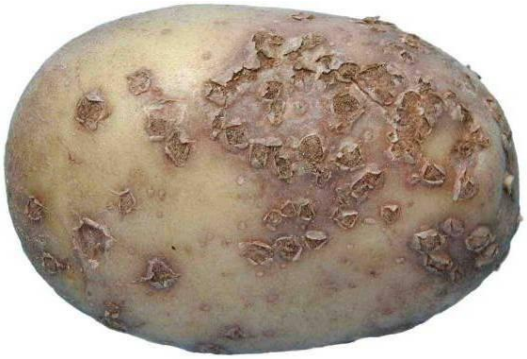
Epidemiology and control of Powdery scab on potato cultivated under hot climate conditions



Leah Tsror (Lahkim)

Agricultural Research Organization (ARO)
Gilat Research Center

Potato Production in the Negev, Israel

2007 frost event

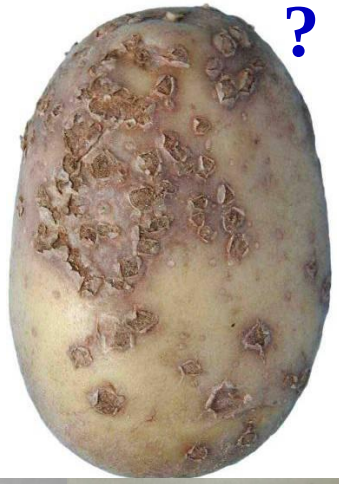
PS Symptoms on daughter tubers

Imported seed tubers

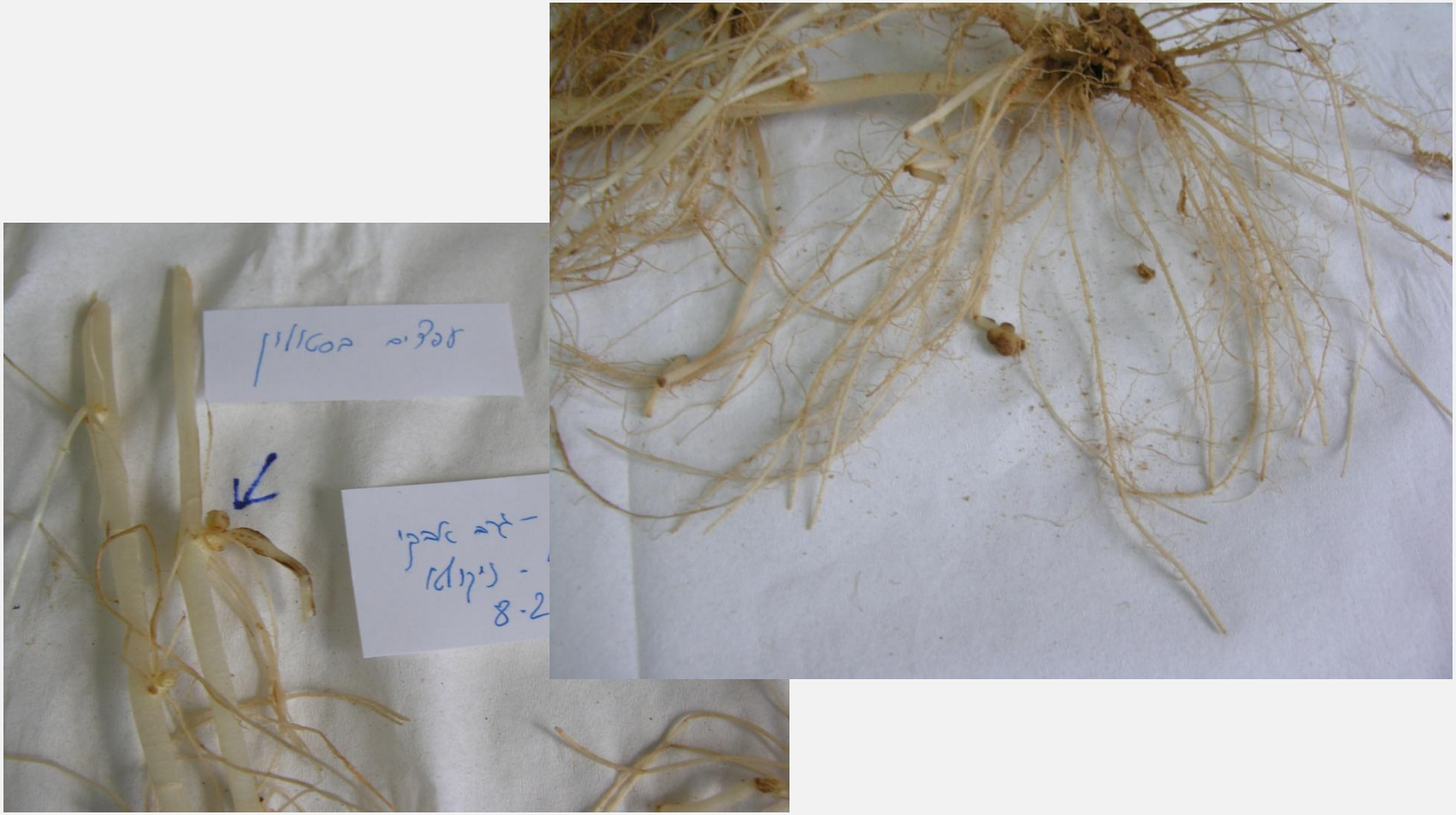
Powdery Scab

?

Common Scab



PS Galls on Roots



Economic damage in IL due to PS

- Downgrading tuber quality
  (fresh marketing; processing; storage)
- Rejecting contaminated seed tubers for the winter

Why Powdery Scab Intensity has increased?

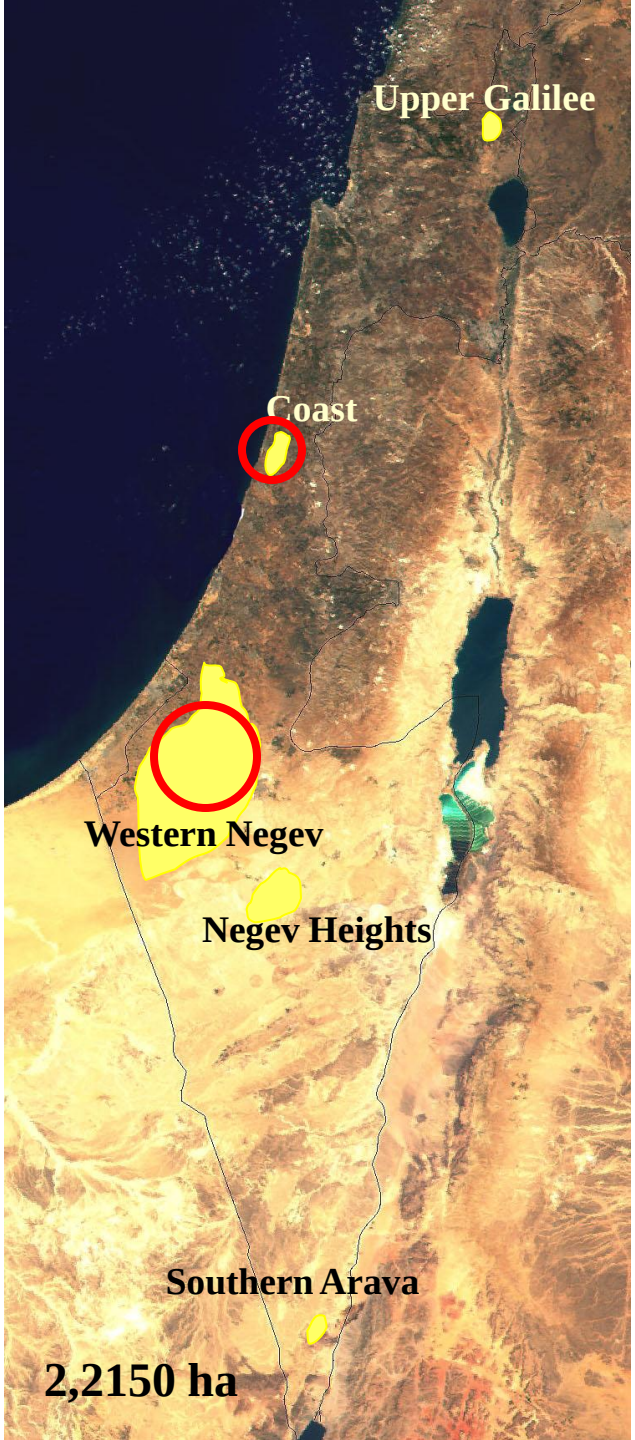
- Intensification of potato production
- Intensive irrigation
- Use of susceptible cultivars
- Banning of methyl bromide (efficient soil fumigant)
- Neglecting prevention measures

Powdery Scab Occurrence in IL

First reported in IL in 1984

Occured mostly in Terra Rosa soils,
In recent years occurs also in sandy soils

Since 2005 – a significant increase !
[due to phase out of MBr]



Disease management

Preventing measures

Use of pathogen-free seed tubers & soil
Resistant/tolerant cultivars
Import regulations

Reducing inoculum sources

Seed tubers treatments
Soil treatments

Agricultural factors

Long crop rotation
Avoiding water logged
Sanitation
Planting date?

Monitoring seed tubers

Import regulations

Israeli phyto-sanitaric requirements (partial)

- Brown & ring rot: zero tolerance (field inspection)
- PVY^{NTN}: zero tolerance (tuber inspection)
- *E. chrysanthemi* zero tolerance (tuber inspection)

- Blackleg: <0.5% infected plants in the field

- Common scab: 66% of the tubers <1/6 of surface; 1% - more 5 spots; 0.3% deep scab
- **Powdery scab: 1% of the tubers <1/8 of surface; zero tolerance to cankerous form**
- Black scurf: 10% of tubers (1/8 of tuber surface); 1% higher than 1/8
- Black dot: 30% of tubers (1/3 of tuber surface);

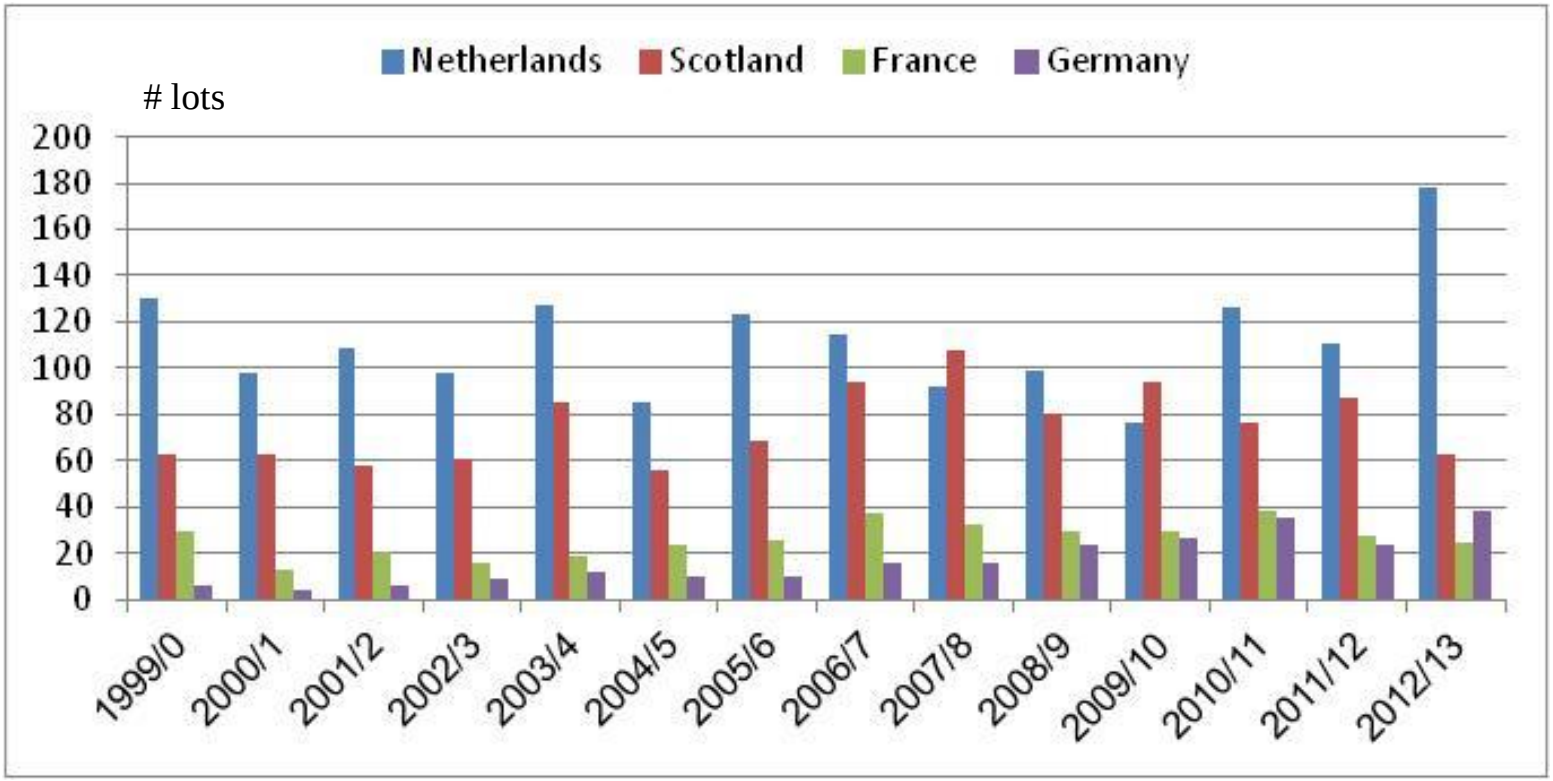
- Late blight: 0.3% of tubers
- Fusarium&Phoma: 1% of tubers

Monitoring seed tubers

Seed tuber lots checked for blemish diseases

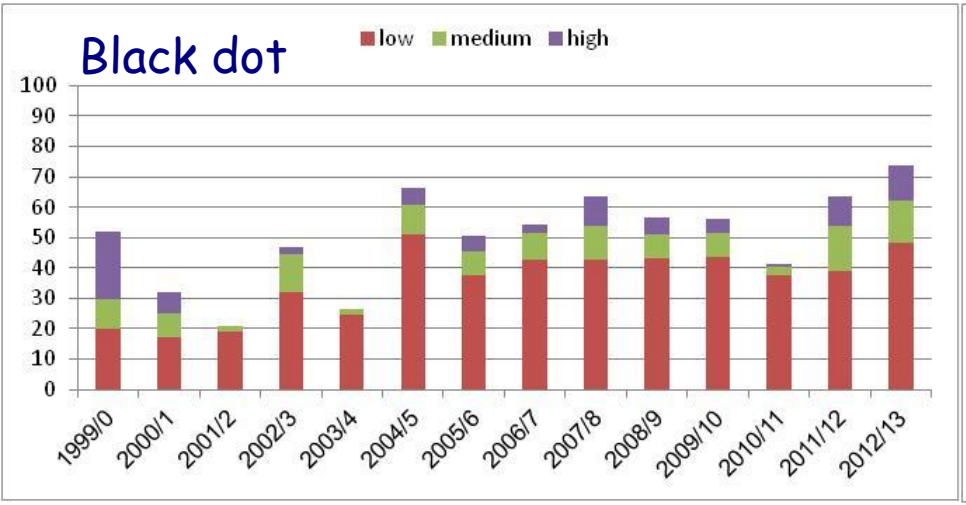
Import of seed tubers to IL

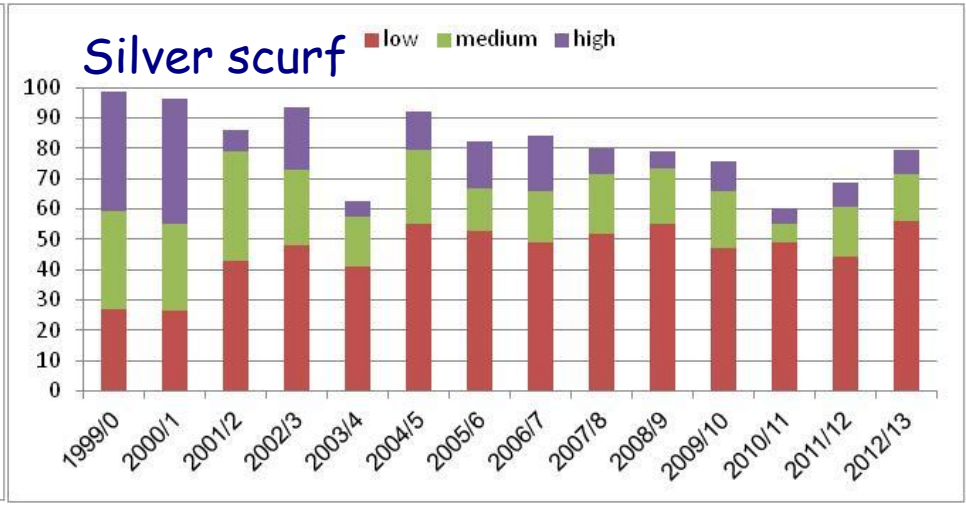
25-30,000 ton annually

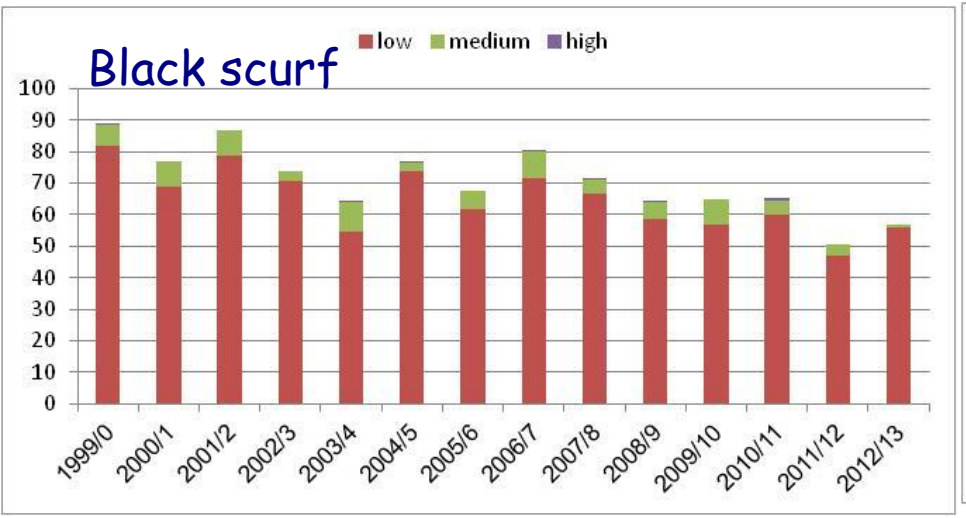


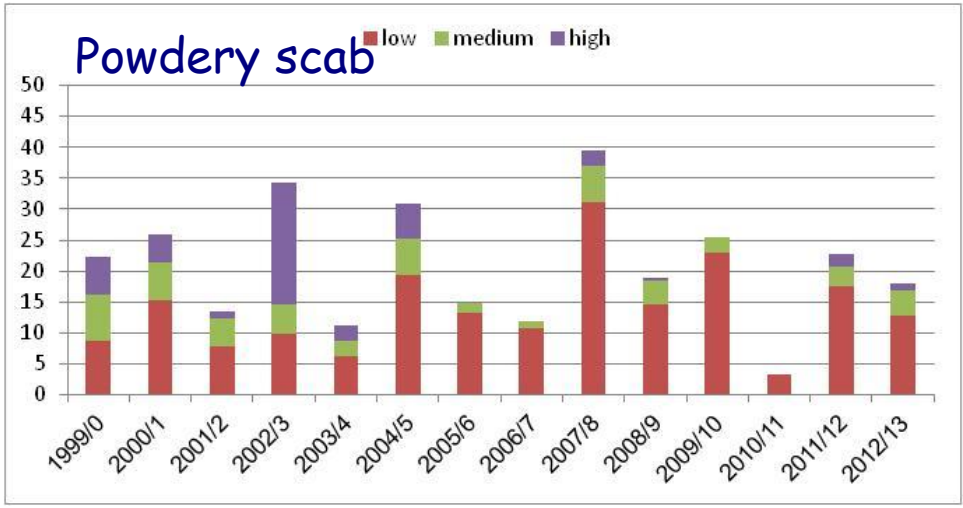
Monitoring seed tubers

200 tubers/lot



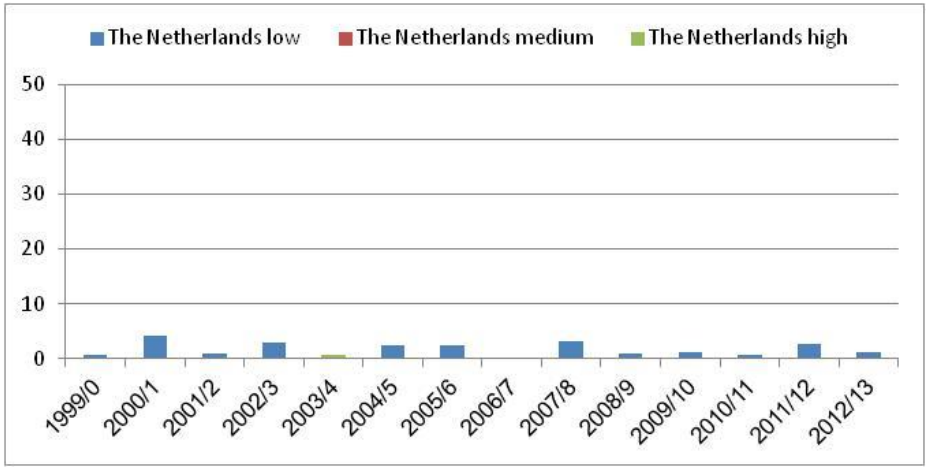


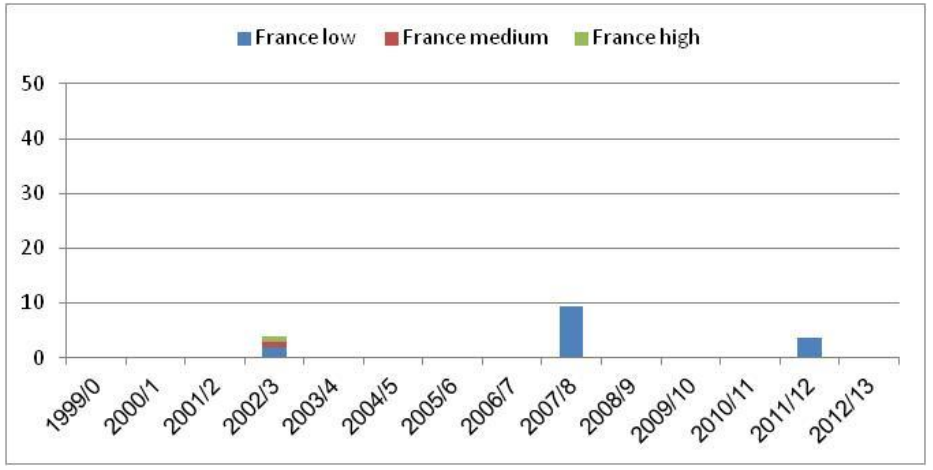


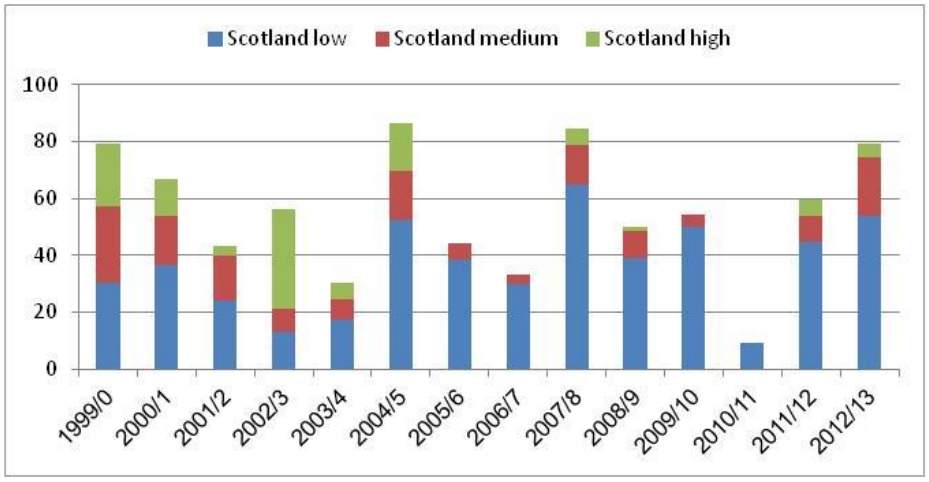


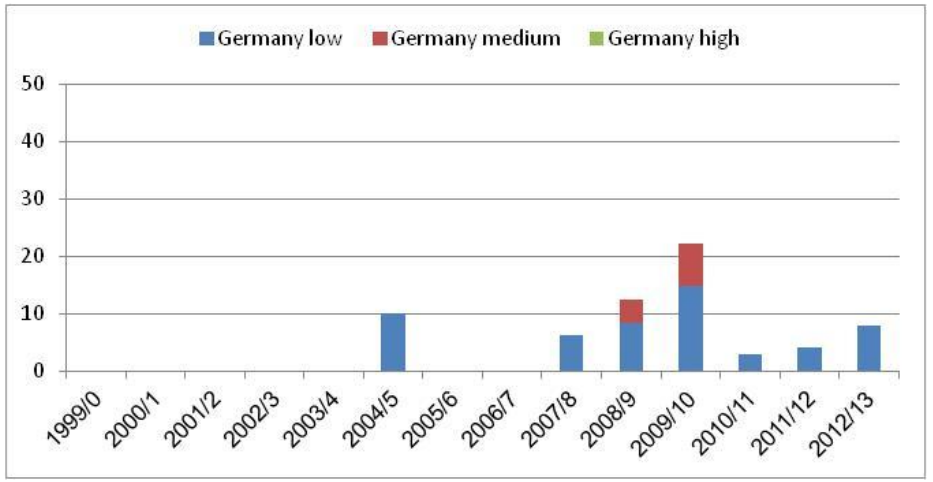
Monitoring seed tubers

PS-infection according source country



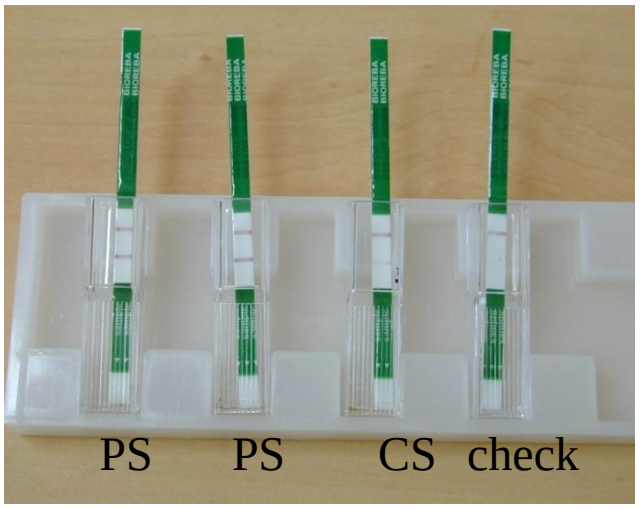




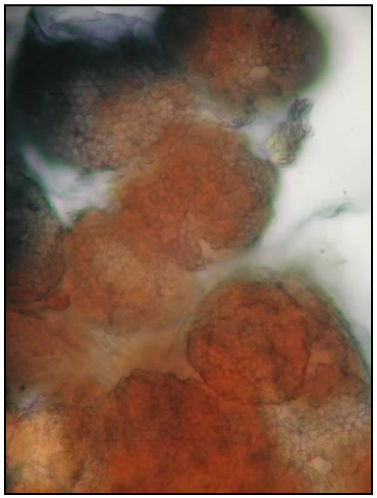


Detection

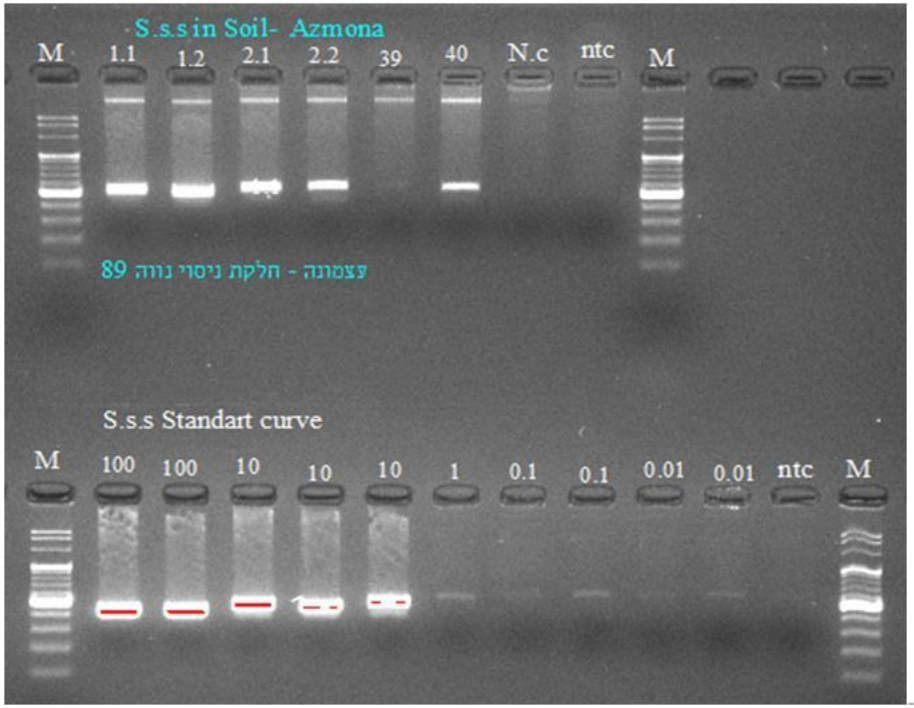
Serology



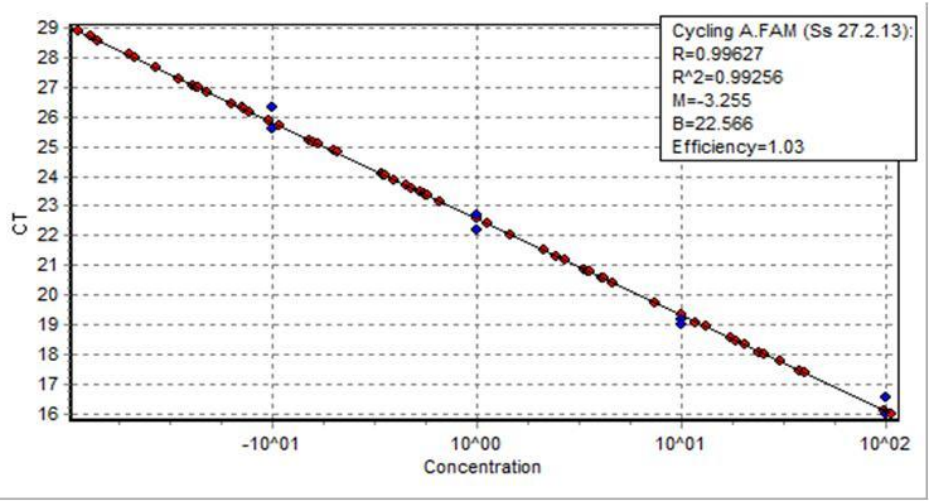
Microscopy



PCR - ITS analysis, using specific primer SPS_{1-2} (391bp)



RT-PCR

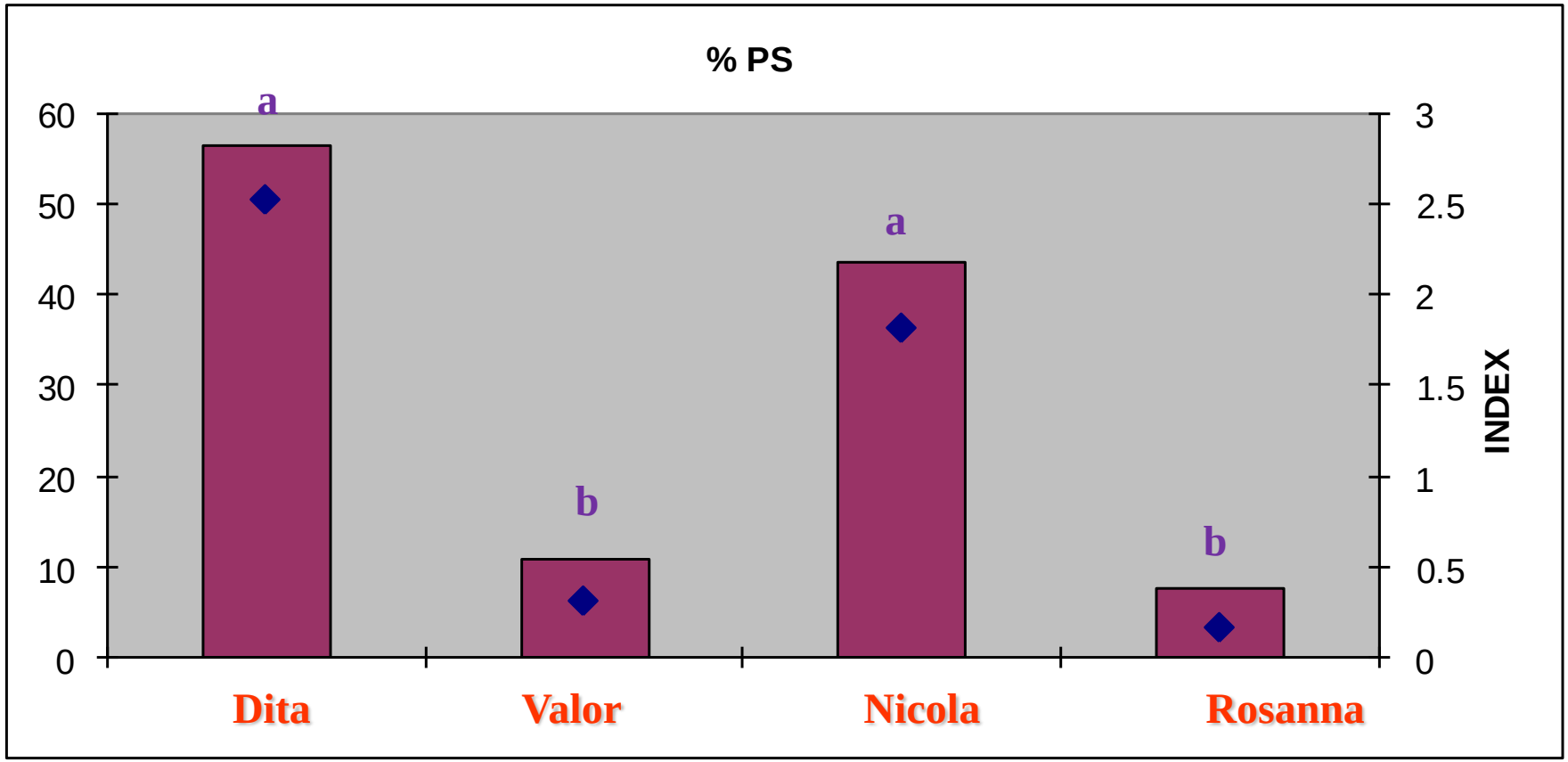


Resistance/tolerance

Resistance/tolerance

Assessment of susceptibility to Powdery Scab

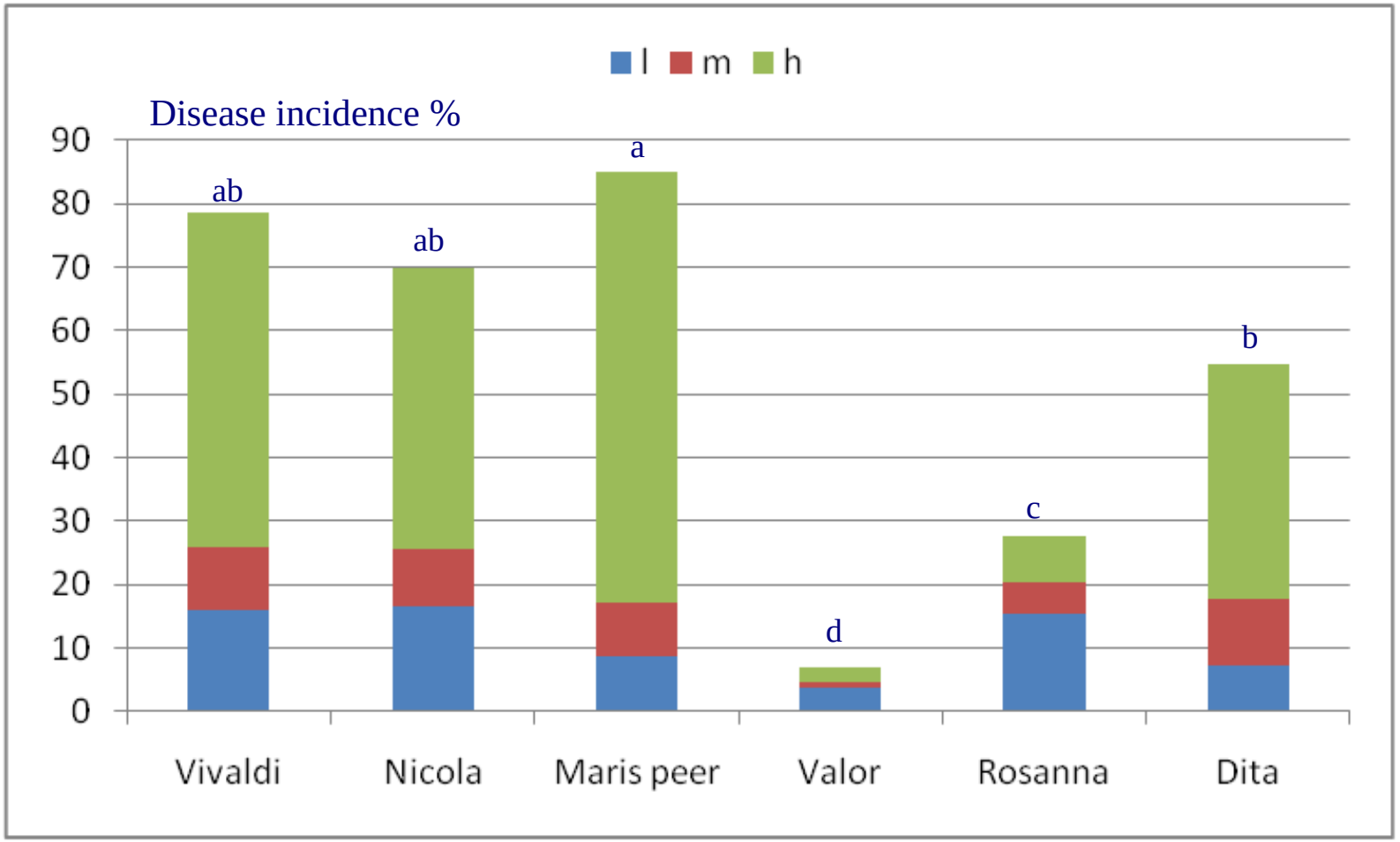
Greenhouse trial; naturally infested soil; 2008



Resistance/tolerance

Assessment of cultivars to Powdery Scab

Field trial; sandy soil naturally infested; Winter 2007-08




ניסוי גרב אבקי
חיטוי קרקע: ללא
זן: מריס פיירר
נגיעות בזרעים: 0%
Maris peer a


ניסוי גרב אבקי
Dita b
09. 06. 2008


Vivaldi ab
09. 06. 2008


Rosanna c

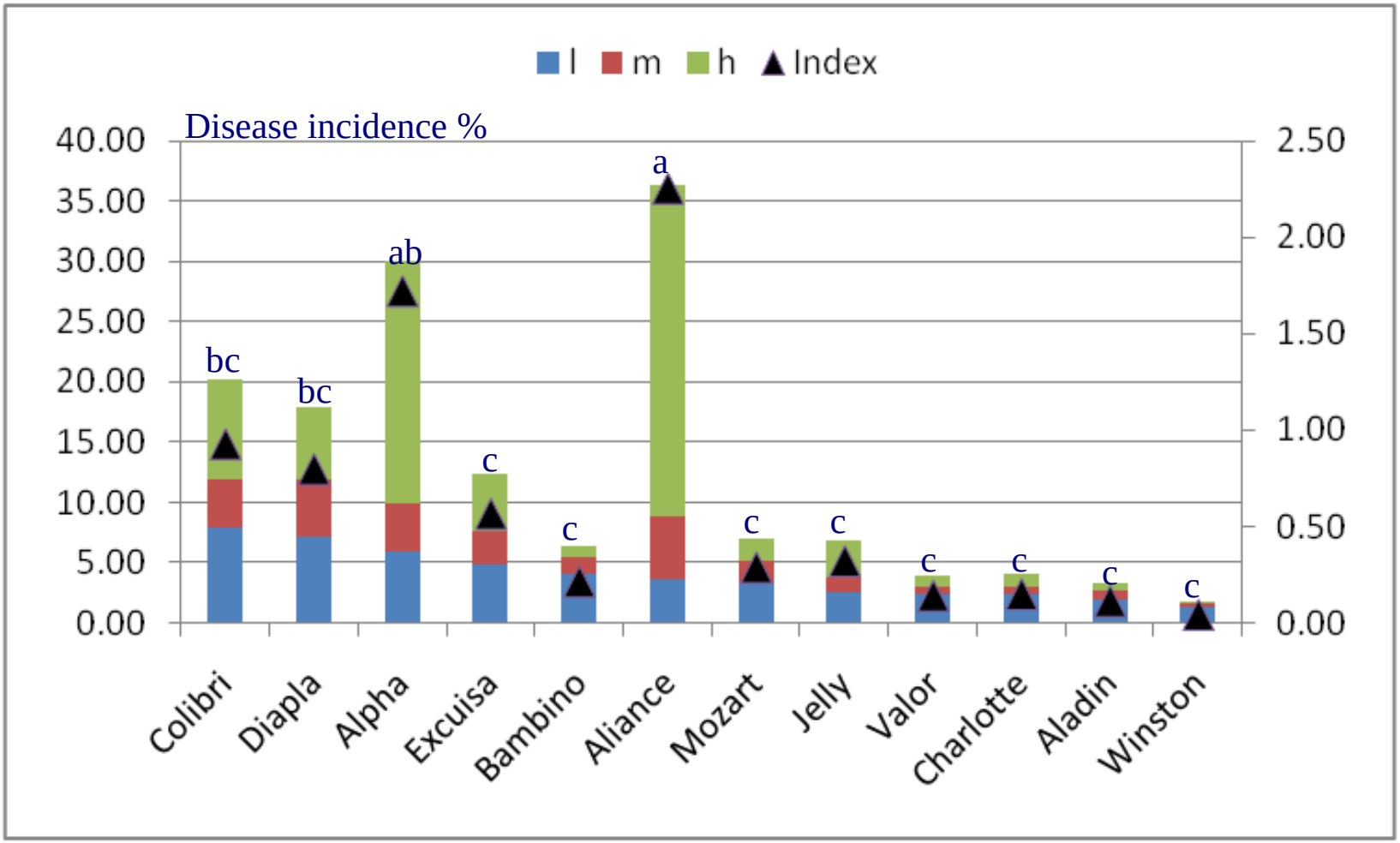

ניסוי גרב אבקי
Nicola ab
09. 06. 2008


Valor d
09. 06. 2008

Resistance/tolerance

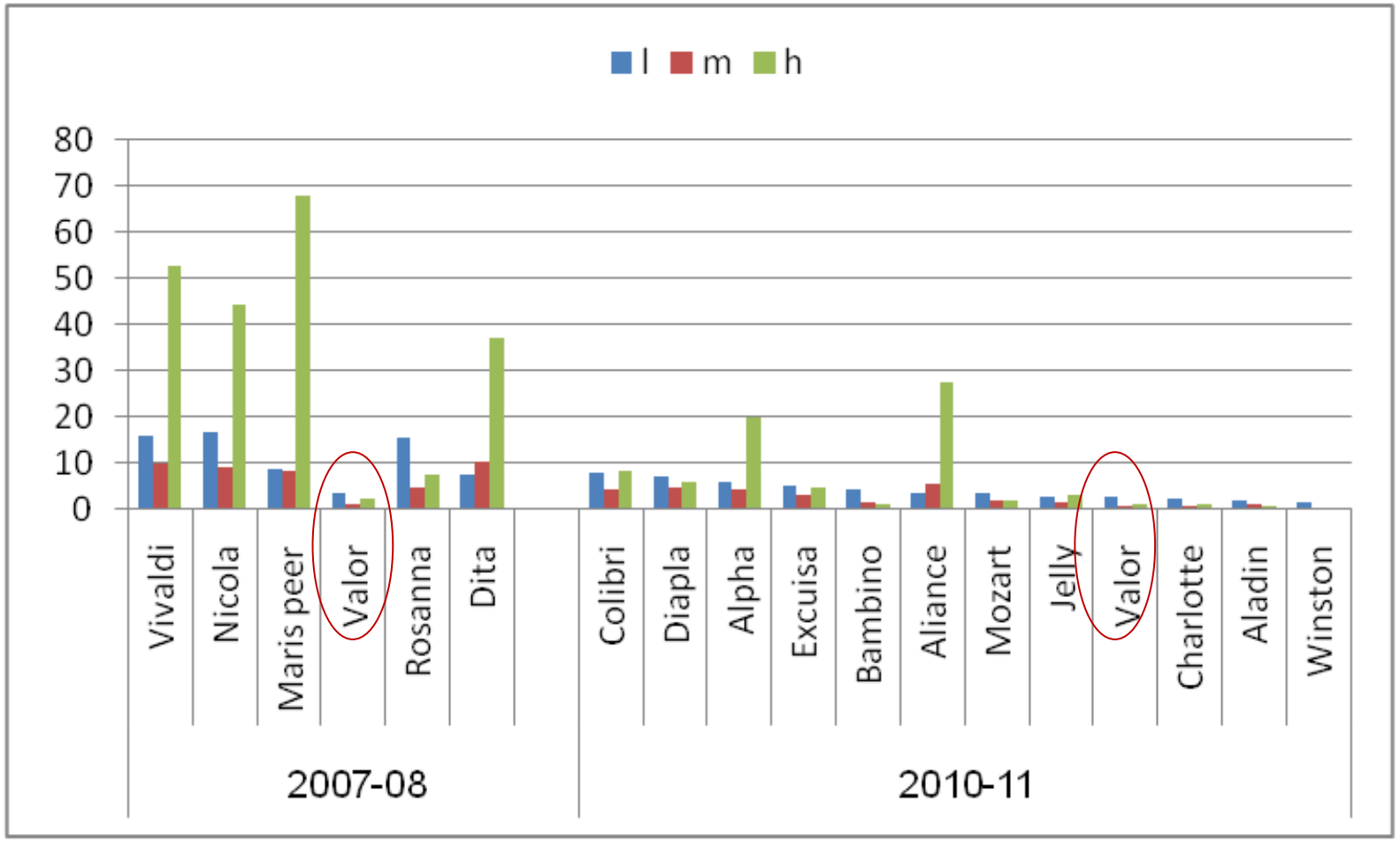
Assessment of cultivars to Powdery Scab

Field trial; sandy soil naturally infested; Winter 2010-11



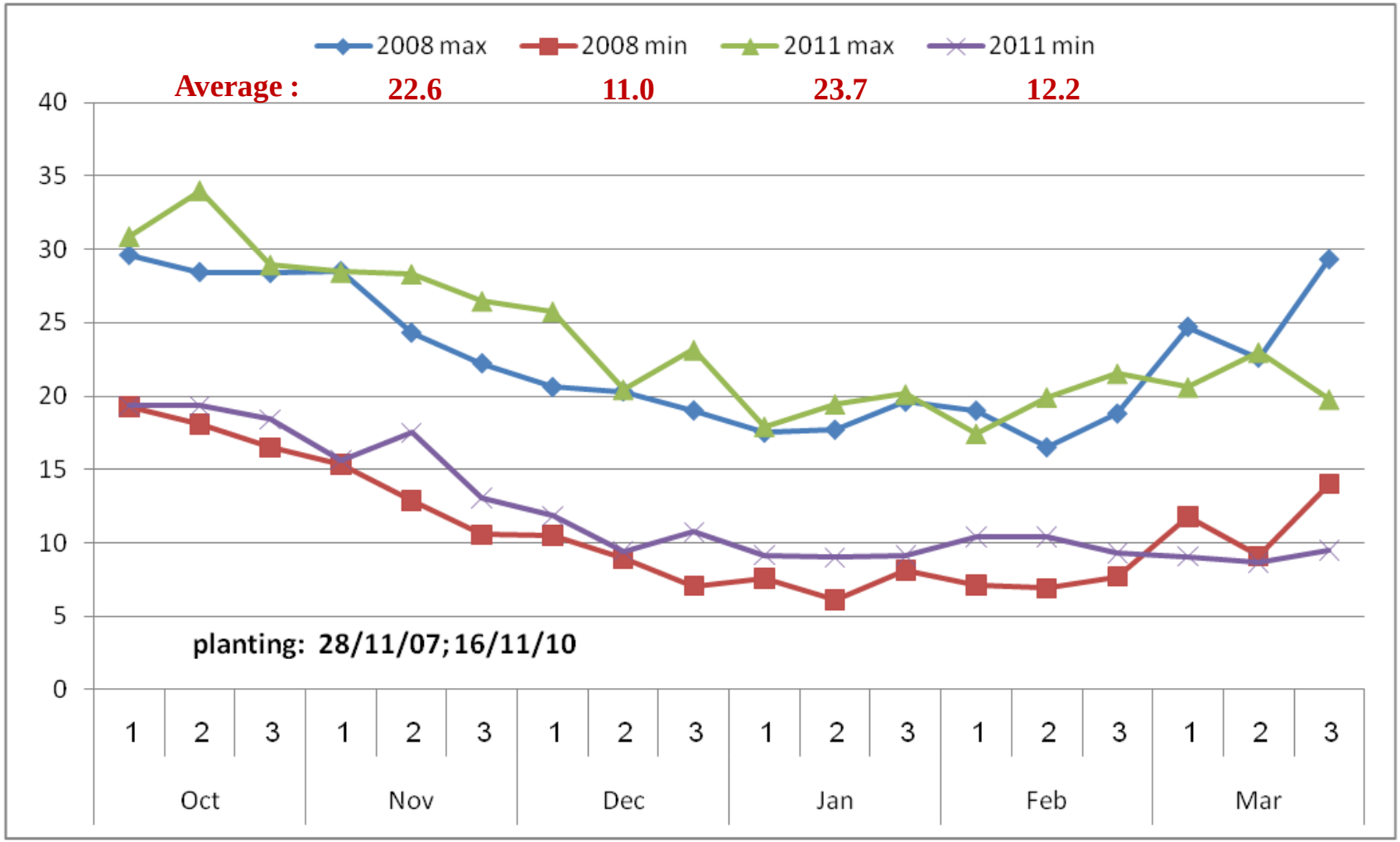
Resistance/tolerance

Assessment of cultivars to Powdery Scab



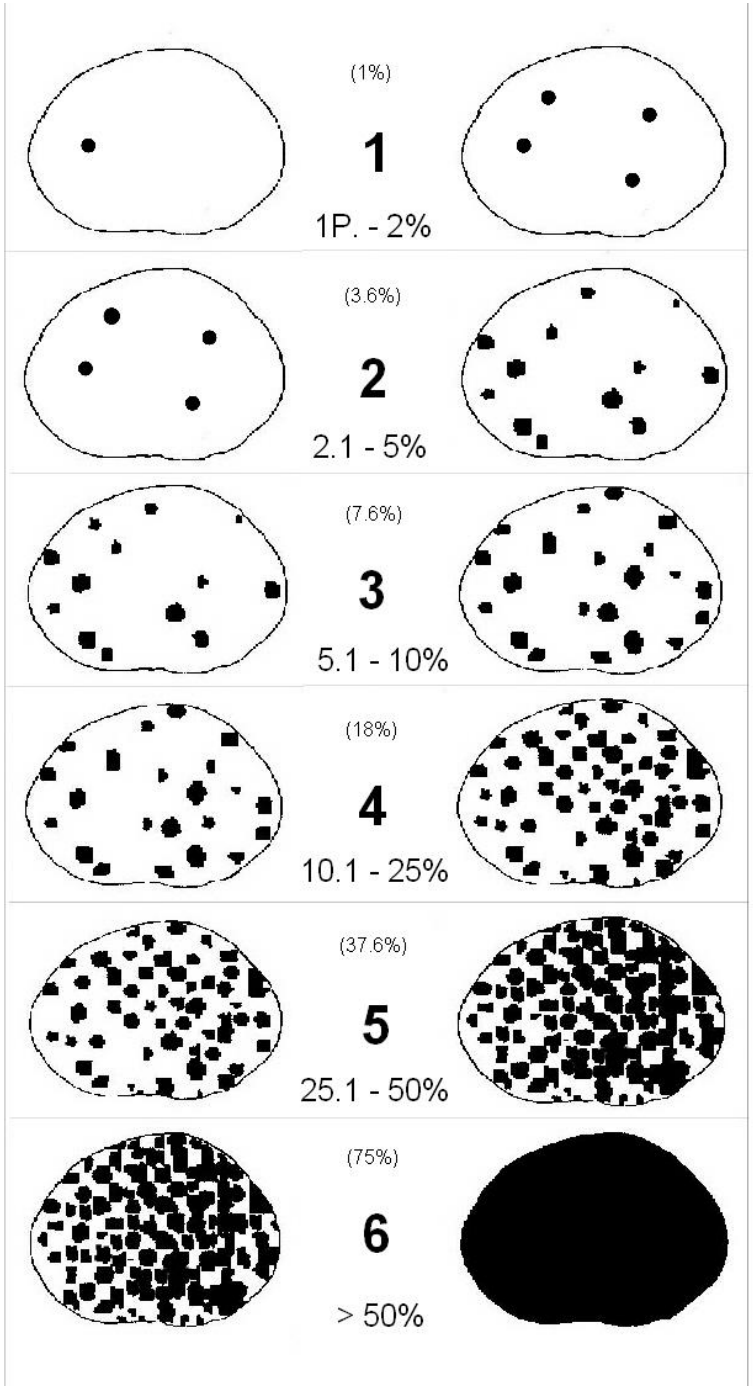
Meteorological data

2007-8 and 2010-11



Resistance/tolerance

Scale for PS severity on tubers (Falloon *et al.*, 1995)

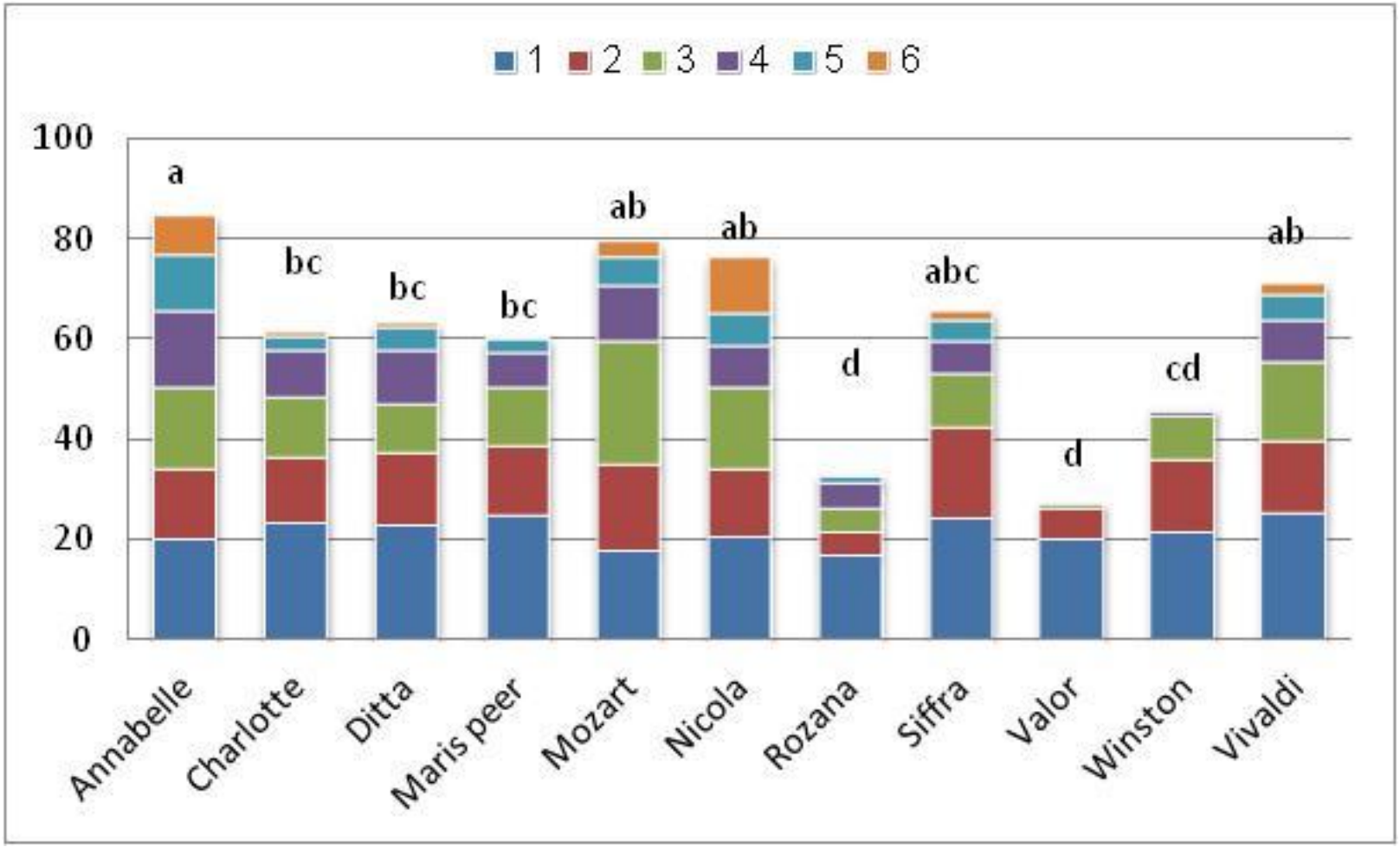


Powdery Scab Scoring Table

Resistance/tolerance

Assessment of cultivars to PS incidence & severity

Field trial; sandy soil naturally infested; Winter 2012-13

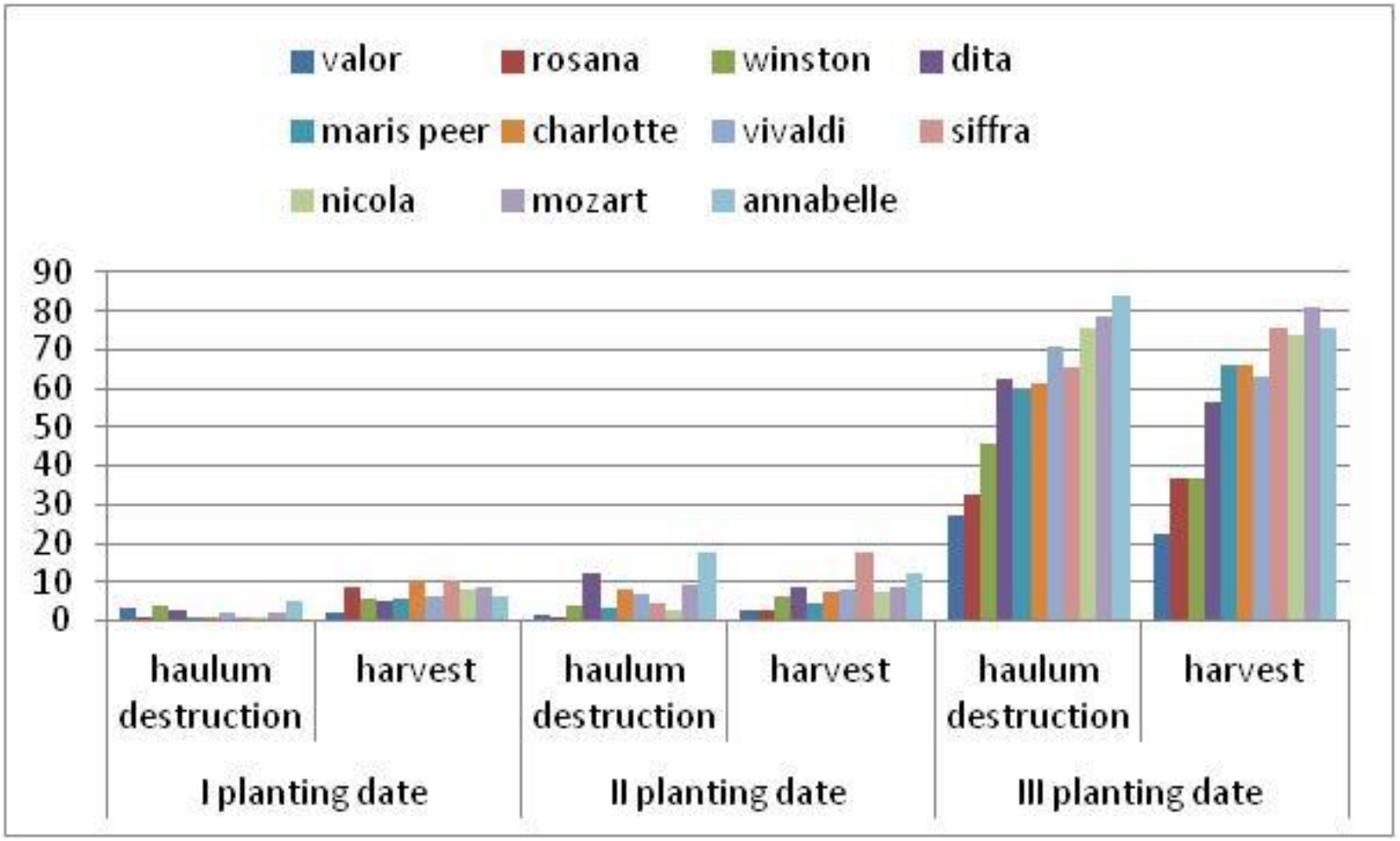


mid-November planting

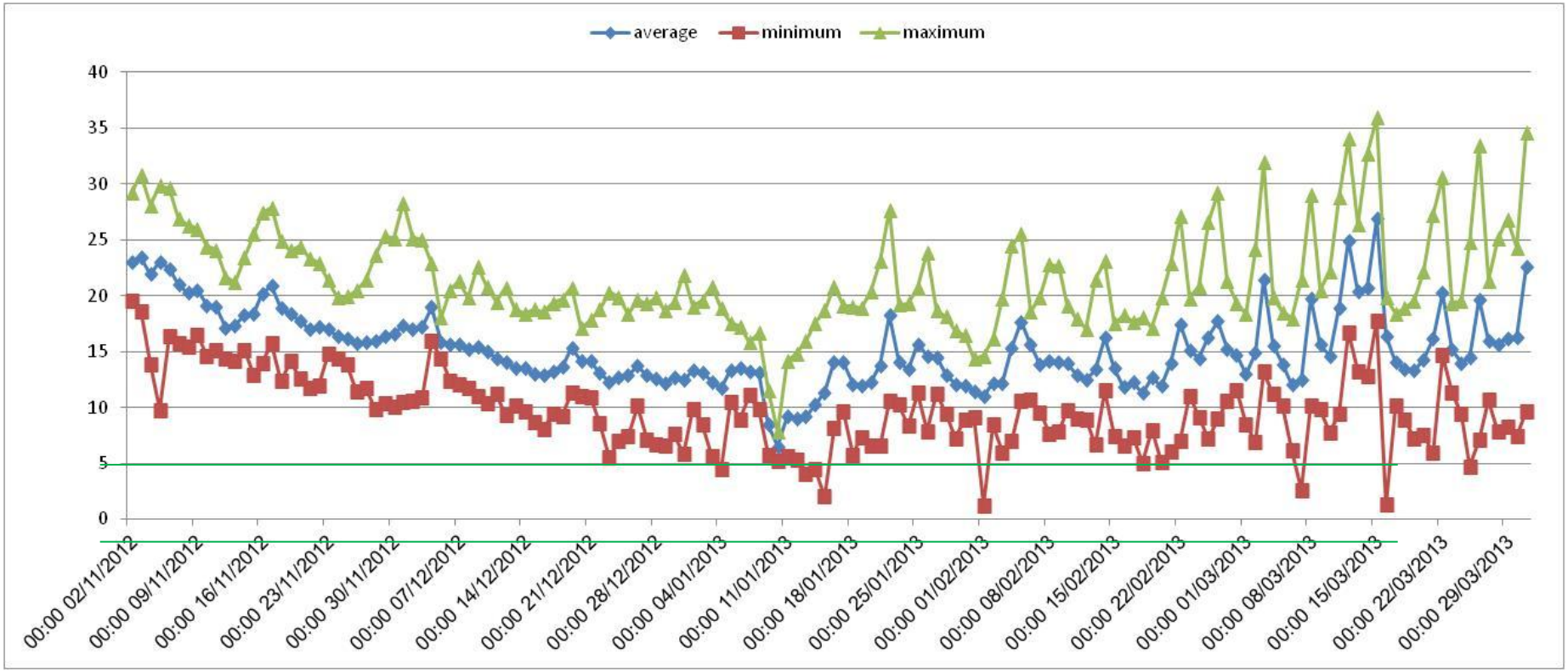
Resistance/tolerance/ ESCAPE

Effect of planting dates & cultivars on Powdery Scab

Field trial; sandy soil naturally infested; Winter 2013



Meteorological data 2012-13



Average Temp during the growing season Max - 23°C; Min Temp-11°C

Temp 55 DAP (tuber initiation)

Planting Date	Min Temp	Max Temp
Oct 7	15.1 °C	26.9 °C
Oct 25	13.0 °C	24.0 °C
Nov 15	**10.3 °C**	**20.8 °C**

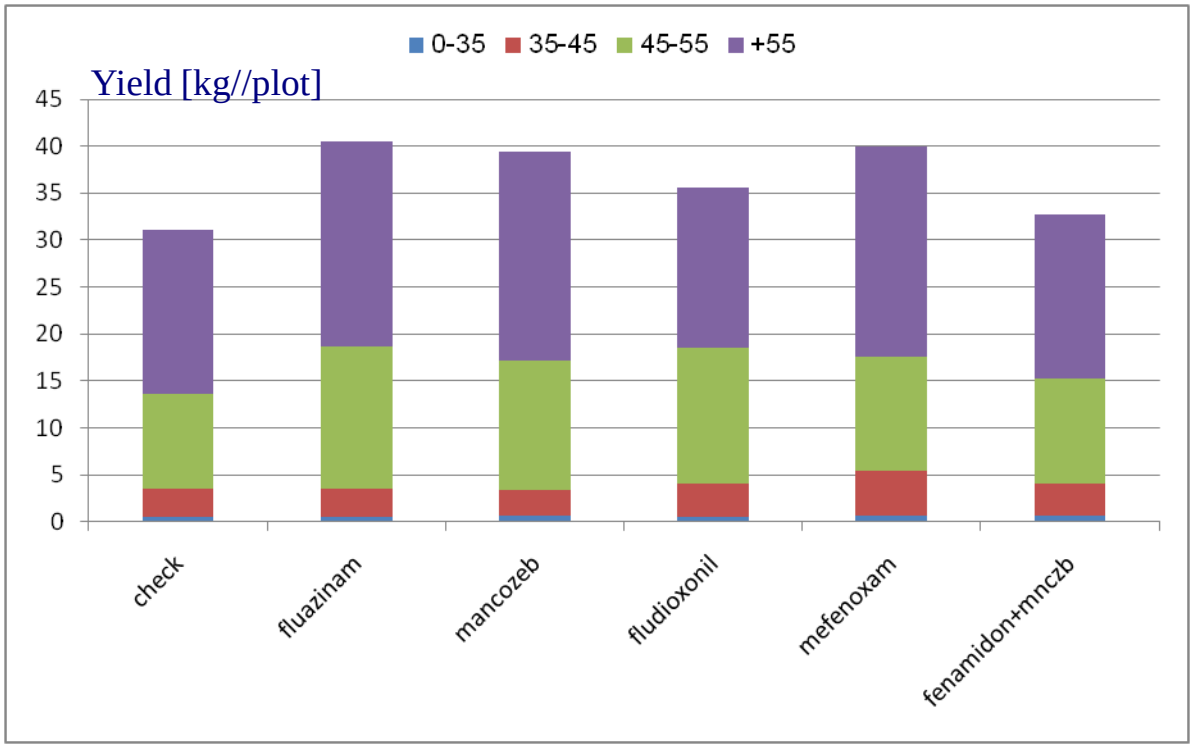
Assessment of cultivars to PS

Chemical control

Chemical control

Seed treatments for PS control

Field trial Spring 2006; clean soil; infected seeds (11%); Cara



Treatments:

1. Check
2. fluazinam 500 ml/t
3. mancozeb 3 kg/t
4. fludioxonil 200 ml/t
5. mefenoxam 100 ml/t
6. fenamidone 10% + mancozeb 50%, 400 gr/t

No disease on progeny tubers!

Chemical control

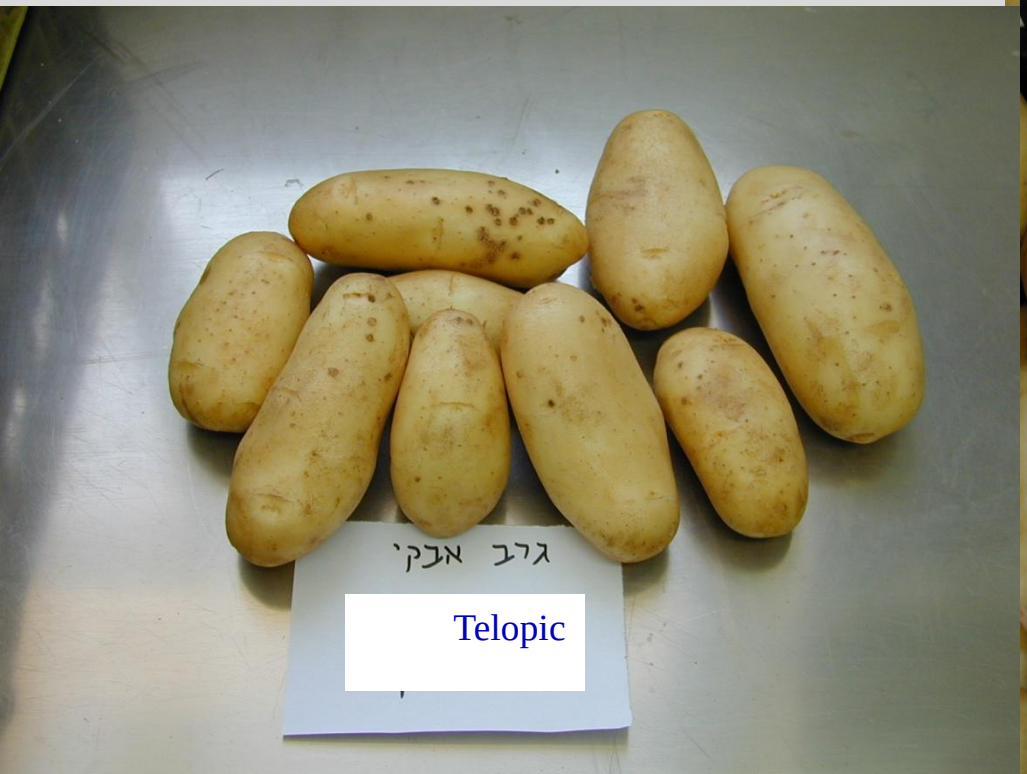
Soil fumigation

Chemical control

Field observation, Spring 2005

Treatment	Disease incidence (%)
Control	**58**
Methyl bromide (500 kg/ha)	**1**
35%chloropicrin + 61% 1,3-D (400 kg/ha)	**8**

Soil fumigation



Combined seed treatment & soil fumigation

Field trial, Winter 2007, cv. Nicola

Infested soil; infected seeds (6.2%)

Soil treatments

1. Metham sodium 900L/ha
2. TeloPic 500 kg/ha
3. Check

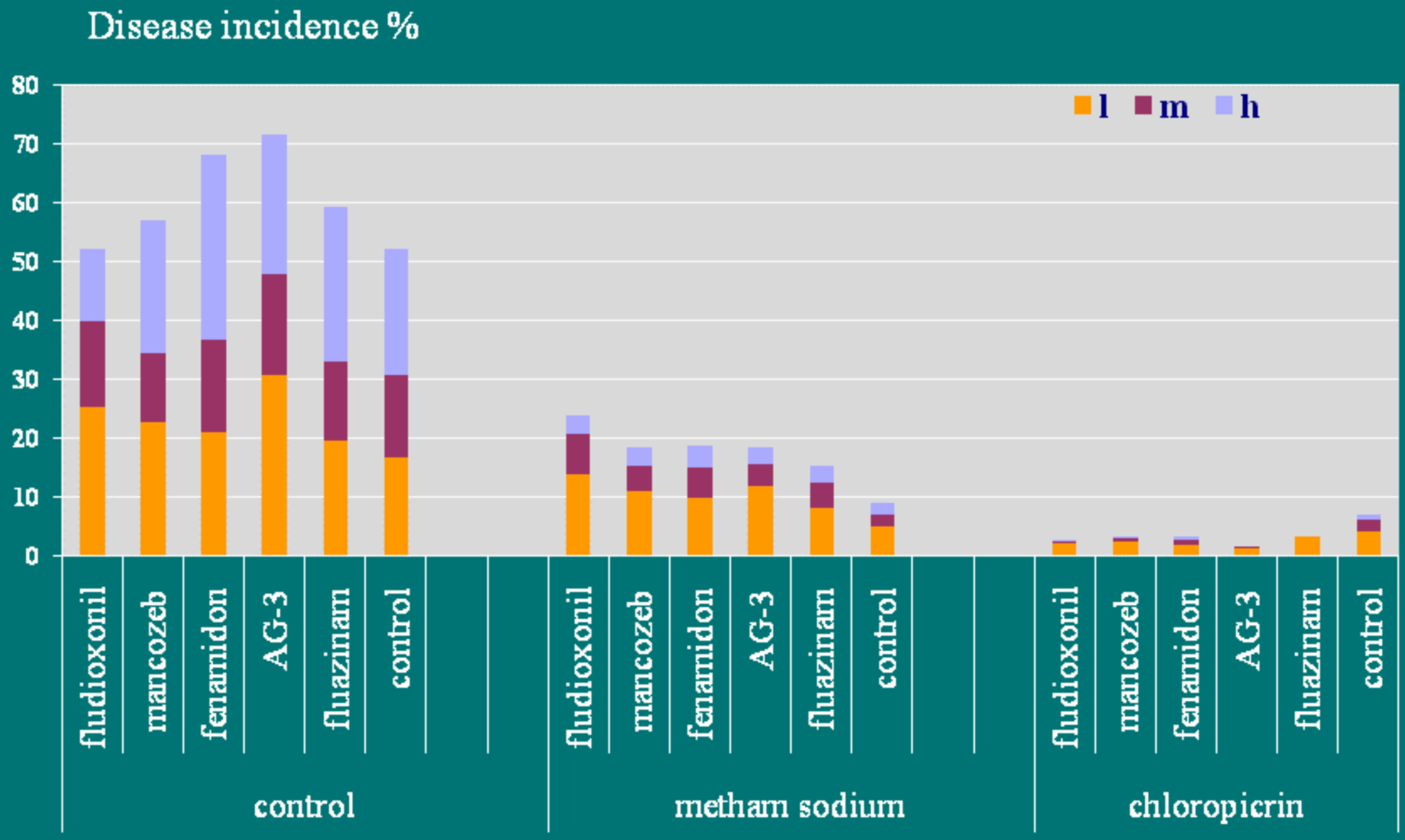
Seed tuber treatments

1. Fludioxonil 200 ml/ton
2. Mancozeb 3 kg/ton
3. Fenamidon 400 gr/ton
4. AG-3 500 ml/ton
5. Fluazinam 500 ml/ton
6. Control

Bi-factorial trial, 4 replicates
MS application 5/11/07
Telopic application 30/10/07
Planting 28/11/07
Haulaum destruction 28/3/08

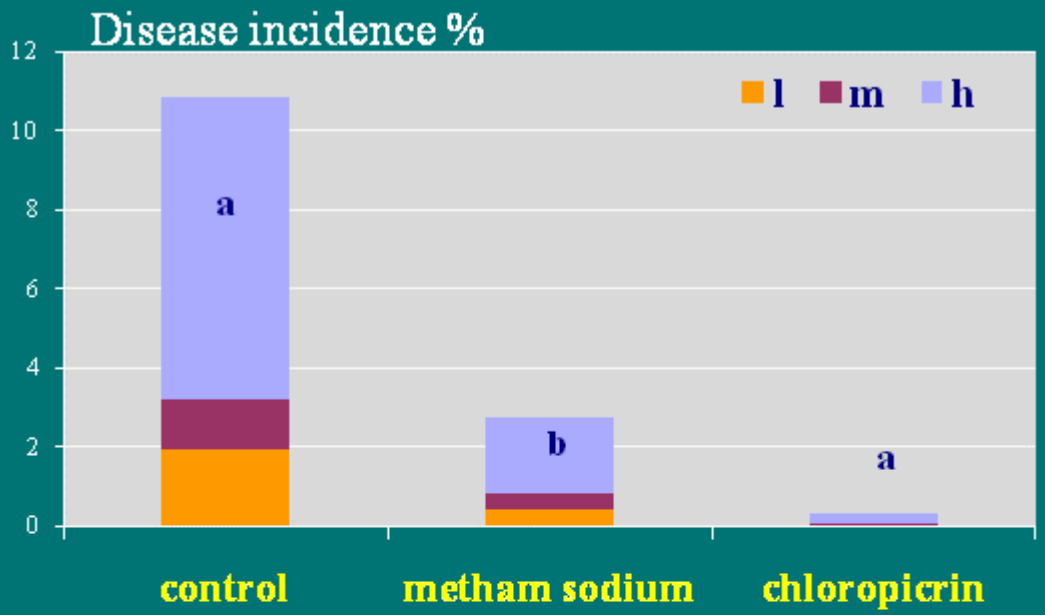
Combined seed treatment and soil fumigation

Field trial, Winter 2007-08 cv. Nicola



Infested soil; 6.2% PS on seed tubers

Combined seed treatment and soil fumigation

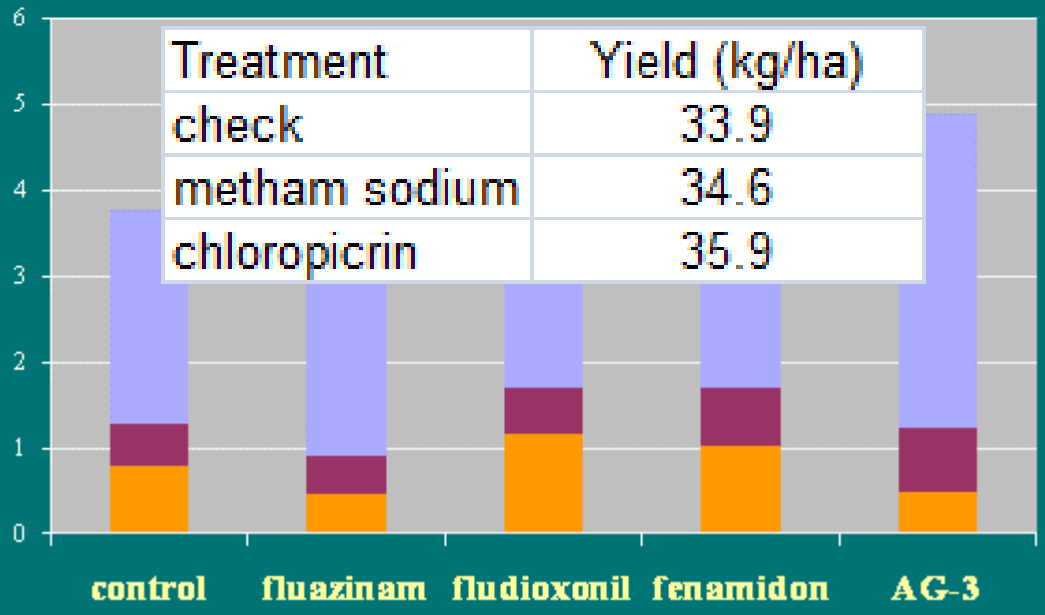


Field trial,
Winter 2007-08
cv. Nicola

Infested soil

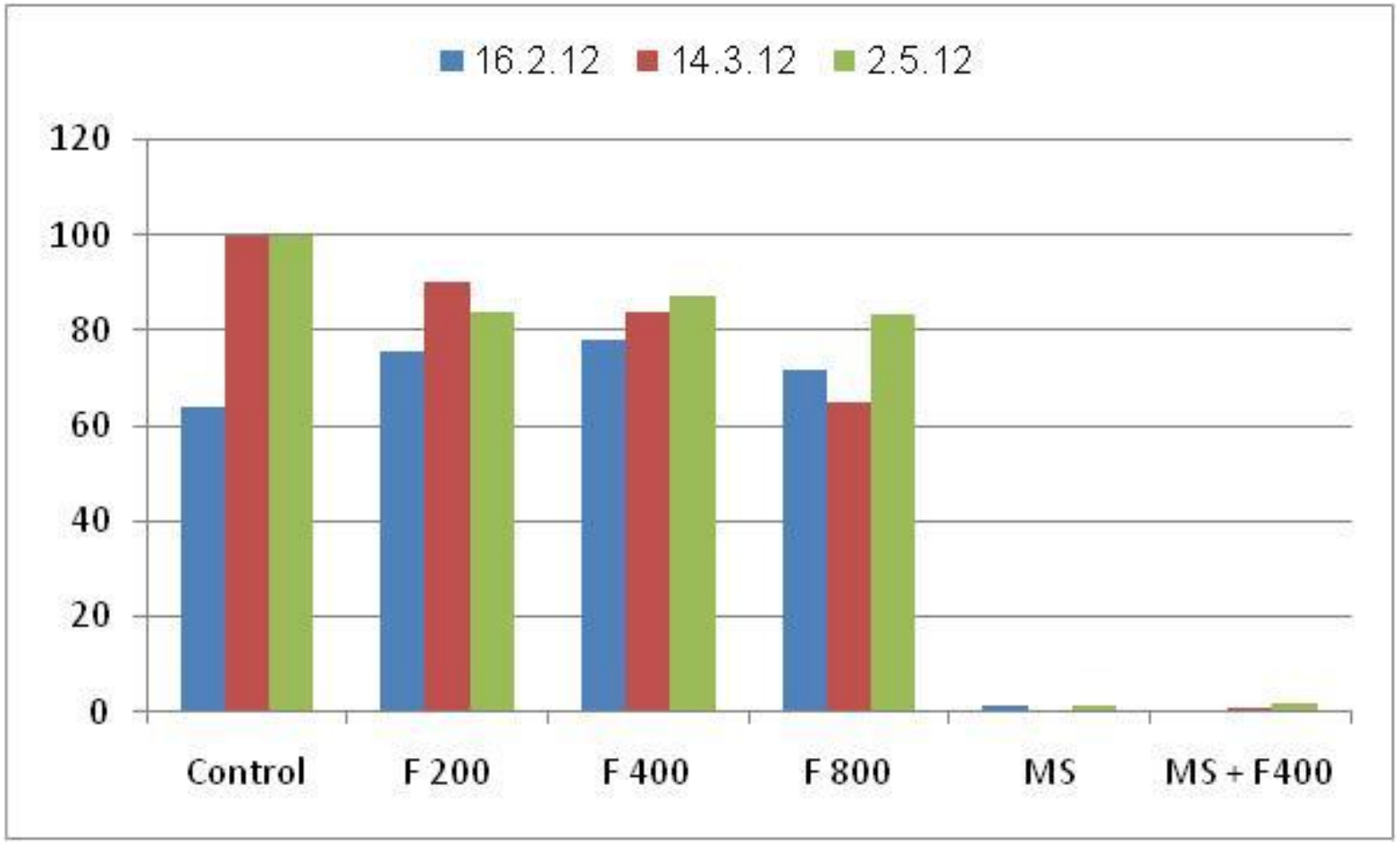
6.2% PS on seed tubers

Treatment	Yield (kg/ha)
check	33.9
metham sodium	34.6
chloropicrin	35.9



Chemical control

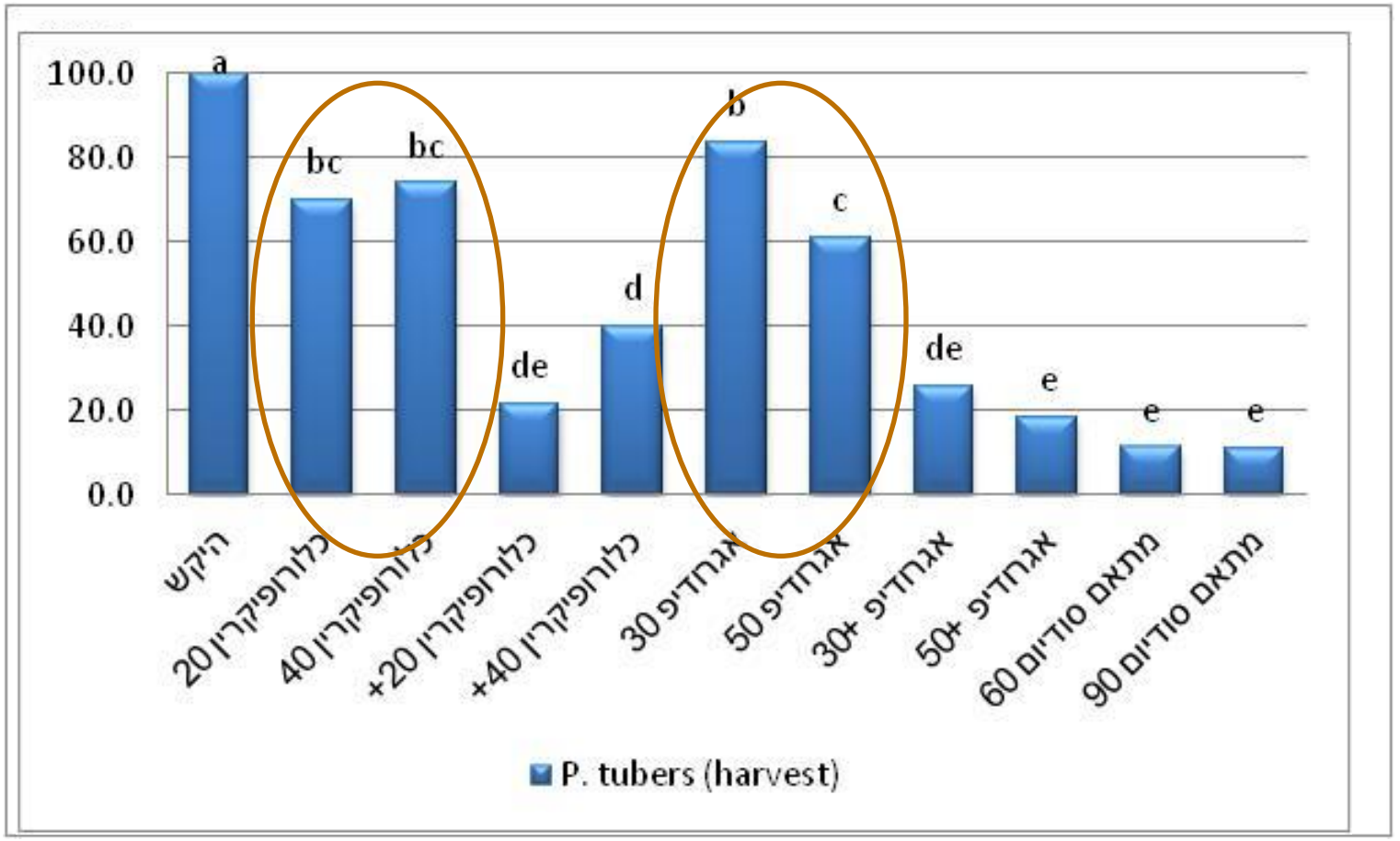
Soil fumigation, field trial winter 2011-12



Field trial in sandy soil naturally infested; cv. Exquiza

Chemical control

Soil fumigation, field trial 2012-13



Field trial in sandy soil naturally infested; cv. Exquiza

SUMMARY

- The disease is prevalent in Israel although conditions are not favorable
- The pathogen is imported with seed tubers
- The pathogen is dispersing with the wind
- Using disease free seed tubers will prevent yield damage in the short term, and field infestation in the long term
- Efficient seed treatment is not yet available
- Soil fumigation with metam sodium or chloropicrin is effective.

Acknowledgments

Asaf Rosenberg, Sara Lebiush, Orly Erlich, Marina Hazanovsky – ARO, Gilat Research Center
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Jonathan Binnefeld- Atzmona Enterprises
Gilan Maharshak - Ego Enterprises