

Influence of fungicides and cultivar on development of cavity spot of carrot.

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Plant  Agriculture



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Muck Crops Research Station, Ontario, Canada

44° 5' N, 79° 35' W

Pasco, Washington 46° 15' N, 119° 10' W

Vegetable Production in Ontario and Canada (2008 data, acres)

➤ Crop	Ontario	Canada
➤ Carrots	8,300	20,690
➤ Onions	5,890	13,875
➤ Lettuce	1,540	9,115
➤ Celery	520	1,965
➤ Carrots in Ontario worth \$18 million		



Ontario production of carrots



**About 50 % of carrots
(4000 acres) on muck
soils**

**(Approx 14,000 acres of
muck soil in the province)**

**Seeded from late April
until late June,
harvested from July to
November,**

**Kept in cold storage for 6-
8 months**



Cavity spot in carrots in Ontario

Field trials on muck soils
each year

Pythium spp. isolated
from cavities in 2009:

P. violae, 5/30

P. ultimum 4/30 and

P. irregulare 1/30

P. sulcatum has been
isolated in the past



Cavity spot symptoms

Field Trials

- Plots- Holland Marsh, near Muck Station Soil: 39
– 60% organic matter pH 6.7- 7.0
- Carrots seeded on raised beds 86 cm apart, 70-80 seeds/m. Plots 2 beds, 6 m long
- Seeded 29 May – 2 June
- **First assessment- early harvest** 11-12 weeks after seeding (August- Sept), 25 carrots
- **Harvest assessment- main harvest** 17-22 weeks after seeding (Oct-Nov) 50 carrots
- Cultivars: Dominion, Envy, various colours

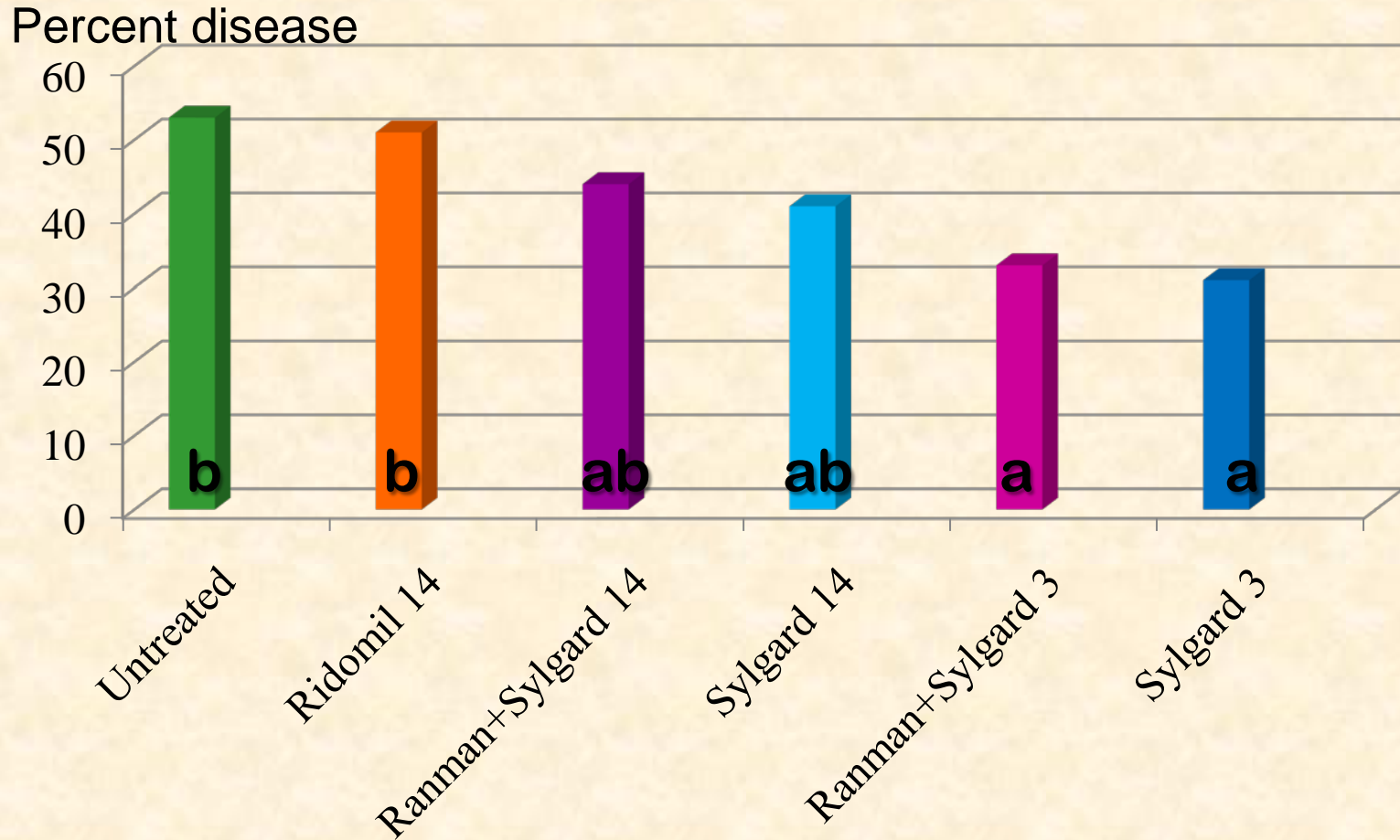
Fungicide Trials

- **Ridomil Gold (metalaxyl-M 1.0%)**
 - 735 g/ha
 - standard fungicide, applied 14 das
- **Ranman 400SC (cyazofamid 34.5%) + Sylgard**
 - 440 ml/ha product
 - recently registered in Canada
- **Sylgard 309 (polysiloxane 80%)**
 - Surfactant
 - 150 ml/ha

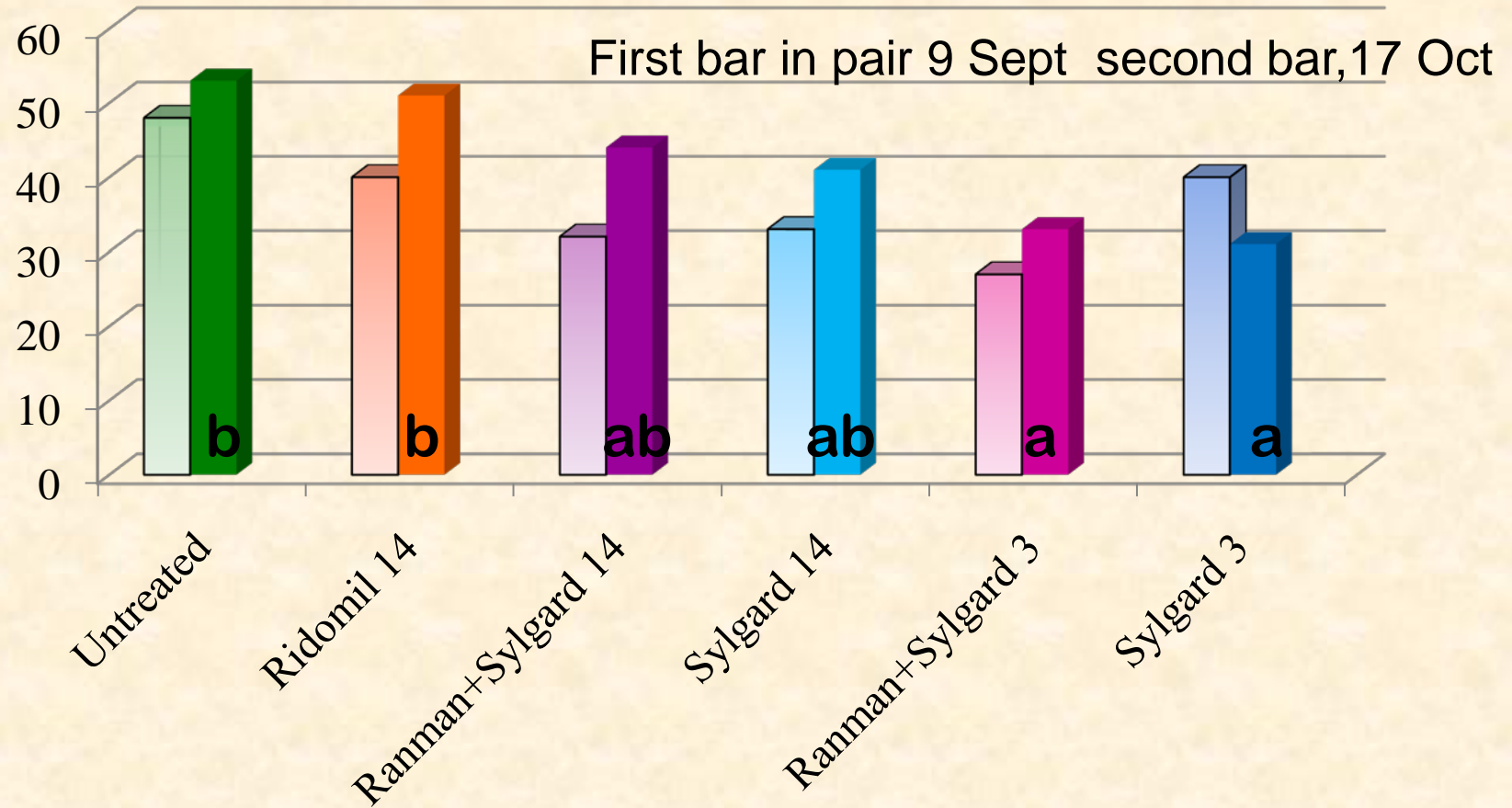
Applied as a band 3 and 14 days after seeding, followed by irrigation



Fungicides and timing for control of cavity spot of carrot: harvest assessment- 2008

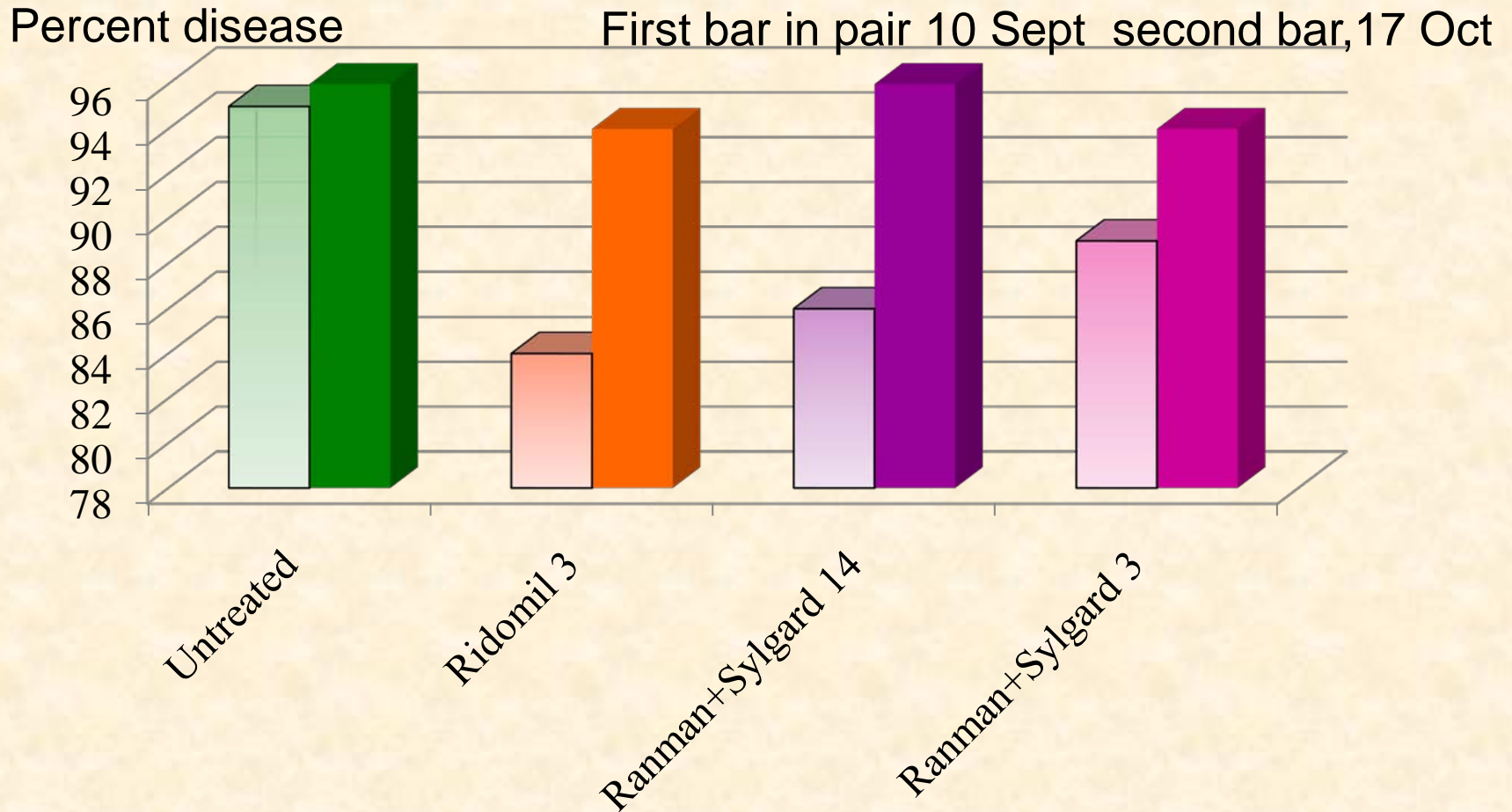


Fungicides and timing for control of cavity spot of carrot, 2 sample dates - 2008



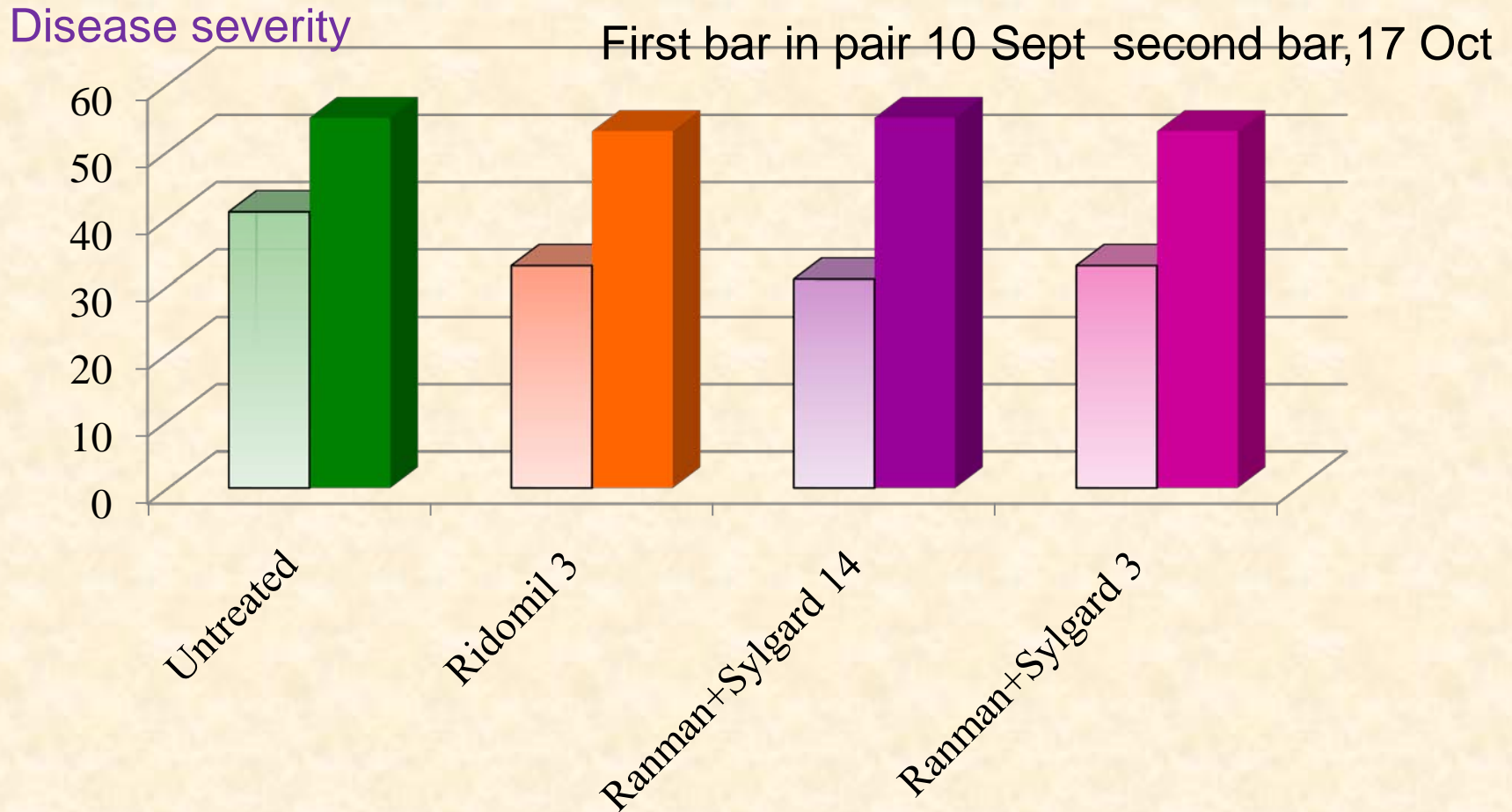
No differences among treatments on 9 Sept, no differences between the two assessment dates. No differences in severity (11-19, 14-22 DSI).

Fungicides and timing for control of cavity spot of carrot, 2 sample dates - 2009



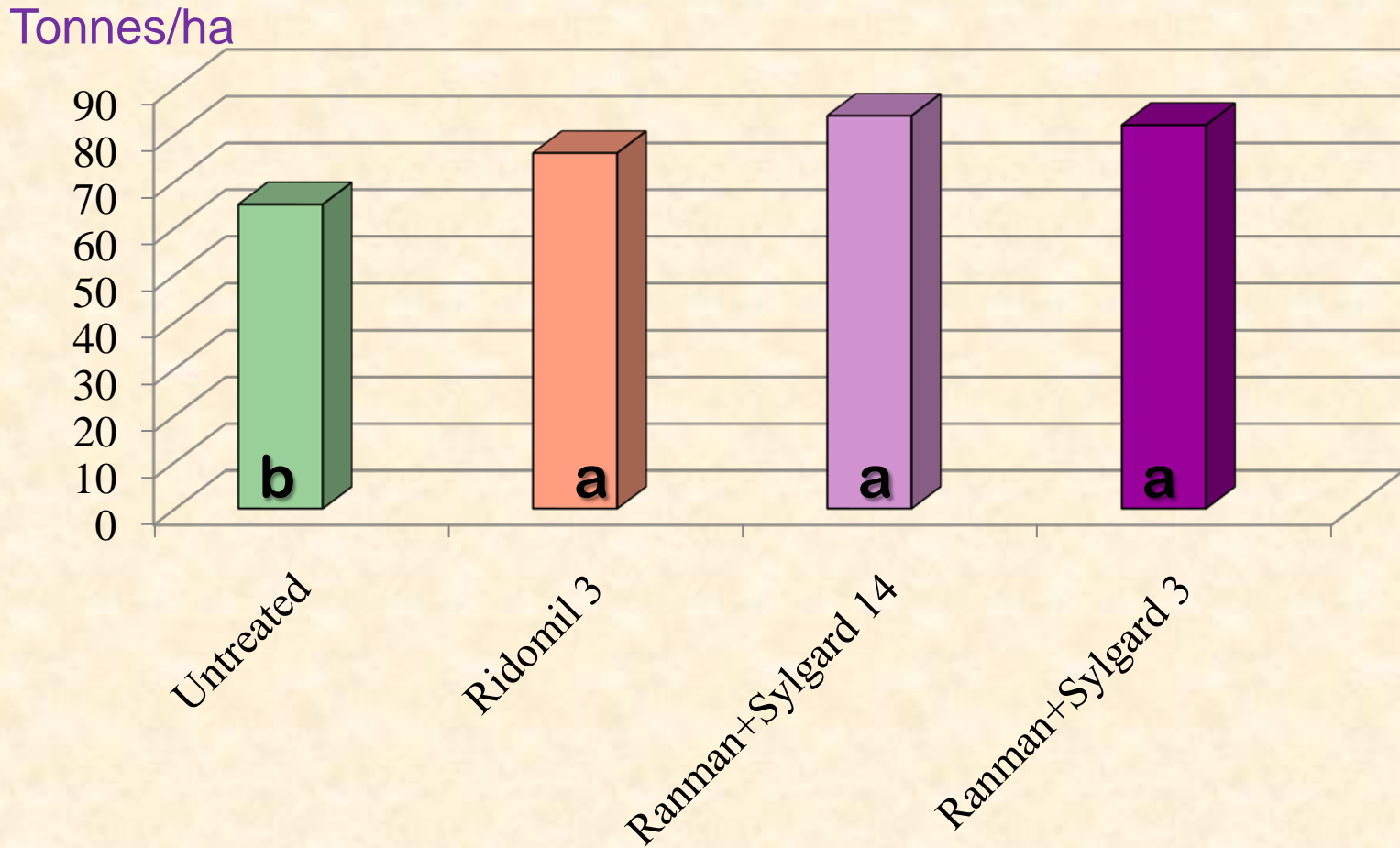
Very high incidence of cavity spot. No differences among treatments at either assessment, sig differences between the two assessment dates

Fungicides and timing for control of cavity spot of carrot, 2 sample dates - 2009



High cavity spot severity. No differences among treatments at either assessment, **differences between the two assessment dates**

Marketable yield in relation to fungicides and timing, 2009



Summary: Fungicides for cavity spot

Ranman plus Sylgard was effective under moderate to high disease pressure, but not under very high disease pressure.

Time of application 3 days after seeding might be best



Fungicides increased yield

Disease incidence and severity increased from Sept to Oct (6 weeks) when disease pressure was high (2009)

There is continued interest in carrots with different pigments



Carrots with different pigments

Breeding lines from ARS/USDA, Univ. of Wisconsin: 2002- 2009, except 2007

White	W105-7
Yellow	W102-1
Dark Orange	W101-23
Red	W104-3
Purple	W106-3



Carrots 2005- 2008

Indian	red	India
Atomic red	red	Johnny's
Dragon	red	Garden City Seeds
Cellobunch	orange	Seminis
Envy	orange	Seminis
Ya Ya	orange	Seminis
Alpha	orange	Alpha Seeds S.A.
(resistant?)		



Carrots 2005- 2008

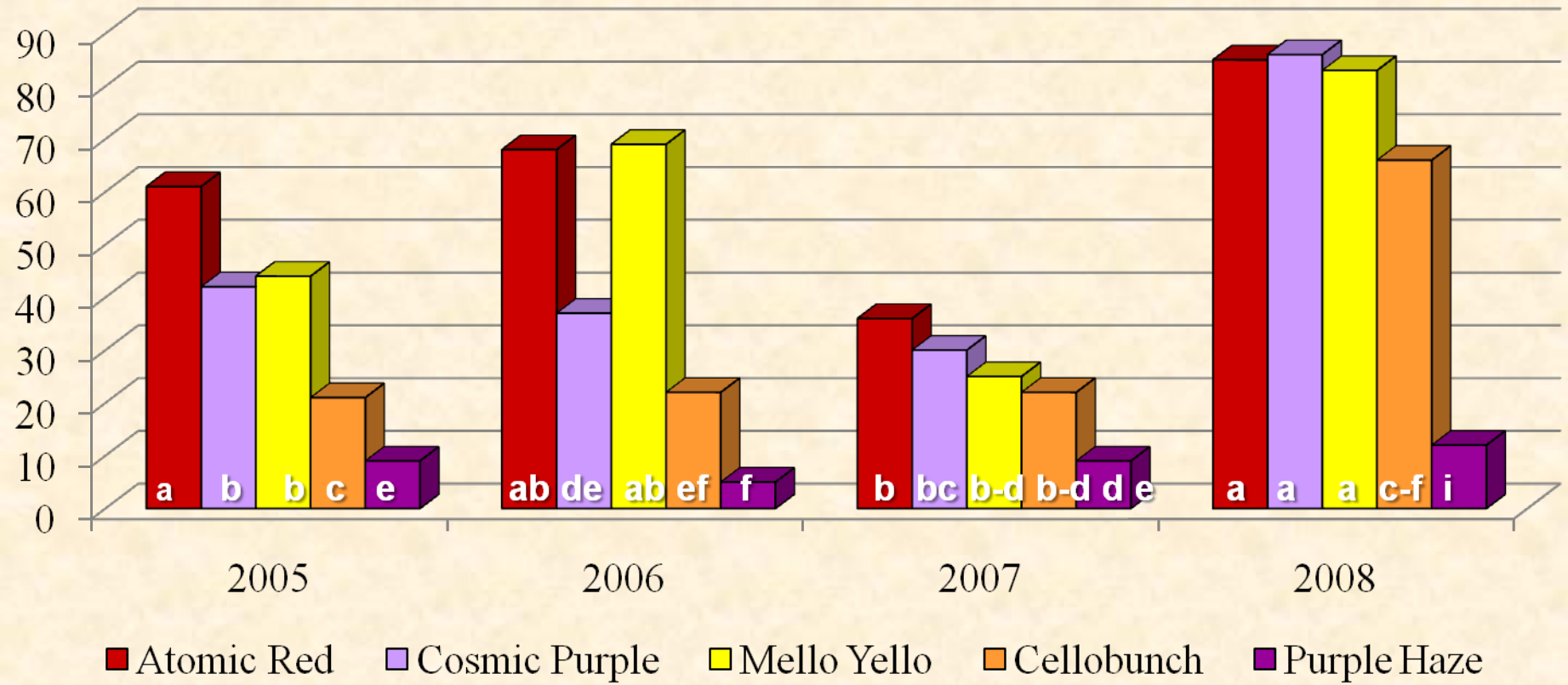
Mello Yello	yellow
Amarillo Yellow	yellow
White Satin	white
Crème de Lite	white
Cosmic Purple	purple
Purple Rain	purple
Purple Haze	purple

Bejo
Bountiful Gardens
Bejo
Nunhems
Johnny's Select S
Bejo
Bejo

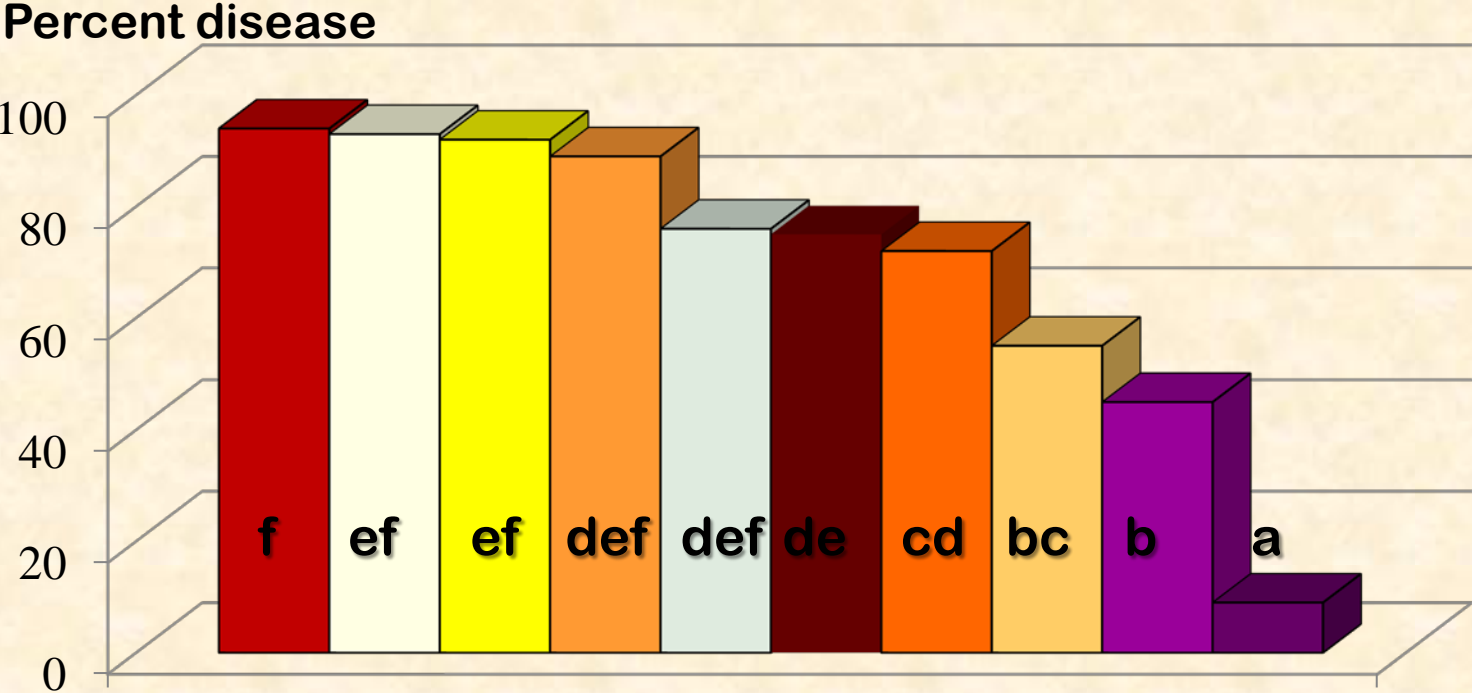


Cavity spot incidence on carrot cultivars with different pigments 2005-2008

Incidence (%)



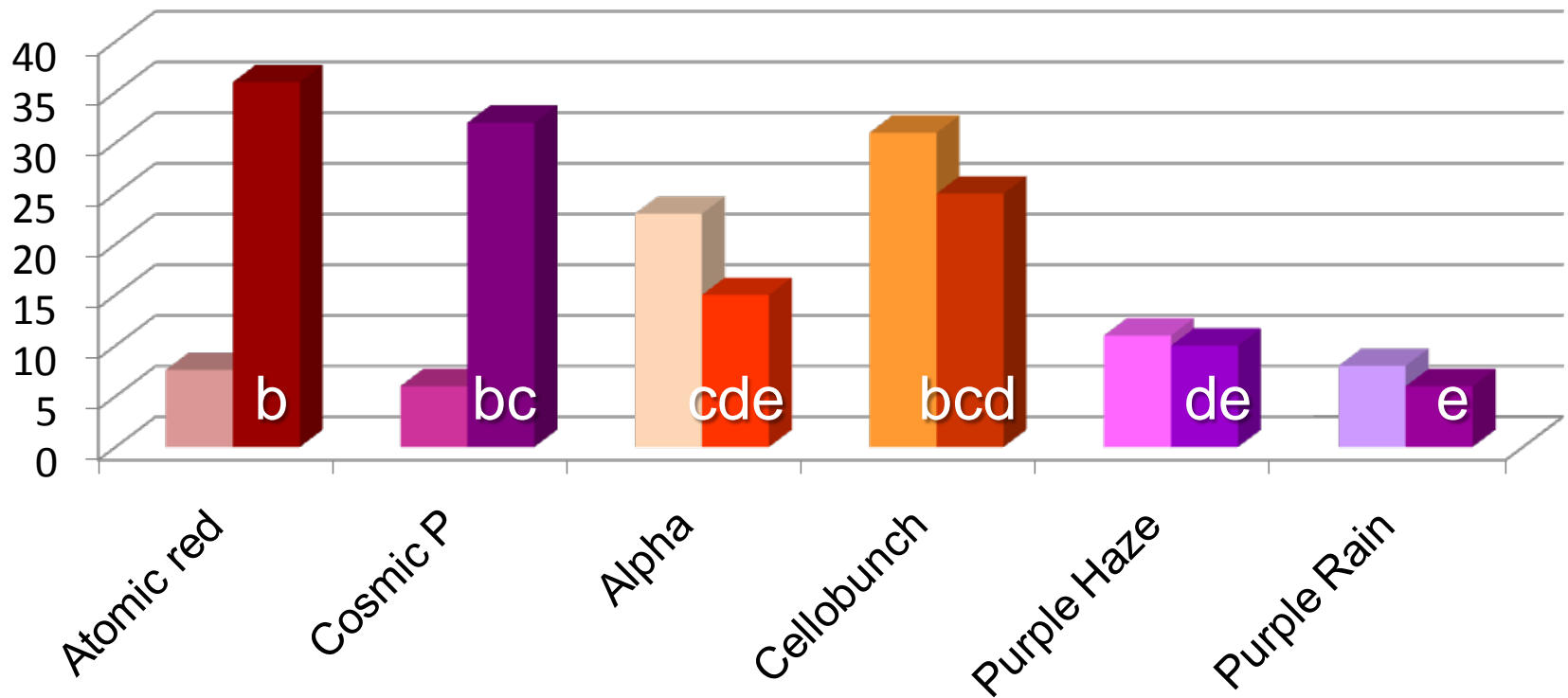
Cavity spot on coloured carrots 2009



- Atomic red
 White satin
 Mello Yello
 Envy
- White
 Red
 Cellobunch
 Yellow
- Purple
 Purple Haze

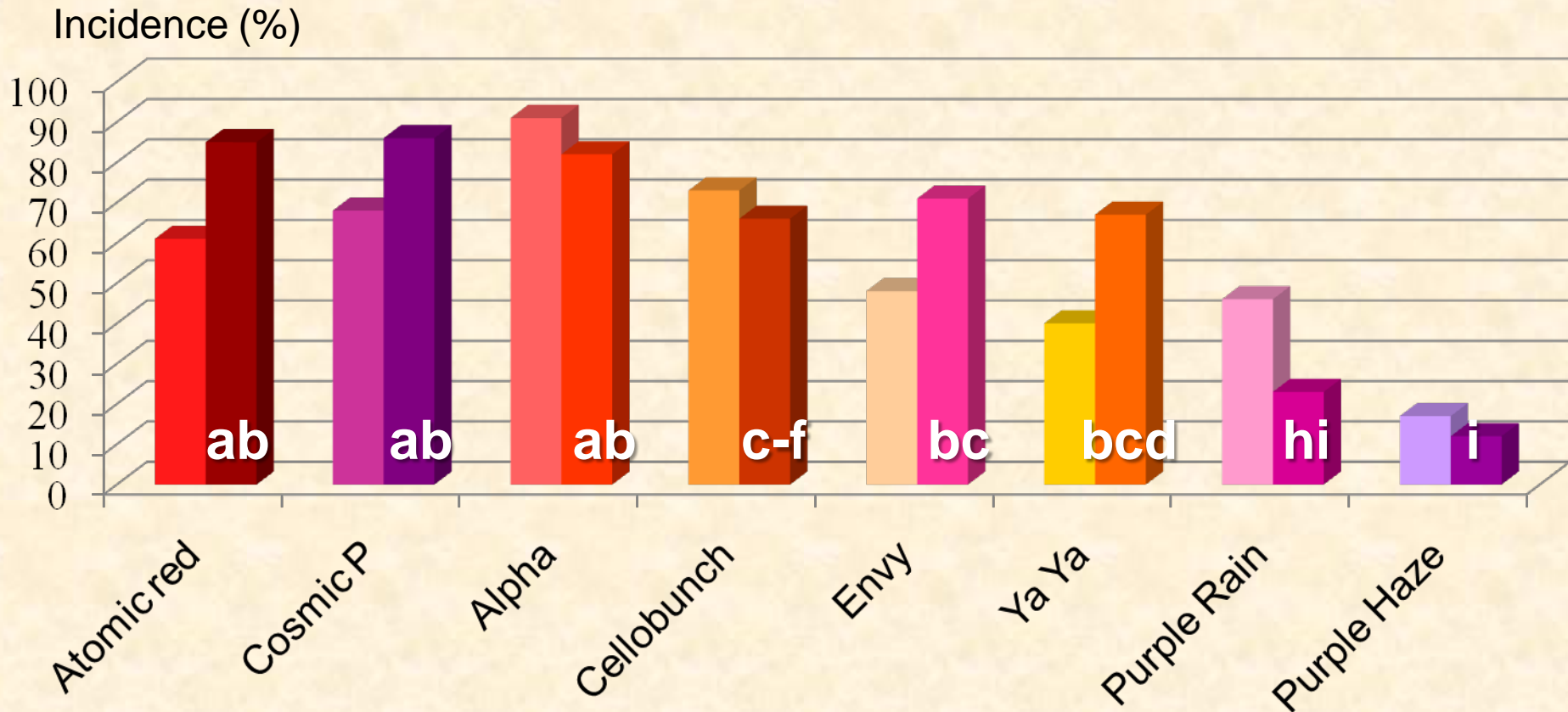
Early or late development of cavity spot -2007

Incidence (%)



First bar in cluster- August, second bar harvest assessment

Early or late development of cavity spot -2008



First bar in cluster- August, second bar harvest assessment

Weather in relation to cavity spot incidence and severity

Correlations with monthly weather

- Total rainfall per month (mm)
- Number of days with rain (over 5 mm)
- Mean air temperatures, maximum, minimum and average for month.



Severity is related to:

- number of days with rain in August ($r = 0.92$)
- Total rain in July and August combined ($r = 0.86$)
- minimum temperatures in August and September ($r=0.87$)
- *negatively correlated with average temperatures in August, September and October, ($r = -0.90, -0.93, -0.86$)
- mean maximum temp. in August and September ($r = -0.91$)

Rainfall at the plot sites 2007-2009

Year and month	Actual (mm)	Long term average
2007 July	27	61
2007 August	33	57
2008 July	137	69
2008 August	63	56
2009 July	135	76
2009 August	89	57

Cavity spot on coloured carrots

- **Cavity spot highest in red carrots, especially 'Atomic Red,'**
- **Cavity spot lowest in most purple carrots, especially 'Purple Haze'.**
- **Orange carrots such as 'Cellobunch', and 'Envy' were moderately susceptible to cavity spot.**
- **Under low disease pressure (2007) 'Alpha' showed some resistance, but under high disease pressure (2008) it was more susceptible than 'Cellobunch'.**



Cavity spot development



- The resistant purple cultivars develop some cavity spot early, but it doesn't increase with time
- Others develop high levels of cavity spot early
- **Paper by Fredric Suffert and Francoise Montfort**
- **Primary infection from inoculum in soil**
- **Autoinfection and alloinfection: secondary infection that follows primary infection**
- **Increases in disease severity = lesion size. Is this another form of resistance?**

Cavity spot and coloured carrots?

Cultivar selection – red carrots are very susceptible, some purple carrots are highly resistant, most orange carrots are moderately susceptible, but there are differences!

Can't control rainfall, but for muck soils, don't irrigate after the end of June unless absolutely necessary. On other soils, manage irrigation carefully.

Early harvest may avoid some disease, but this depends on cultivar and the weather

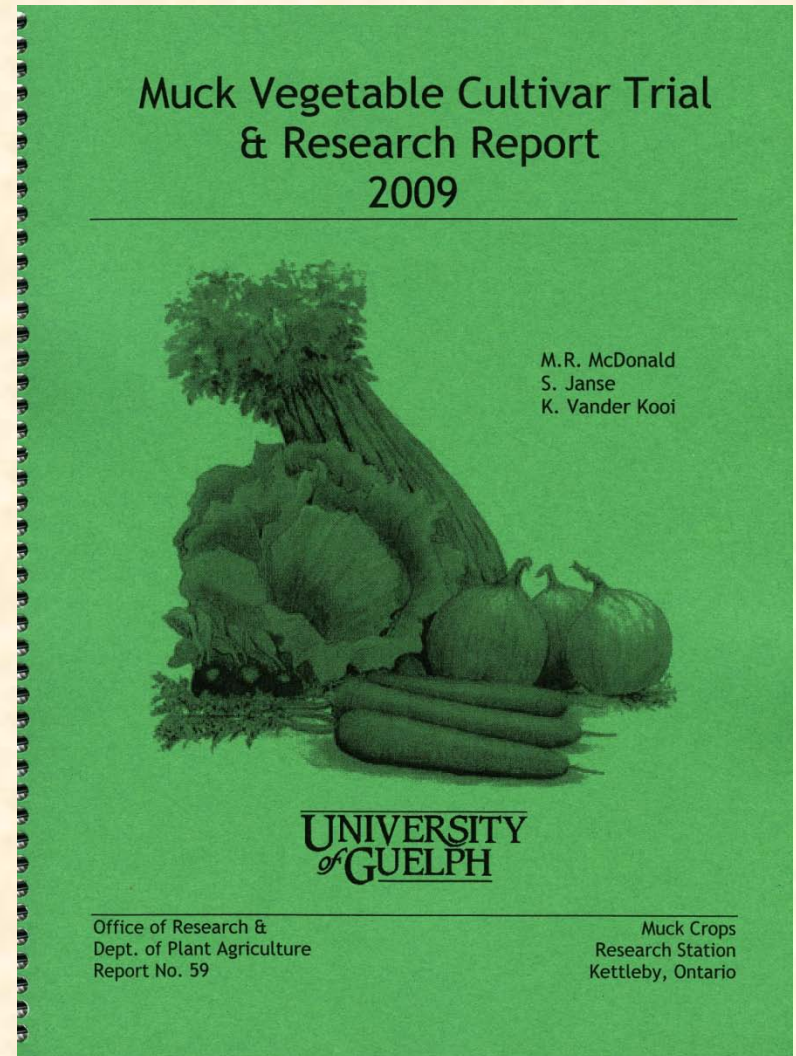


All research trials are summarized in the Annual Report

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.



Muck Vegetable Cultivar Trial & Research Report 2009

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Office of Research &
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Report No. 59

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Thank you
Questions?

RESEARCH STATION



**A new, or emerging,
disease of carrots in
Ontario?**

Fusarium root rot

**Fusarium infection that
develops in the field is
unusual- it is most often
seen as Fusarium dry rot
in storage.**



Two Fusarium species were isolated from infected carrots. One is *F. solani*, the second not yet identified.



Healthy carrots were inoculated.

The unidentified Fusarium caused the most disease, but both can infect carrots.



