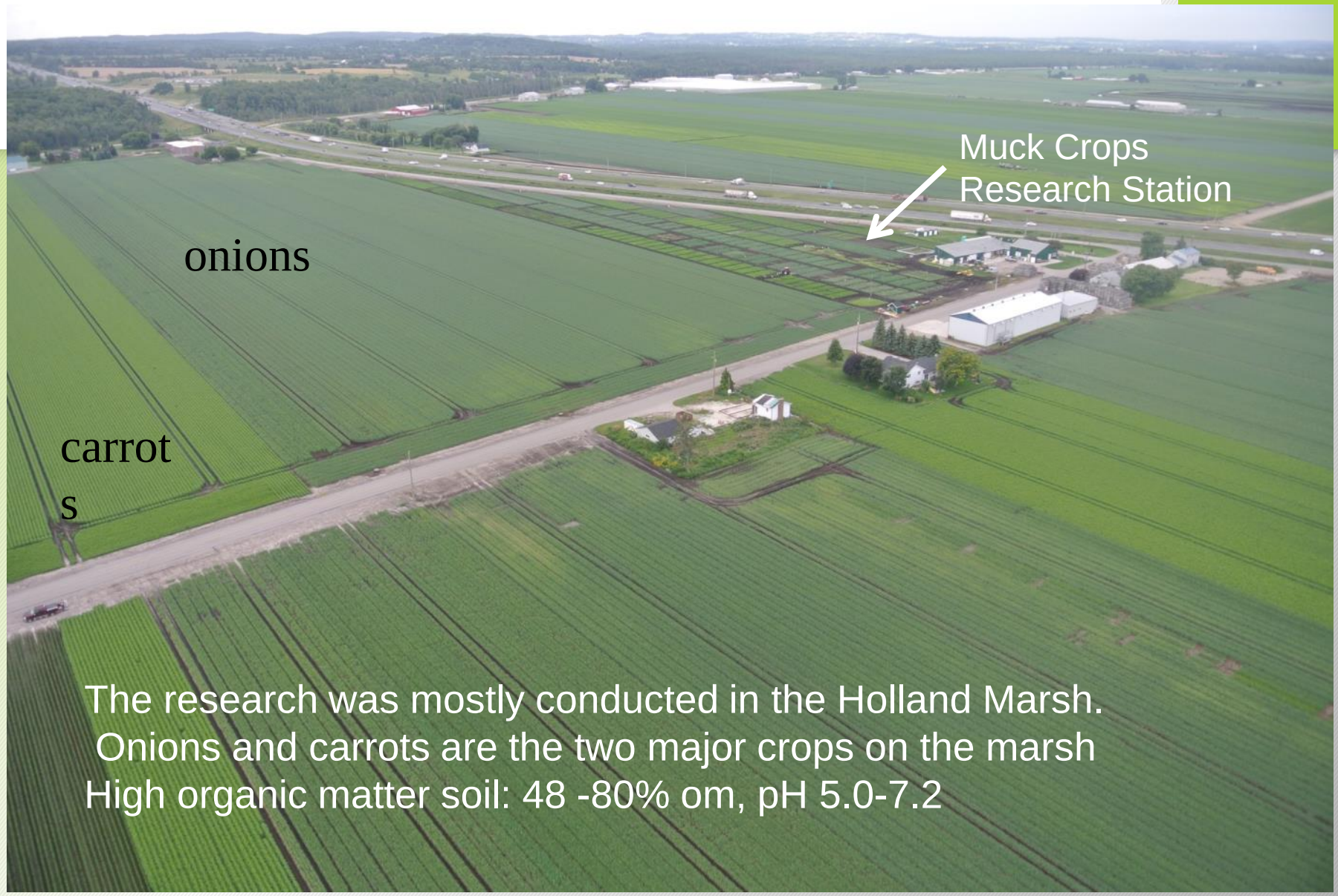
Management of nematodes and carrot diseases

Mary Ruth McDonald,

Dennis Van Dyk, Kevin Kooi and Laura Riches



The research was mostly conducted in the Holland Marsh.
Onions and carrots are the two major crops on the marsh
High organic matter soil: 48 -80% om, pH 5.0-7.2

Muck Vegetable Production in Ontario (acres)

- Carrots - 7750 acres
  - Half on muck soil
- Onions - 5600
  - All on muck soil
- Chinese cabbage- 3197
- Other Asian veg ?
- Red beets- 1428
- Celery - 619
- Green onions- 522
- Lettuce - 430
- Radishes- 327
- Leeks- 166

Carrots in Ontario

- Cello pack
- Jumbo
- Processing- mineral soil
- Bunched (minor)
- Cut and peel (baby cut) carrots, also minor
- Some interest in multicoloured “heirloom” carrots

Nematode Damage

Root Knot Nematode

Root Knot Damage

Also carrot cyst nematode

Lesion Nematode Damage

Products

Biologicals

- MustGrow: Oriental mustard seed meal
- Dazitol
  - Essential oil of mustard + oleoresin of capsicum
- Agri-Mek: Abamectin *Streptomyces avermitilis*

Nematicides

- Nimitz: Fluensulfone
- Movento: Spirotetramat (also an insecticide)

Fumigants

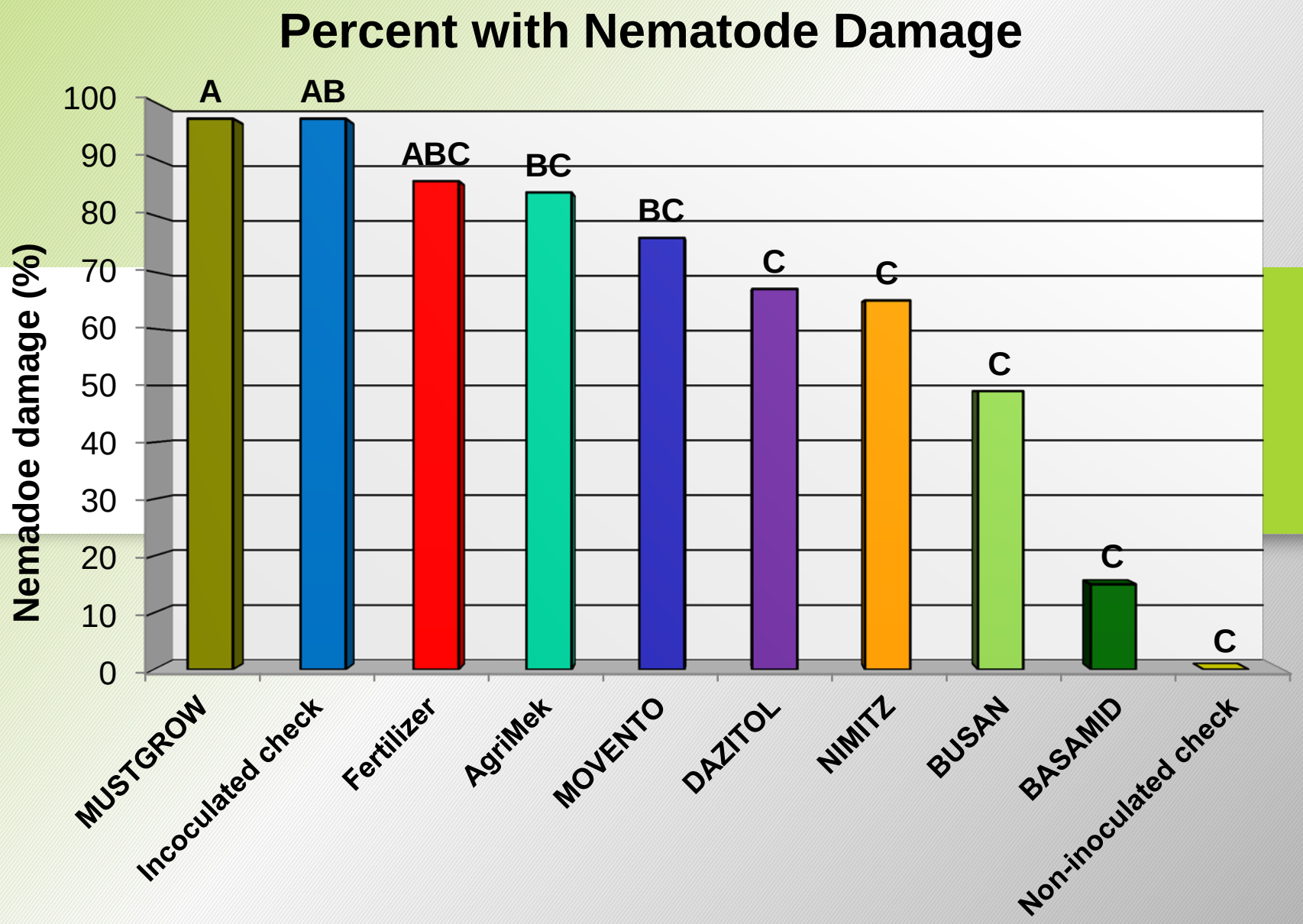
- Pic Plus: Chloropicrin
- Busan/Vapam: Metam sodium
- Basamid: Dazomet

Root knot nematode: Carrot growth room trials

- Treatments

1. Non-inoculated check
2. Inoculated check
3. Movento at 350 ml/ha spray post-plant
4. Agri-Mek at 20 L/ha
5. Dazitol at 60L/ha
6. Basamid at 392 kg/ha
7. Nimitz EC at 8.3 L/ha
8. MustGrow at 1680 kg/ha
9. **5-5-5 slow release fertilizer**
10. Busan 1236 at 275 L/ha

Carrot Growth Room Trial



Nematode management

Field Trials

Pic Plus – chloropicrin

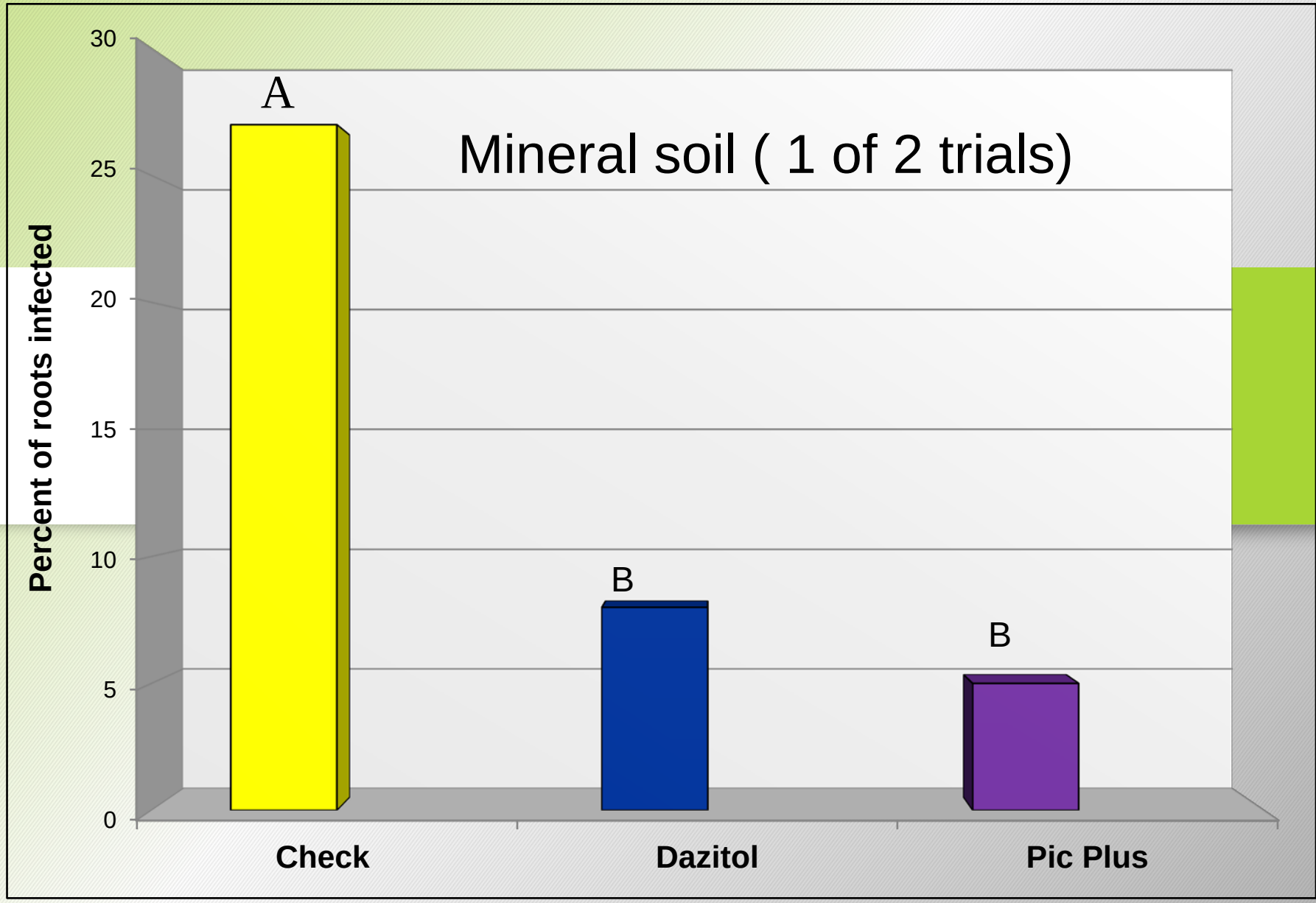
Applied below the seed, in the hill, at the time of seeding

Applying PIC PLUS

Mineral Soil Trial 2013

Assessing Pic Plus, Dazitol and other products – 2 trials

Carrot Fumigant Field Trial- 2014



Stunting of carrots can be caused by nematodes and Pythium

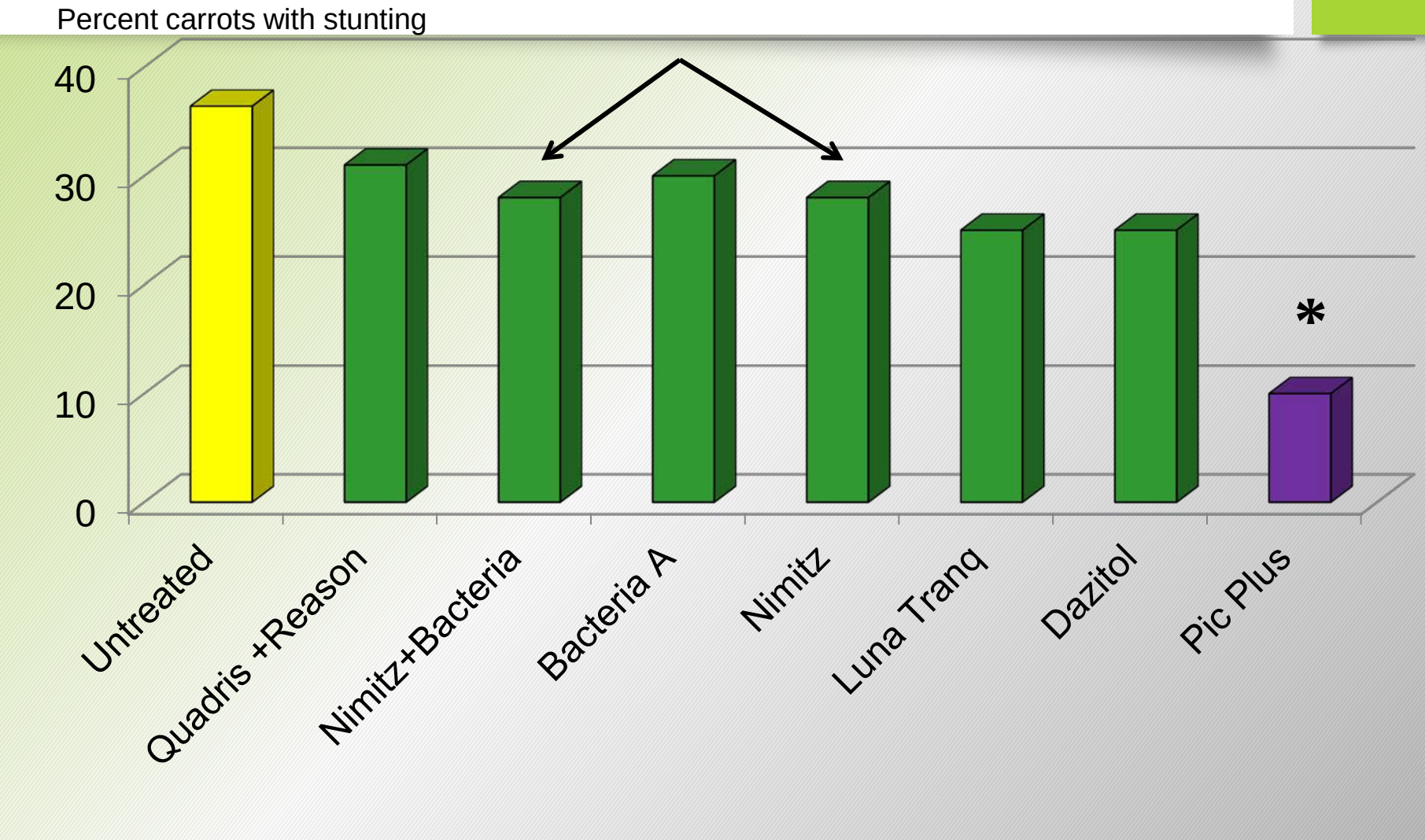
Biocontrols for Pythium root dieback?

Treatments for carrots Pythium and Nematodes 2014

Treatment	Timing of Applications (DBS)	Equipment	Product Location
PIC PLUS	at seeding	custom seeder	**banded -25cm below seed**
DAZITOL	2 DBS	custom fumigator	**broadcast 25 cm below soil**
LUNA TRANQUILITY	at seeding	HYPRO roller pump	**in-furrow above seed**
NIMITZ	7 DBS	custom fumigator	**broadcast 15 cm below soil and soil surface**
BACTERIA A	at seeding	HYPRO roller pump	**in furrow above seed**
NIMITZ + BACTERIA	7 DBS + at seeding	HYPRO roller pump	**broadcast 15 cm below soil and soil surface + in-furrow**
QUADRIS + REASON	at seeding	HYPRO roller pump	**in-furrow above seed**
Check	**--**	**--**	**--**

Field site on muck soil. Some products have to applied 2 weeks before seeding

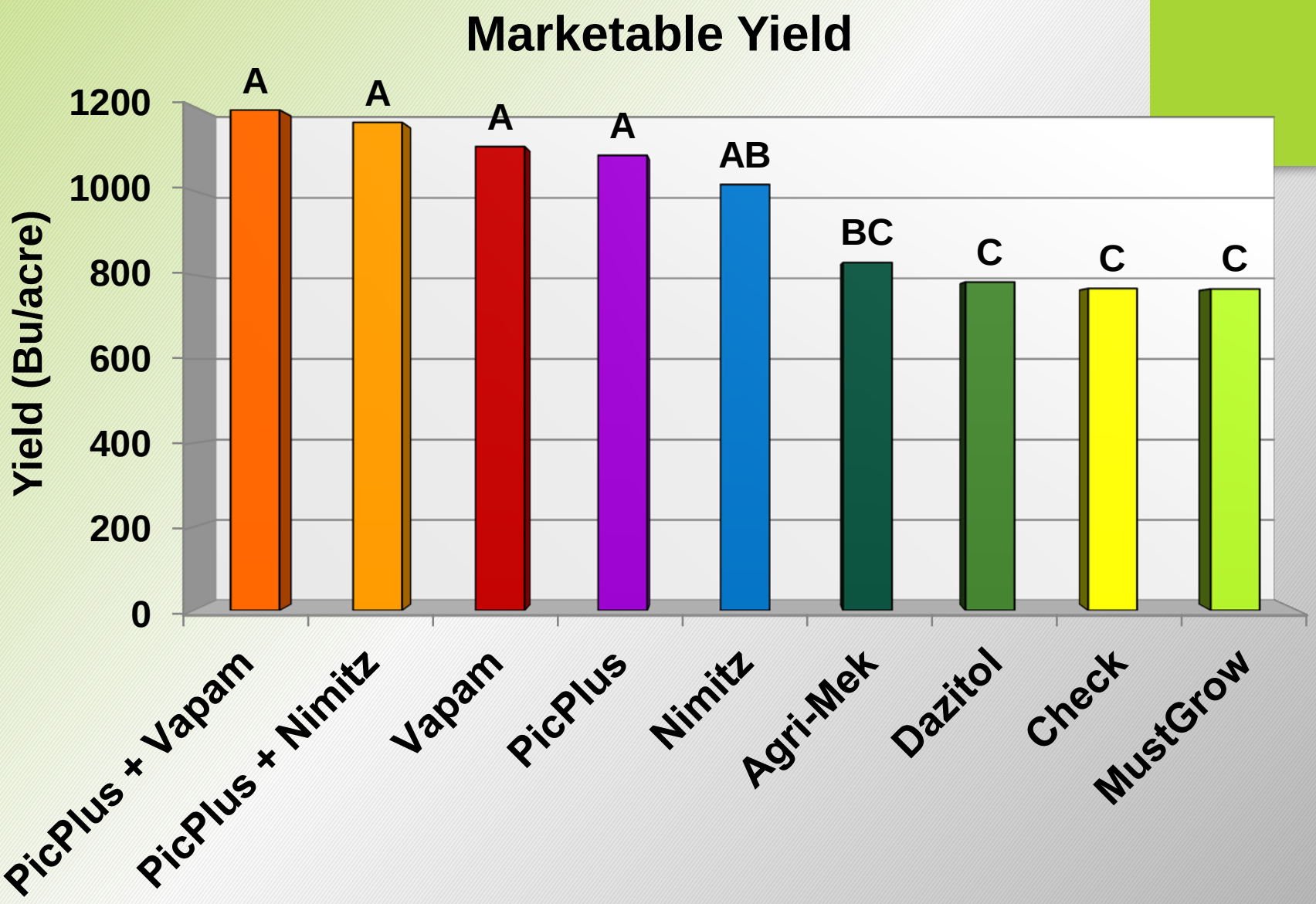
Nematicides and fungicides to control Pythium stunt and carrot cyst nematode



2014 Trial 2 on muck soils Treatments

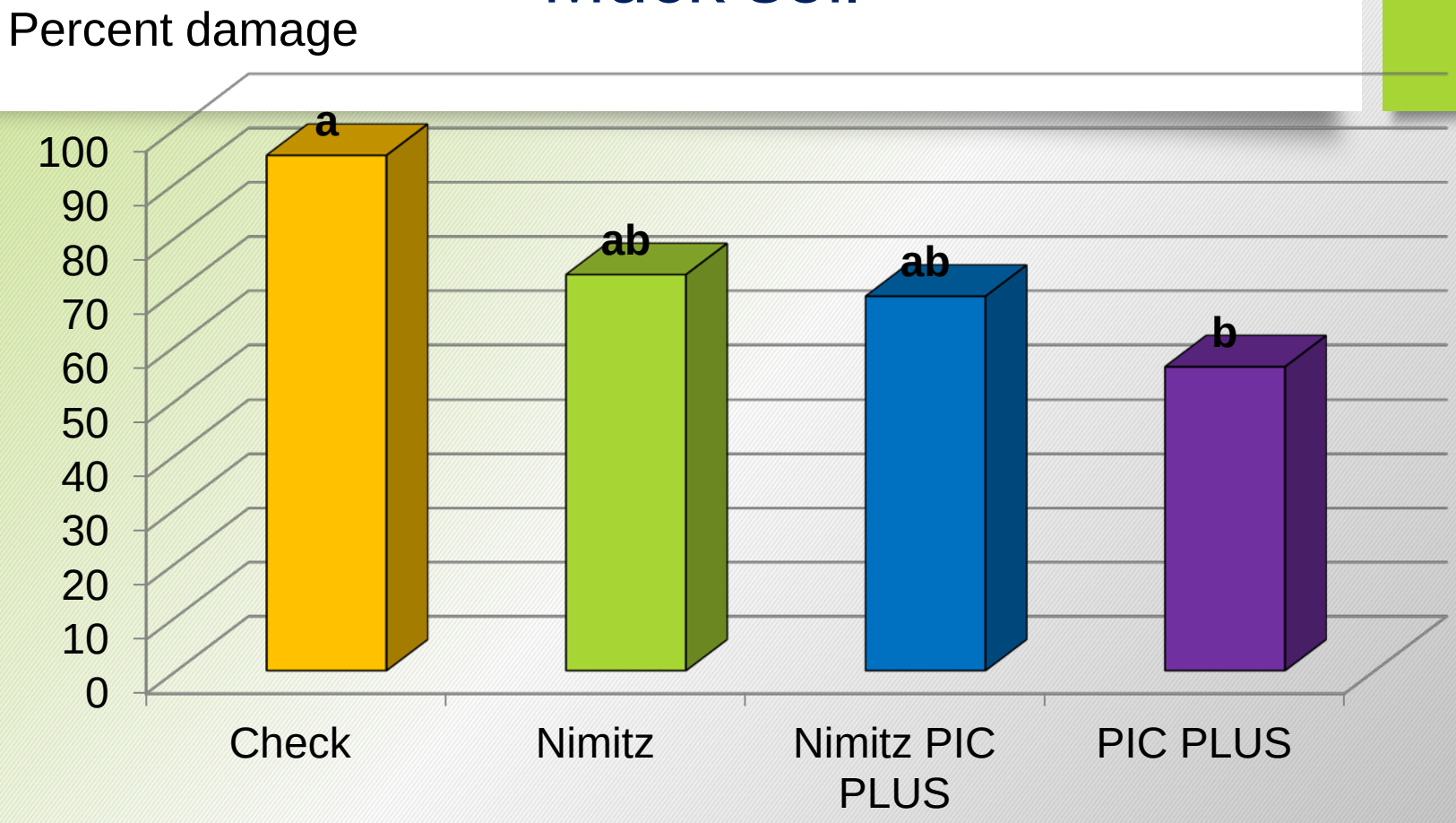
1. **Untreated check**
2. **PicPlus** (at seeding)
3. **Vapam** (broadcast 2 weeks before seeding)
4. **Nimitz** (broadcast/incorporate 1 week before seeding)
5. **PicPlus** + **Vapam**
6. **PicPlus** + **Nimitz**
7. **AgriMek** (drench over furrow during seeding)
8. **MustGrow** (granular broadcast 2 weeks before seed)
9. **Dazitol** (broadcast 3 days before seeding)

Field Trial 2 2014




Modifications for
applying Nimitz

Field trials- nematode control -2015 Muck soil



Note: Nimitz is not expected to be effective on high organic matter soils

Managing carrot nematodes

- Fumigants provided most consistent control
- Nimitz reduced nematode damage comparable to fumigation in some trials
- Agri-Mek reduced nematode damage in some trials, Dazitol in one trial
- No advantage of combining fumigants and Nimitz
- **New regulations for applying fumigants:**
  - **Tarping, separation distances, notification**

Carrot Leaf Blights

- **Two diseases are managed together:**
- ***Alternaria dauci*** ((Kuhn) Groves and Skolko)
- ***Cercospora carotae*** ((Pass. Solheim)

Ministry of Agriculture and Food

Ontario

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Factsheet

Weather-Timed Sprays For Carrot Blight Control

(Reprinted July 1983)

J.C. Sutton, Department of Environmental Biology, and **T.J. Gillespie**, Department of Land Resource Science, University of Guelph

Two leaf-blight diseases commonly affect carrots grown in Ontario: Alternaria leaf blight and Cercospora leaf blight. Leaves weakened by blight diseases often break off when gripped by a mechanical harvester, resulting in unharvested carrots. Harvesting losses tend to be greater if blighted leaves are also affected by frosts. The blights normally do not reduce growth of taproots in carrot cultivars presently grown in Ontario.

For many years, growers have controlled blights by means of about 5 to 7 fungicide sprays applied to carrot leaves at regular intervals of 7 to 10 days beginning in late July. This Factsheet describes a new scheme for timing fungicide sprays according to blight-favorable weather. This weather-timed spray scheme controls blight effectively, yet in most seasons fewer sprays are needed than in regular spray programs. Thus the scheme reduces cost, waste and environmental contamination by fungicides.

Recognition of Leaf Blights

For the weather-timed spray scheme it is important to recognize the blights, especially when they first appear.

Alternaria leaf blight (Figure 1) appears as irregular brown spots often surrounded by yellowish halo-like zones. The spots are most frequent near the edges and tips of the numerous lobes of carrot leaves. As disease progresses, entire leaf lobes turn brown, shrivel, and appear "burned".

Cercospora leaf blight (Figures 2 and 3) is recognized by the almost circular, gray or brown spots that appear on the leaves.

Figure 1. Alternaria leaf blight developing in carrots. Note the irregular brown spots near the edges and tips of the leaves, and the "burned" appearance of some leaf lobes

Figure 2. Cercospora blight in a carrot leaf. Note the almost circular, gray or brown spots on the leaf lobes
Photo: D.J. Hamilton

Cercospora Leaf Blight

Alternaria Leaf Blight

Background

- Suncor, a petroleum company, has developed a good grade oil, Civitas, that is registered for use on turf grass
- They are interested in potential registrations of similar products for edible crops
- Different products, adjuvants, and methods of application
- Tested on carrots and onions
  - 2013, 2014 and 2015

Food grade oil has some interesting activity, but also some problems:

- The adjuvants often separate in the spray bottle (constant agitation needed)

- Different adjuvants (not bright green) are needed

Food grade oil = A
Green adjuvants = B

Treatments

- Cv Belgrado
- Seeded 2, 3 June
- Randomized complete block, 4 reps per treatment
- 4 rows (raised beds), 5 m in length
- Food grade oil in combination with 4 adjuvants (B-E)
- Second type of food grade oil in 2014
- In combination and comparison to fungicide boscalid (Lance) in 2013
- Endura (boscalid /Lance) and Quadris Top (azoxystrobin plus difenoconazole) in 2014
- Drench, foliar sprays, drench plus foliar sprays (500 L/ha)
- 5 sprays at 2 week intervals, starting 6 Aug (2013) and 30 July (2014)

Treatments 2014

1st Application		2nd, 3rd, 4th, 5th Applications	
Products	Rates (L/ha)	Products	**Rates (L/ha)**
check	--	--	**--**
QUADRIS TOP at	1.0	QUADRIS TOP at	**1.0**
QUADRIS TOP + A + B	1.0+ 25 + 1.6	QUADRIS TOP + A + B	**1.0+ 25 + 1.6**
Endura/ LANCE	315 g	LANCE	**315 g**
Endura/ LANCE	315 g + 25 + 1.6	LANCE	**315 g + 25 + 1.6**
A +B (soil drench[1])	100 + 6.3	A +B (std rate)	**100 + 6.3**
A +B (std rate)	25 + 1.6	A +B (std rate)	**25 + 1.6**
A +B (half rate)	12.5 + 0.8	A +B (half rate)	**12.5 + 0.8**
A + B + C	25 + 1.6 + 4	A + B + C	**25 + 1.6 + 4**
A + D	25 + 1.6	A + D	**25 + 1.6**
A + B + E	25 + 1.6 + 5	A + B + E	**25 + 1.6 + 5**
G at 25 L + B	**25 + 1.6**	**G at 25 L + B**	**25 + 1.6**

Soil drench on 31 July applied at 2,000 L/ha drench volume.

Disease Assessments

9 October, 26 September

10 plants per rep harvested and all leaves sorted in to classes

Scale of 0 – 5

0= all healthy

1= < 10 % disease leaf blight per leaf

2= 11-25%

3 = 26-50%

4= 51-75%

5= over 75%

A disease severity index was calculated (0-100)

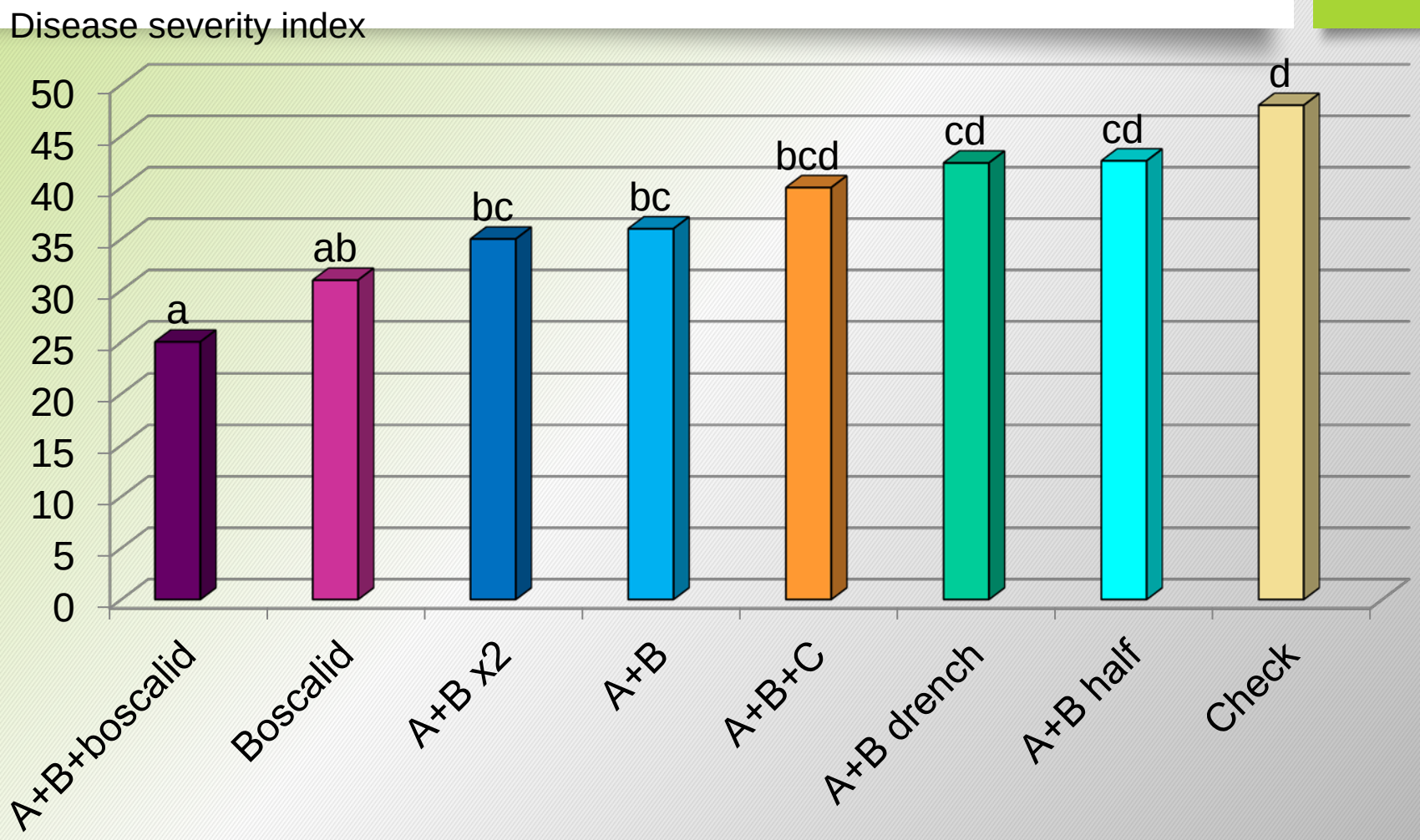
Dead leaves were counted separately

Number of plants per rep with symptoms of aster yellows

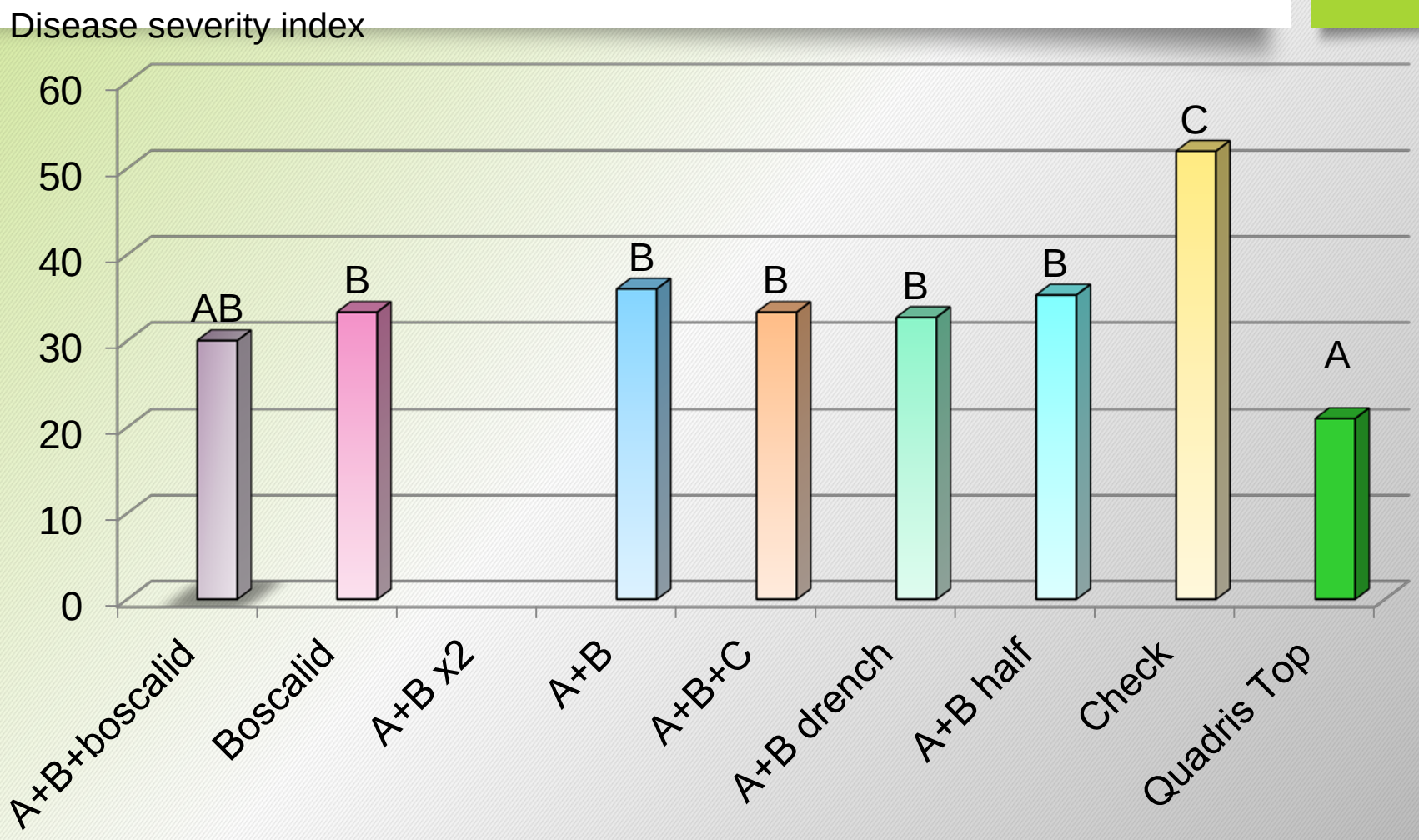
Yield and quality

- Harvested 29, 22 October
- 2 x 1.16 m sections of row
- Total yield (tonnes/ha)
- Percent culls,
- % medium (2.0- 4.4 cm diameter,
- % Jumbo (> 4.4 cm dia)

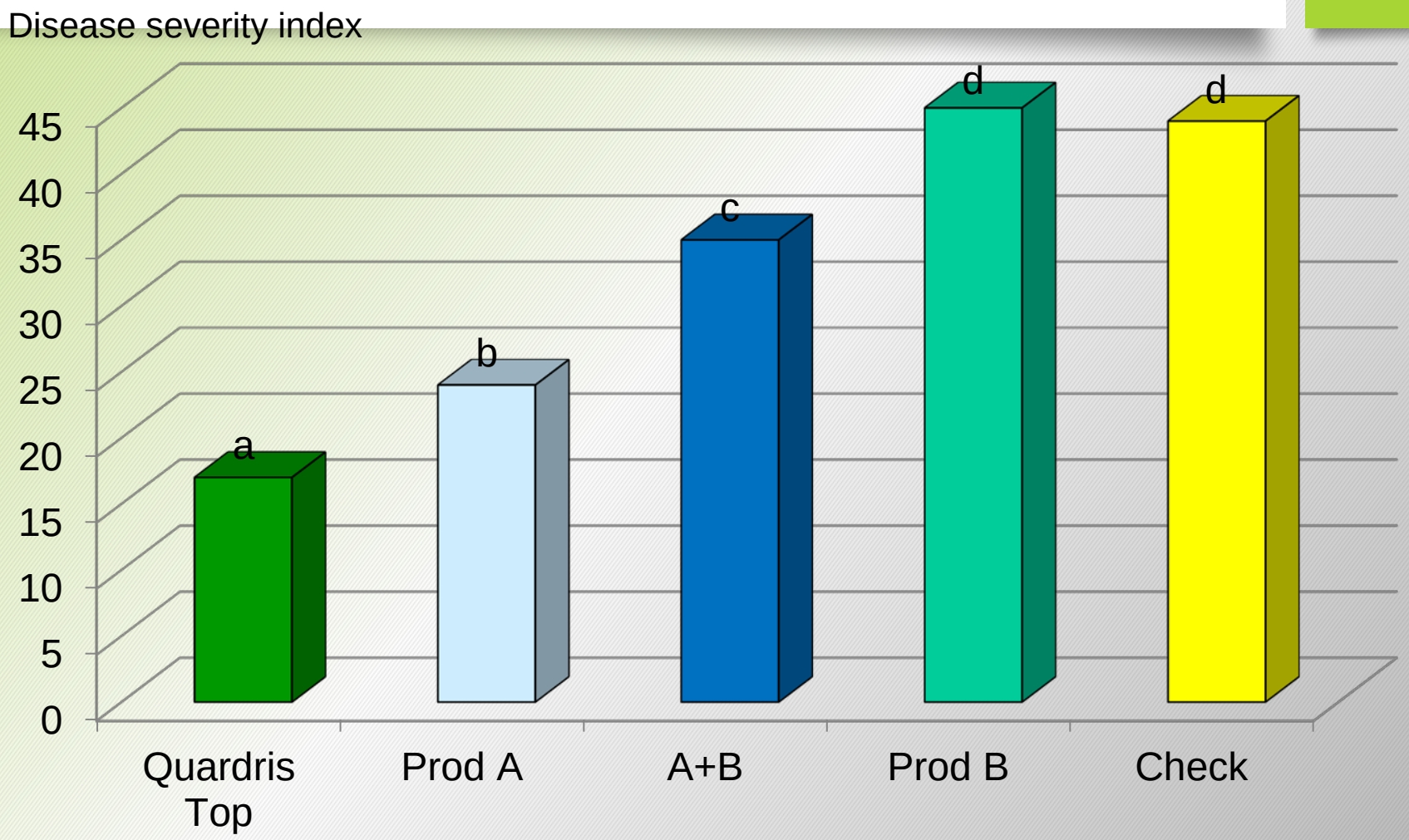
Food grade oil and carrot leaf blight 2013



Food grade oil and carrot leaf blight 2014



Food grade oil and carrot leaf blight 2015



Conclusions- leaf lights

- **Leaf blight pressure was moderately high all years**
- **The food grade oil plus adjuvant, or alone, suppressed carrot leaf blights**
- **There was no advantage to combining food grade oil with the fungicide boscalid or azoxystrobin plus difenoconazole for leaf blights**
- **In 2014, Quadris Top was more effective than Endura (boscalid) for reducing leaf blight**

Aster yellows of carrots

Caused by a phytoplasma
Candidatus phytoplasma asteris

Spread by the aster leafhopper (*Macrosteles quadrilineatus*)

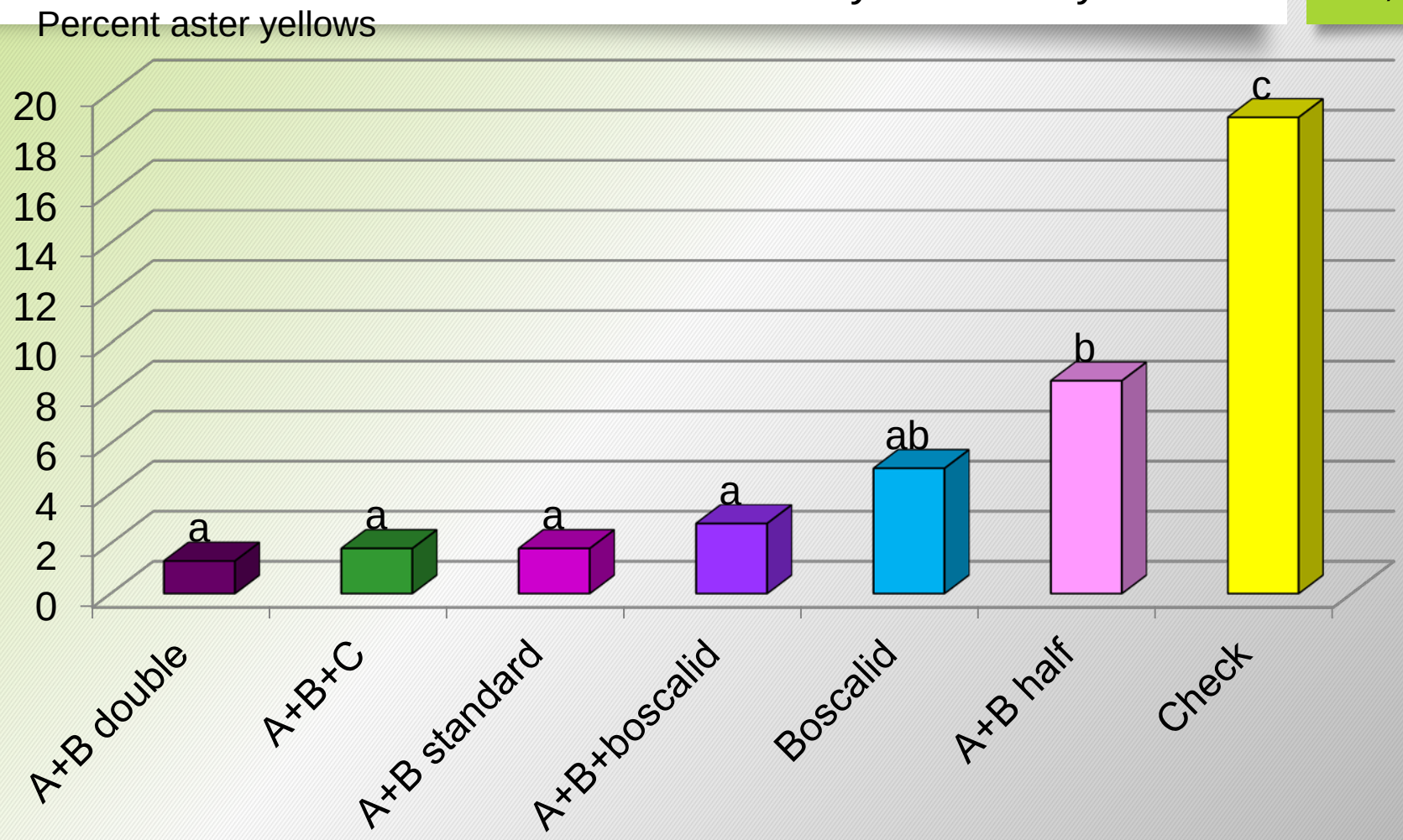
Many pale green leaves from crown meristem

Red leaves in canopy

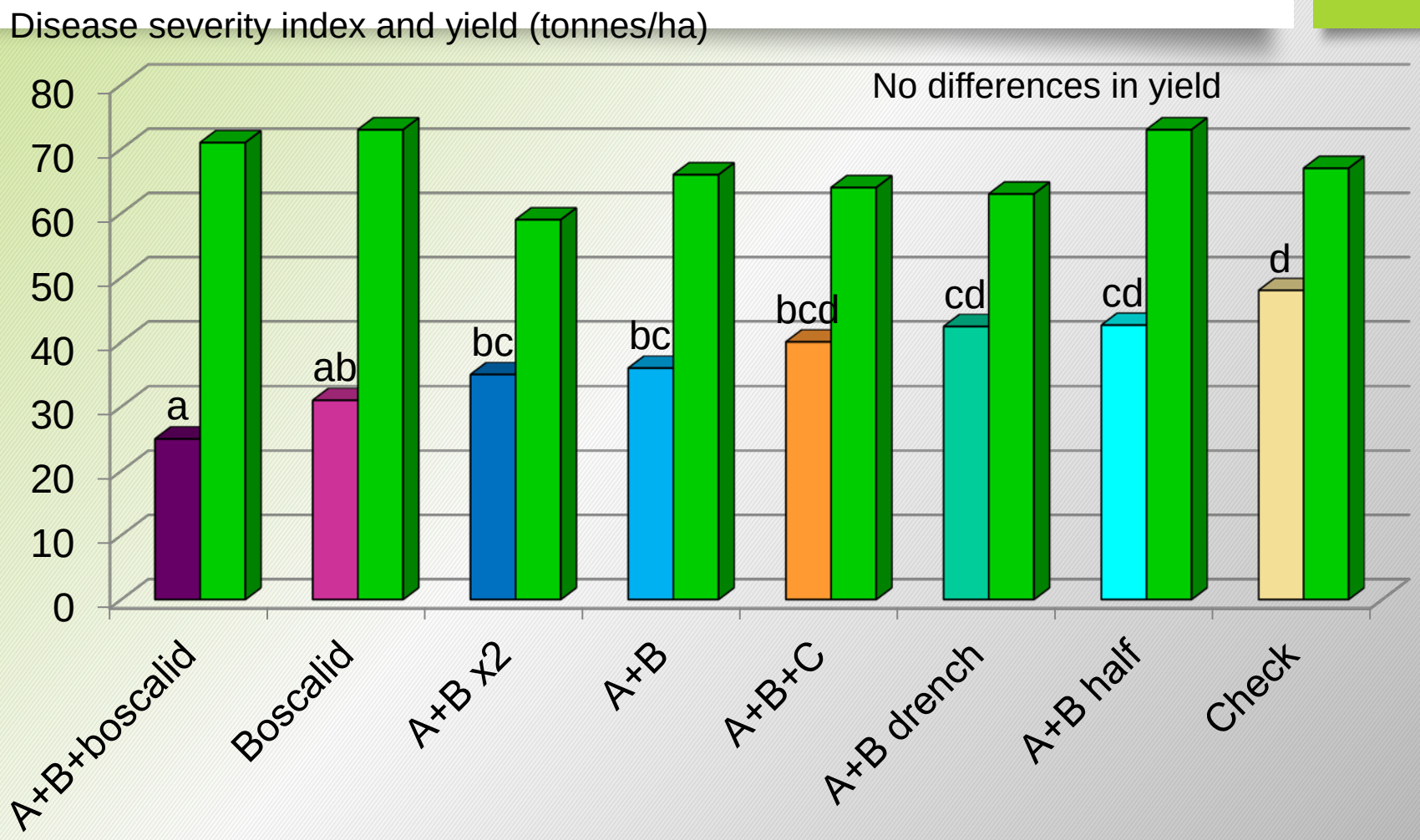
“Hairy roots” and bitter taste= unmarketable carrots

Food grade oil and aster yellows of carrots: 2013

Very low aster yellows in 2014, 2015

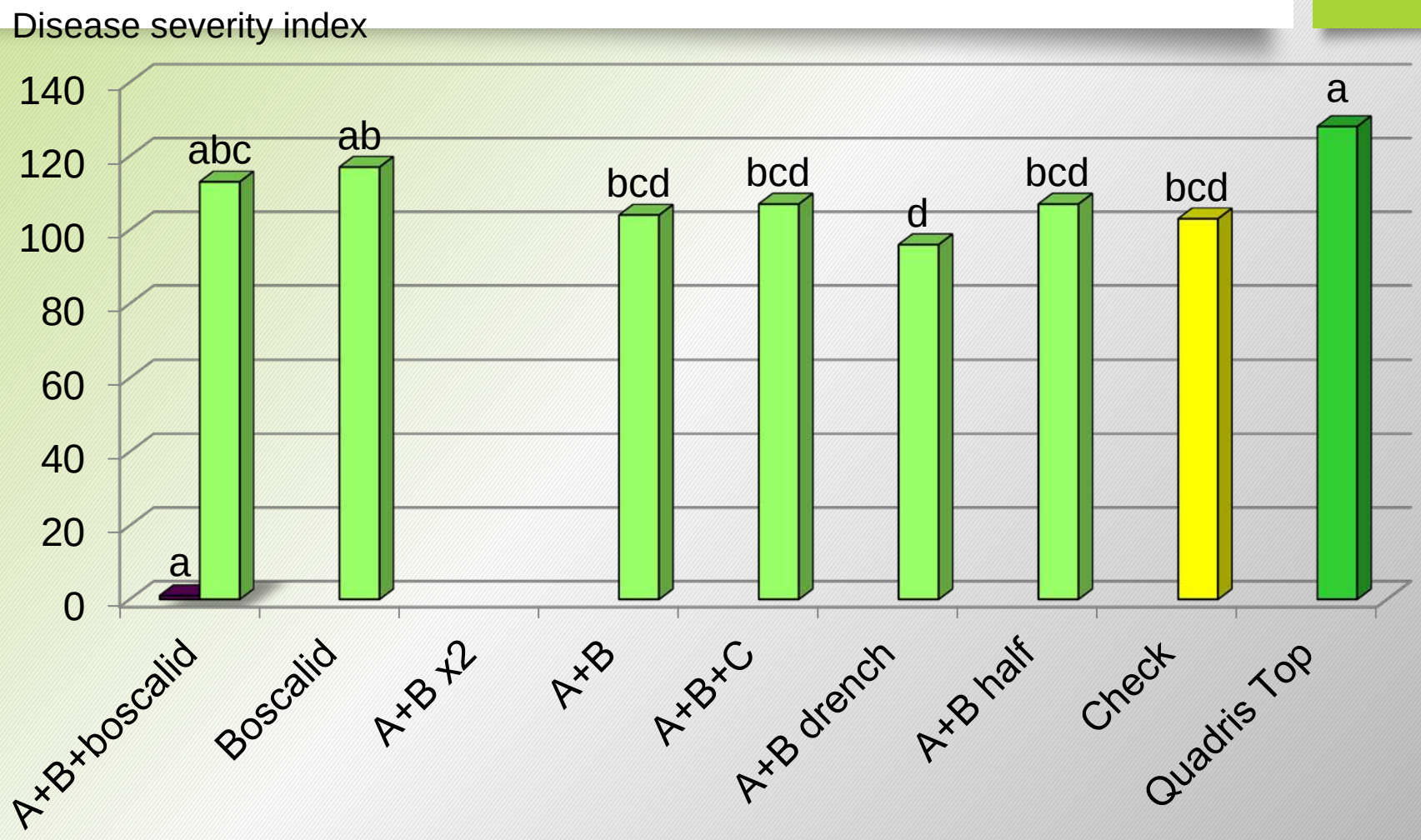


Food grade oil and yield 2013



Food grade oil and yield 2014

Low aster yellows



Conclusions

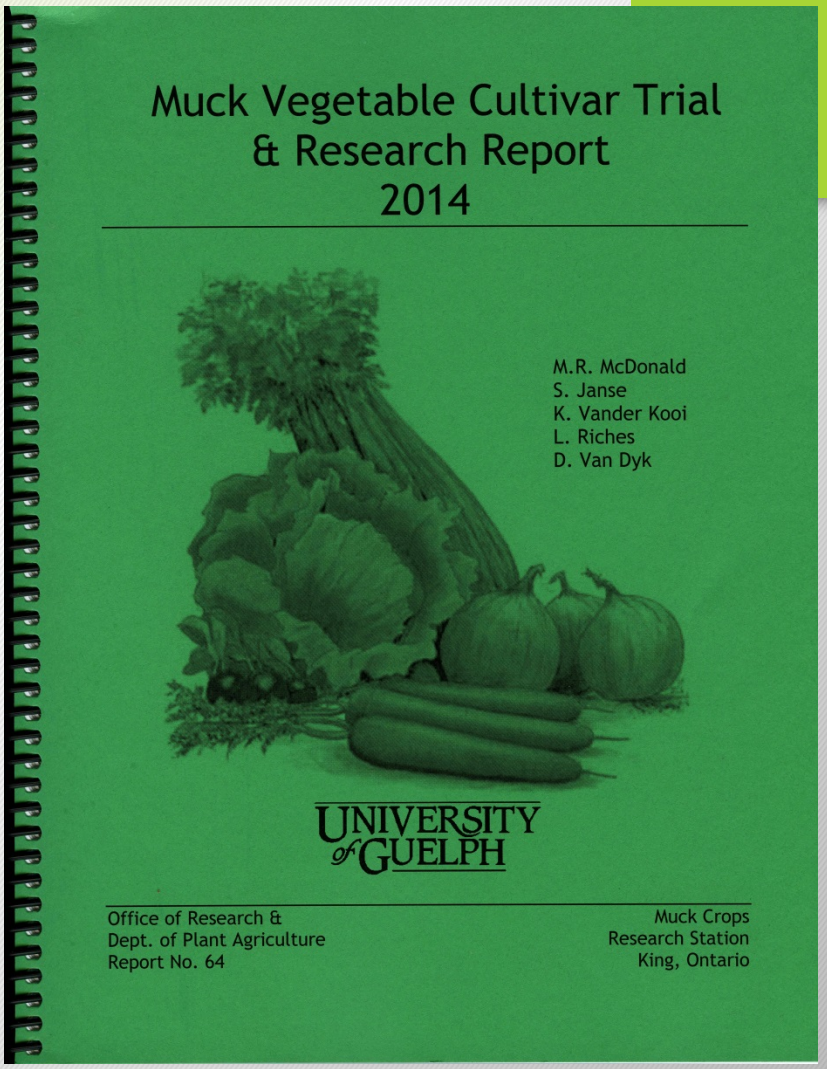
- **Aster yellows was very high in 2013, very low in 2014 and 2015**
- **The food grade oil plus adjuvant (and boscalid) suppressed symptoms of aster yellows**
- **There was no advantage to combining food grade oil with the fungicide boscalid**
- **The mode of action is not known**
  - **Does the food grade oil induce resistance to the phytoplasma or make the plants less attractive to the leaf hoppers?**

All research trials are summarized in the Annual Report

Download at the Muck Station web site:

www.uoguelph.ca/muckcrop

The report will also be on the web site of the Ontario Ministry of Agriculture, Food and Rural Affairs.

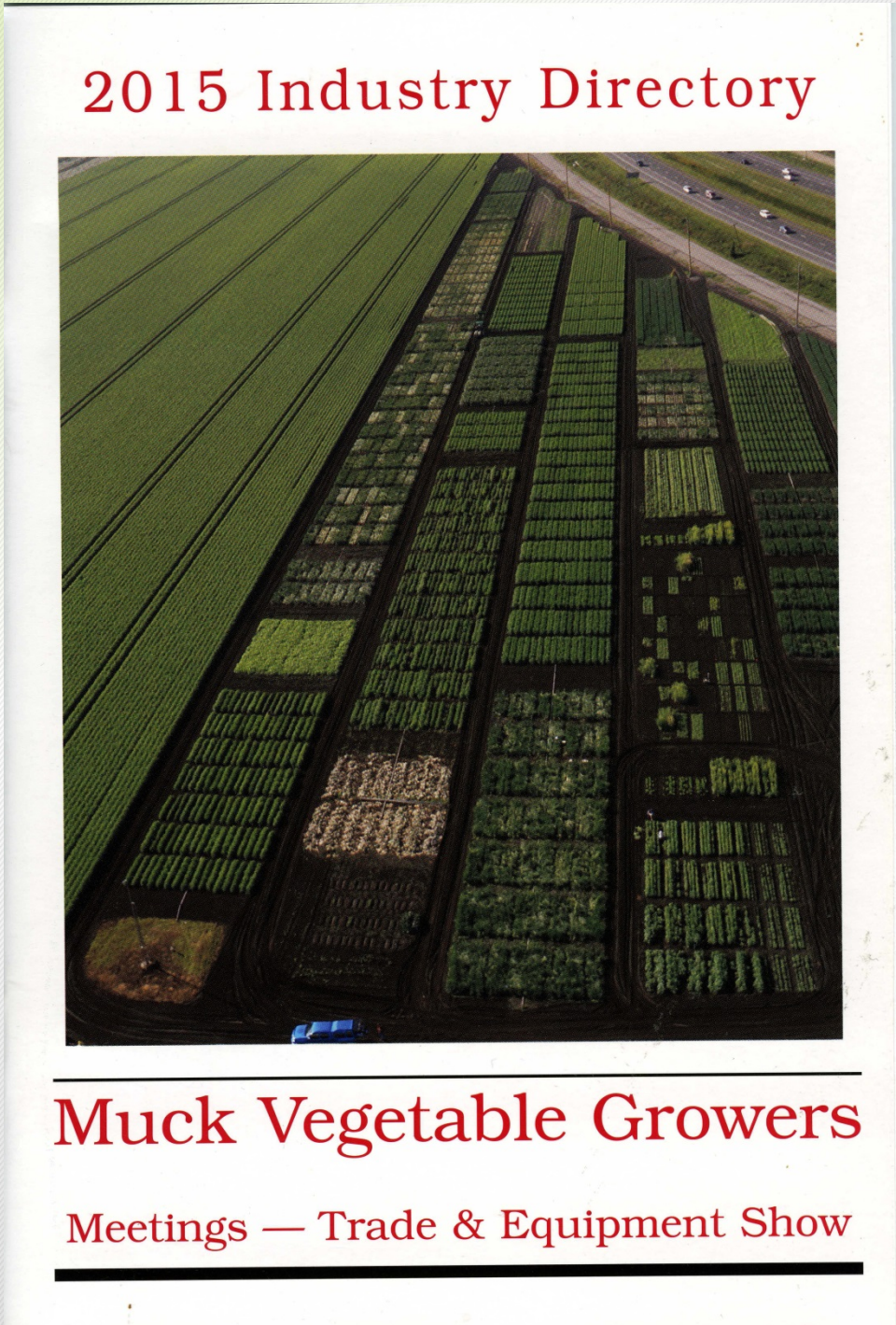


Annual Muck Vegetable Growers Conference: Bradford, Ontario, Canada

2016 conference
June 22 and 23

Carrot day- June 22

Onion day - June 23



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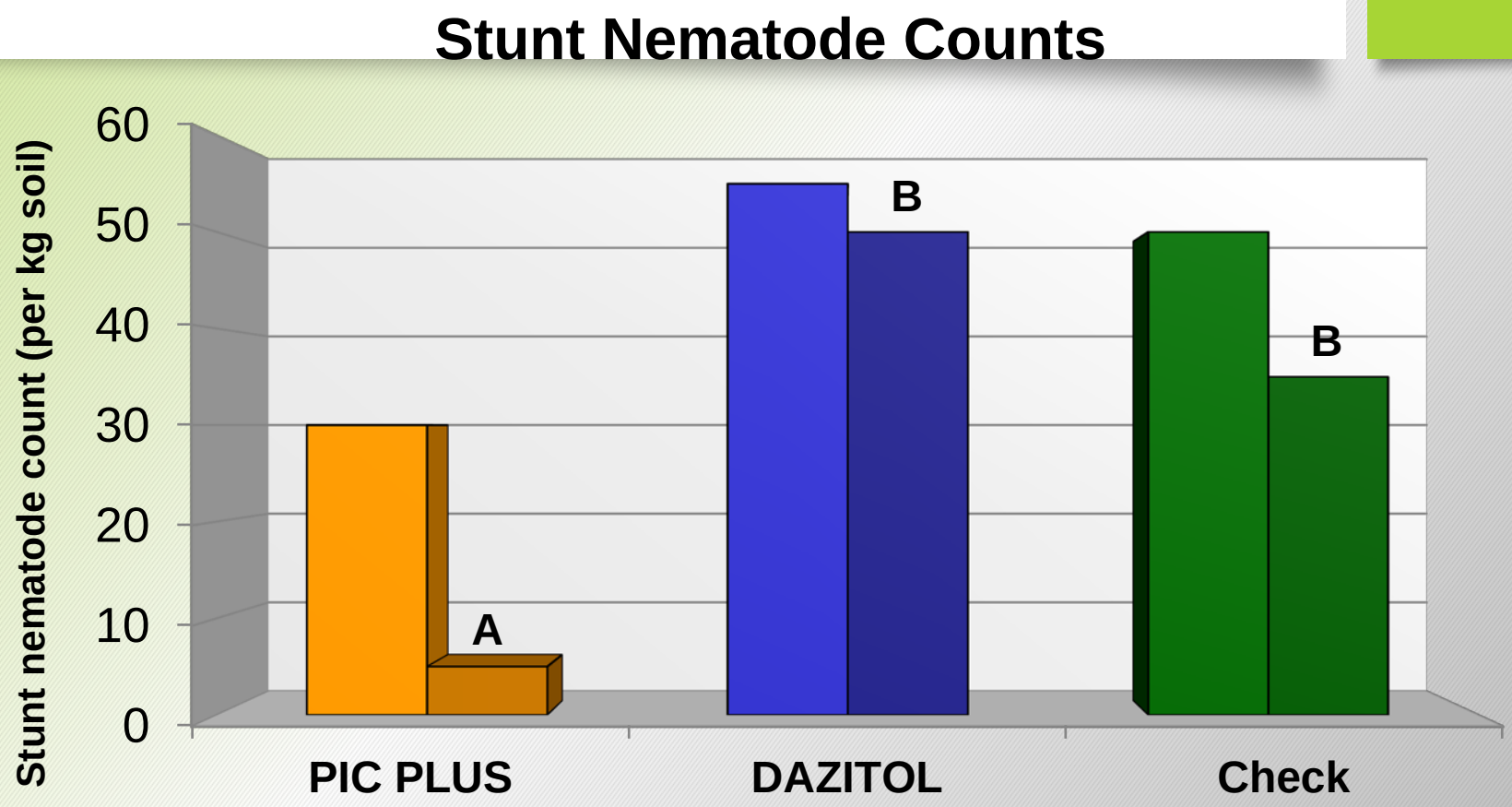
A&L Biolgoicals

Suncor

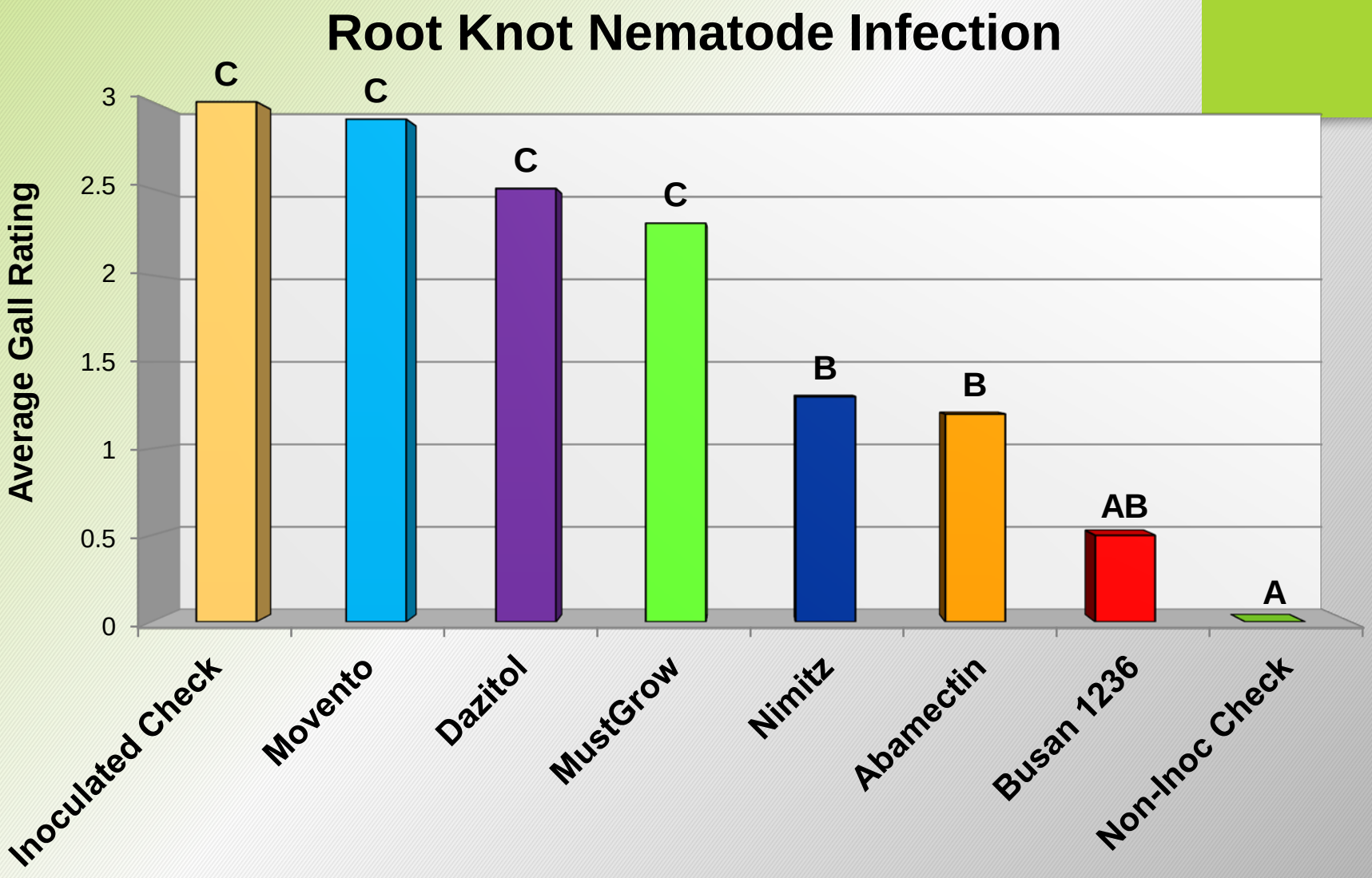
Engage and Engage Plus programs of NSERC


Thank you
UNIVERSITY of GUELPH
Department of Plant Agriculture

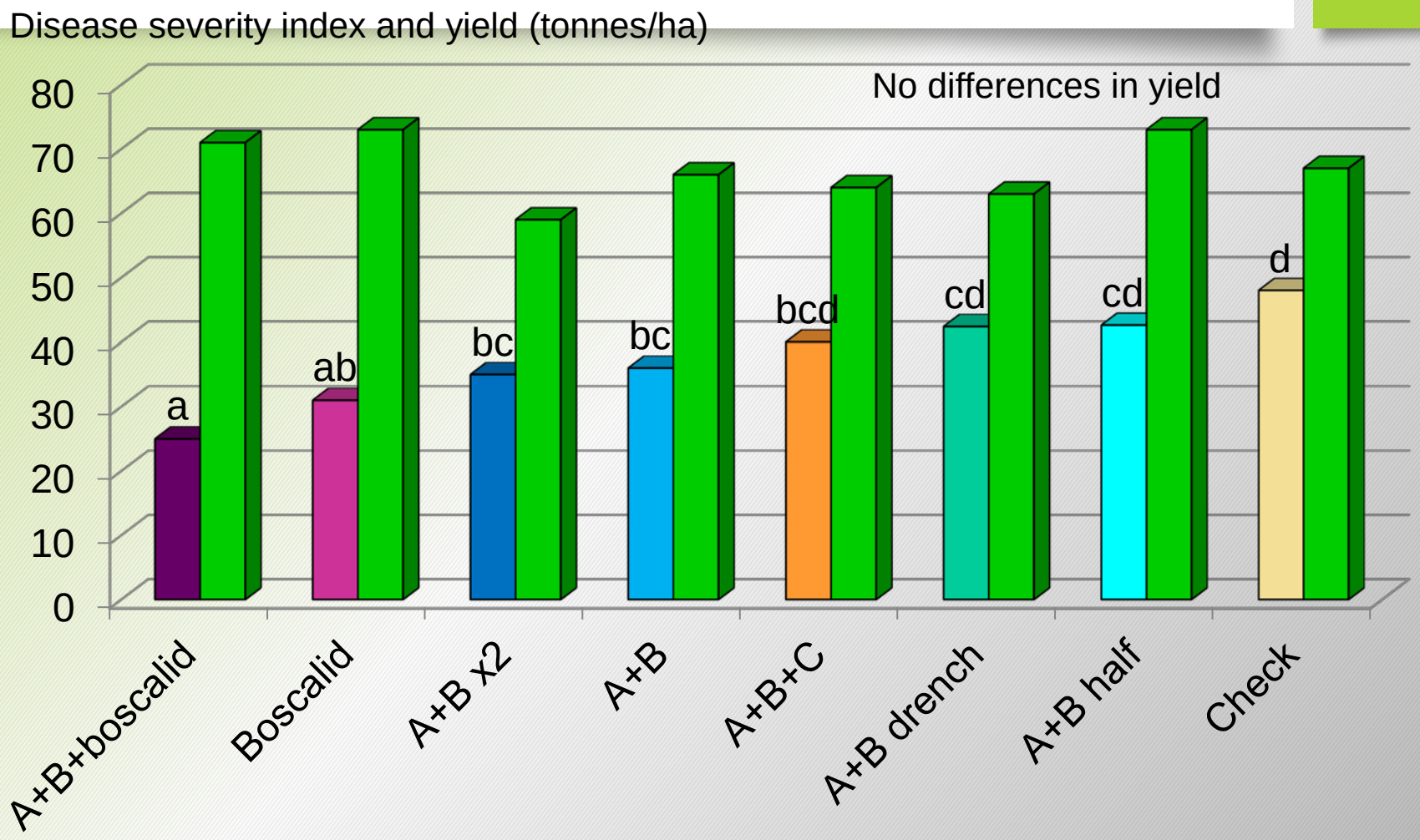
Mineral Soil Results 2013



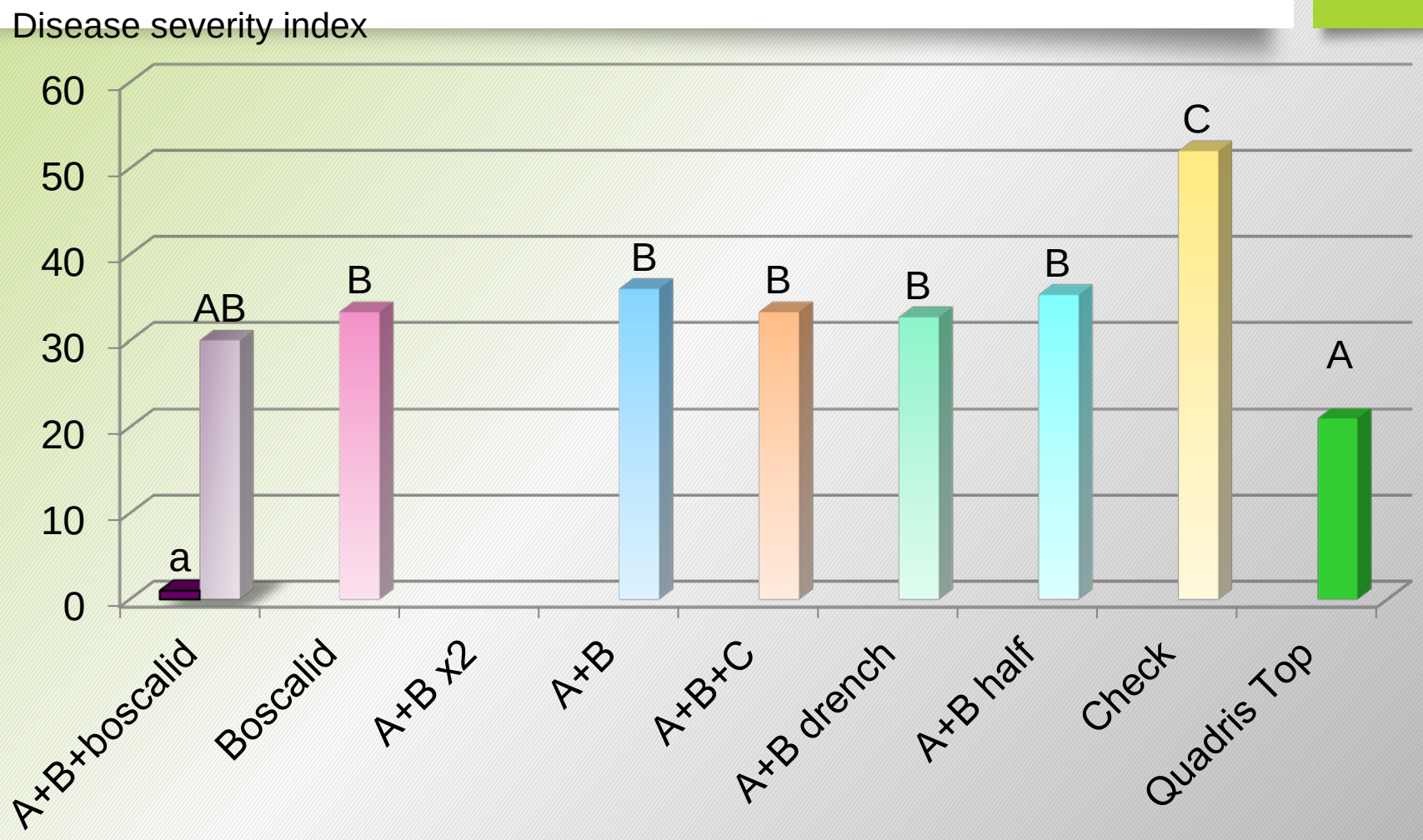
Carrot Growth Room Trial



Food grade oil and yield 2013

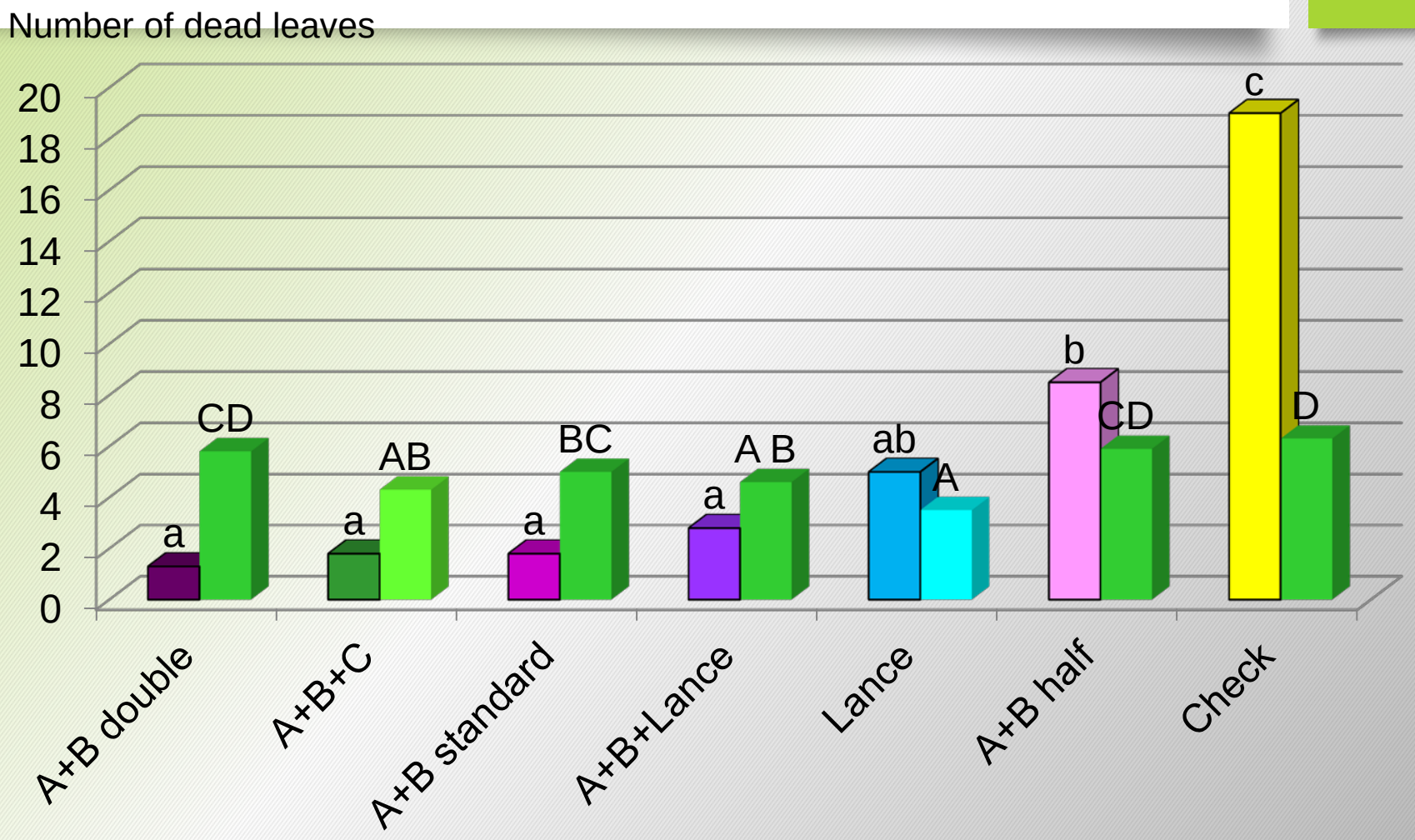


Food grade oil and carrot leaf blight 2014

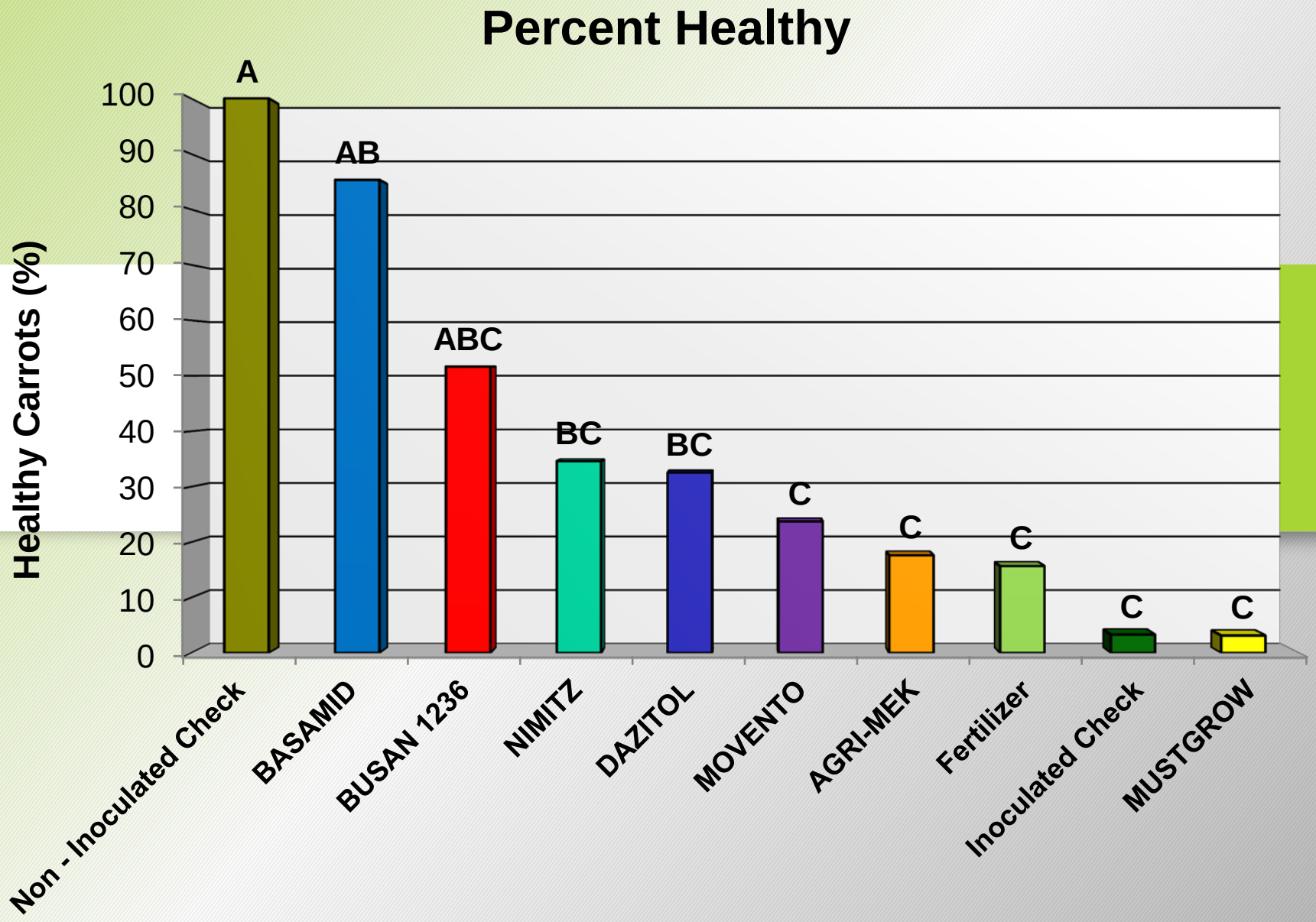


50 – 60 % of carrots in Ontario are grown on muck soil, primarily for packaging and processing

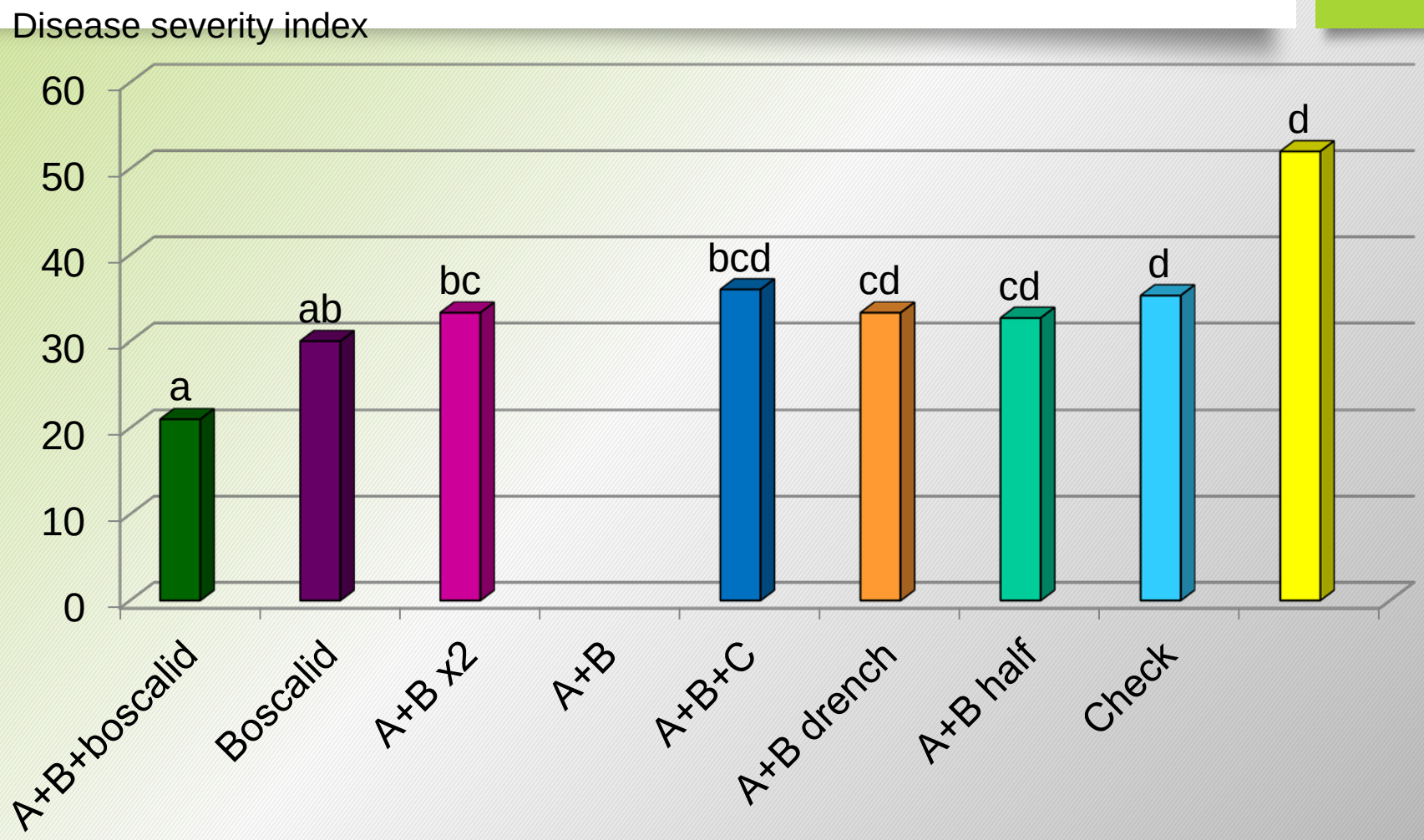
Food grade oil and leaf blight (number of dead leaves) in relation to aster yellows of carrots



Carrot Growth Room Trial 2



Food grade oil and carrot leaf blight 2014

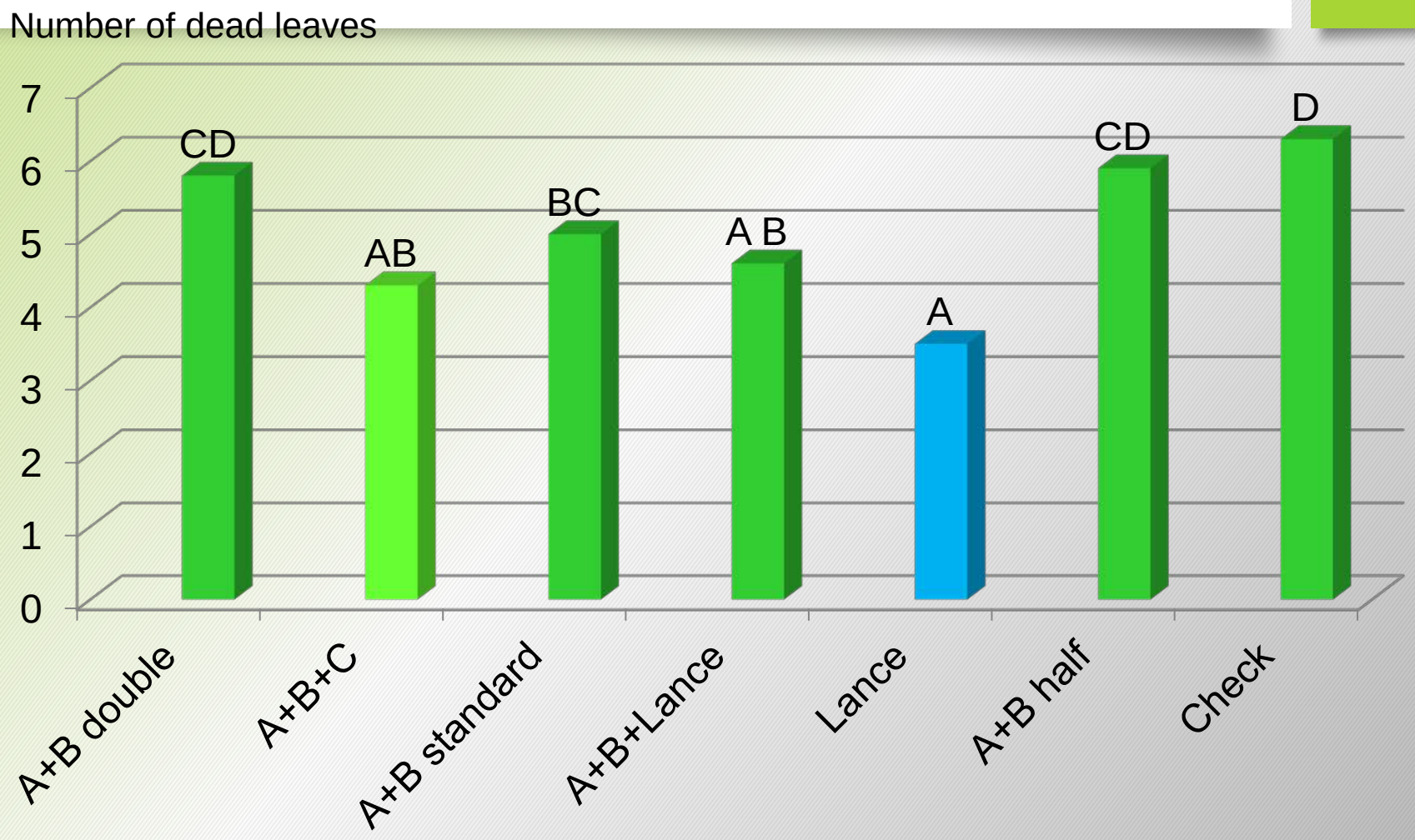


Alternaria Le
Blight

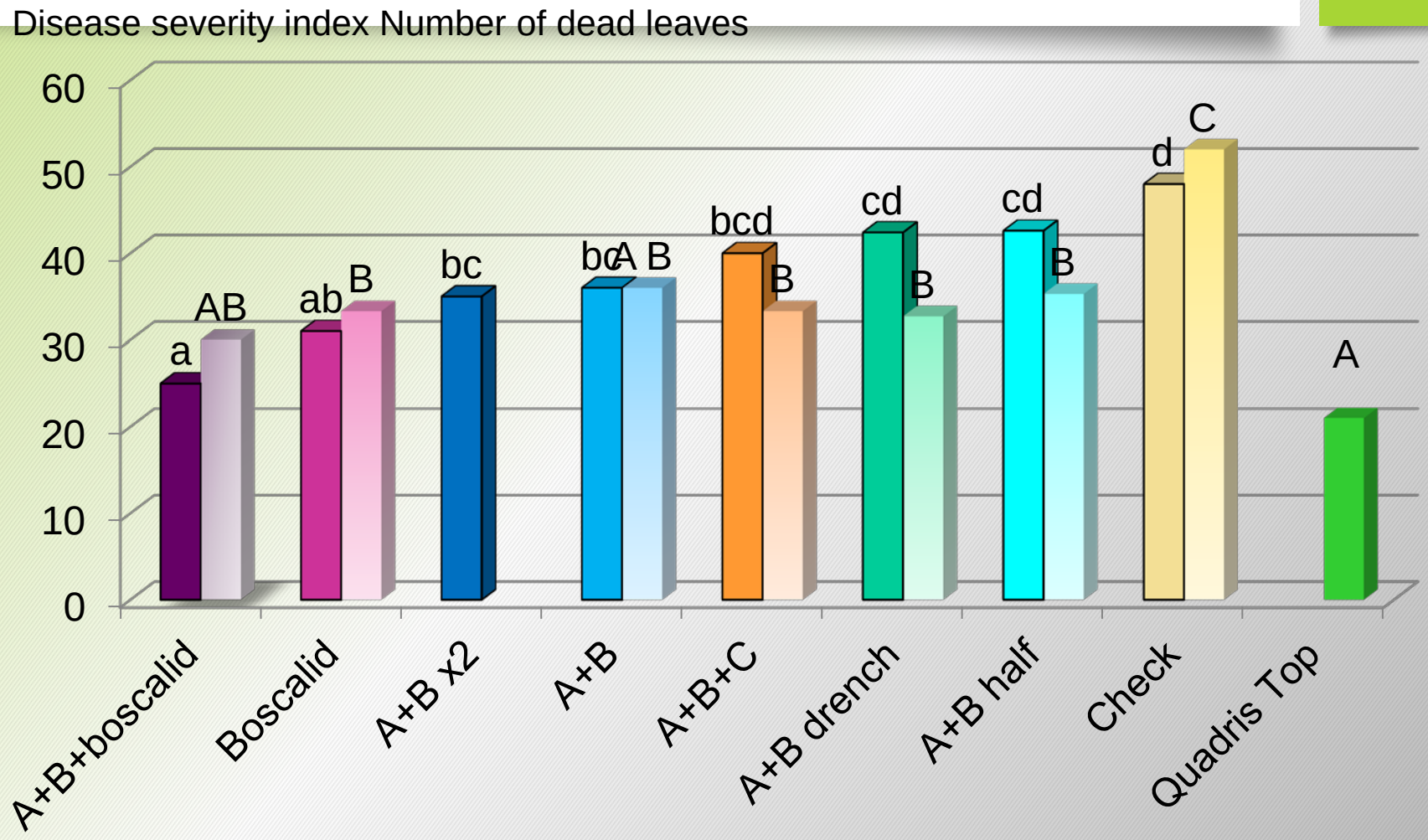
Cercospora Leaf
Blight

Most years, growers apply 5-7 fungicide sprays based on field scouting and crop growth stage (canopy closure)

Food grade oil and carrot leaf blight (number of dead leaves)



Food grade oil and carrot leaf blight 2013 and 2014



Food grade oil and dead leaves per plant 2013 and 2014