Recent Research

Garlic stem and bulb nematode
Onion downy mildew
Onion maggot

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Same latitude as Eugene, Oregon

Muck Crops Research Station, Ontario, Canada
44° 5’ N, 79° 35’ W

Research site for onion trials in the Holland Marsh

Research station

High organic matter soil ~ 45- 80%
Onions and carrots in rotation

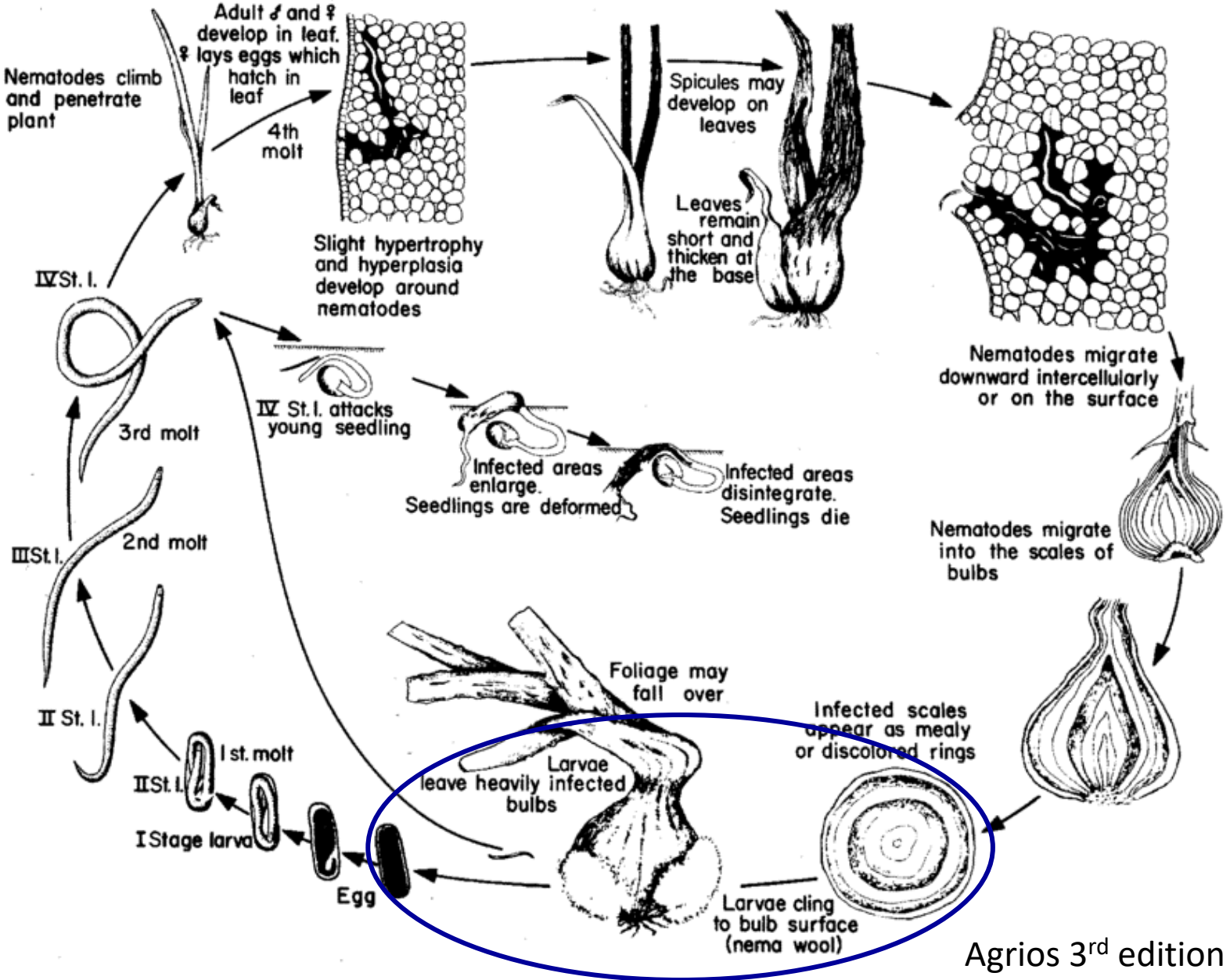
Garlic trials were conducted on mineral soil

Evaluation of products to control stem and bulb nematode on garlic (*Ditylenchus dipsaci)*

Spread in infected seed cloves
Severe damage can be seen in the field

Severe damage can cause total crop loss

Life cycle stem and bulb nematode *Ditylenchus dipsaci*



- Optimum development 59 – 70 F
- Life cycle 3 weeks at 59 F
- Can dehydrate and survive for years in soil or on dry plant material (nematode wool) and become active when rehydrated
- Nematodes leave heavily infected plants to move to other plants

Agrios 3rd edition

Evaluating products for stem and bulb nematode

Treatments of garlic seed cloves

Soak in product solution for 1, 2 or 4 hr Plant the following day

Drench into the open furrow on top of cloves, then cover with soil

Planted 9 November, 2023 Harvested 30 July, 2024

Cloves planted 9 Nov., 2023
Assessed for height on 3 July, 2024 and plant stand on 30 July

After harvest on 9 Aug., assessed for amount of basal plate damage

- Disease severity index based on damage to the basal plate
- Percent and weight of marketable bulbs
- Number of nematodes per clove

Untreated check in 2022

Classes: 0 = no symptoms, 1= 1 -24% of bulb with nematode damage, 2= 25-50%, 4 = completely dead

Bulbs in class 0 and 1 are considered marketable

Products for stem and bulb nematode on garlic 2021-2022

Mineral soil, clean site, ~4 nematodes /g seed clove

Product	Application	Time/rate	Severity	Mkbl Yield (g/plot)	SBN/g
Velum Prime	**Soak**	**2 hr**	**4 a**	**864 a**	**4**
Velum Prime	**Soak**	**1 hr**	**8 a**	**1055 a**	**1**
Velum Prime	**Drench**	**7 oz/acre**	**19 a**	**840 a**	**79**
Reklemel	**Drench**	**0.48 gal/acre**	51 b	355 b	18
PROMAX	**Soak**	**4 hr**	79 cd	112 b	14
Reklemel	**Soak**	**4 hr**	85 d	44 b	6
Untreated			**57 bc**	267 b	14

Water for the drench applications (1000 L/ha) = 107 gal/acre

Products for stem and bulb nematode on garlic 2023-2024

Mineral soil, clean site, **less than 1 nematode /g seed** clove

Product	Application	Time/rate	Severity	Mkbl Yield (g/plot)	SBN/g
EXPERIMENTAL High rate	drench		12 ns	2570 ns	0.04 ns
EXPERIMENTAL	soak	4	11	2430	0
EXPERIMENTAL	soak	1	14	2340	0
EXPERIMENTAL Low rate	drench		15	1970	0
Velum Prime	Soak	**1**	15	2390	0.02
Velum Prime	Drench	**7 oz/acre**	17	2340	0.01
Untreated			17	2139	0

Water for the drench applications (1000 L/ha) = 107 gal/acre

Summary: Stem and bulb nematode on garlic

- **Velum Prime (fluopyram)** is very effective for control of stem and bulb nematode
- The drench application of Velum Prime is also effective.
  - Registered in Canada as a drench in 2022
- The **experimental product** from Syngenta looks very promising -
- No treatments were different from the check in 2024
- All treatments were very healthy because of low nematode infestation on seed

- **Is there a threshold for SBN nematodes in seed?**

Threshold for SBN in garlic seed?

- Widespread use of Velum Prime in Ontario has really cleaned up the garlic seed.
- Seed in 2023/34 had less than 1 nematode per gram of clove- no differences in nematode damage. Compare to other years

Year	Nematodes/g clove	DSI on check
2018 High	172	63
2018 Low	114	51
2019 High	18	91
2019 Low	2	22
2019 clean seed	0	11
2020	7	8
2020 clean seed	0	5
2022	4	57
2024	>1	17

There is no clear threshold:

Less than 1/gram is ideal

4/g caused severe damage in 2022.

In small trials, the nematodes leave the heavily infected plants and move to healthier nearby plants.

Evaluation of insecticide seed treatments to protect onions from onion and seed corn maggots

Damage varies from year to year but can be up to 40 to 100% loss

Worst damage is usually on seedlings, other generations can also be damaging at times

.

5-8 maggots at base of bulb

Onion maggot pressure

- **2020**: High maggot damage in untreated onions (40% damage)
- **2021**: Low maggot damage (<5%)
- **2022**: Moderate maggot damage (21%)
- **2023**: Low (<9%)
- **2024:** Moderate to high **(37%)**

Tested a new mode of action - PLINAZOLIN Technology

and a new formulation of spinosad, Lumiverd, in 2023 and 2024

Onion maggot damage is assessed in 2 m sections of the plots for **first** generation of onion flies, **second** generation, and at **harvest**.

Assessed 2- 3 times a week for first generation.
Followed by destructive sampling after the 1st, 2nd gen and at harvest
Total and marketable yield assessed

Onion cv. Safrane
Trial seeded May 8, 2024
Soil organic matter 80%, pH 5.8

All seed was also treated with Evergol Prime to control onion smut and with FARMORE 300
Windrowed on 15 September
Assessed for yield on 3 October

Treatment		Rate (mg ai/seed)	Total Season
LUMIVERD + CRUISER	spinosad + thiamethoxam	0.2 mg + 0.2 mg	0.0 a[2]
TRIGARD	cyromazine	0.225 mg	0.0 a
LUMIVERD + SEPRESTO	spinosad + imidacloprid +chlothianidin	0.2 mg + 0.32 mg	0.5 a
PLINAZOLIN TECH	isocycloseram	0.0909 mg	1.7 a
PLINAZOLIN + SEPRESTO	isocycloseram + imidacloprid + chlothianidin	0.0909 mg + 0.32 mg	1.9 a
TRIGARD + CRUISER	cyromazine + thiamethoxam	0.225 mg + 0.2 mg	2.1 a
LUMIVERD	spinosad	0.2 mg	2.7 a
PLINAZOLIN + CRUISER	isocycloseram + thiamethoxam	0.0909 mg + 0.2 mg	2.7 a
TRIGARD + SEPRESTO	cyromazine+ imidacloprid + chlothianidin	0.225 mg + 0.32 mg	2.8 a
SEPRESTO	imidacloprid +chlothianidin	0.32 mg	2.8 a
CRUISER	thiamethoxam	0.2 mg	3.0 a
CHECK		---	**8.8 b**

2023

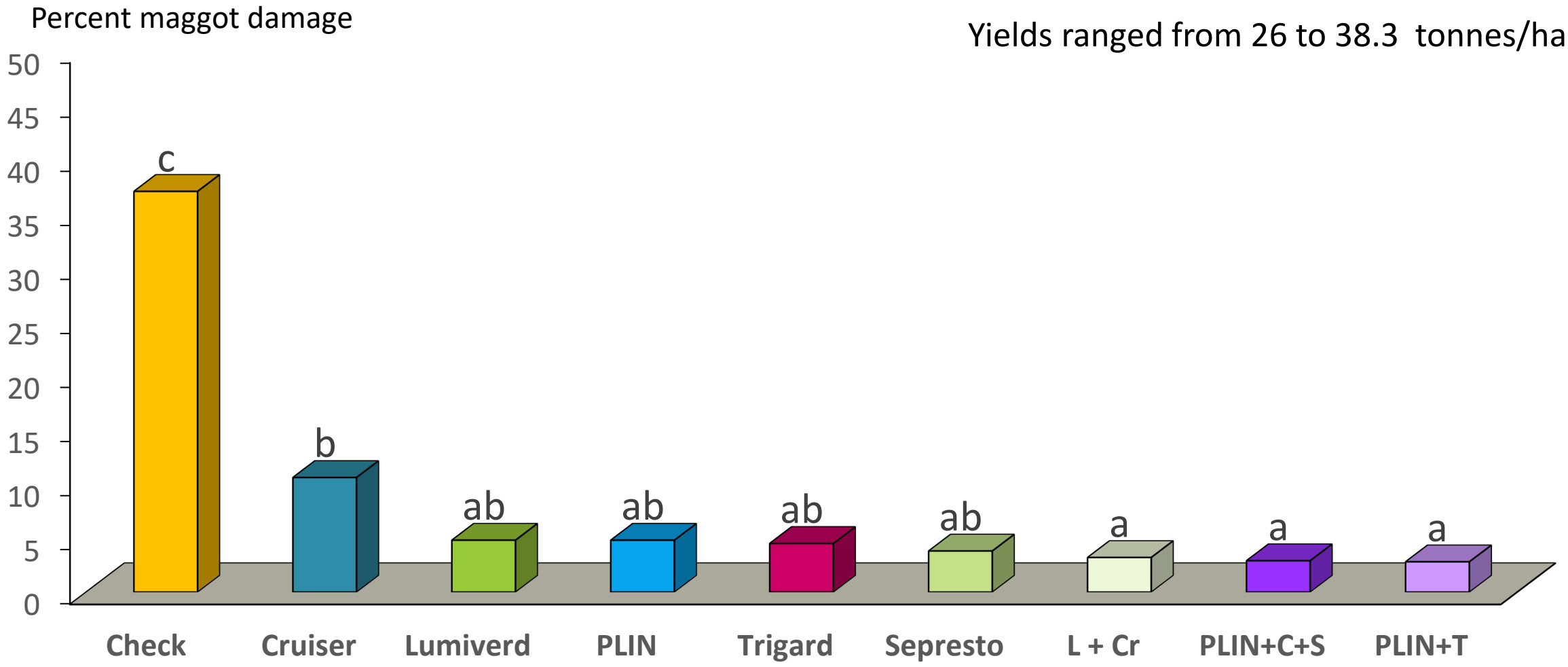
Randomized complete block with four blocks per treatment
12 treatments

FI500: includes 80% spinosad+ 70% thiamethoxam Regard +Cruiser or Lumiverd + Cruiser

Onion maggot total season damage 2024

Onion cv. Catskill. Assessed Aug. 15

Yields ranged from 26 to 38.3 tonnes/ha in



Summary: Seed treatments for onion maggot

- Onion maggot damage was quite high in 2024.
- The trend was similar to 2023 trials.
- All seed treatments reduced total damage compared to the nontreated check.
- Cruiser (thiamethoxam) alone was not as effective as some combinations

- Joint trials with Brian Nault in New York, Rob Wilson in California, Tim Waters in Washington State and Stuart Reitz in Oregon.

- Repeating in 2025 with a few changes.
- PLINAZOLIN won’t be registered for several years.
- S0: More emphasis on combinations with Trigard and Lumiverd
- Will have one treatment of PLINAZOLIN Technology

Seed Treatments:

What to Know to Protect Your 2023 Onion Crop

By Brian Nault, Department of Entomology, Cornell AgriTech, Cornell University
Christy Hoepting, CCE Cornell Vegetable Program

Figure 1. Onion maggots actively feed on an onion seedling (photo A). Onion maggot feeding results in damage to onion plants (photo B). Photos courtesy Erica Moretti, Cornell University

There has been a great deal of interest across the U.S. about how best to protect next year's onion crop from maggots given the limited supply of spinosad seed treatment (Regard SC). This article focuses on what insecticide seed treatments should be used for managing maggots (Fig. 1) as well as what fungicide seed treatments should be used to manage the disease complex (damping off, stunting and onion smut) in major production regions across the U.S. In all cases, there are no rescue treatments once onions are either infested with maggots or infected with these pathogens. Therefore, selecting effective seed treatments is especially

regions. In the Great Lakes, both maggot species routinely damage onions, and this requires a strategy that will control both.

Onion smut (*Urocystis cepulae*) is a fungal disease that infects onion seedlings and can either kill seedlings or render bulbs unmarketable (Fig. 2). Onion smut is a major disease of onion grown in the Great Lakes region and can be a problem in certain locations in the western U.S., but it is typically not a concern in other production areas. In contrast, *Rhizoctonia* spp., which are one of the causes of stunting, are not a major issue for onions in the Great Lakes, but can be a problem elsewhere.

Insecticides

Regard

Regard SC is a formulation of the active ingredient spinosad, which has excellent activity on both onion maggot and seedcorn maggot. This active ingredient is owned by Corteva, and Syngenta has been contracting with Corteva to offer it as part of its FarMore FI500 seed treatment package. In addition to Regard, the FarMore FI500 package includes the insecticide Cruiser 70WS (thiamethoxam) and the three fungicides in FarMore F300 (Apron XL, Maxim and Dynasty) (Table 1).

Earlier this year, Syngenta ended its contract with Corteva. There is a limited

Trigard

Trigard OMC will be available for the 2023 season. Syngenta will continue to offer "FarMore FI500 with Trigard" as a seed treatment package. This FarMore package will include both insecticides Trigard and Cruiser, as well as the FarMore F300 fungicide package (Table 1). Trigard also can be applied without Crusier. Trigard currently works very well on onion maggot, but it is not very effective against seedcorn maggot.

Cruiser

Cruiser is poor on onion maggot control, but may provide limited control of seedcorn maggot (Table 1). The combination of Trigard and Cruiser should protect the onion crop from maggot damage in the Great Lakes region, but it is not a viable option for seedcorn maggot control in other production regions.

Sepresto

Sepresto contains two insecticide active ingredients, clothianidin and imidacloprid. Sepresto has not performed well against onion maggot in New York, but has performed fair to good against seedcorn maggot in the western U.S. (Table 1). In the absence of Regard SC, Sepresto would be the best seed treatment option for seedcorn maggot control.

Non-Seed Treatment Options

There are not effective insecticide options other than seed treatments for maggot control in the Great Lakes region. Past research in New York in muck-grown onion examined the following products and none controlled maggots: 1) in-furrow drench treatments of Entrust SC (spinosad), Admire Pro (imidacloprid), Verimark (cyantraniliprole), Coragen (chlorantraniliprole) and Capture LFR (bifenthrin); 2) pre-plant incorporated treatment of Diazinon AG500 (diazinon); 3) post-emergent banded applications (two-leaf stage when flies were active) of either Radiant (spinetoram), Exirel (cyantraniliprole) or Mustang Maxx (zeta-cypermethrin).

In Washington state, Diazinon AG500 (diazinon) is effective when applied pre-plant and mechanically incorporated.

Insecticide Resistance Concerns

Resistance to insecticides is a concern for onion maggot, but not as much for seedcorn maggot (based on their different life histories). Onion maggot

Onion maggot predominant in east
Seed corn maggot common in west

Rotate insecticides to reduce risk of insecticide resistance
Trigard then Lumiverd

More of a concern for onion maggot than seed corn maggot

Onion downy mildew
(Peronospora destructor)

Onion downy mildew

Develops in cool, humid weather with some leaf wetness at night

Disease forecasting important: **DOWNCAST**

Fungicides are most effective when applied before infection takes place

It takes 9 - 16 days from infection before symptoms develop. First symptoms often difficult to see

Disease develops about 1 year in 4

Disease forecasting very important

No disease in 2022, yes in 2023, 2024

DOWNCAST for Onion downy mildew

Sporulation when temperatures **below 75 F** (24 - 26 ºC) previous day

Temperatures over 81 ºF inhibit sporulation

38 - 75 ºF (4 – 24 ºC) at night, with humidity above 95%

No rain after 1:00 am

Infection occurs in 3-6 hours, temp 38- 78 ºF (4- 26 C)

Conditions for sporulation and infection are recorded, including temperatures the previous day, to determine if there are conditions for sporulation and infection

= sporulation/infection period

Spray recommended when there is a sporulation/infection period plus spores (sporangia) on spore trap

OR when downy mildew is found in the area

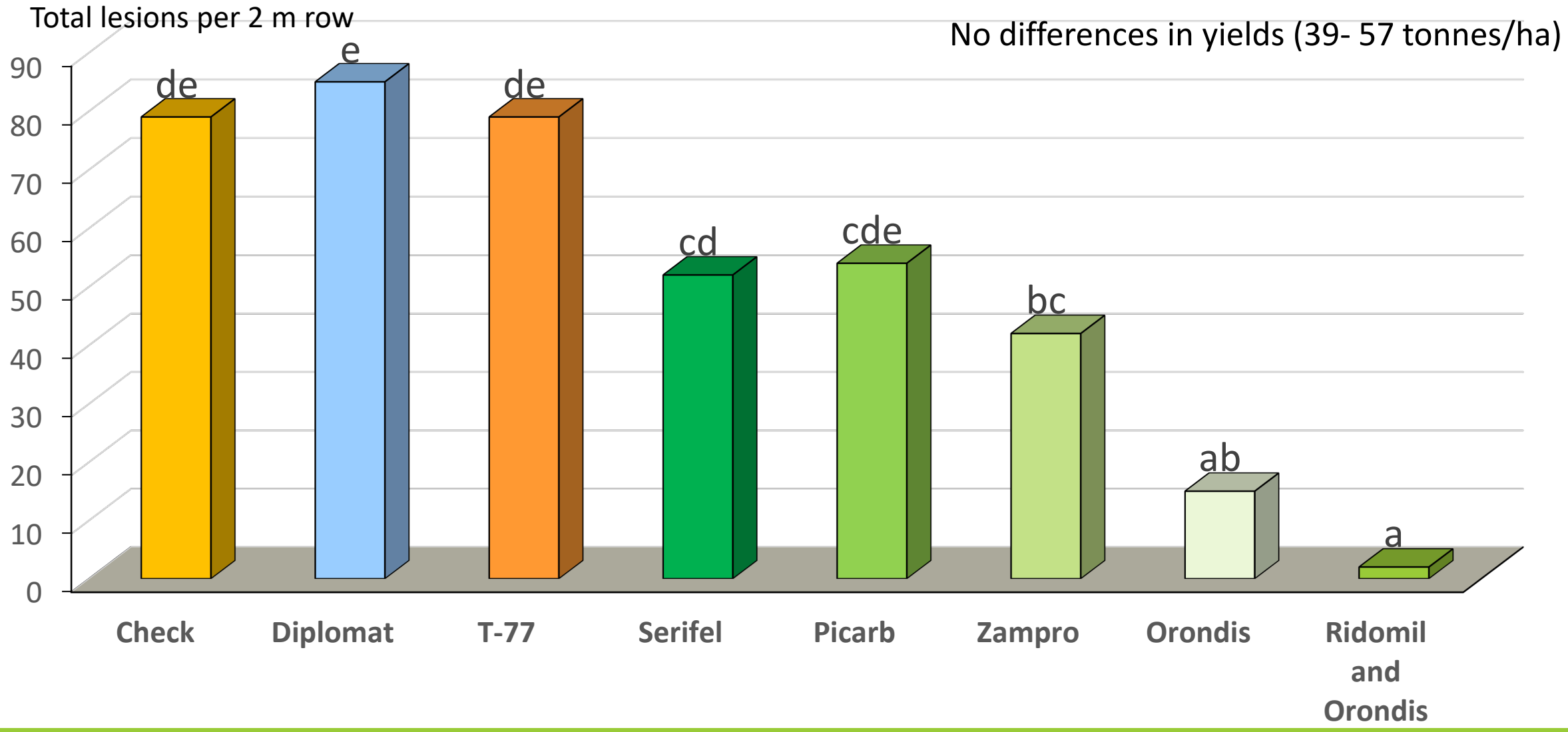
Fungicide treatments for downy mildew control – 2021- 2023

Treatment	Active ingredient	Rate (per ha)
RIDOMIL GOLD MZ / ORONDIS ULTRA	metalaxyil +mancozeb/oxathiapiprolin	2.5 kg/400mL
ORONDIS ULTRA	oxathiapiprolin 100 g/L +mandipropamid 250 g/L	400 mL
ZAMPRO +Sylgard	ametoctradin+dimethomorph	1.0 L + 0.25% v/v Sylgard
PICARBUTRAZOX	picarbutrazox	880 ml
SEREFIL	*Bacillus amyloliquefaciens* strain MBI 600	1 L/ha
T-77	***Trichoderma atroviride***	250 g/ha
DIPLOMAT	polyoxin D	32.5 kg
Check		

Fungicide sprays started on July 20, 2023. Four sprays applied

Onion downy mildew 2023

Onion cv. Catskill. Assessed Aug. 15



The onions were already starting to bulb when downy mildew became severe, so there was no effect on yield, although infected onions would not keep well for long term cold storage

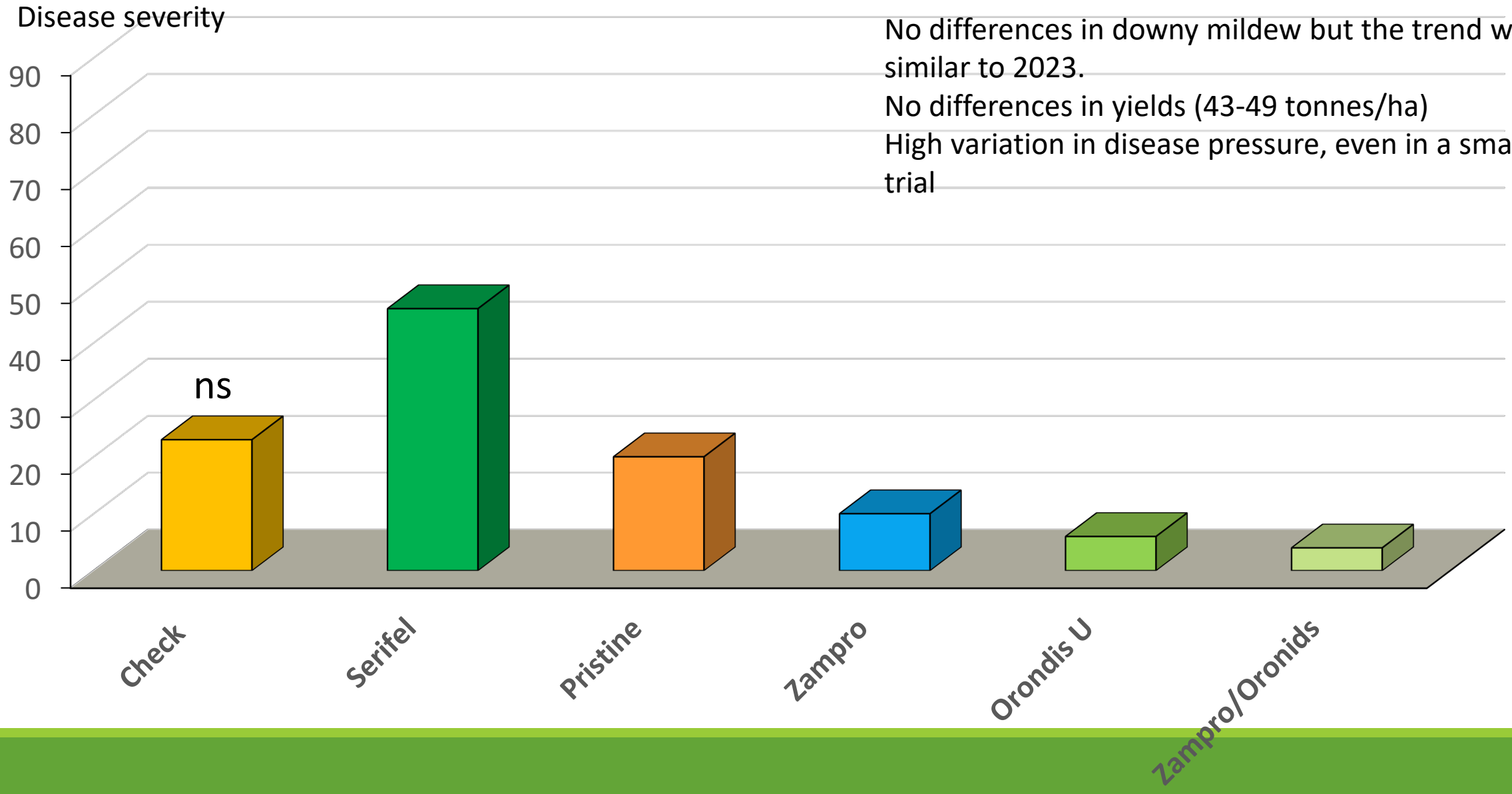
Fungicide treatments for downy mildew control – 2021- 2023 and 2024

Treatment	Active ingredient	Rate (per ha)
RIDOMIL GOLD MZ / ORONDIS ULTRA	metalaxyil +mancozeb/oxathiapiprolin	2.5 kg/400mL
ORONDIS ULTRA	oxathiapiprolin 100 g/L +mandipropamid 250 g/L	400 mL
ZAMPRO +Sylgard	ametoctradin+dimethomorph	1.0 L + 0.25% v/v Sylgard
~~**PICARBUTRAZOX**~~	~~picarbutrazox~~	~~880 ml~~
SEREFIL	Bacillus amyloliquefaciens strain MBI 600	1 L/ha
Check		
2024 added Pristine	Boscalid and pyraclostrobin	1.3 kg/ha

Fungicide sprays started on July 20, 2023. Four sprays applied

Onion downy mildew 2024

Onion cv. Catskill. Assessed Aug. 9 Sprayed 4 times (9, 16, 23, 31 July)



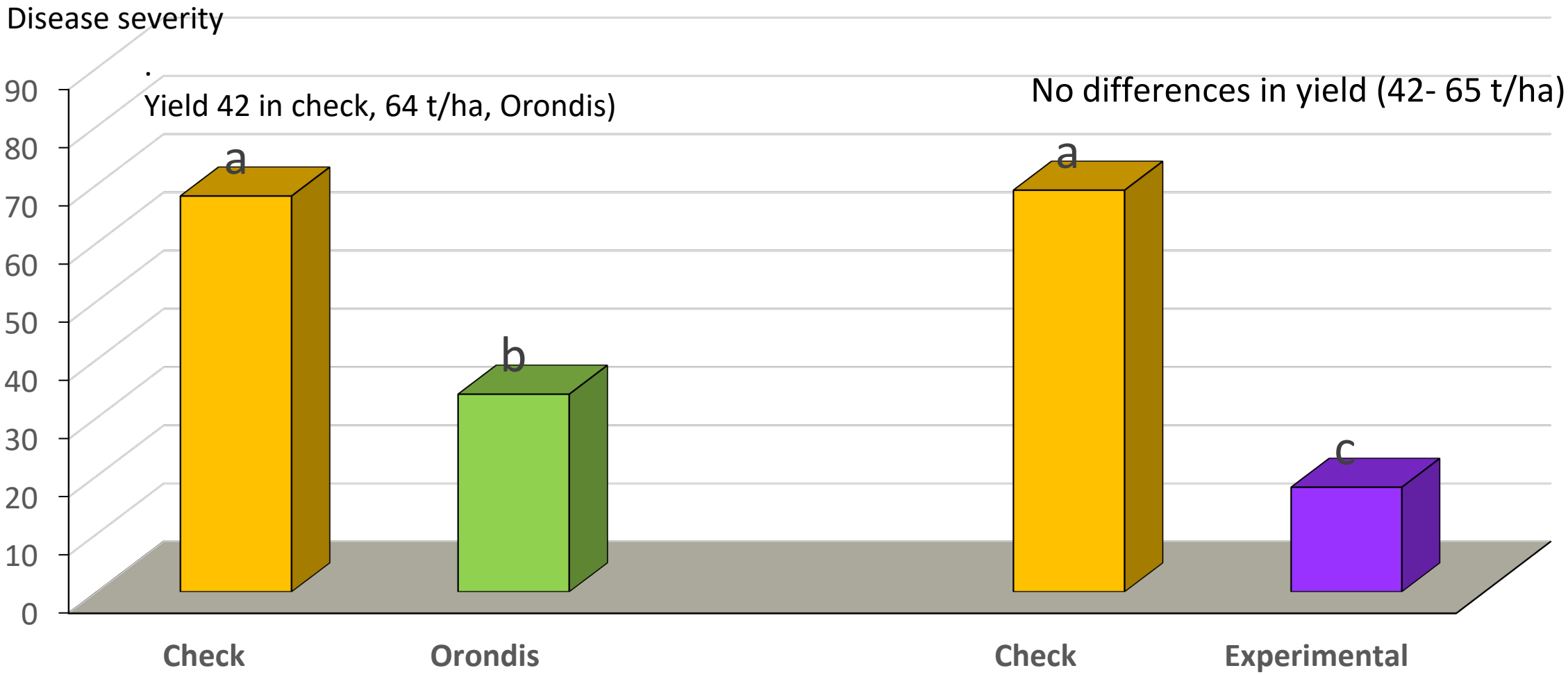
No differences in downy mildew but the trend was similar to 2023.

No differences in yields (43-49 tonnes/ha)

High variation in disease pressure, even in a small plot trial

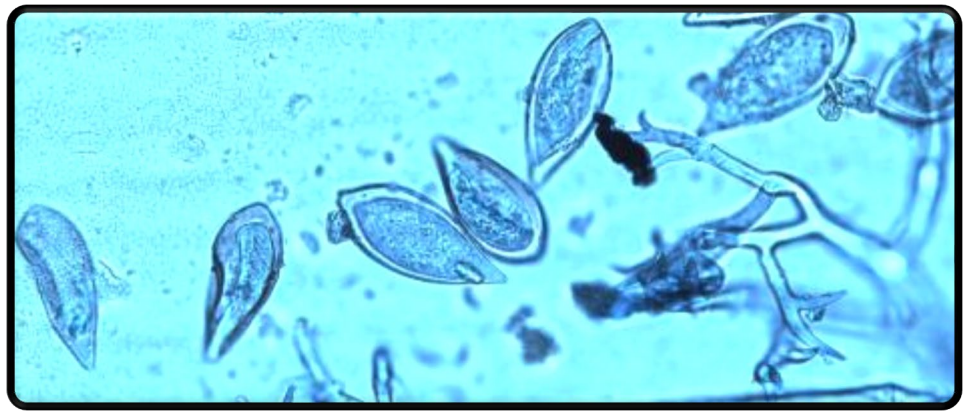
Onion downy mildew 2024 Other trials

Onion cv. Catskill. Assessed Aug. 9 Sprayed 4 times (9, 16, 23, 31 July)



Spore traps

Adding presence of *P. destructor* sporangia to disease forecasting



The rotorods were most effective.

Sporangia were found on the rotorods on days they were not detected by other traps

Spornado and Burkhard spore traps

Rotorod spore trap

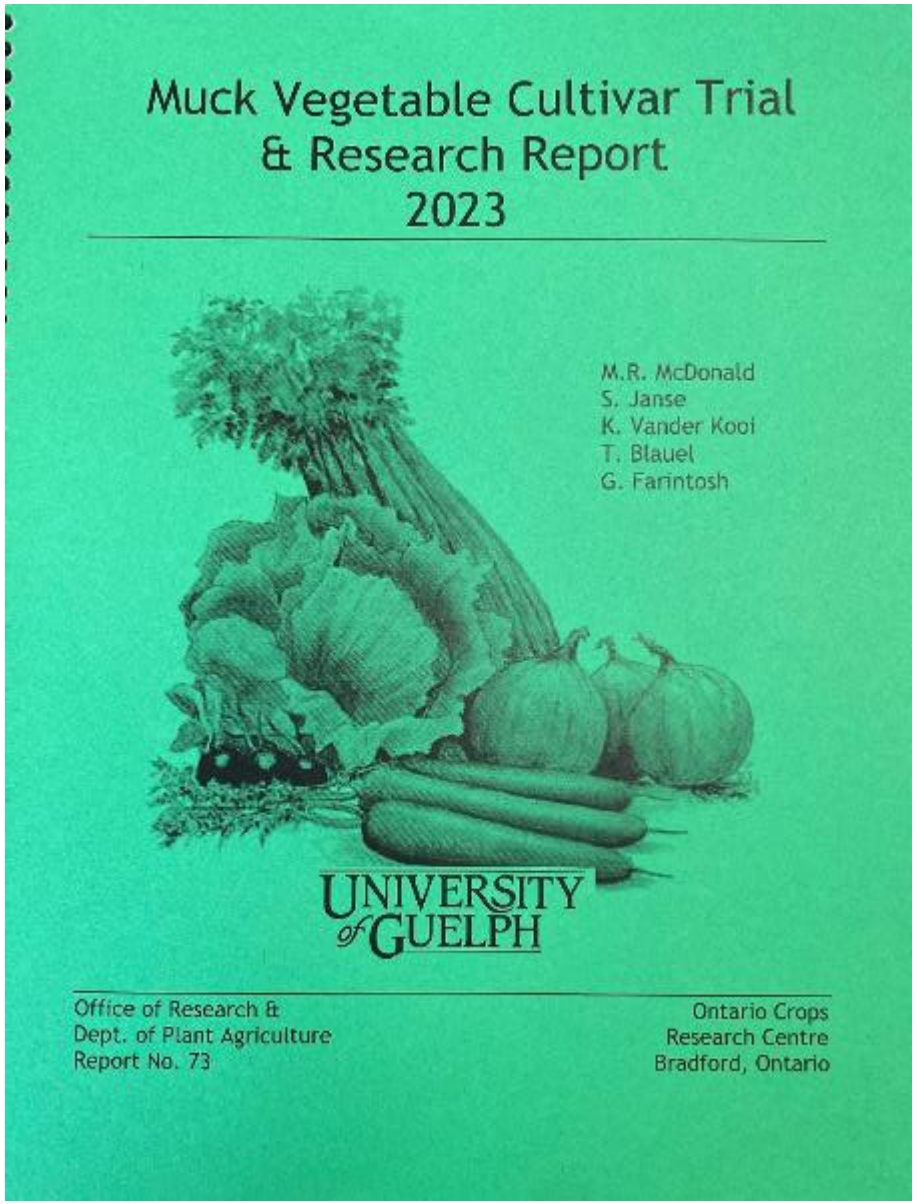
Onion downy mildew

- **Several fungicides very effective in 2023**
- **Same trend in 2024, but variable disease in the main plot, so no significant differences**
- **Orondis Ultra remains an effective product**
- **A new experimental product also looks promising**

- Good spray timing, with appropriate fungicides is critical
- Growers spray when there is a warning that disease risk is high
- Very low downy mildew in growers' fields in 2023 and 2024– good uptake (7 fields with low downy mildew in 2024)
- Adding spore trapping to Downcast

DOWNCAST 2024

- First sporulation-infection period on 6 and 7 July, plus spores found on the rotorod.
- Spray warning went out on 8 July, and first downy mildew was found on 8 July- first spray on 9 July
- Did we miss an earlier sporulation/infection period?
- Spore trapping with Downcast can improve confidence in the forecast
- We will check the calibration of leaf wetness sensor



All research trials are summarized in the Annual Report

Download at the Research Station web site (new website)

https://bradford-crops.uoguelph.ca/

The 2024 results will be available in March

Acknowledgements

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Questions?