Utilizing Brassicaceae seed meal as a soil amendment to suppress weed and soil borne pathogens

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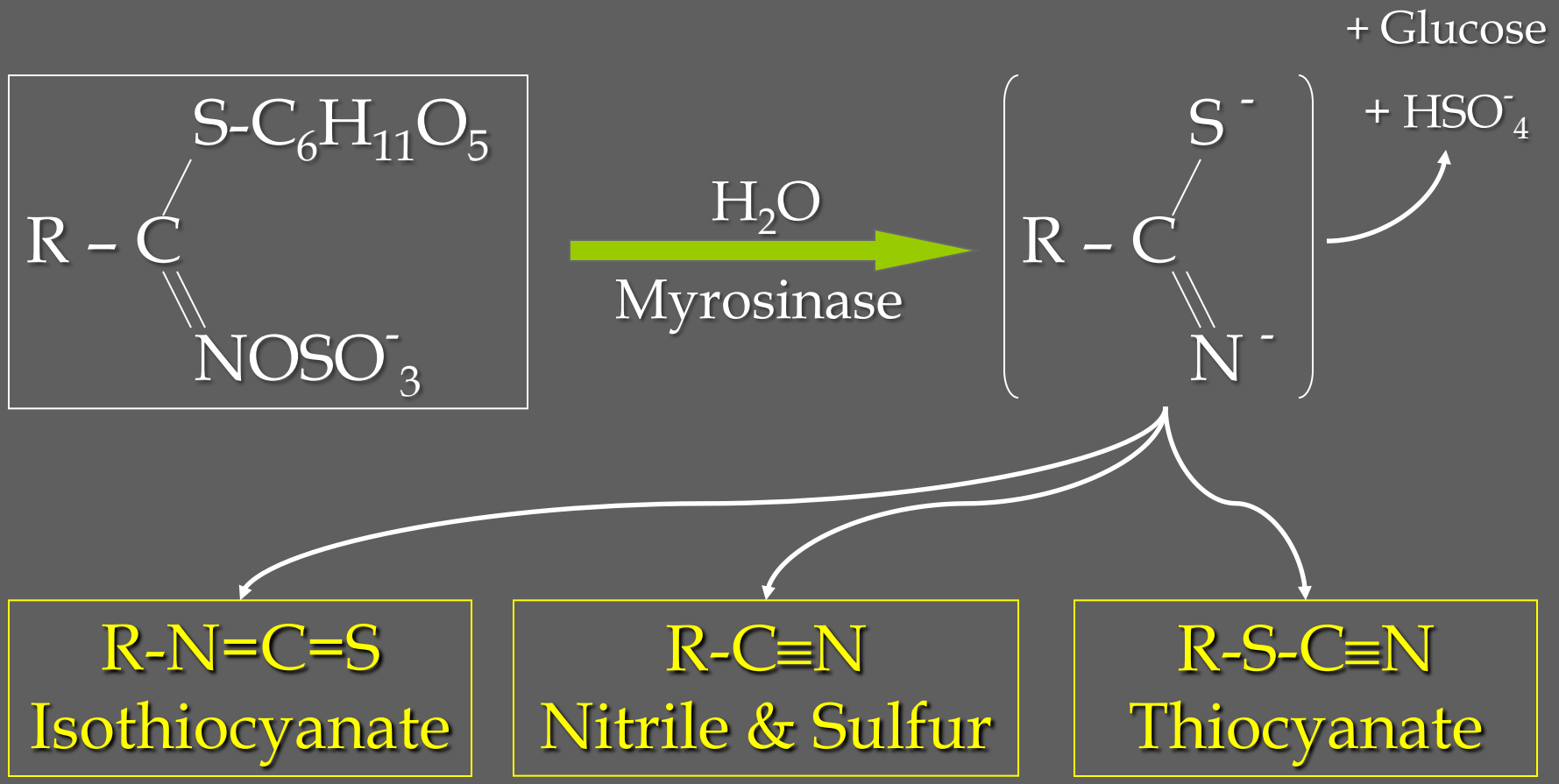
Jack Brown, Maxwell Hamdiseni & Mark Mazzola[1]
University of Idaho
[1] USDA-ARS, Wenachee, WA

Introduction

- Ensuring a high and consistent supply of agricultural commodities.
- Dependence on the use of pesticides.
- Some pesticides are harmful. e.g. Methyl bromide.

Glucosinolate profiles



Glucosinolates profiles

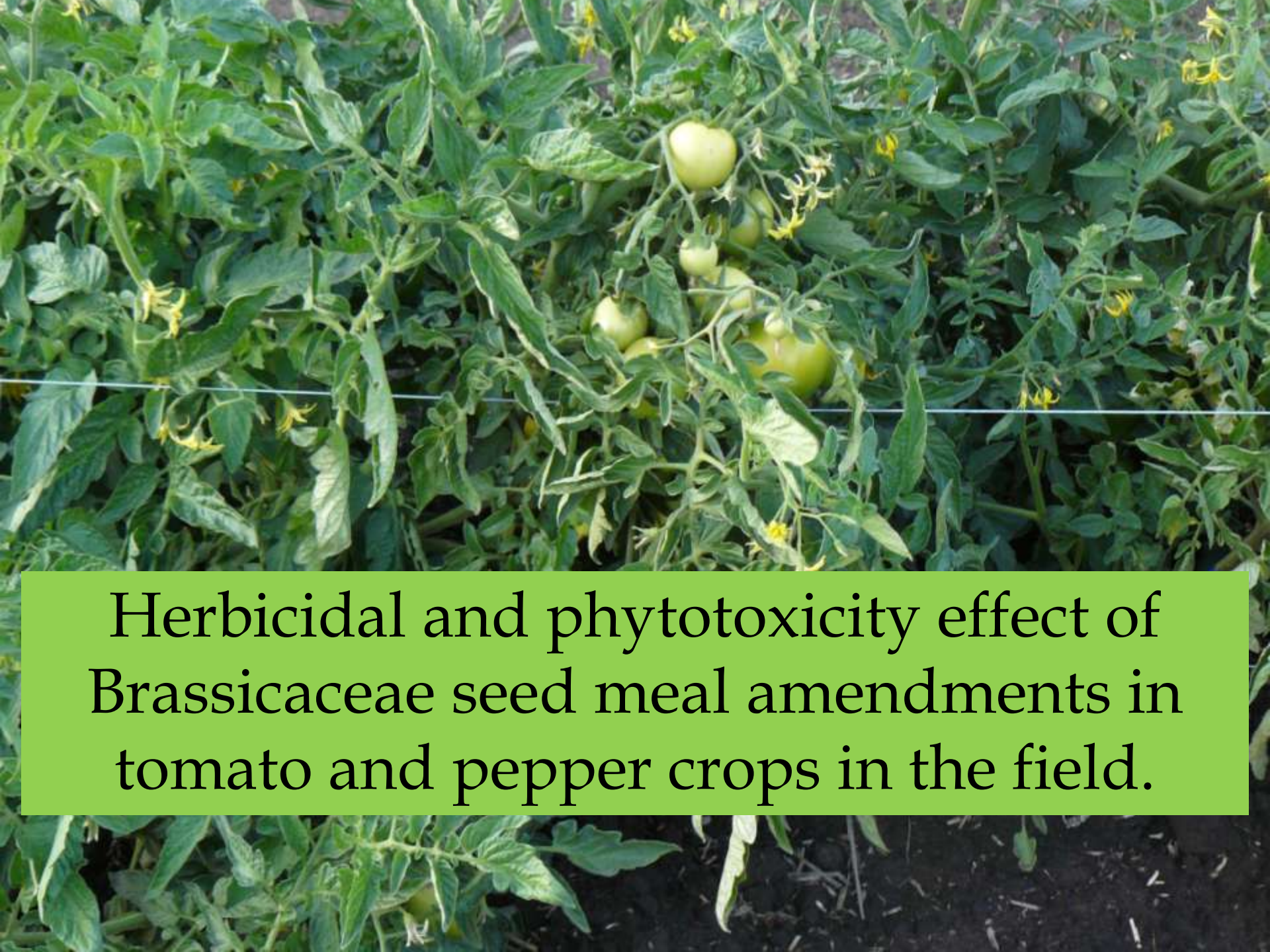
Type	*B. napus* 'Athena'	*B. juncea* 'P. Gold'	*S. alba* 'IdaGold'
Allyl	-	174.6	-
3-butenyl	3.9	1	-
4-pentnyl	1.2	-	-
4-hydro-xybenzyl	-	-	195.5
Total	15.7	176.3	201.3

Crop Species

Tomato
(*Lycopersicum esculentum*)

Pepper
(*Capsicum annuum*)

- Tomato (*Lycopersicum esculentum*) and pepper (*Capsicum annuum*) are among the most valuable vegetable in the USA.
- Tomato and peppers production depends on effective soil fumigation.
- Broad leaved and grass weeds are constrains in production, and limited herbicide options are available.
- Soil borne pathogens as *Pythium* spp. threat to pepper and tomato germination.



Herbicidal and phytotoxicity effect of Brassicaceae seed meal amendments in tomato and pepper crops in the field.

Materials and Methods

Three meals examined:

- *Sinapis alba* ('Ida Gold'), yellow mustard.
- *Brassica juncea* ('Pacific Gold'), Oriental mustard.
- *Brassica napus* ('Athena'), canola.

Materials and Methods

Meal rate application

- 1 Mt ha^{-1} and 2 Mt ha^{-1} equivalent.
- Control with no amendment but compensated for the nitrogen.

Transplanting delay

- 0, 4 and 8 days after amendment.

Materials and Methods

Crop species

- Tomato cv's. Celebrity and Scarlet Red.
- Pepper cv's. New Ace and Ladybell.

Design

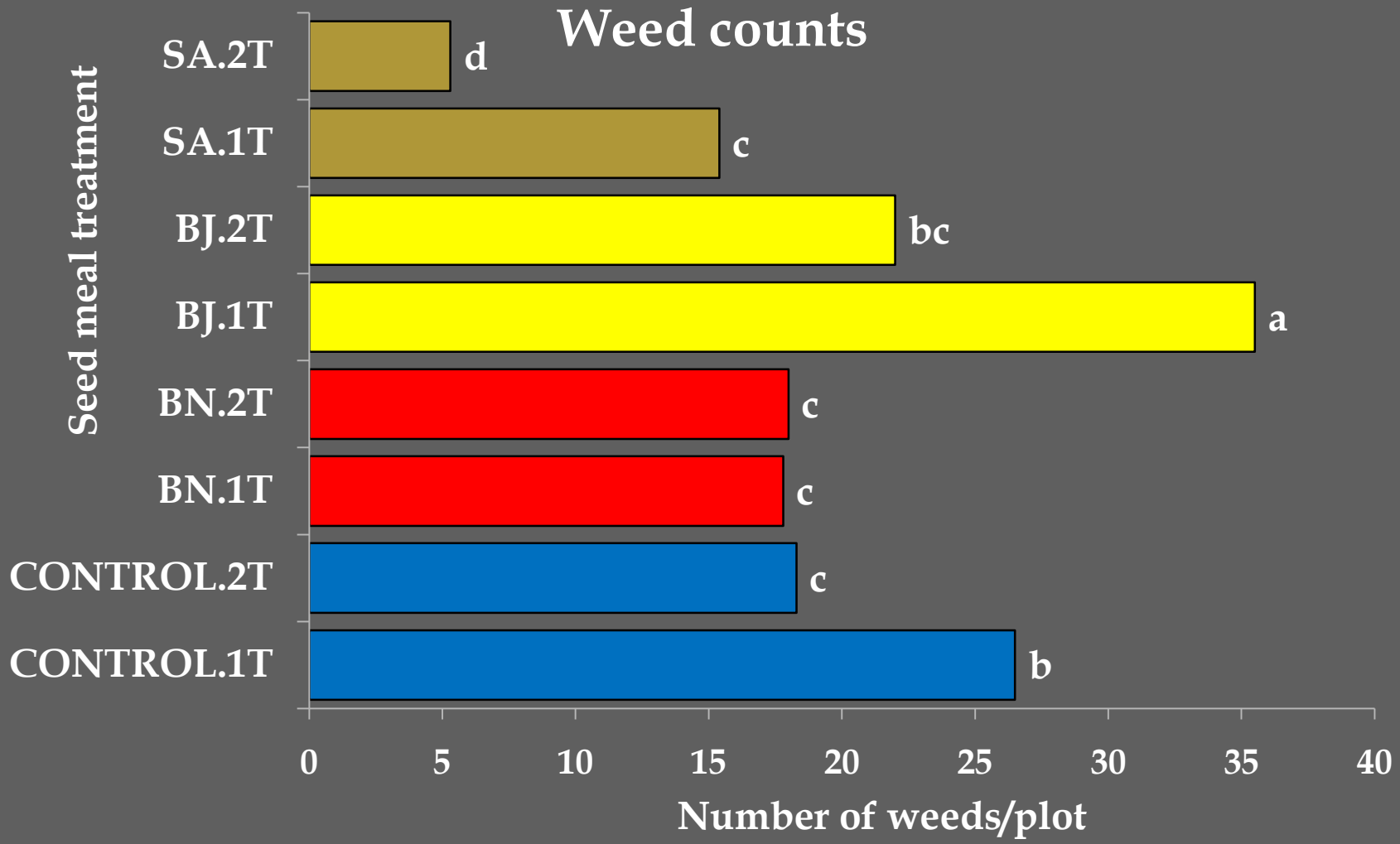
- Randomized strip-strip-split-plot design.
- Crop species and transplanting delay as strips.
- Meal treatments as the split plot factor and cultivar as a sub plot factor.
- Four replications and repeated twice.

Data collection and Analysis

Data collected

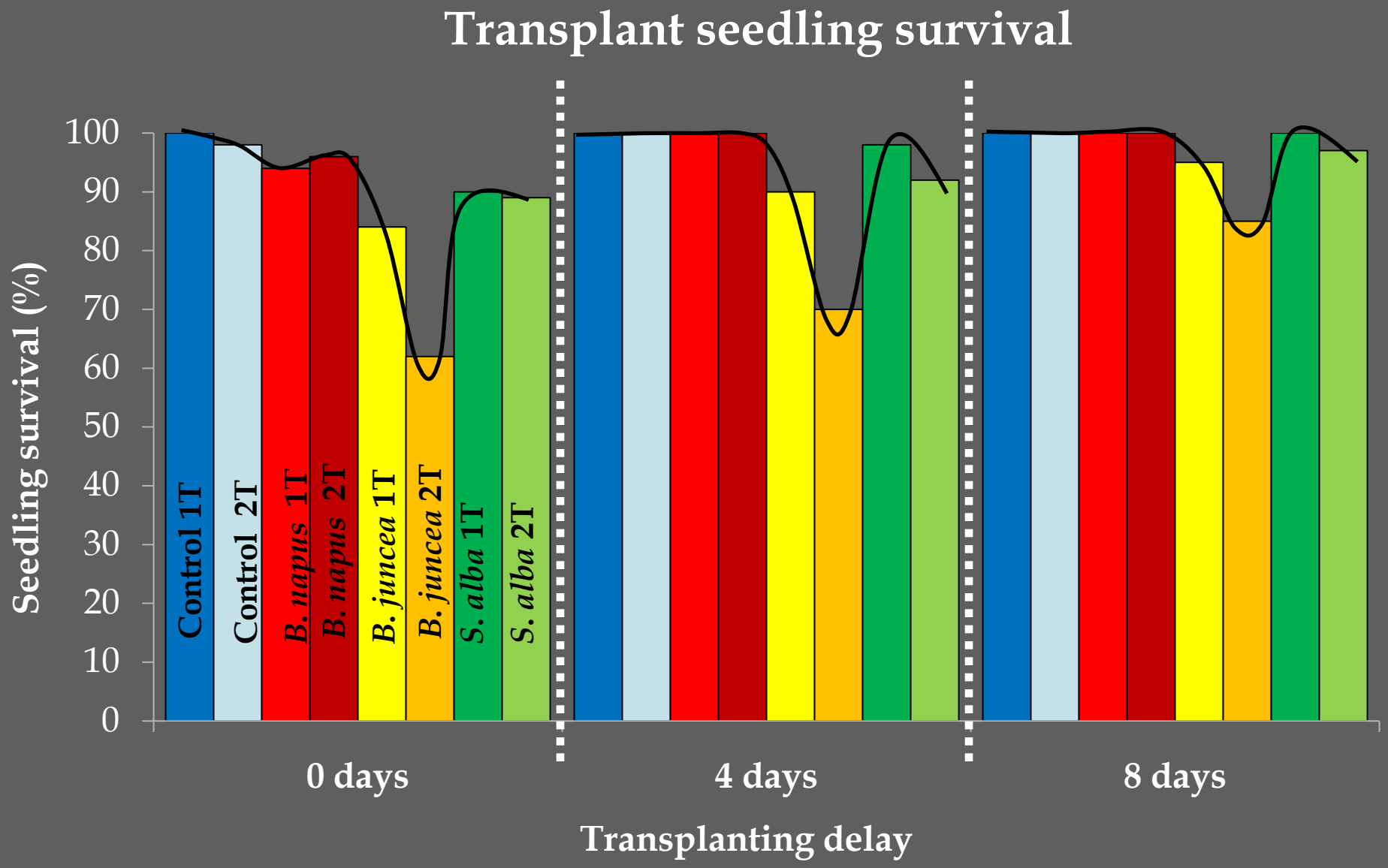
- Seedling survival.
- Phytotoxicity on a 1-9 scale.
- Above ground weed biomass.
- Fruit yield.

Results

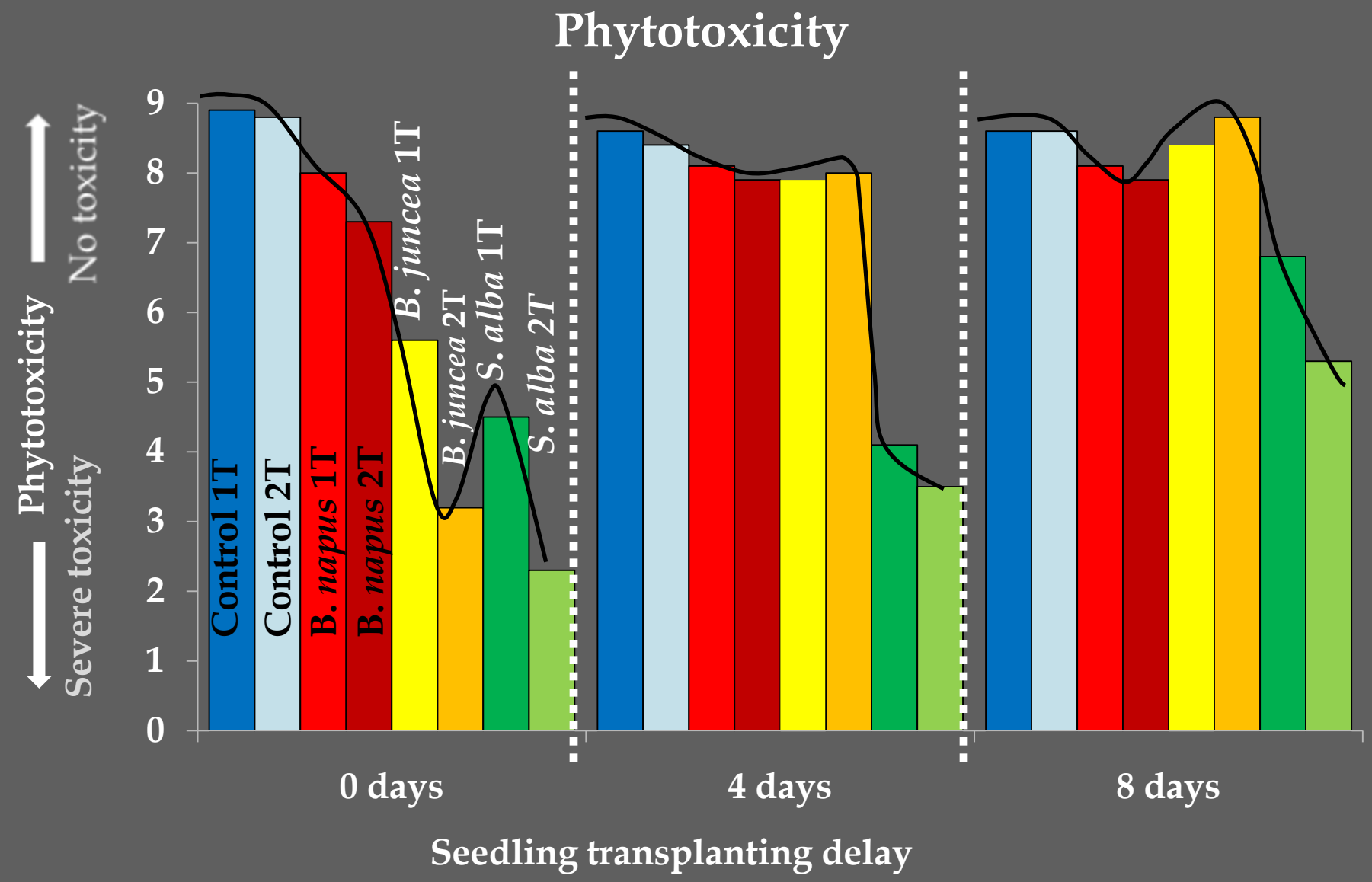

Weed counts
Seed meal treatment
SA.2T
SA.1T
BJ.2T
BJ.1T
BN.2T
BN.1T
CONTROL.2T
CONTROL.1T
d
c
bc
a
c
c
c
b
0
5
10
15
20
25
30
35
40
Number of weeds/plot


Transplant
Mortality

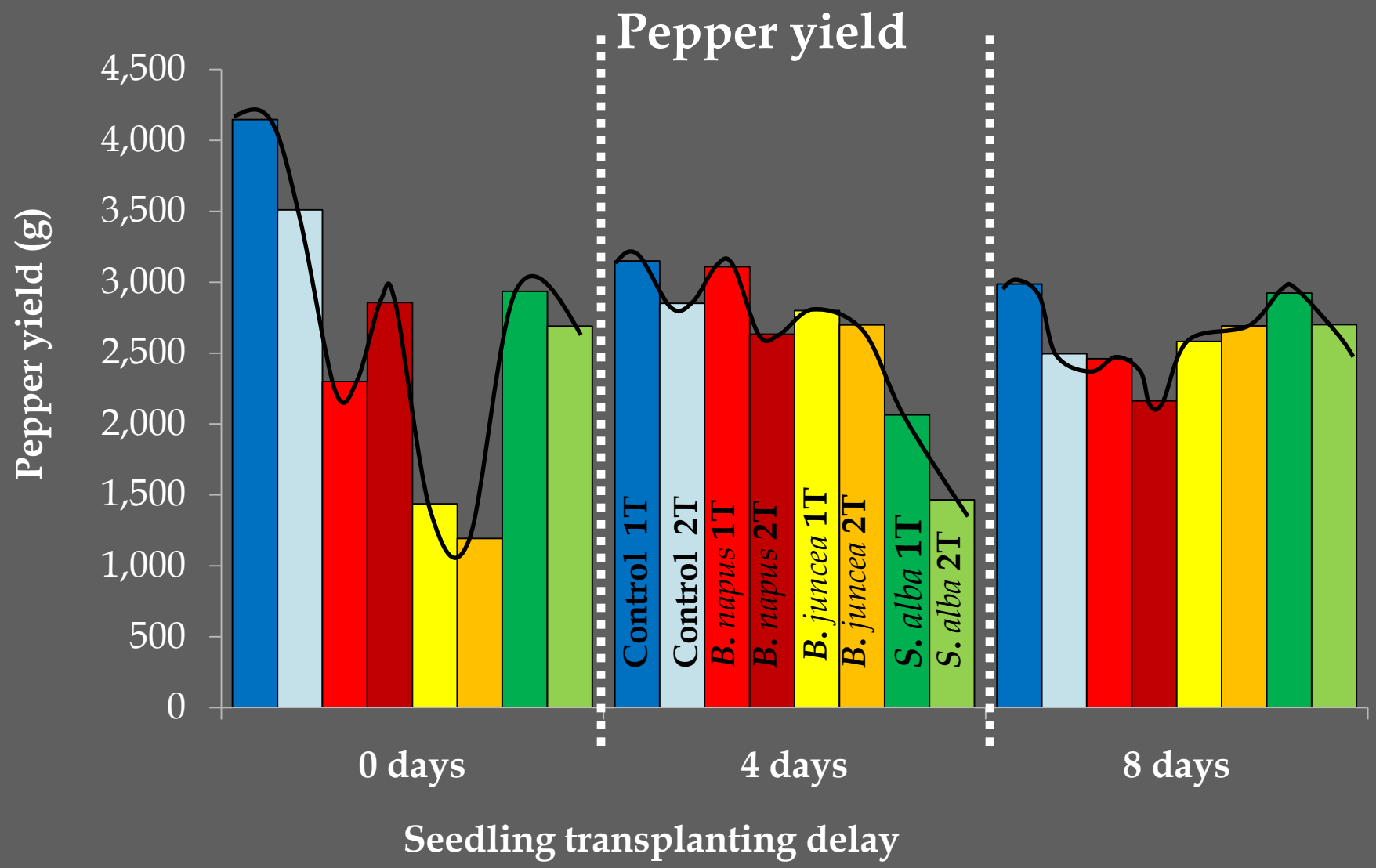
Results


Transplant seedling survival
Seedling survival (%)
100
90
80
70
60
50
40
30
20
10
0
Control 1T
Control 2T
B. napus 1T
B. napus 2T
B. juncea 1T
B. juncea 2T
S. alba 1T
S. alba 2T
0 days
4 days
8 days
Transplanting delay

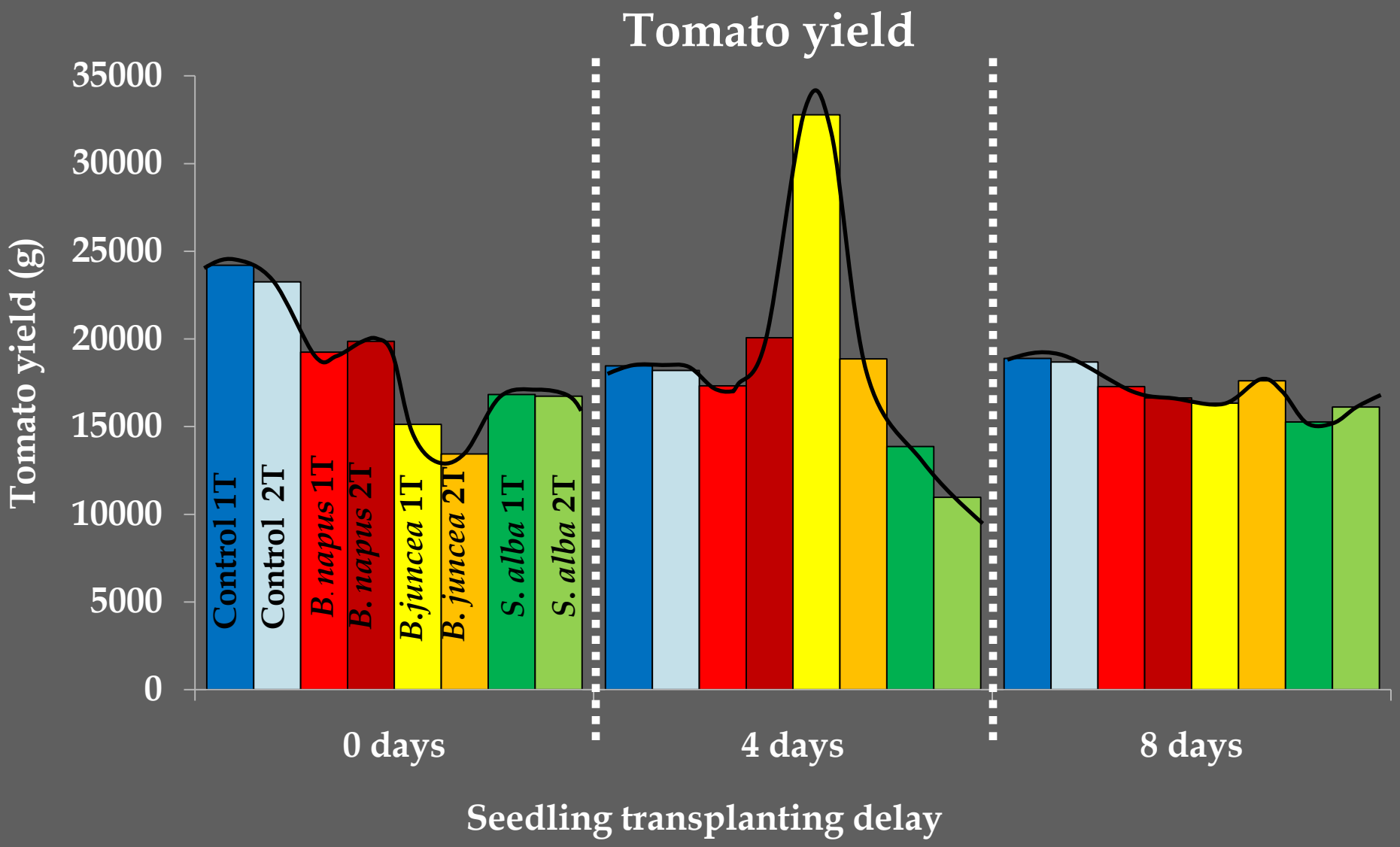
Results


Phytotoxicity
No toxicity
Phytotoxicity
Severe toxicity
9
8
7
6
5
4
3
2
1
0
Control 1T
Control 2T
B. napus 1T
B. napus 2T
B. juncea 1T
B. juncea 2T
S. alba 1T
S. alba 2T
0 days
4 days
8 days
Seedling transplanting delay

Results


Pepper yield
Pepper yield (g)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Control 1T
Control 2T
B. napus 1T
B. napus 2T
B. juncea 1T
B. juncea 2T
S. alba 1T
S. alba 2T
0 days
4 days
8 days
Seedling transplanting delay

Results


Tomato yield
Tomato yield (g)
35000
30000
25000
20000
15000
10000
5000
0
Control 1T
Control 2T
B. napus 1T
B. napus 2T
B.juncea 1T
B. juncea 2T
S. alba 1T
S. alba 2T
0 days
4 days
8 days
Seedling transplanting delay

Conclusions

- The best consistent weed control was achieved by amending soils with *S.alba* at 2 Mt ha^{-1}.
- Delaying transplanting after seed meal amendment resulted in an increase in weed populations in *B. napus* and *B. juncea* treatments.
- High fruit yield were obtained from seed meal treatments when transplanting was delayed 4 to 8 days.

Rhizoctonia solani damage on wheat

Use of Brassicaceae seed meal soil amendments for the suppression of *Rhizoctonia solani* AG-8 in wheat.

Materials and Methods

Three meals examined:

- *Sinapis alba* ('Ida Gold'), yellow mustard.
- *Brassica juncea* ('Pacific Gold'), Oriental mustard.
- *Brassica napus* ('Dwarf Essex'), rapeseed.

Materials and Methods

Meal treatments:

- 0.5% (w/w) denatured seed meal.
- 0.5% (w/w) non denatured seed meal.
- *Rhizoctonia solani* and no amendment control.

Materials and Methods

Pathogen species

- *Rhizoctonia solani* AG-8.
- Inoculated by using colonized oat seeds.
- 7 day incubation period.

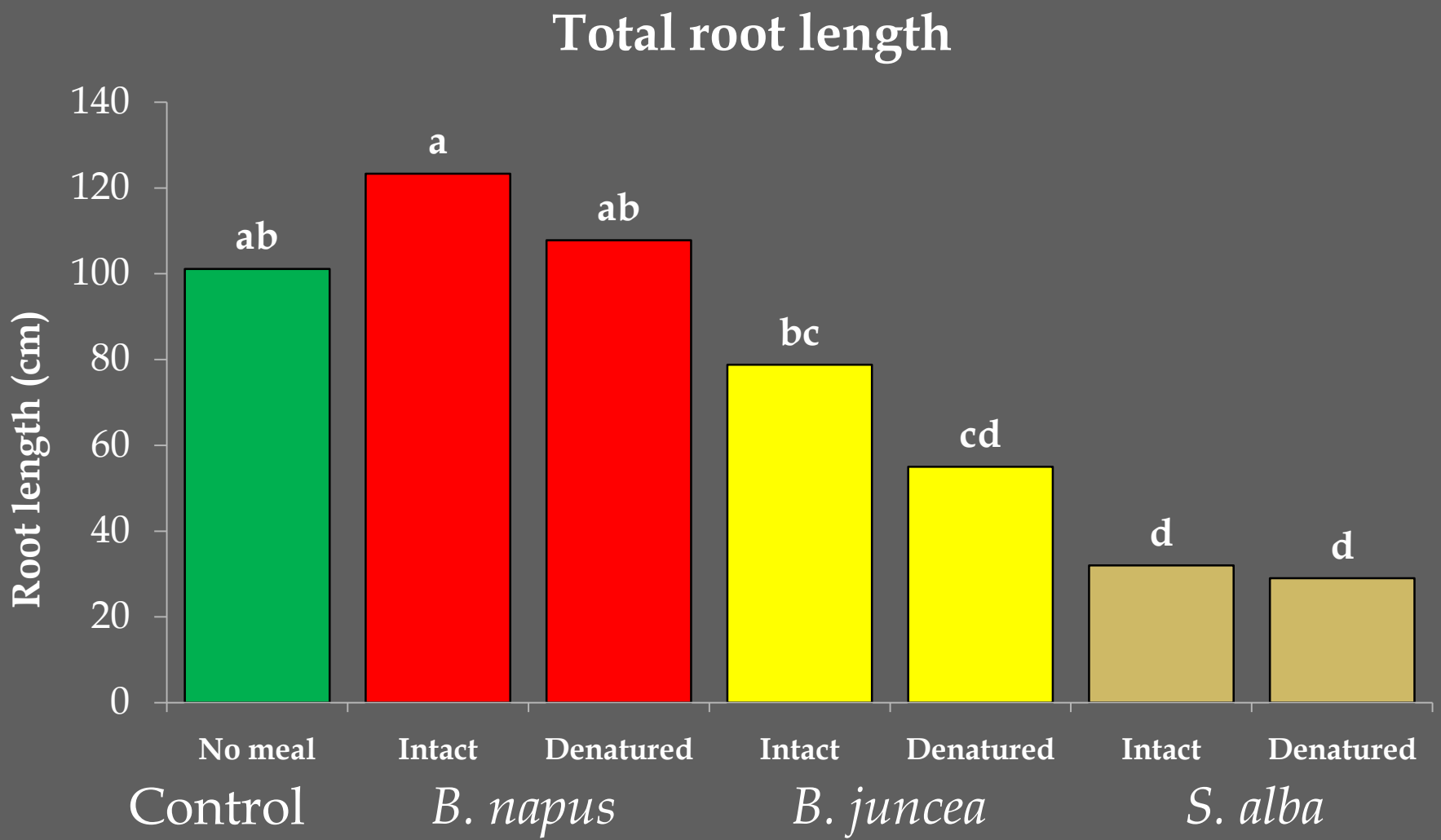
Crop species

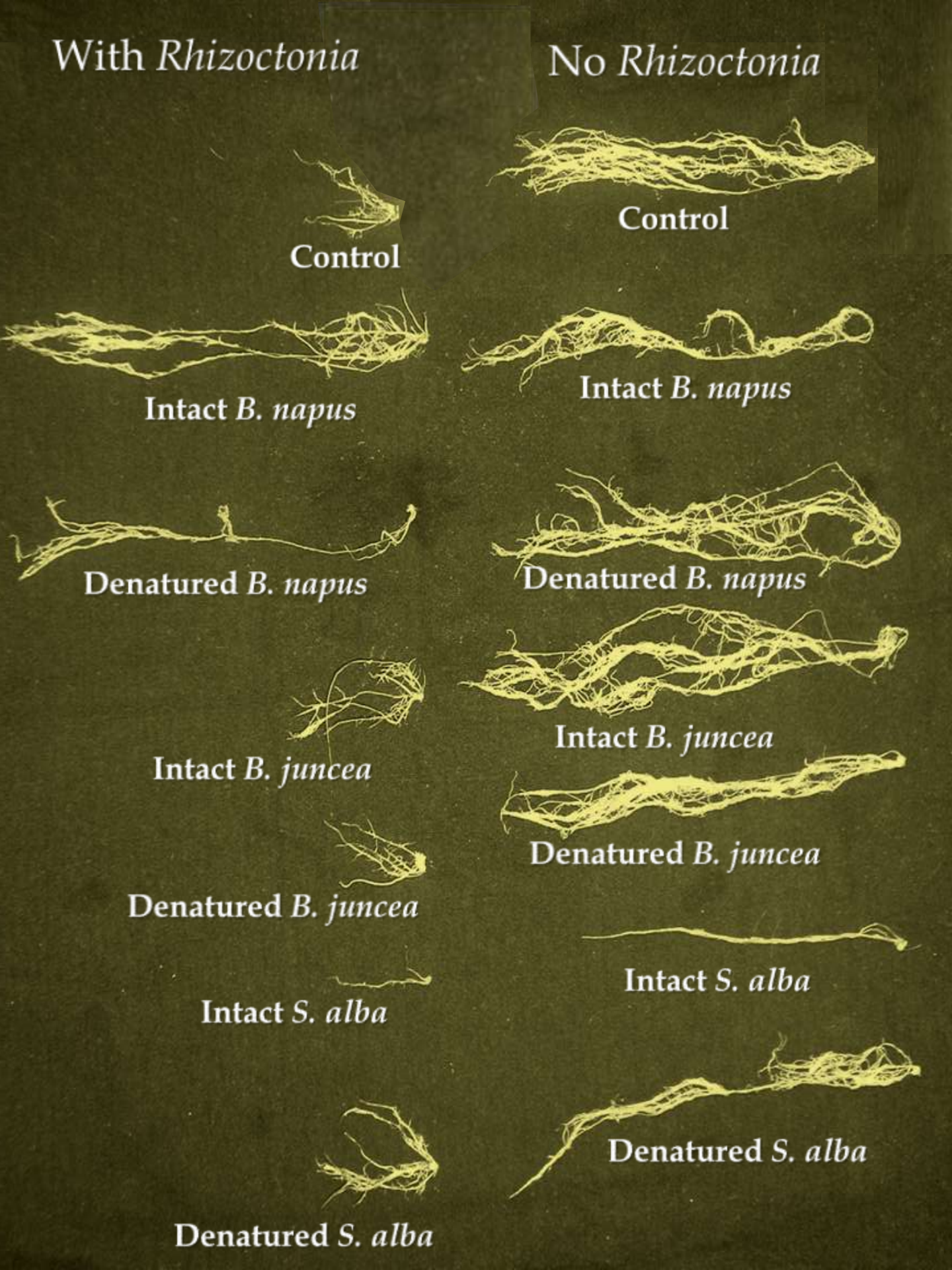
- Winter Wheat (‘Brundage’)

Each experimental unit

- 7 conical pots each with two seeds.

Results


Total root length
Root length (cm)
140
120
100
80
60
40
20
0
ab
a
ab
bc
cd
d
d
No meal
Intact
Denatured
Intact
Denatured
Intact
Denatured
Control
B. napus
B. juncea
S. alba


With *Rhizoctonia*
No *Rhizoctonia*
Control
Control
Intact *B. napus*
Intact *B. napus*
Denatured *B. napus*
Denatured *B. napus*
Intact *B. juncea*
Intact *B. juncea*
Denatured *B. juncea*
Denatured *B. juncea*
Intact *S. alba*
Intact *S. alba*
Denatured *S. alba*
Denatured *S. alba*

Conclusions

- Greatest wheat seedling weight and root weight was in soils amended with *B. napus* or *B. juncea* seed meal.
- Similar disease suppression by *B. napus* and *B. juncea* seed meals.
- *S. alba* seed meal was associated with greatest disease suppression.
- Future use of *S. alba* seed meal in *R.solani* AG-8 suppression, phytotoxicity must be addressed.


QUESTIONS