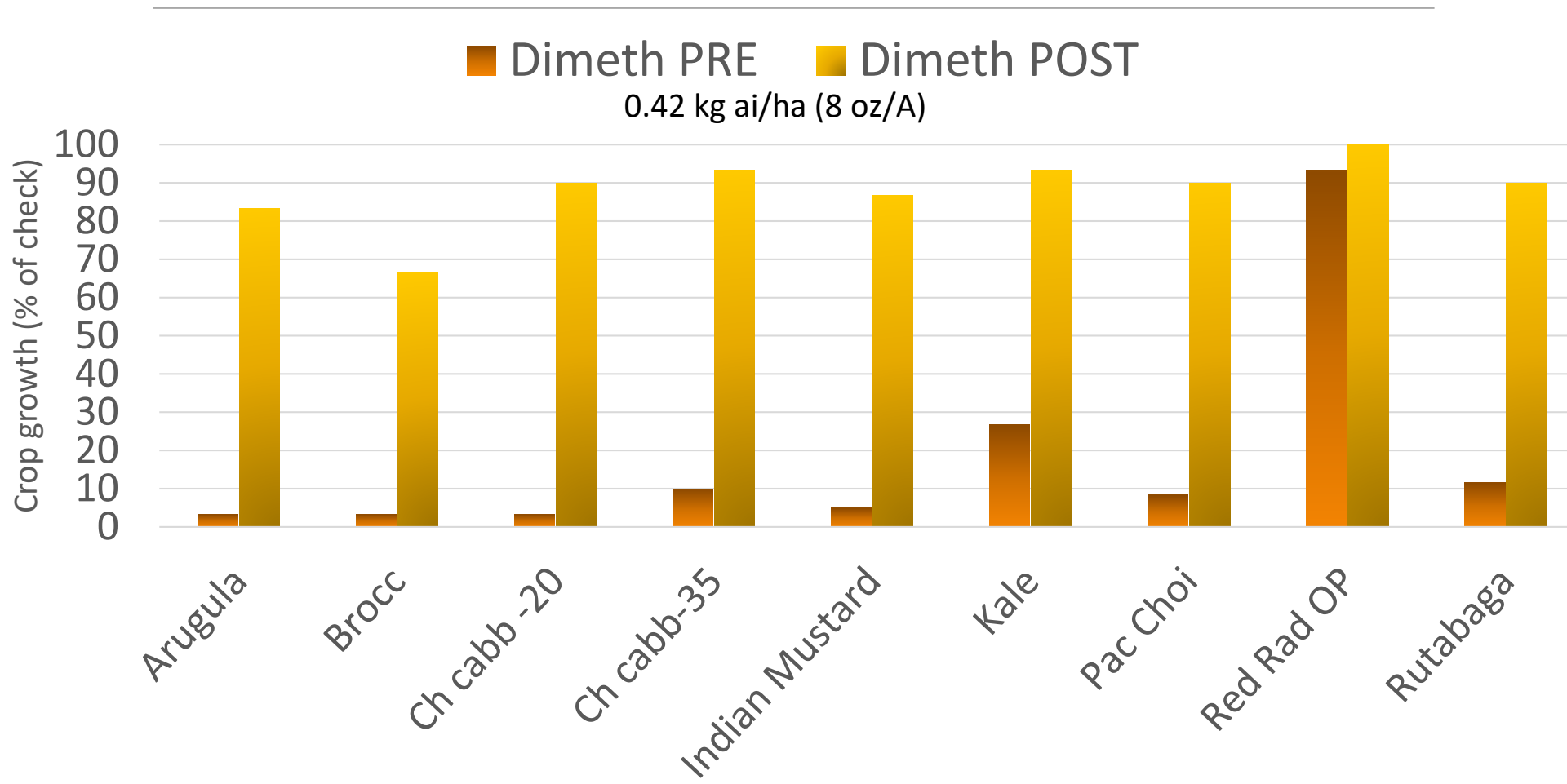
Postemergence 2 to 4 lf

2015

Radish Seed Yield Response to Dimethenamid-P



Tolerance of Brassicaceae to Dimethenamid-p (2018)



Outcome

- Radish tolerant to dimethenamid-P POSTTRANS
- Use pattern well established and documented

Fluroxypyr
Starane

Control of shepherdspurse, nightshades, and other broadleaves

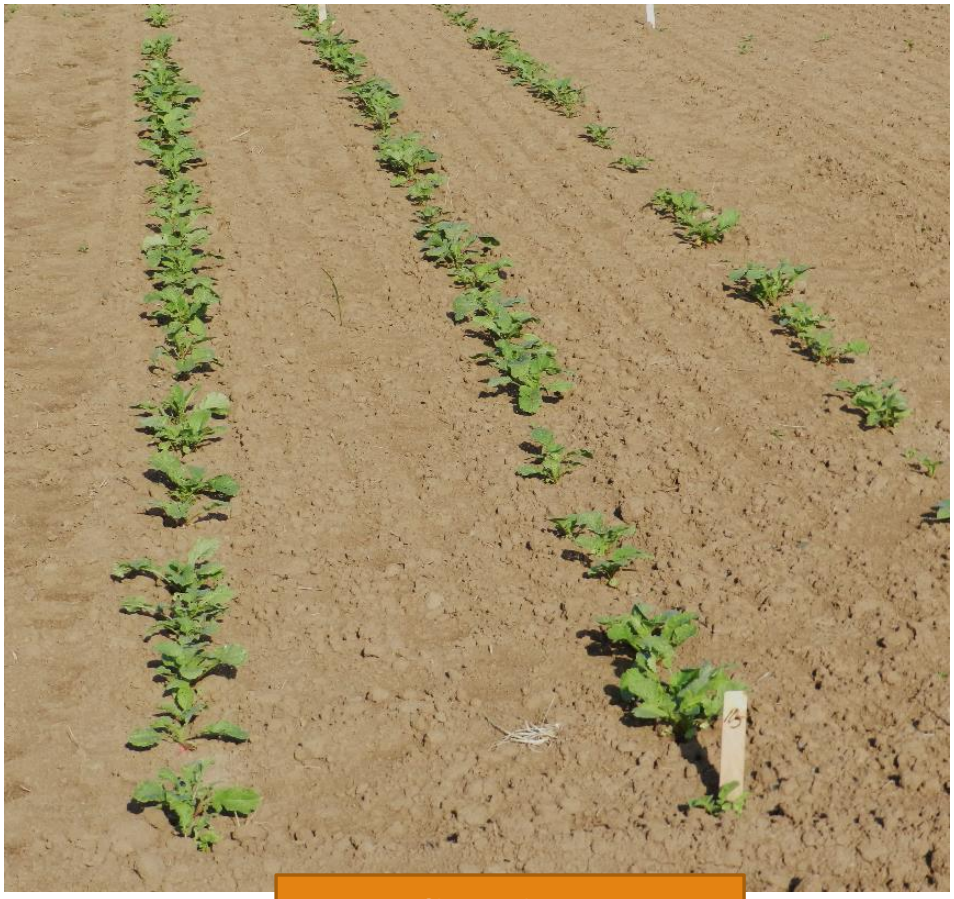
Radish Tolerance to Fluroxypyr

(2019)

	Herbicide	Timing	Product rate	Active rate	6-Jun	
					Phyto	Stunting
			#/acre	kg ai/ha	0-10	%
1	Fluroxypyr	2 lf	2 oz	0.049	0.0	19
2	Fluroxypyr	2 lf	4 oz	0.098	0.5	25
3	Fluroxypyr	4 lf	6 oz	0.147	0.8	33
4	Fluroxypyr	4 lf	12 oz	0.295	1.3	23
5	S-metolachlor	PPS	10.7 oz	0.72	0	8
6	Naprop XT	PPS	2 lbs	1.12	0	11
7	S-metolachlor	2 lf	10.7 oz	0.72	0	24
10	Ethalfluralin	PPS	2 pts	0.84	0.0	14

Consistent with
on-farm and 1
station trial

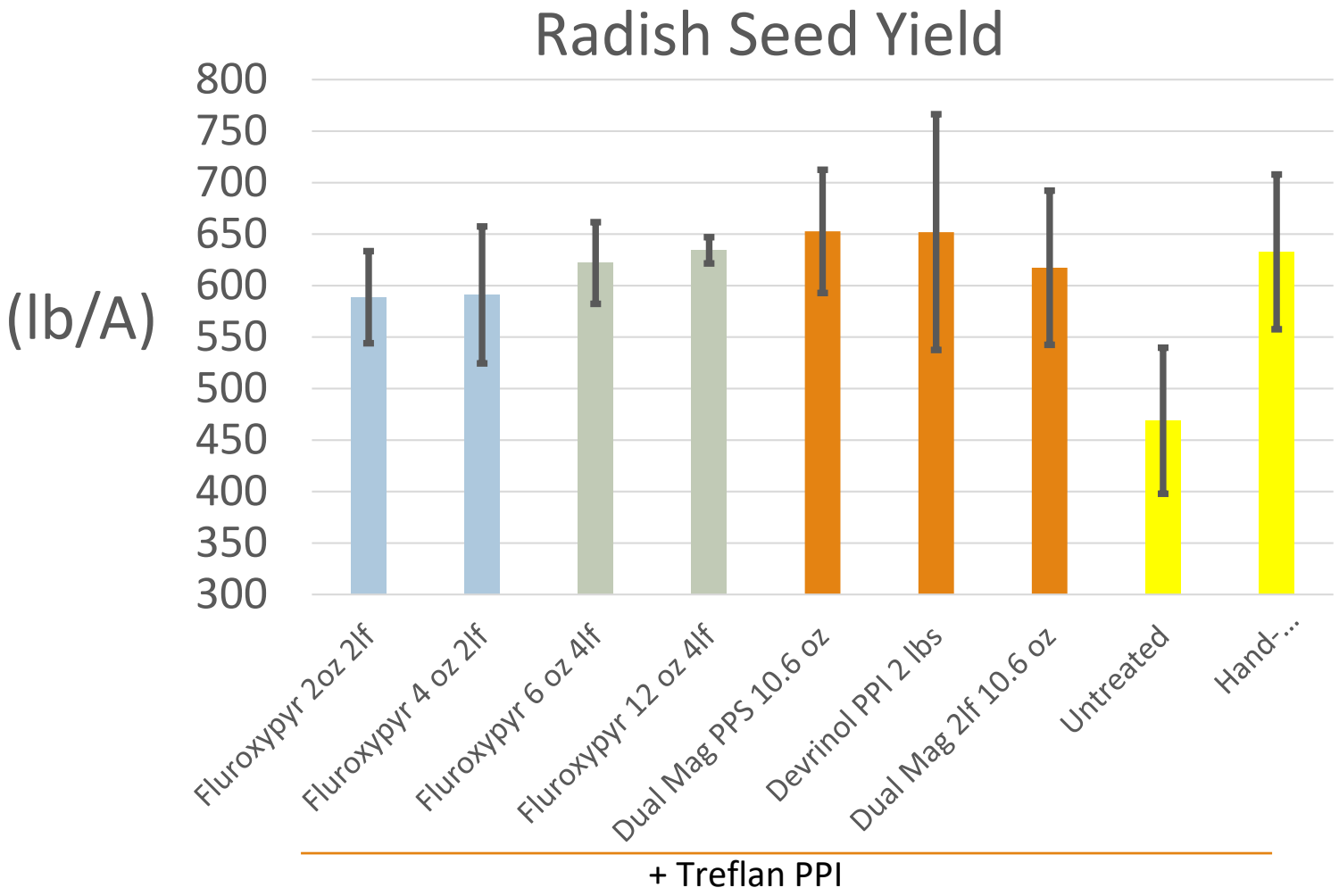
Fluroxypyr
0.147 kg/ha (6 oz/A)
4 leaf



Trifluralin PPI
S-metolachlor PES

Radish Tolerance to Fluroxypyr

(2019)



Effect of Fluroxypyr on Seed Wt. and Germination

	Treatment	Growth stage	Rate	Date	Seed wt	Days after germination initiation		
						Day 2	Day 4	Day 6
			lb ai/A		*g/100 seeds*	*--------% germ------*		
1	Fluroxypyr	2 lf	0.049	14-May	1.07	74	97	99
2	Fluroxypyr	2 lf	0.098	14-May	1.05	63	93	97
3	Fluroxypyr	4 lf	0.147	20-May	1.10	81	97	99
4	Fluroxypyr	4 lf	0.295	20-May	1.12	78	99	99
8	Nontreated, unweeded				1.03	68	88	98

Fluroxypyr Summary

- No effect on seed weights or seed germination
- Letters of support submitted for OR-SLN

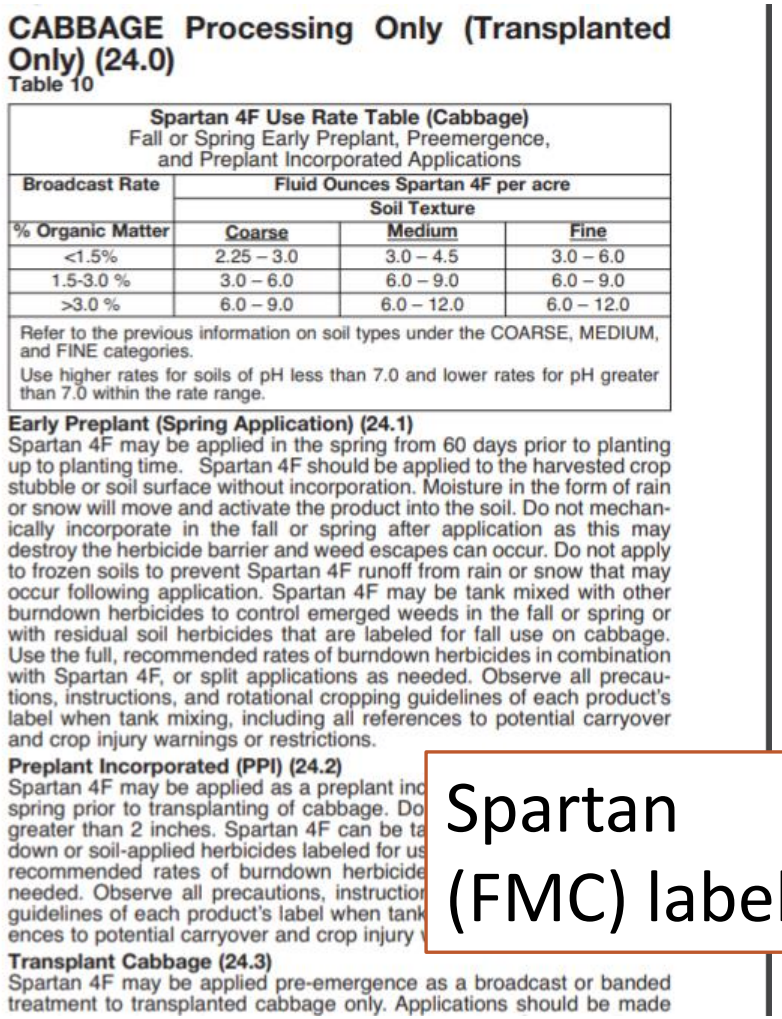
Sulfentrazone
Zeus/Spartan

Brassicacea

Sulfentrazone (0.21 kg/ha)
6 oz/A
1% COC
4 weeks after transplant

Expand uses for Sulfentrazone

- Broccoli
- Chinese cabbage
- Radish



CABBAGE Processing Only (Transplanted Only) (24.0)
Table 10

Spartan 4F Use Rate Table (Cabbage) Fall or Spring Early Preplant, Preemergence, and Preplant Incorporated Applications			
Broadcast Rate	Fluid Ounces Spartan 4F per acre		
	Soil Texture		
% Organic Matter	Coarse	Medium	Fine
<1.5%	2.25 – 3.0	3.0 – 4.5	3.0 – 6.0
1.5-3.0 %	3.0 – 6.0	6.0 – 9.0	6.0 – 9.0
>3.0 %	6.0 – 9.0	6.0 – 12.0	6.0 – 12.0

Refer to the previous information on soil types under the COARSE, MEDIUM, and FINE categories.

Use higher rates for soils of pH less than 7.0 and lower rates for pH greater than 7.0 within the rate range.

Early Preplant (Spring Application) (24.1)
Spartan 4F may be applied in the spring from 60 days prior to planting up to planting time. Spartan 4F should be applied to the harvested crop stubble or soil surface without incorporation. Moisture in the form of rain or snow will move and activate the product into the soil. Do not mechanically incorporate in the fall or spring after application as this may destroy the herbicide barrier and weed escapes can occur. Do not apply to frozen soils to prevent Spartan 4F runoff from rain or snow that may occur following application. Spartan 4F may be tank mixed with other burndown herbicides to control emerged weeds in the fall or spring or with residual soil herbicides that are labeled for fall use on cabbage. Use the full, recommended rates of burndown herbicides in combination with Spartan 4F, or split applications as needed. Observe all precautions, instructions, and rotational cropping guidelines of each product's label when tank mixing, including all references to potential carryover and crop injury warnings or restrictions.

Preplant Incorporated (PPI) (24.2)
Spartan 4F may be applied as a preplant inc
spring prior to transplanting of cabbage. Do
greater than 2 inches. Spartan 4F can be ta
down or soil-applied herbicides labeled for us
recommended rates of burndown herbicide
needed. Observe all precautions, instructio
guidelines of each product's label when tank
ences to potential carryover and crop injury

Transplant Cabbage (24.3)
Spartan 4F may be applied pre-emergence as a broadcast or banded treatment to transplanted cabbage only. Applications should be made

Spartan (FMC) label

Uses of interest

Pre-Transplant

- Broccoli, Cabbage, Cauliflower, and other head, stem, and leafy green crops of the Brassicacea family

Post Emergence

- Suppression of yellow nutsedge in broccoli, cabbage, and cauliflower only

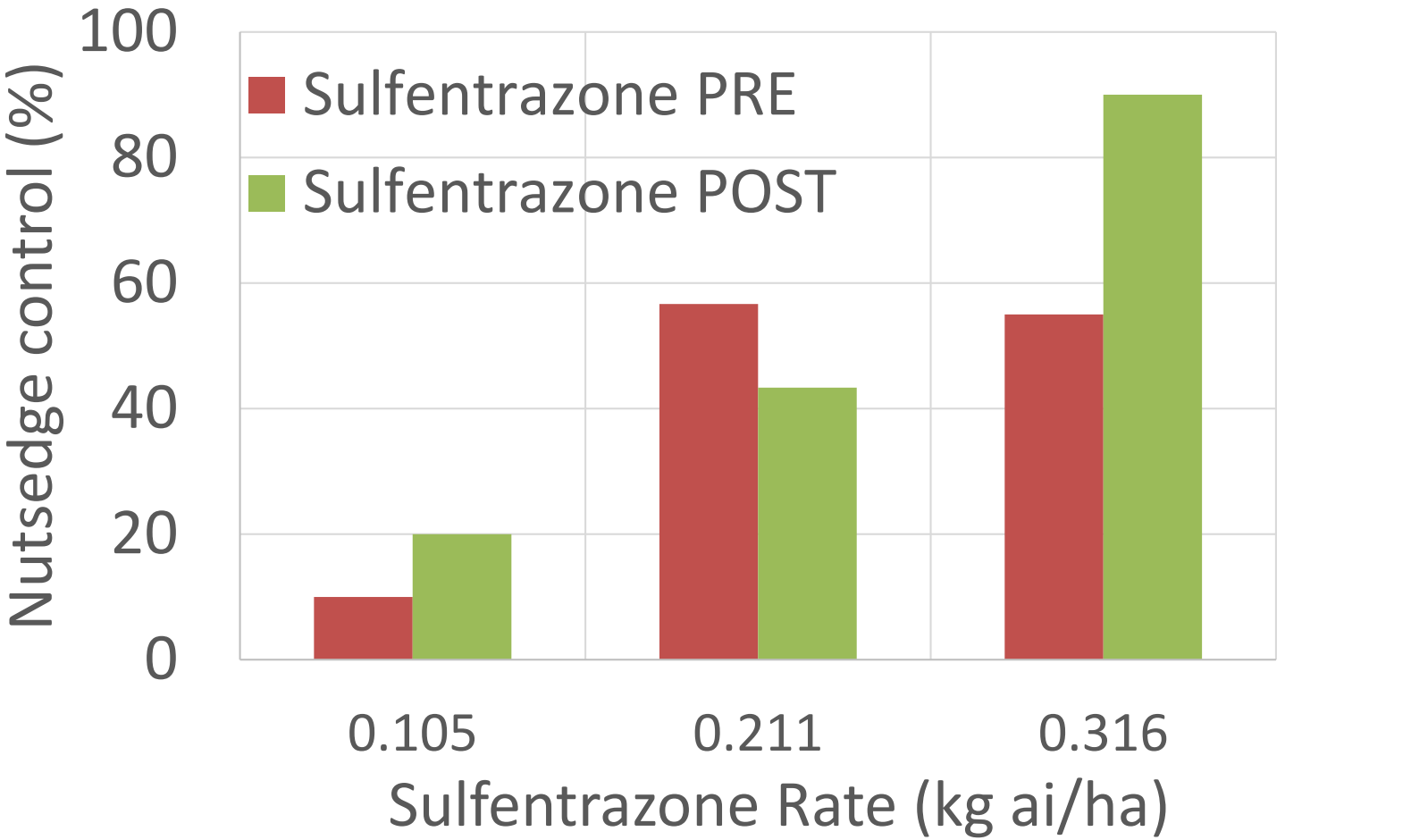
Direct-Seeded Brassicas Grown for Seed

- Charcoal seeding

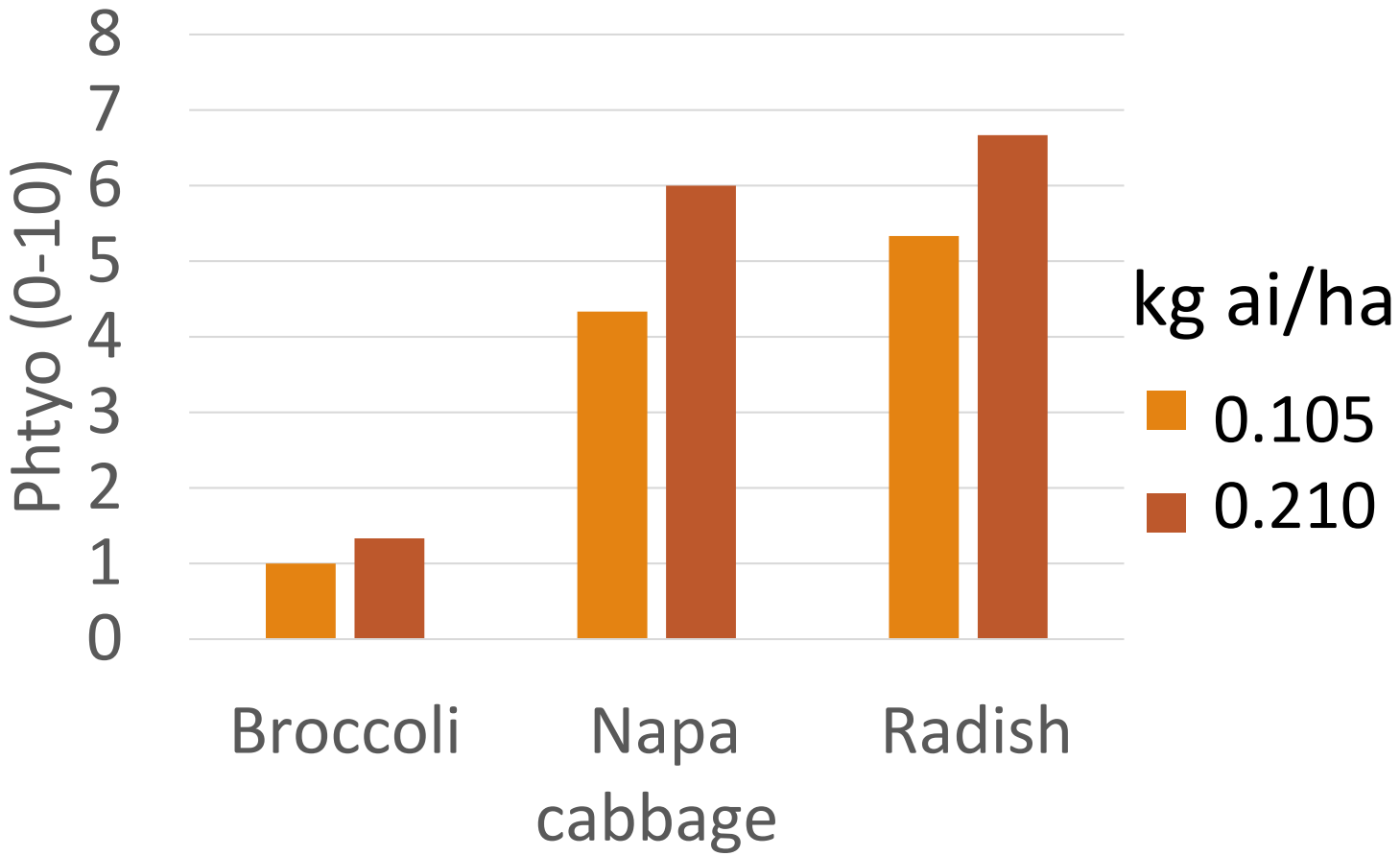
Postemergence for Nutsedge Control

Nutsedge Control with Sulfentrazone

(transplanted broccoli, 2019)



Crop Tolerance POST Trans



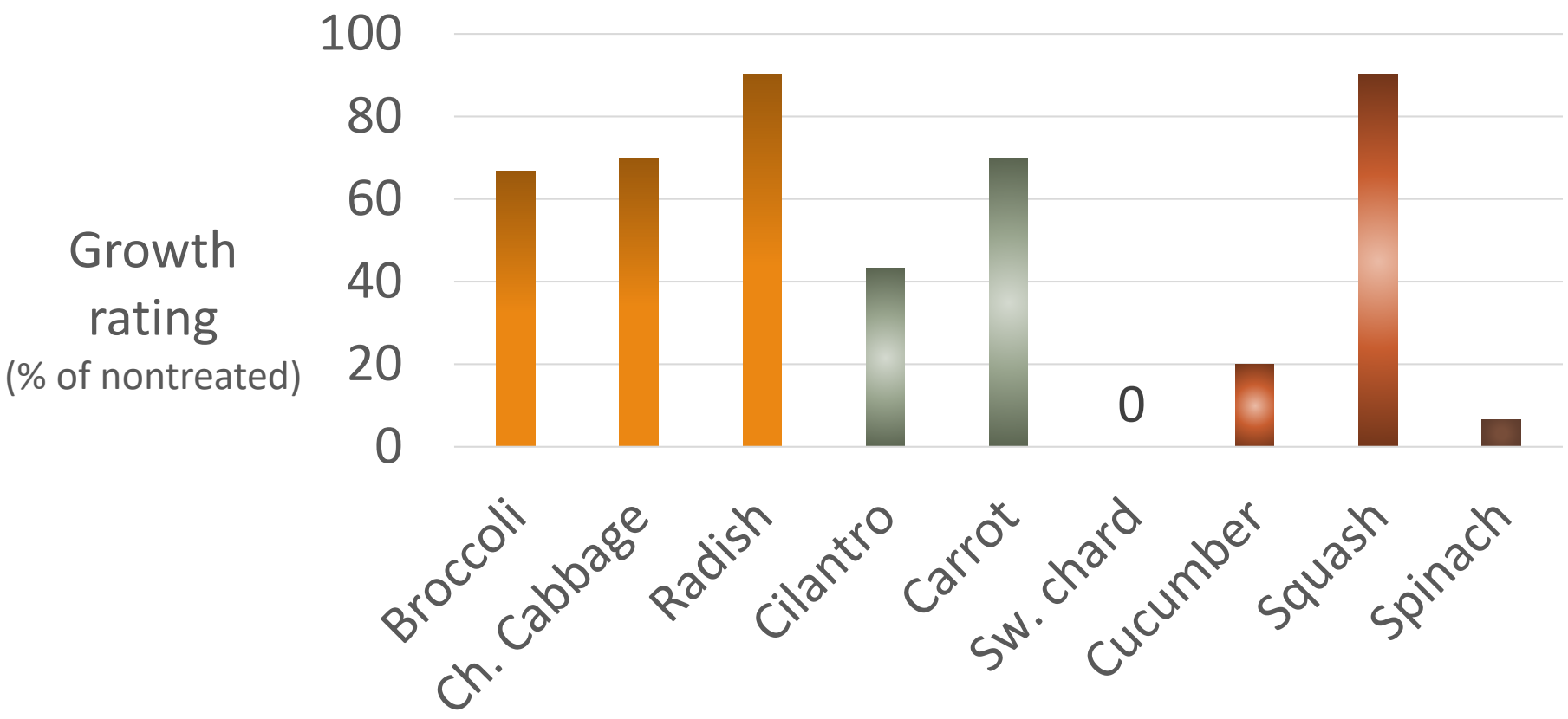
Sulfentrazone

Brassicacea
PPS in direct-seeded crops

Charcoal seeding

Crop Response to Sulfentrazone PPS

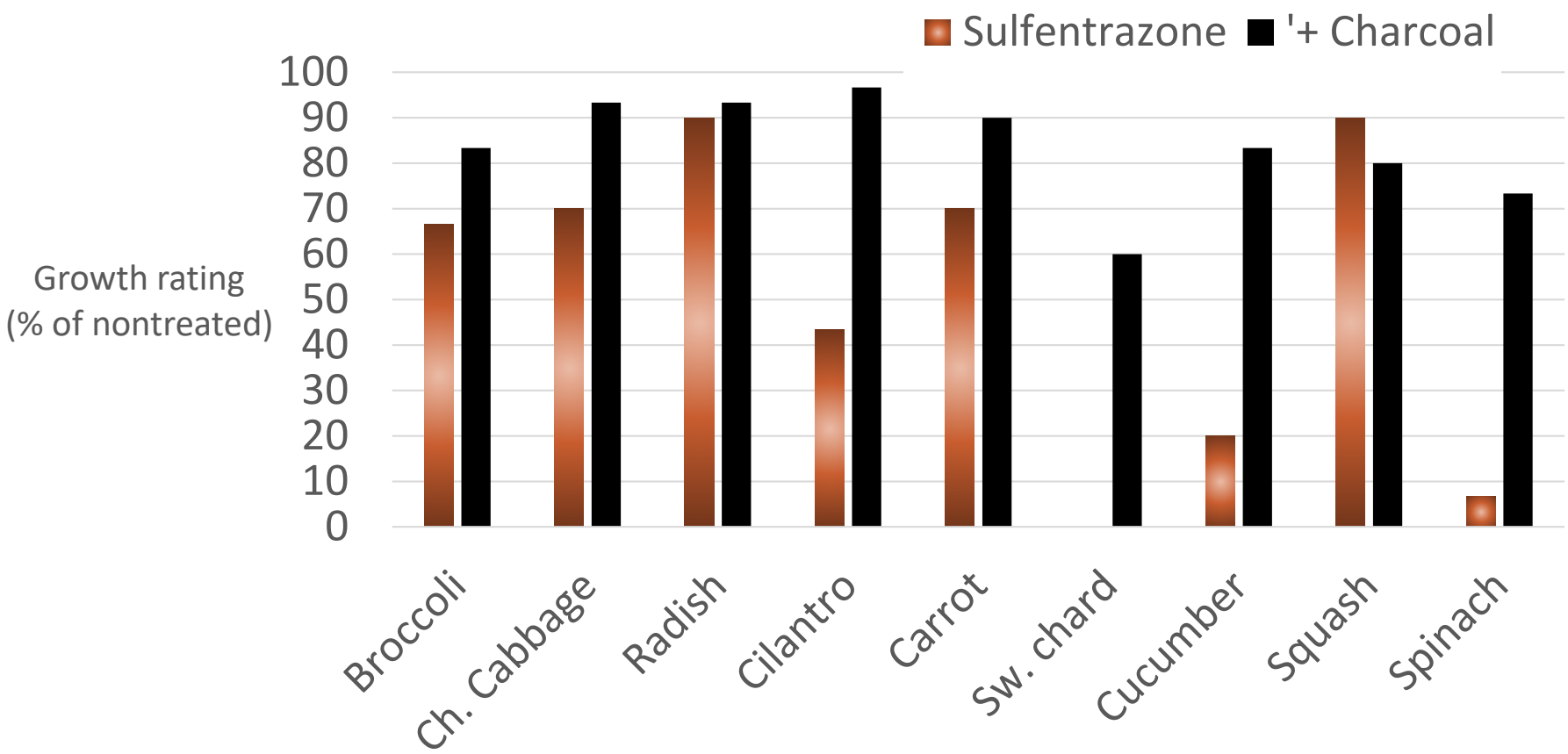
(3 oz/A, 0.105 kg ai/ha, 2018)

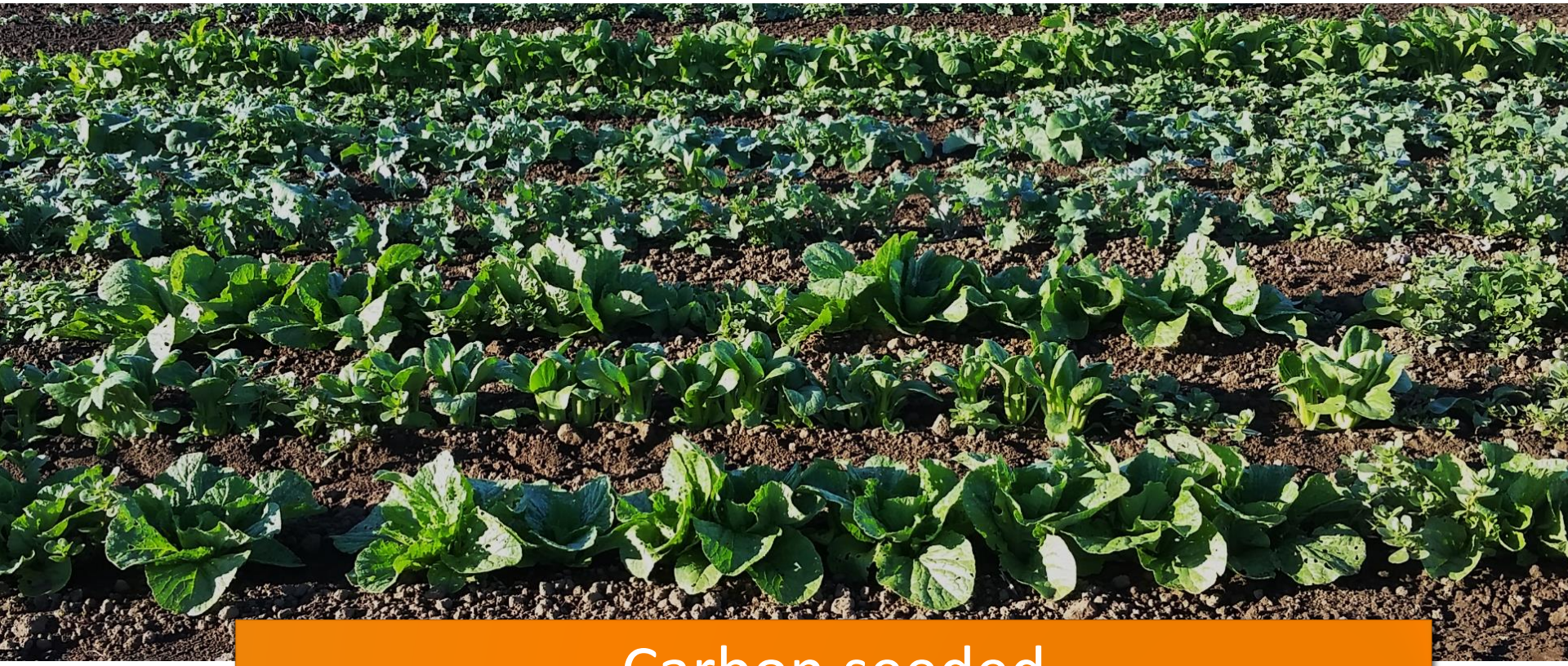


Strip-plot design
Non-treated

Sulfentrazone
(0.10 kg ai/ha)

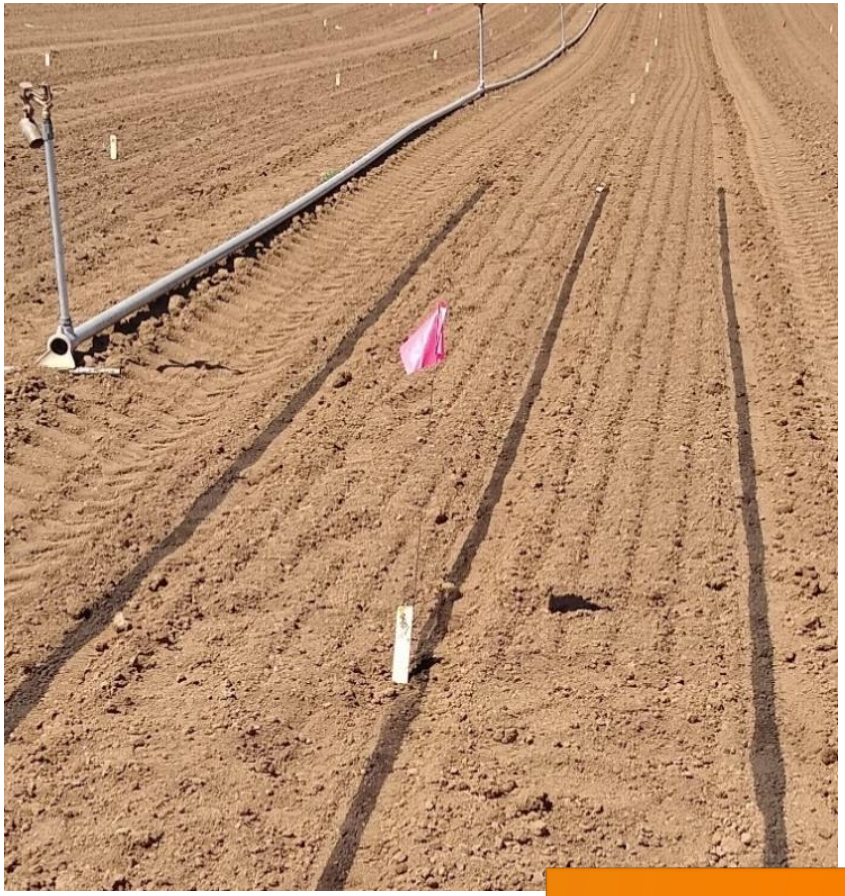
Effect of **Charcoal Seeding** on Crop Response to Sulfentrazone PPS

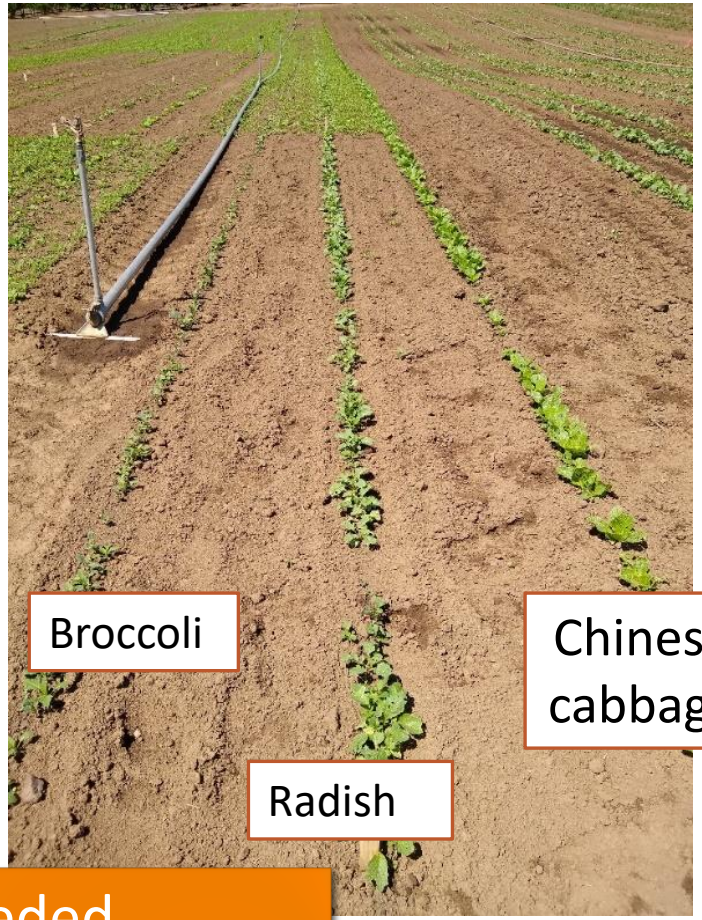




Carbon seeded
Sulfentrazone (0.10 kg ai/ha)

Effect of Charcoal Seeding on Crop Tolerance to Sulfentrazone





Carbon seeded
Sulfentrazone (0.10 kg ai/ha)

Charcoal Seeded Brassicas Grown for Seed

Similar to grass seed production

- 336 kg/ha charcoal/effective acre
- 2 to 4 cm inch band over the seed row
- 0.10 kg/ha sulfentrazone PPS

Current Revised Zeus Label
(FMC)

Pre-Transplant Spring and Fall

- Cabbage, Broccoli, and Cauliflower

Post Emergence for Suppression of Yellow Nutsedge

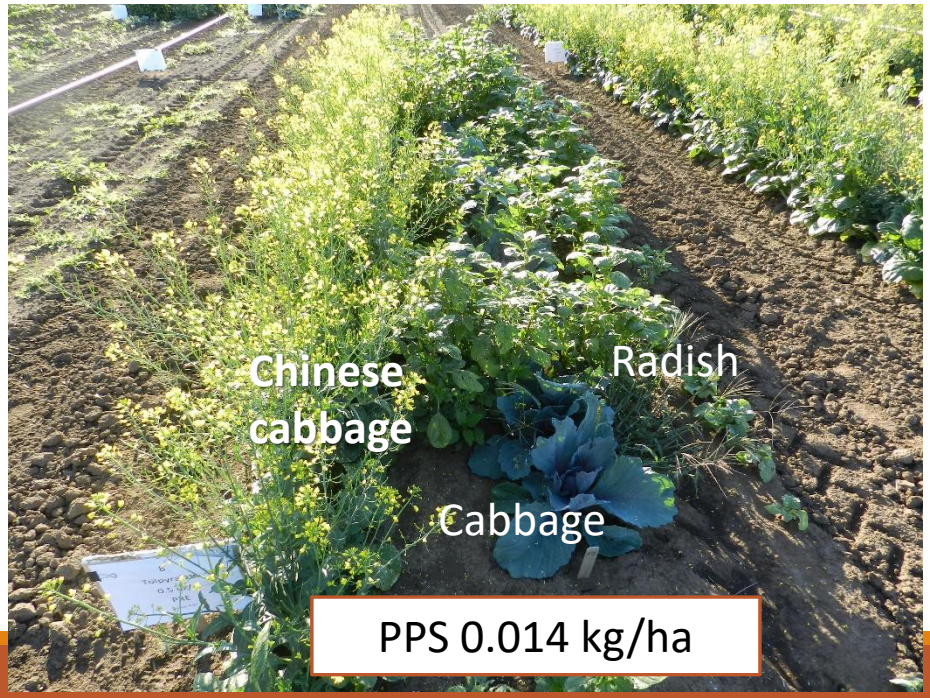
- Cabbage, Cauliflower, and Broccoli **Grown for Seed**
- ***Missing tolerances for food crops***

Activated Charcoal Seeded Brassicas Grown for Seed

- Cabbage, Chinese Cabbage, Kale, Broccoli, Chinese Mustard, Pak Choi, Red Radish and Rutabaga

Group 27 Herbicide Selectivity

Tolpyralate



Summary

Opportunities to intervene with herbicides:

○ Dimethenamid-P	Transplanted radish
○ Fluroxypyr	Direct seeded radish
○ Sulfentrazone	PreTransplant Transplanted *Brassica spp.* Direct-seed carbon seeding

Acknowledgements

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Oregon Processed Vegetable Commission