Broomrape Resurgence:
a Weed of Concern

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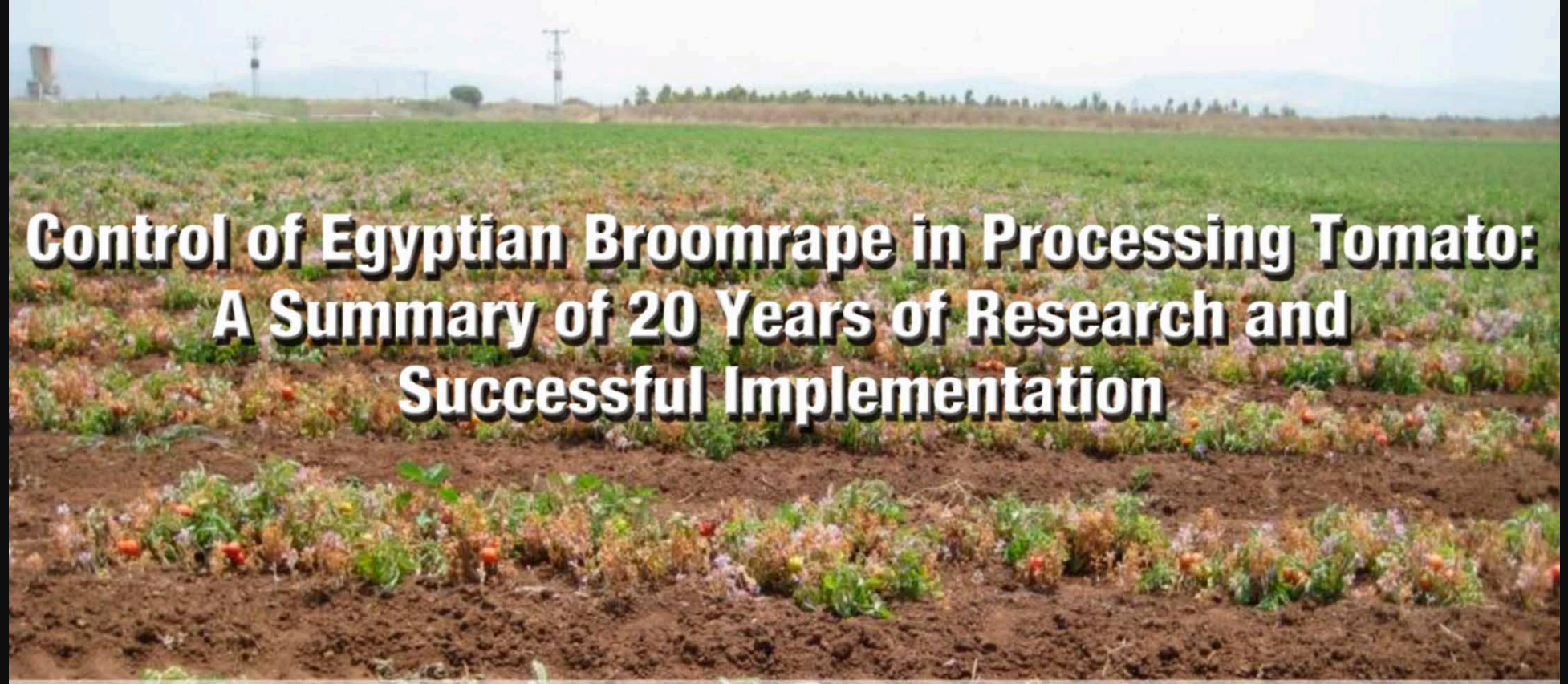
Branched Broomrape X
(Orobanche ramosa)

Egyptian Broomrape X
(Orobanche aegyptiaca)



Control of Egyptian Broomrape in Processing Tomato: A Summary of 20 Years of Research and Successful Implementation

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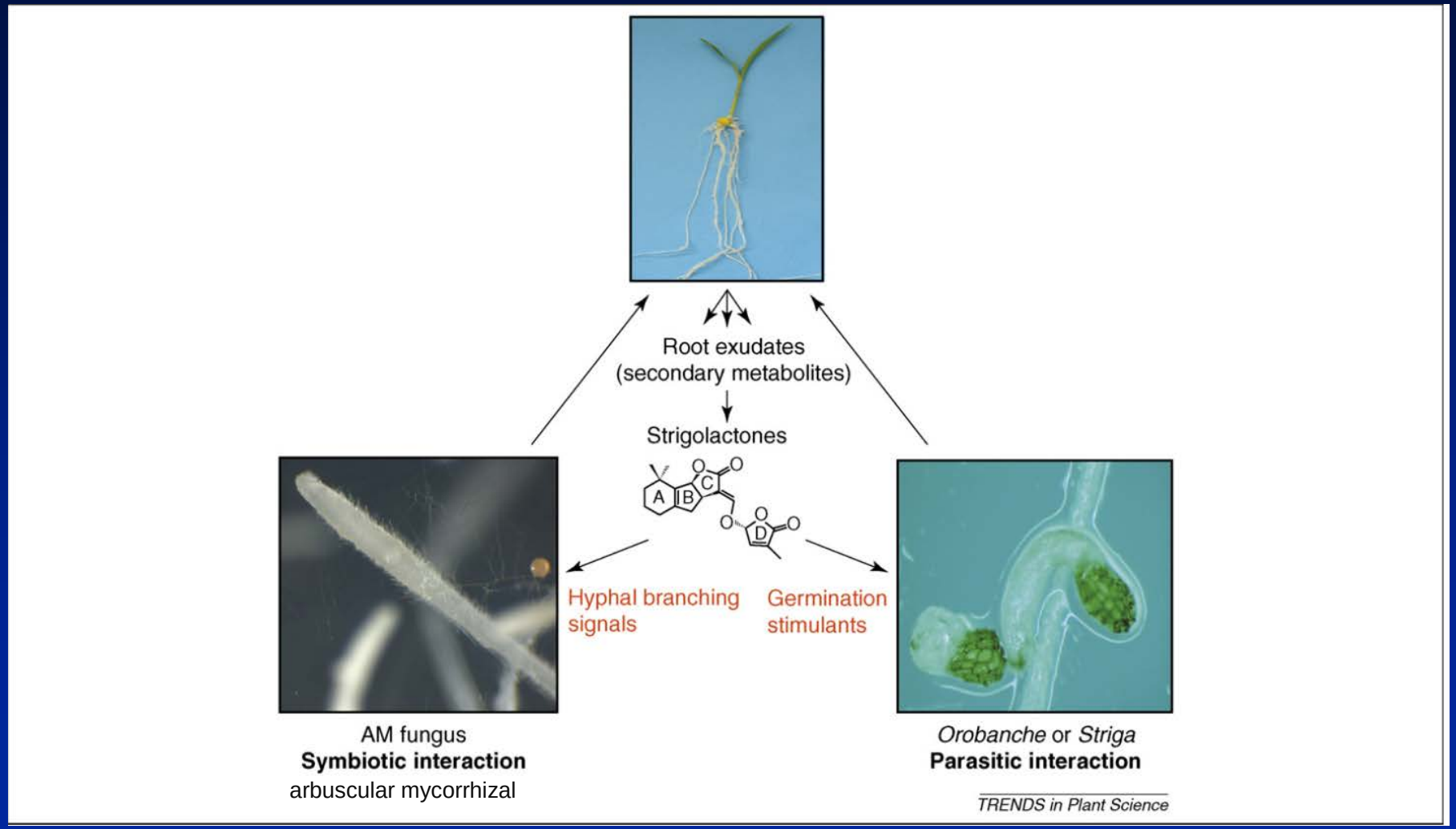
	O. ramosa	*O. aegyptiaca*
Leguminosae		
bird's foot trefoil	—	—
chickpea	x	x
clovers	x	—
groundnut	x	x
faba bean	x	x
lentil	x	x
lucerne/alfalfa	—	—
pea	x	x
Solanaceae		
eggplant	xxx	xxx
pepper	x	x
potato	x	x
tobacco	xxx	xxx
tomato	xxx	xxx
Umbelliferae		
carrot	x	x
celery	x	x
fennel	x	x
parsnip	.x	x

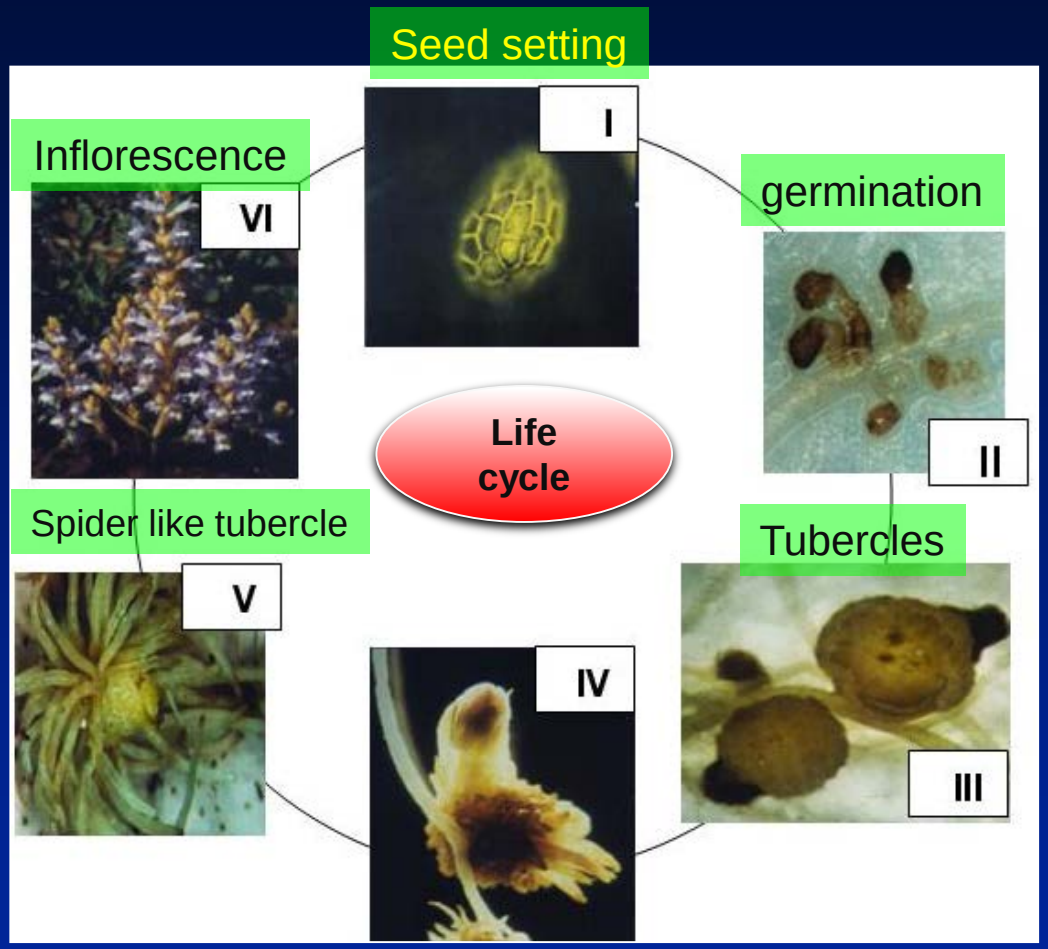
xxx seriously attacked; xx moderately attacked; x lightly attacked; — attack doubtful.

Family/crop	*O. ramosa*	*O. aegyptiaca*
Alliaceae		
onion	x	—
Cannabidaceae		
hemp	xx	—
Compositae		
lettuce	xx	—
noog/niger seed	—	—
safflower	—	—
sunflower	x	xx
Cruciferae		
cabbage	x	x
mustard	xx	xxx
rapeseed	xxx	x
Cucurbitaceae		
cucumber	x	xx
melon	x	xx
squash	x	xx
water melon	x	xx

Strigolactone is a stimulant for the parasite seed germination



Once conditions are optimal, the parasite seeds will germinate



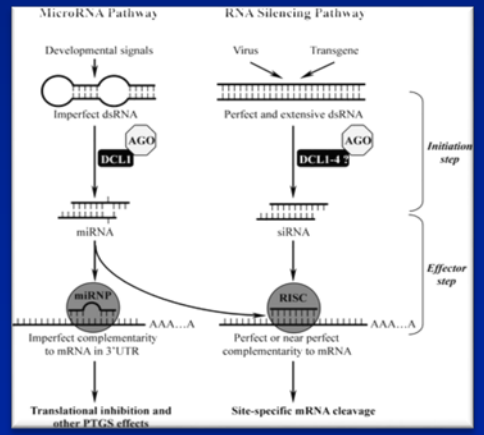
P. aegyptiaca reduced quality and yield quantity in tomato fields

Cabbage highly infested with *P. aegyptiaca*

Novel control strategy

Approaches

Gene silencing and editing



Plant arming by toxic compounds

Non-transgenic

Transgenic

(Aly et al., 2006); (Hamamouch et al., 2005)

Non-transgenic

Transgenic

(Aly et al., 2006); (Hamamouch et al., 2005)

Broomrape: Egyptian species

an introduction into U.S.

Sample by
25’ x ~25’ grid
presence/absence

1. √ Limit spread (quarantine)
2. Reduce seed production
   - √ 1. Kill host
   - 2. Hand Remove weed
   - 3. Flame-kill seed
   - 4. Fumigation
3. Post: scout for escapes
4. SANITATION (in general)

Glyphosate-kill host to reduce seed production

1. √ Limit spread (quarantine)
2. Reduce seed production
    1. Kill host
    2. ~~Hand Remove weed~~
    3. Flame-kill seed
    4. Fumigation
3. Post: scout for escapes
4. √ SANITATION (in general)

88 hours/acre

Bag shoots
to reduce seeds

Problem:
Incomplete as many seeds have already shed.

Seeds are:

Tiny
Abundant
Long-lived

Seeds:

Dispersal

1. Limit spread (quarantine)
2. Reduce seed production
   1. Kill host
   2. ~~Hand Remove weed~~
   √ 3. Flame-kill seed
   4. Fumigation
3. Post: scout for escapes
4. SANITATION (in general)

~ $200 per acre

Intense heat kills exposed seed

…but not when protected under:

fruit
vines
soil & clods

Department of Food and Agriculture
GRANT AGREEMENT
GAU-03 (Rev. 7/13)

GRANT AGREEMENT SIGNATURE PAGE

AGREEMENT NUMBER
14-0488-SA

1. This Agreement is entered into between the State Agency and the Recipient named below:

STATE AGENCY'S NAME
DEPARTMENT OF FOOD AND AGRICULTURE (CDFA)

RECIPIENT'S NAME
UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

2. The term of this Agreement is: November 1, 2014 through June 30, 2015

3. The maximum amount of this Agreement is: $88,223.00
Eighty Eight Thousand Two Hundred Twenty Three Dollars and Zero Cents

4. The parties agree to comply with the terms and conditions of the following exhibits which are by this reference made a part of the Agreement:

Exhibit A: 3 Page(s)
- Recipient and Project Information
- Scope of Work

Exhibit B: 2 Page(s)
- Budget & Payment Provisions
- Budget

Exhibit C – General Terms and Conditions 2 Page(s)

Name of Project: Egyptian Broomrape (EBR)

IN WITNESS WHEREOF, this Agreement has been executed by the parties hereto.

RECIPIENT

RECIPIENT'S NAME *(Organization's Name)*
UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

BY *(Authorized Signature)*	DATE SIGNED *(Do not type)*
✍	

PRINTED NAME AND TITLE OF PERSON SIGNING

ADDRESS
70 Cottonwood Street, Woodland, CA 95695

STATE OF CALIFORNIA

AGENCY NAME
DEPARTMENT OF FOOD AND AGRICULTURE (CDFA)

BY *(Authorized Signature)*	DATE SIGNED *(Do not type)*
✍	

PRINTED NAME AND TITLE OF PERSON SIGNING
CRYSTAL MYERS, MANAGER - FEDERAL FUNDS MANAGEMENT OFFICE

ADDRESS
1220 N STREET, ROOM 120
SACRAMENTO, CA 95814

CJ

CA Tomato Processors

CALIFORNIA Tomato GROWERS ASSOCIATION

California Tomato Research Institute

1. Limit spread (quarantine)
2. Reduce seed production
    1. Kill host
    2. ~~Hand Remove weed~~
    3. Flame-kill seed
    4. √ Fumigation ~ $4K per acre
3. √ Post: scout for escapes
4. SANITATION (in general)

Application of sulfonylurea herbicides directly to the soil, pre-broomrape attachment, controlled Egyptian broomrape in tomato (*Solanum lycopersicum*) and potato

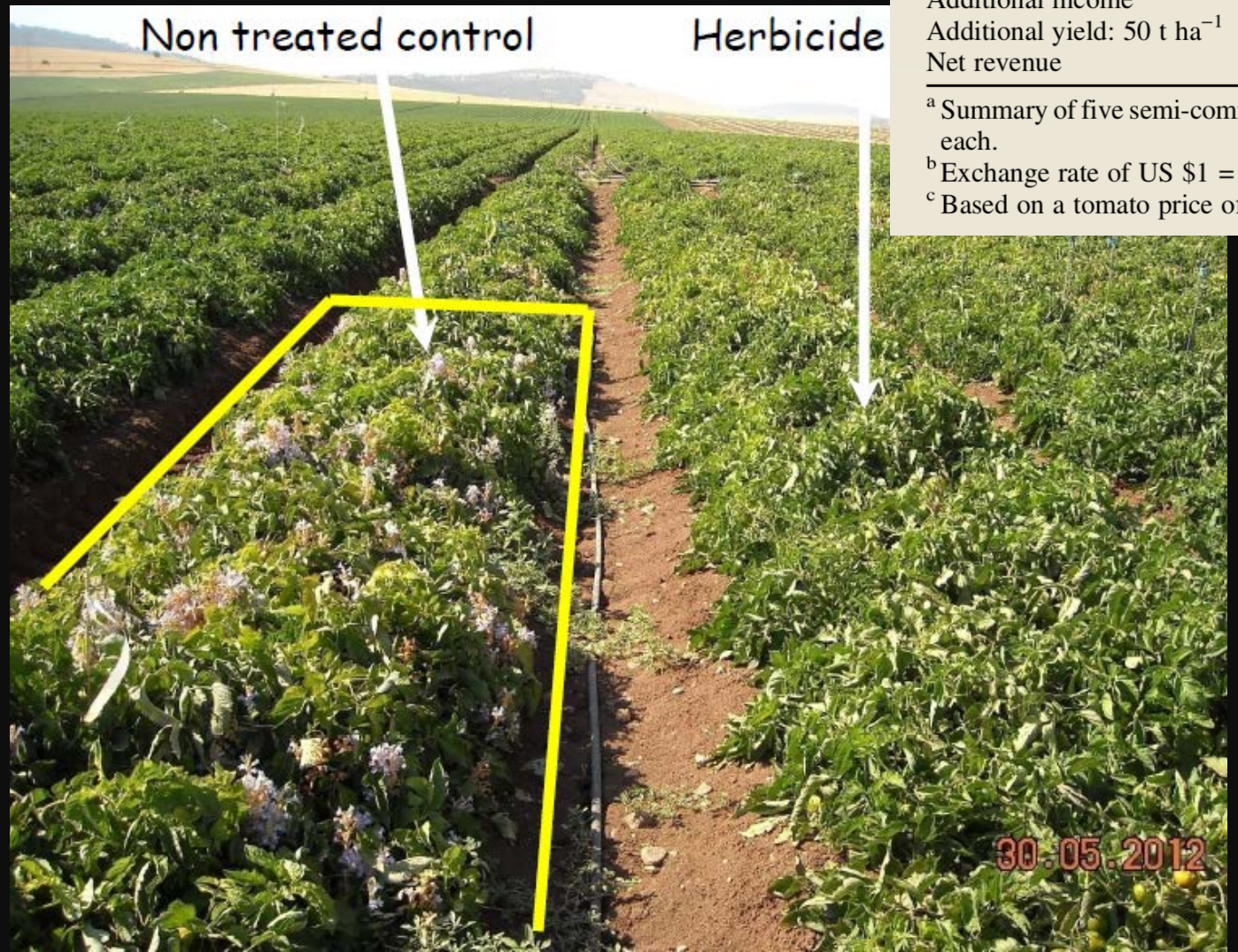


Table 4. *PICKIT* broomrape management balance sheet[a]

Additional costs	Cost/income ($/ha)[b]
Rototilling	112
Sulfosulfuron 50 g ha^{-1}	108
Sulfosulfuron application (sprayer)	24
Imazapic 80 g ha^{-1} (split application)	275
Total cost	519
Additional income	
Additional yield: 50 t ha^{-1}	5,250[c]
Net revenue	4,731

[a] Summary of five semi-commercial plots treated in 2014, 1.5 to 2.5 ha each.
[b] Exchange rate of US $1 = 3.5 NIS.
[c] Based on a tomato price of $105 ton^{-1}.

NOTE: Not Registered for use in California

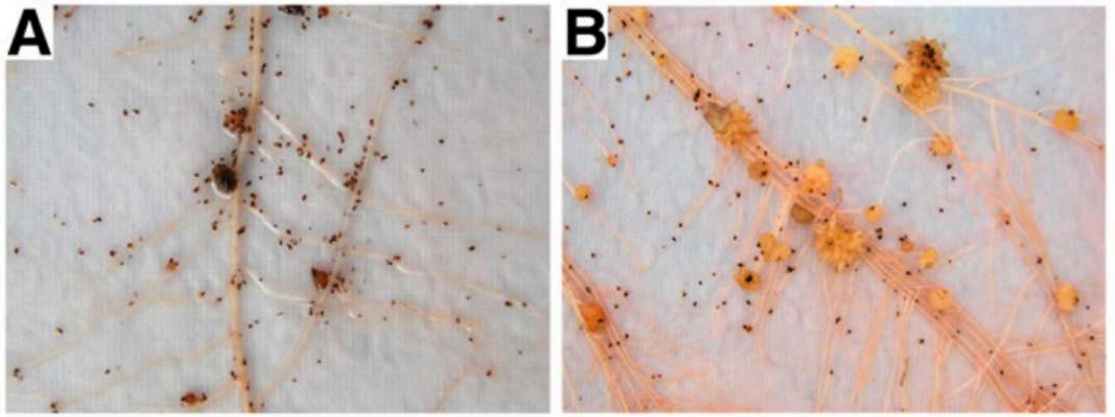


Fig. 5. Effect of imazapic application on Egyptian broomrape attached to tomato roots in the polyethylene bag system. (**A**) Treated with 5 ppb imazapic. (**B**) Untreated control.

Fig. 6. Damage to tomato fruit caused by foliar application of 4.8 g a.i. ha^{-1} imazapic. Left, damage to fruit set. Right, damage to young fruits.

Broomrape Control Choices:

$pend lots <u>early to eradicate</u> vs.

$pend <u>continuously</u> to routinely manage??