



Identification and management of PSbMV in field peas

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Viruses

Aphid transmitted:
aphids move viral diseases from
diseased to healthy plants.



Photo by Sam Markell



Photo by Patrick Beauzay

Viruses

**Pea seed-borne mosaic virus
(PSbMV)**



**Bean leaf roll virus
(BLRV)**



FIELD PEAS

Pea seed-borne mosaic virus (PSbMV)

Seed-borne:

- Transmitted from seed to seedlings
- Difficult to eradicate

Yield losses

Quality losses

- Seed discoloration
- Splitting of seed coat
- Shriveling of seeds



Photo by
Kevin McPhee



Photo by
Julie Pasche

Pea seed-borne mosaic virus (PSbMV)

Damaged Peas: Includes peas discolored by disease

WHOLE DRY PEAS

GRADES, GRADE REQUIREMENTS, AND GRADE DESIGNATIONS

406 Grades and grade requirements for dockage-free dry peas. (See also 408.)

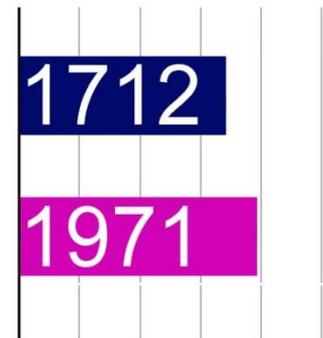
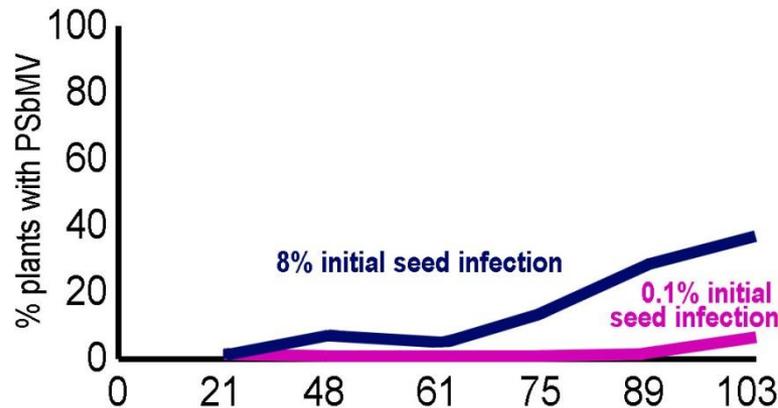
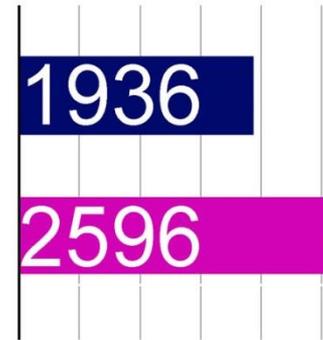
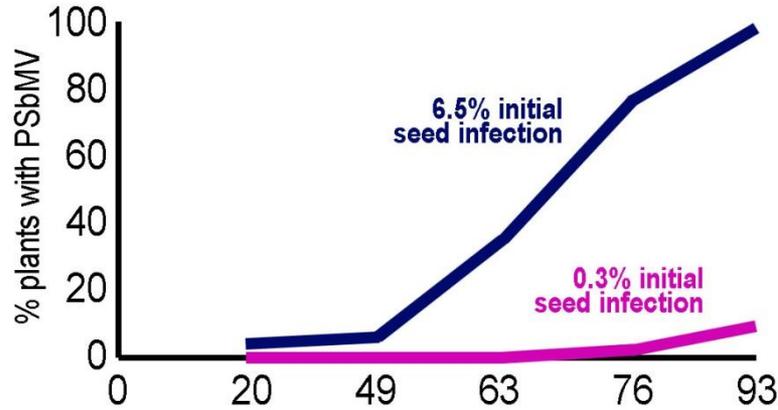
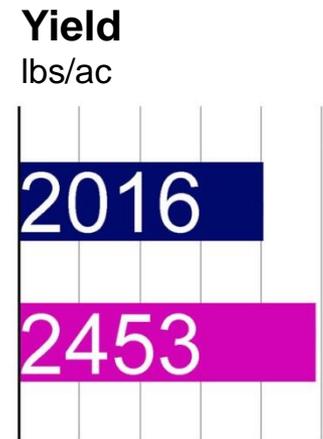
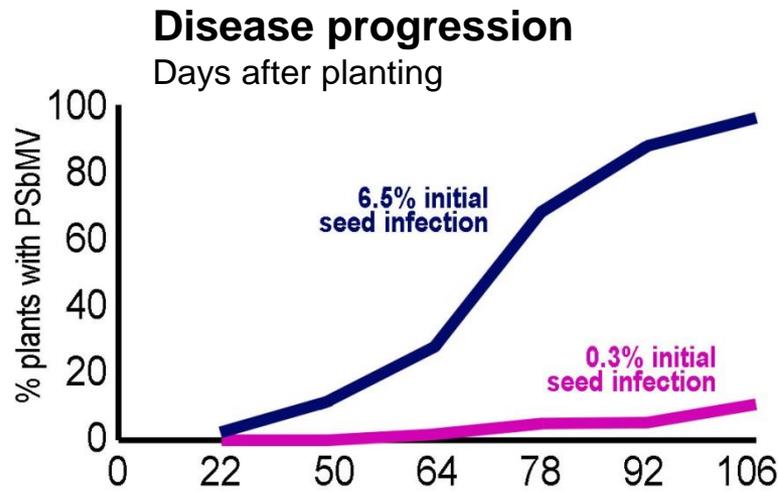
Grading Factors	Maximum percent limits of:		
	Grades U.S. Nos. <u>1</u> /		
	1	2	3
Defective Peas			
Weevil-Damaged Peas	0.3	0.8	1.5
Heat-Damaged Peas	0.2	0.5	1.0
Damaged Peas <u>2</u> /	1.0	1.5	2.0
Other Classes <u>3</u> /	0.3	0.8	1.5
Bleached Peas <u>4</u> /	1.5	3.0	5.0
Split Peas	0.5	1.0	1.5
Shriveled Peas	2.0	4.0	8.0
Peas with Cracked Seedcoats	5.0	7.0	9.0
Foreign Material	0.1	0.2	0.5
Minimum Requirements for Color	Good	Good	Poor

FIELD PEAS

Pea seed-borne mosaic virus (PSbMV)

Australia:
PSbMV can cause
13 to 25% yield loss

Coutts et al. 2009.
Phytopathology 99:1156-1167.

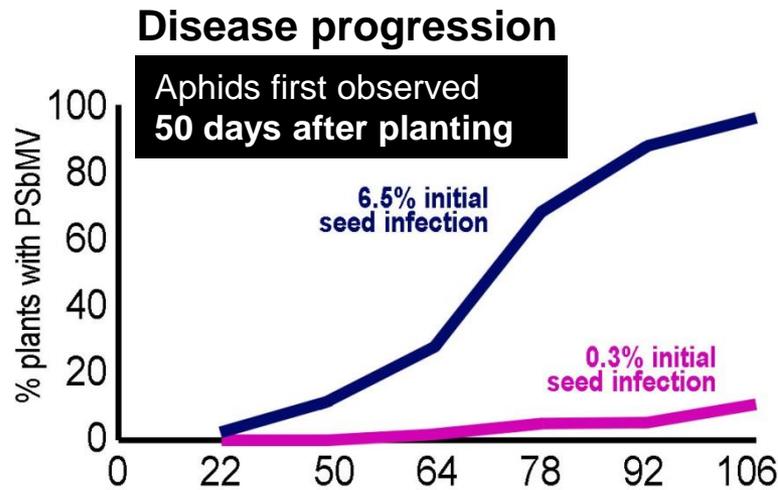


FIELD PEAS

Pea seed-borne mosaic virus (PSbMV)

Australia:

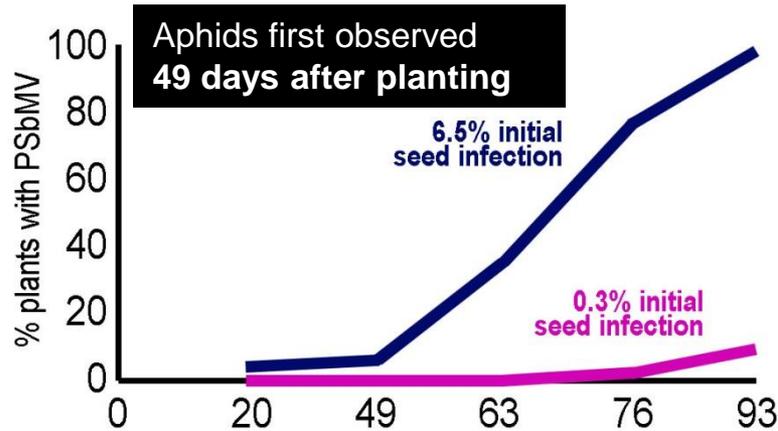
Yield losses to PSbMV most severe when aphids observed on peas during bloom



Yield
lbs/ac

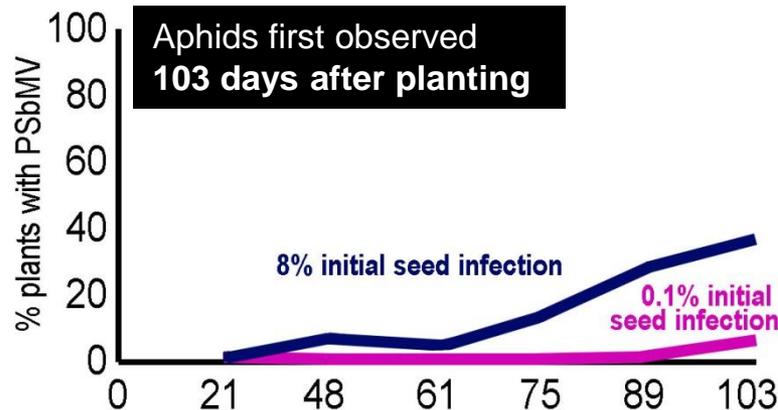
2016

2453



1936

2596



1712

1971

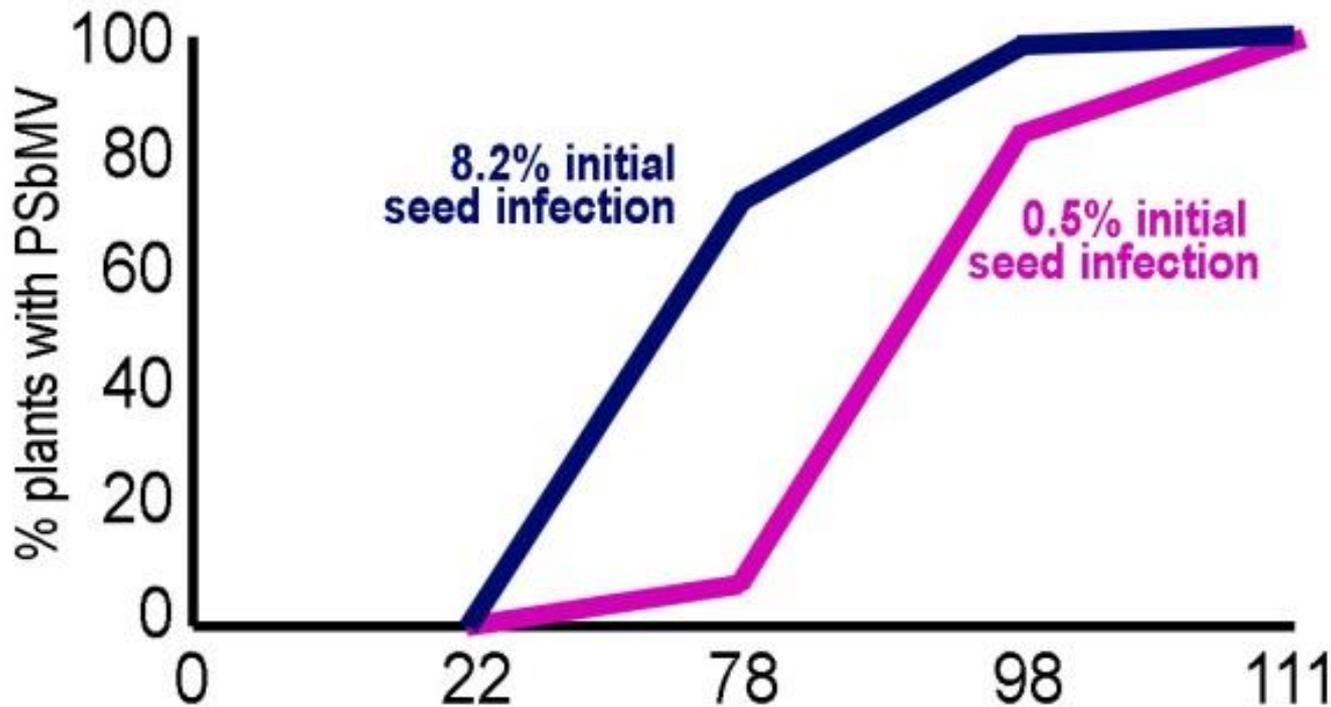
FIELD PEAS

Pea seed-borne mosaic virus (PSbMV)

Australia:

Under high aphid pressure, even low levels of seed infection can lead to severe epidemics.

Disease progression - days after planting



Yield - lbs/ac

1632

1552

Pea seed-borne mosaic virus (PSbMV)

SYMPTOMS:

Not always readily apparent!

- Symptoms can be subtle and transient

When symptoms are apparent:

(1) Terminal rosettes

Reduced internode lengths



Pea seed-borne mosaic virus (PSbMV)

SYMPTOMS:

Not always readily apparent!

- Symptoms can be subtle and transient

When symptoms are apparent:

(2) Deformed pods



Pea seed-borne mosaic virus (PSbMV)

SYMPTOMS:

Not always readily apparent!

- Symptoms can be subtle and transient

When symptoms are apparent:

(3) Delayed maturity

Maturity delayed by
1 to 2 weeks.



Pea seed-borne mosaic virus (PSbMV)

SYMPTOMS:

Not always readily apparent!

- Symptoms can be subtle and transient

When symptoms are apparent:

(4) Deformed leaves

Clear, swollen veins

Chlorosis

Slight curling



Pea seed-borne mosaic virus (PSbMV)

INTRODUCTION OF THE DISEASE:

Infected seed

- Original introduction is *always* through infected seed

When was PSbMV first introduced to North Dakota?

- First observed in Manitoba and Saskatchewan in the mid-1970s
- In ND, testing for PSbMV did not occur until this year, but seed lots from as early as 2010 have tested positive

Pea seed-borne mosaic virus (PSbMV)

INTRODUCTION OF THE DISEASE:

Once the disease has been introduced into a region, alternate hosts can be important sources of the disease
(spread from neighboring fields and volunteers)

- Lentils
- Chickpeas
- Alfalfa

Alfalfa, though a latent (asymptomatic) host of PSbMV, is of particular concern as a source of PSbMV

- Perennial
- When alfalfa is cut, aphids migrate to neighboring crops

Pea seed-borne mosaic virus (PSbMV)

MANAGEMENT – CLEAN SEED:

Clean seed is the best management tool.

Clean seed, however, does not guarantee a PSbMV-free crop:

- Aphid-mediated transmission of PSbMV can occur from neighboring fields (infected crops or volunteers)
- Seed tests can sometimes fail to detect low levels of PSbMV.

Pea seed-borne mosaic virus (PSbMV)

MANAGEMENT – HOST RESISTANCE:

Choose a variety with reduced susceptibility to PSbMV

- The relative susceptibility of field pea varieties adapted to North Dakota has not been assessed.
- Several varieties on the market are reported to carry resistance to PSbMV.

FIELD PEAS

Pea seed-borne mosaic virus (PSbMV)

MANAGEMENT – HOST RESISTANCE:

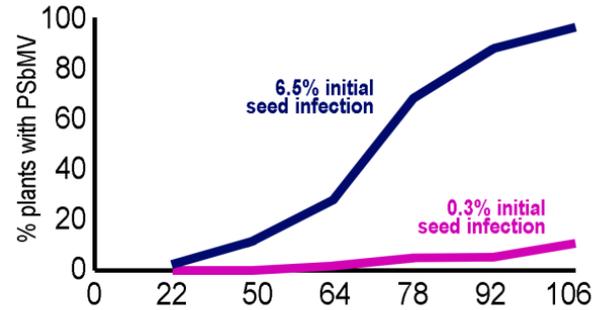
Some varieties are highly susceptible to PSbMV

Variety: 'Kaspa' (highly susceptible to PSbMV)

Coutts et al. 2009.
Phytopathology 99:1156-1167.

Disease progression

Days after planting

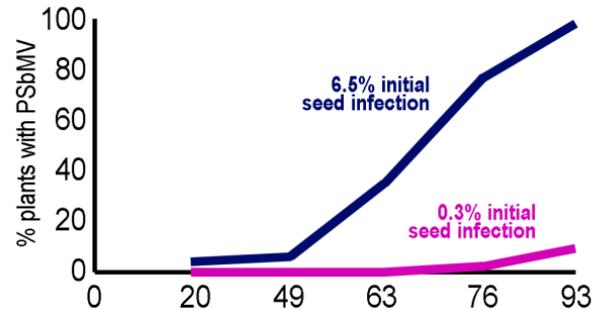


Seed-borne PSbMV

Percent

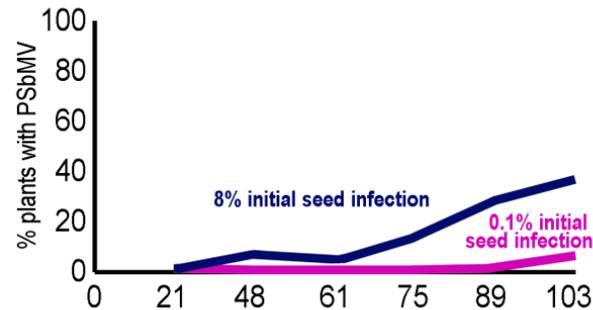
11

1



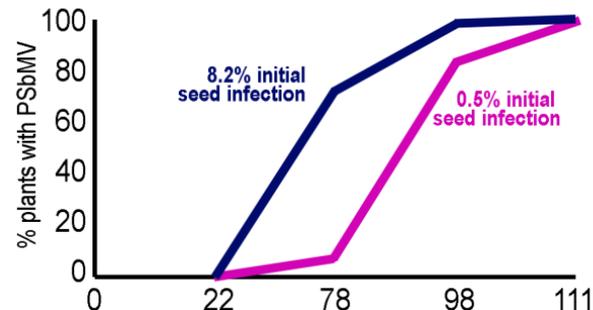
17

3



2

0



36

25

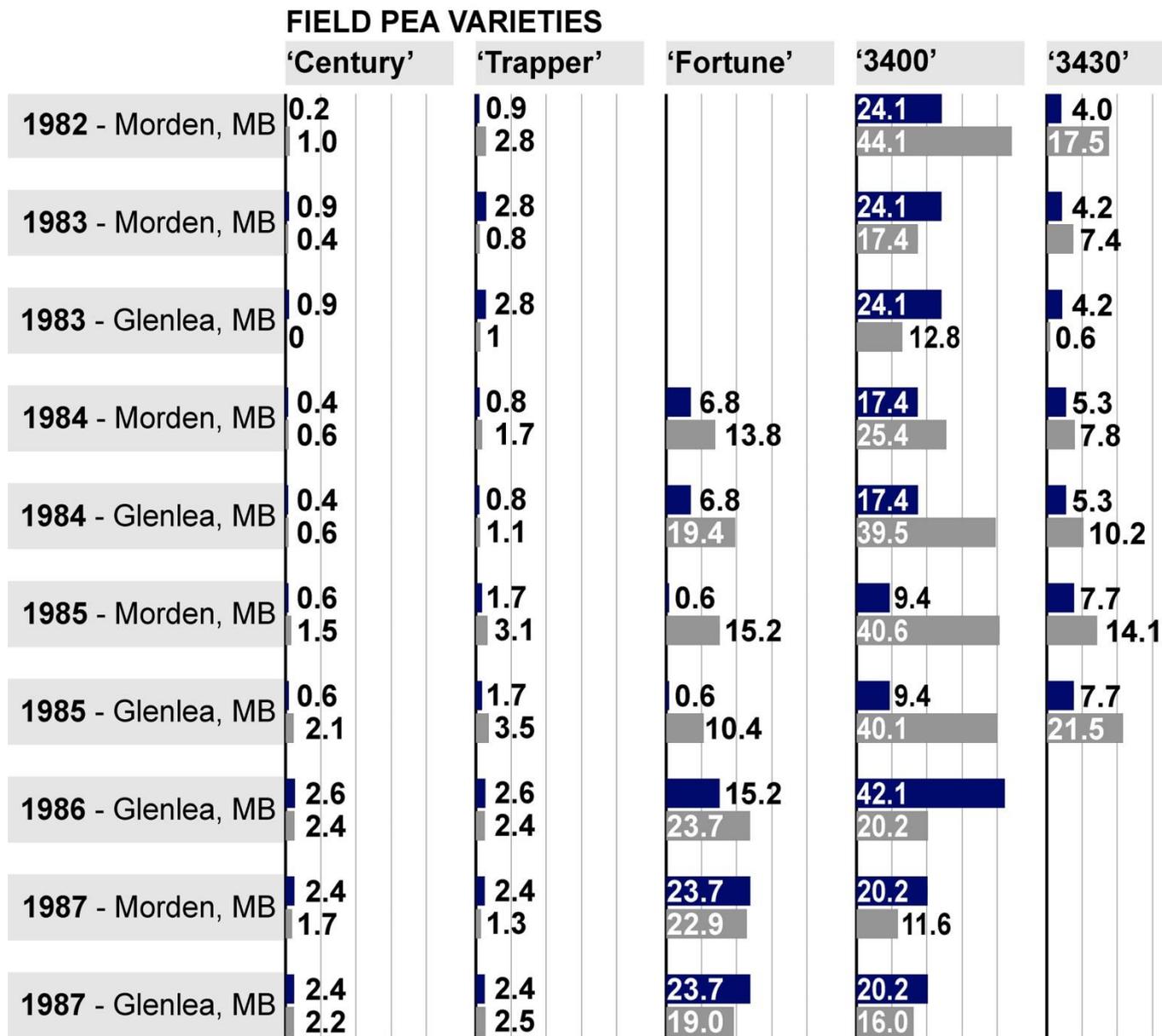
MANAGEMENT – HOST RESISTANCE:

Varieties differ in their susceptibility to PSbMV

Field trials conducted in
Manitoba, 1982-1987:

 = incidence of seed-borne PSbMV in seed at planting

 = incidence of seed-borne PSbMV in seed at harvest



Pea seed-borne mosaic virus (PSbMV)

MANAGEMENT – INSECTICIDES:

Insecticides often have limited effectiveness for controlling aphid-mediated secondary spread of viruses such as PSbMV.

Non-persistently transmitted viruses such as PSbMV are **transmitted after very short feeding periods.**

- Many insecticides are nerve poisons; cause bursts of insect activity prior to death.
- Bursts of activity = bursts of virus transmission.

Non-persistently transmitted viruses such as PSbMV are **transmitted primarily from epidermal cells.**

- Systemic insecticides are concentrated in phloem (sap-transporting) cells.
- Concentrations of systemic insecticides in epidermal cells may be too low to kill aphids prior to virus transmission.

Pea seed-borne mosaic virus (PSbMV)

MANAGEMENT – INSECTICIDES:

To control aphid-mediated secondary spread of non-persistently transmitted viruses, **crop oils and pyrethroid insecticides are generally more effective than organophosphate and neonicotinoid insecticides.**



Photo by Sam Markell



Photo by Patrick Beauzay

Pea seed-borne mosaic virus (PSbMV)

MANAGEMENT – INSECTICIDES:

Thresholds for applying insecticides to control aphids on peas:

- Average of 2 aphids in the top 8 inches of plants
Ten plants from four different areas of the field (40 plants) should be assessed.
- Average of 30 to 40 aphids per sweep of an insect net
25 sweeps of an insect net (180-degree sweeps) in 4 different areas of the field (100 sweeps) should be conducted.

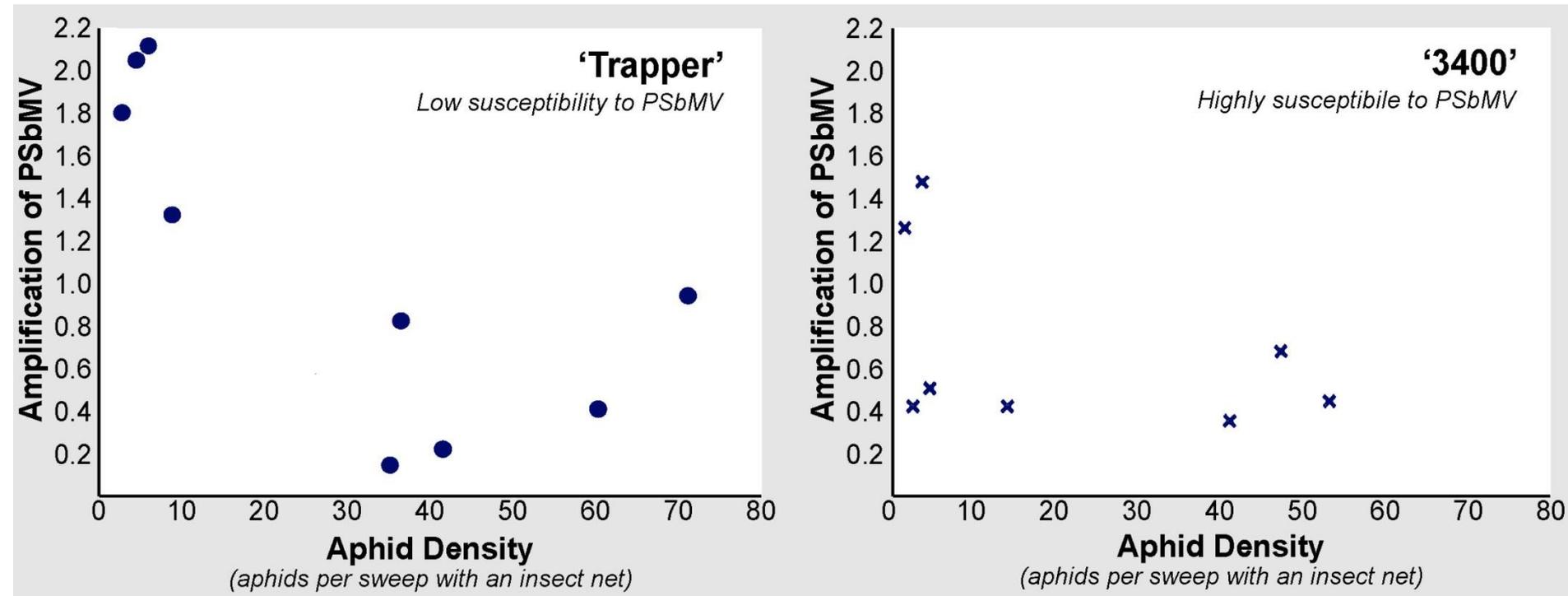
But – caution! – these thresholds were developed for the direct damage caused by aphid feeding, not aphid-transmitted viruses.

Thresholds may be lower for controlling aphid-mediated secondary transmission of viruses such as PSbMV.

Pea seed-borne mosaic virus (PSbMV)

MANAGEMENT – INSECTICIDES:

Optimal aphid thresholds for controlling aphid-mediated secondary transmission of viruses such as PSbMV are unknown but may be low.



Pea seed-borne mosaic virus (PSbMV)

DIAGNOSIS:

PSbMV can be difficult to accurately identify based on symptoms.

- Symptoms easily confused with abiotic stresses
- Symptoms easily confused with other viruses
- Symptoms can be weak, transient, or limited to reproductive tissues

Pea seed-borne mosaic virus (PSbMV)

DIAGNOSIS:

PSbMV can be difficult to accurately identify based on symptoms.

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Laboratory confirmation is needed to confirm PSbMV.

- Enzyme-linked immunosorbent assay (ELISA)
- Tissue blot immunoassay (TBIA)
- Reverse-transcriptase PCR (RT-PCR)

For maximum accuracy, a greenhouse assay + lab confirmation is needed.

- Grow seeds in greenhouse
- Test every plant for PSbMV