Aphanomyces root rot

Aphanomyces
Root Rot

Photos:
Lyndon Porter, USDA-ARS

Aphanomyces

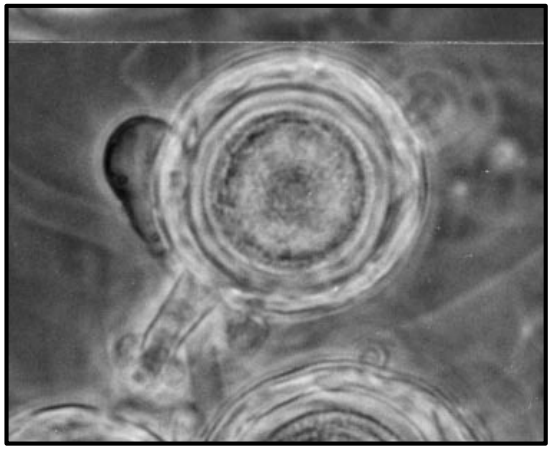
Symptoms:

- Initial root rot symptoms: honey-brown root and epicotyl tissue, often up to soil line
- Later root rot symptoms: necrotic root and epicotyl tissue, often up to soil line; poor nodulation
- Wilt: plants yellow from the bottom up

Aphanomyces

Causal pathogen: *Aphanomyces euteiches*
(an oomycete; “water mold”)

***Aphanomyces euteiches* produces oospores –** thick-walled resting structures **– in diseased tissue. Oospores persist in soils.**



viewed through a microscope

Photos: University of Wisconsin

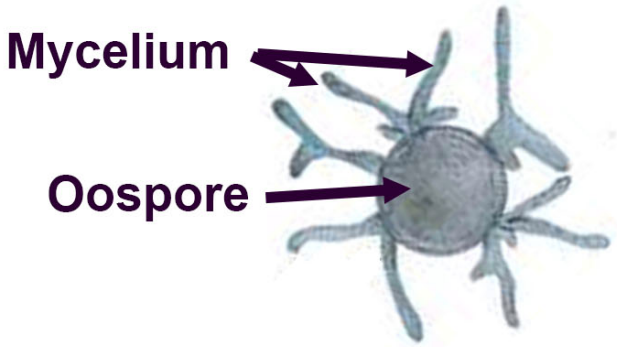
Aphanomyces

Oospores germinate in response to chemical exudates from roots of susceptible hosts.

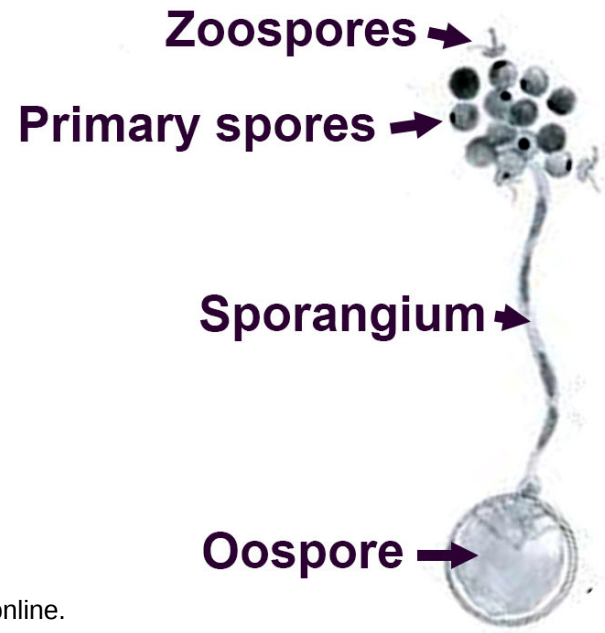
- **Germination is direct** (to produce mycelium) **or**
- **indirect** (to produce sporangia and zoospores).

Zoospores swim through water and water-saturated soil.

Direct germination



Indirect germination



Adapted from Hughes and Grau 2007.
Aphanomyces root rot (common root rot) of legumes. The Plant Health Instructor; online.

Aphanomyces

Aphanomyces typically becomes economically important after peas or lentils have been cropped to a field 3+ times

- The **first epidemic is usually preceded by a previous lentil or pea crop that yielded well but conditions were favorable for disease**, causing pathogen to increase
- **Long crop rotations are most important when last lentil or pea crop was grown in a wet year**

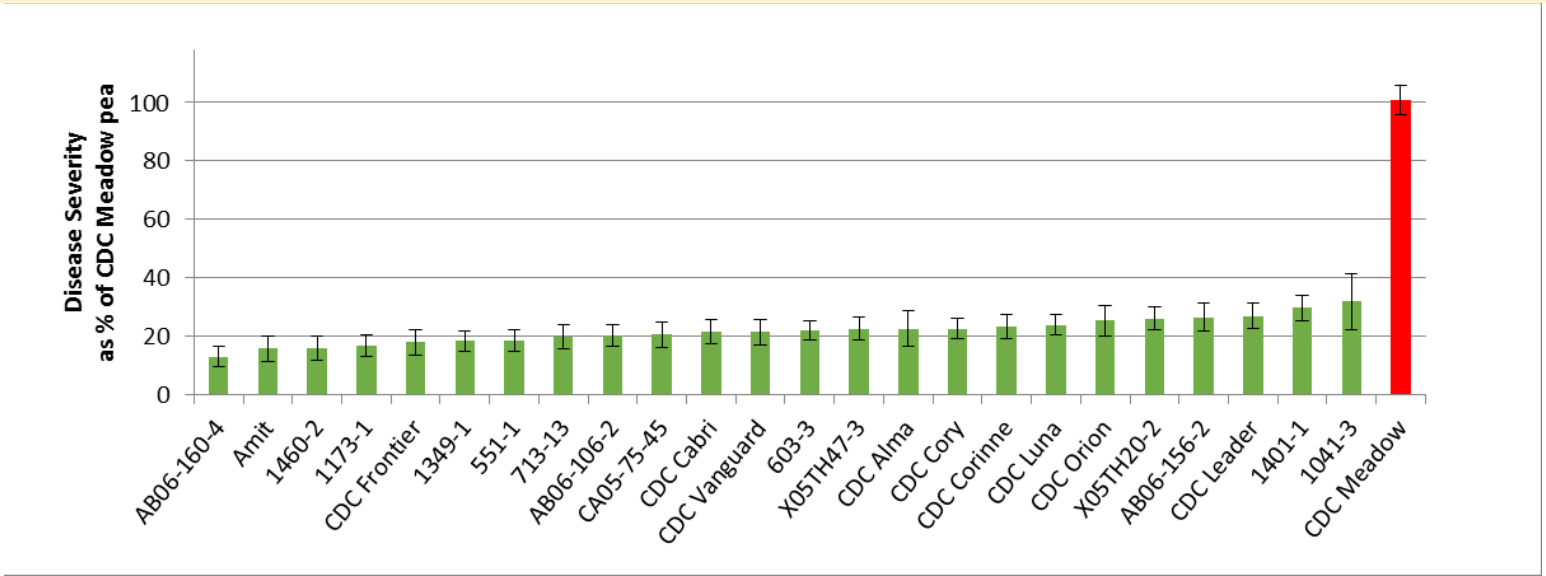
Aphanomyces

Susceptibility:

- Field peas, lentils >> chickpeas
  - Chickpeas are not very susceptible.
  - Lentils and field peas are highly susceptible.

Suceptibility to Aphanomyces, chickpeas vs. a representative field pea variety

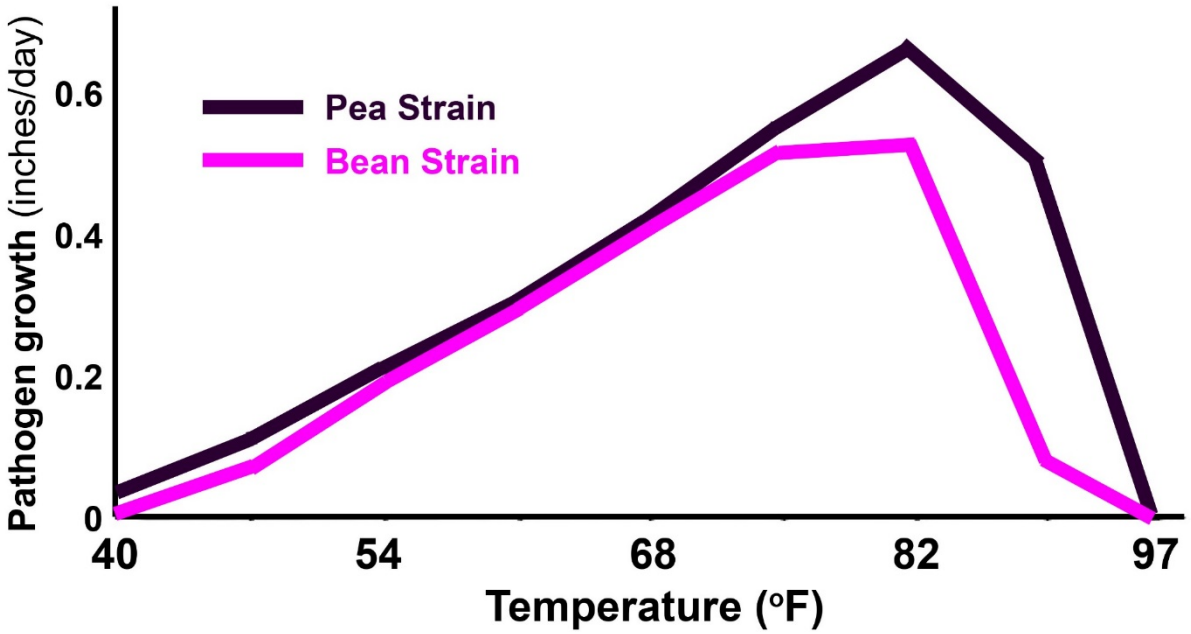
University of Saskatchewan (Cho and Banniza)



Aphanomyces

Conditions that favor infection:

- Soil moisture: high
- Soil temperature: high



Pfender and Hagedorn 1982 Phytopathology 72:306-310

Aphanomyces - Response to soil temperature

Disease development at **61˚F** (snap beans)

Non-inoculated Pythium Aphanomyces

Disease development at **82˚F** (snap beans)

Non-inoculated Pythium Aphanomyces

Pfender and Hagedorn 1982 Phytopathology 72:1200-1204

Aphanomyces

Impact of soil temperature – **field peas**

Carrington, ND (2018) No-till production	Plant population:	Root rot severity	Wilt symptoms	Yield
	6-7 nodes	*7-11 nodes*	*late pod-fill*	13.5% moisture
Planting date	plants/ac	%	%	bu/ac
1 Early (April 30)	**365468** a*	**36** a*	**10** a*‡	**55** a*
2 Intermediate (May 10)	**343137** a	**65** b	**20** b	**39** b
3 Late (May 21)	**361025** a	**65** b	**31** c	**27** c
CV:	8.2	14.5	8.6	10.1

Carrington, ND (2018) Conventional tillage	Plant population:	Root rot severity	Wilt symptoms	Yield
	6-8 nodes	*7-10 nodes*	*late pod-fill*	13.5% moisture
Planting date	plants/ac	%	%	bu/ac
1 Early (April 29)	**320353** a*	**42** a*	**12** a*‡	**52** a*
2 Intermediate (May 10)	**327455** a	**62** b	**27** b	**41** b
3 Late (May 21)	**346447** a	**62** b	**48** c	**20** c
CV:	7.5	14.5	8.6	10.1

*** Within-column means followed by different letters are significantly different** ($P < 0.05$; Tukey multiple comparison procedure).

‡ To meet model assumptions of normality and/or homoskedasticity, analysis of variance was conducted on data subjected to a systematic natural-log transformation. For ease of interpretation, treatments means are presented for the non-transformed data.

Aphanomyces

Impact of soil temperature – **field peas**

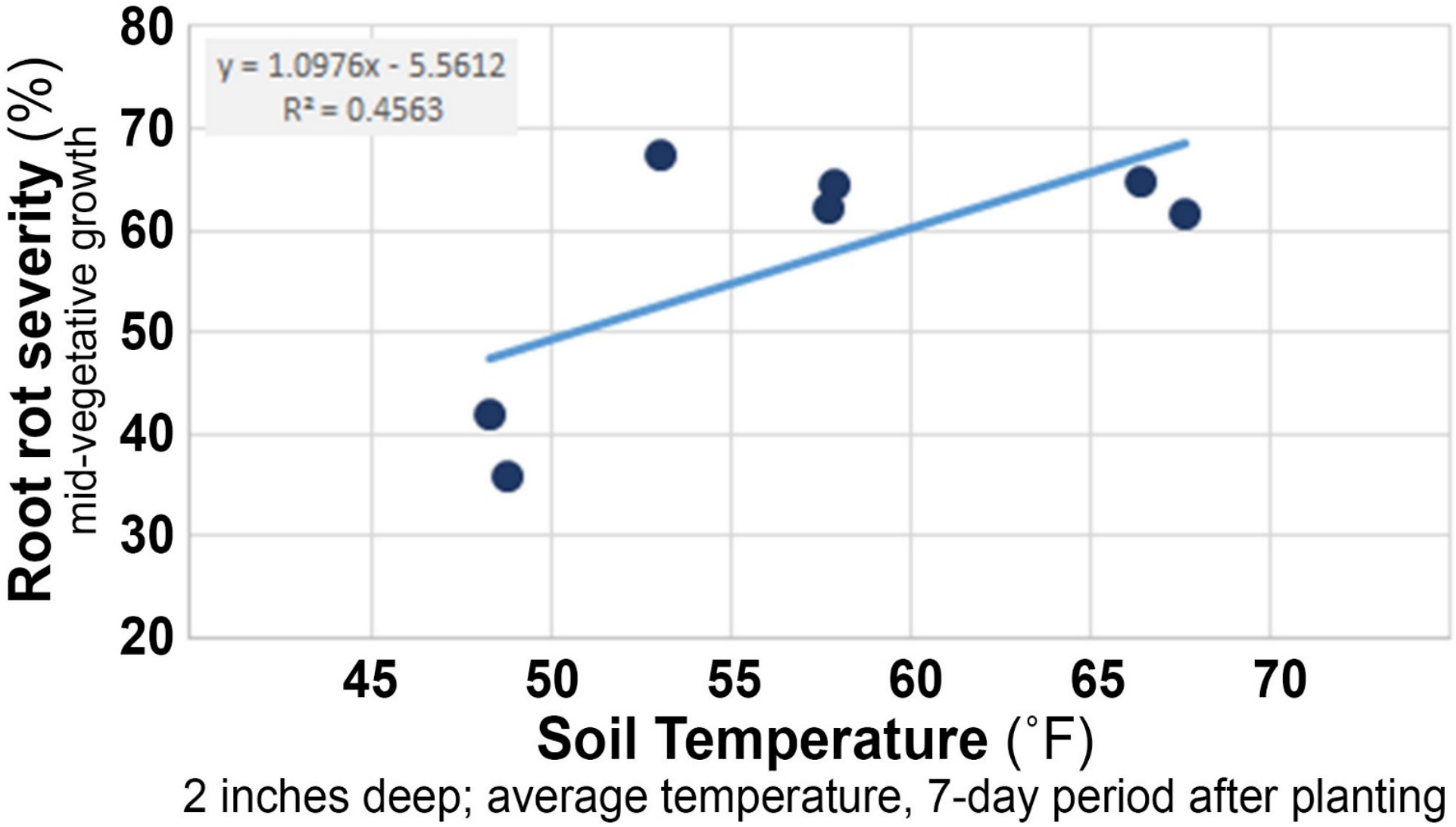
Carrington, ND (2017) - No-till production

Planting date	Plant population: *4-7 nodes* plants/ac	Root rot severity *4-8 nodes* %	Wilt symptoms *late pod-fill* %	Yield 13.5% moisture bu/ac
1 Early planting (April 17)	**223027** a*	**52** a*	**3** a*	**33** a*
2 Intermediate (May 2)	**223318** a	**66** a	**9** ab	**31** a
3 Late (May 15)	**204442** a	**88** b	**13** b	**13** b
CV:	18.8	12.7	26.3	14.4

*** Within-column means followed by different letters are significantly different** ($P < 0.05$; Tukey multiple comparison procedure).

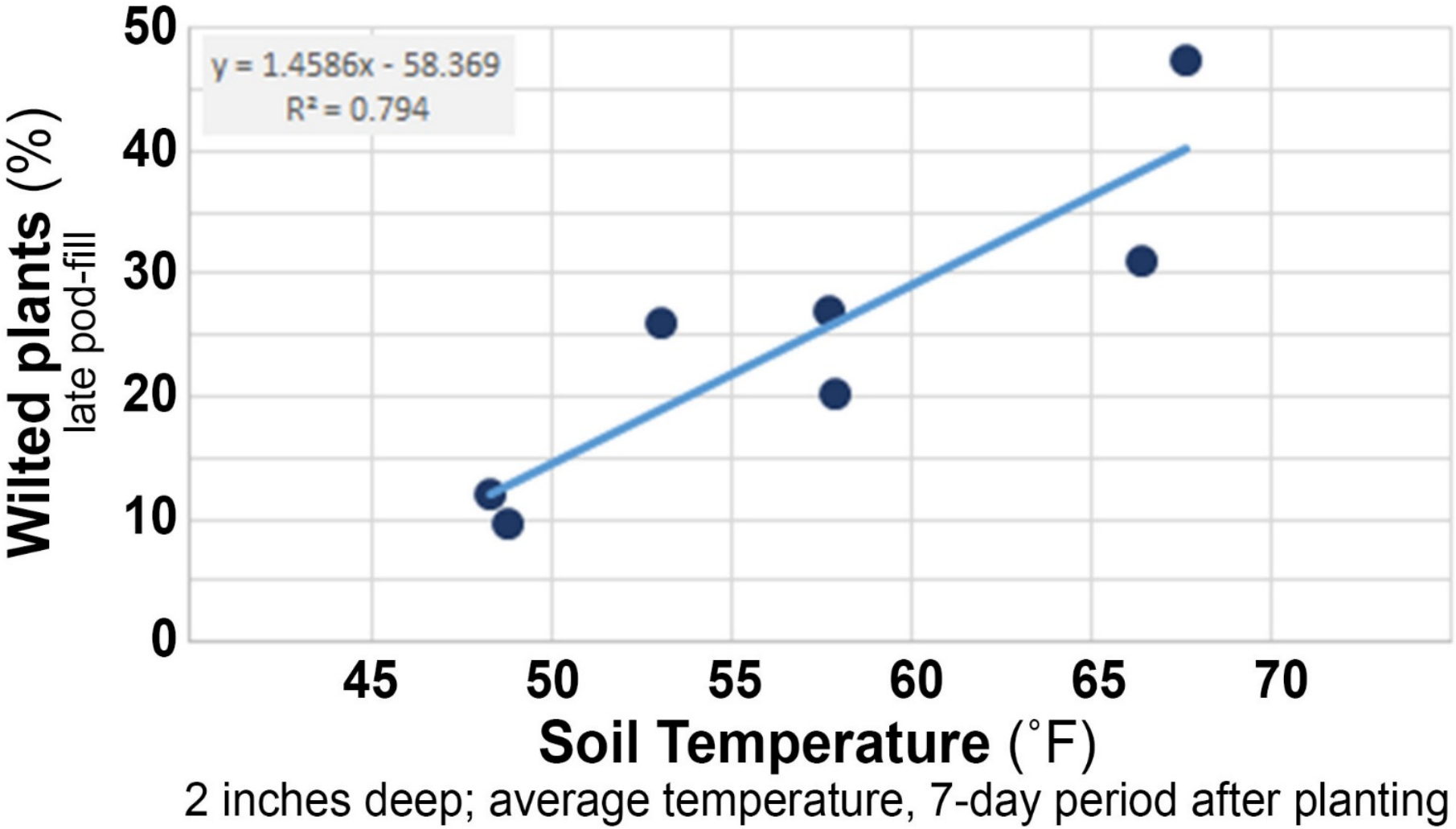
Aphanomyces

Impact of soil temperature – **field peas**



Aphanomyces

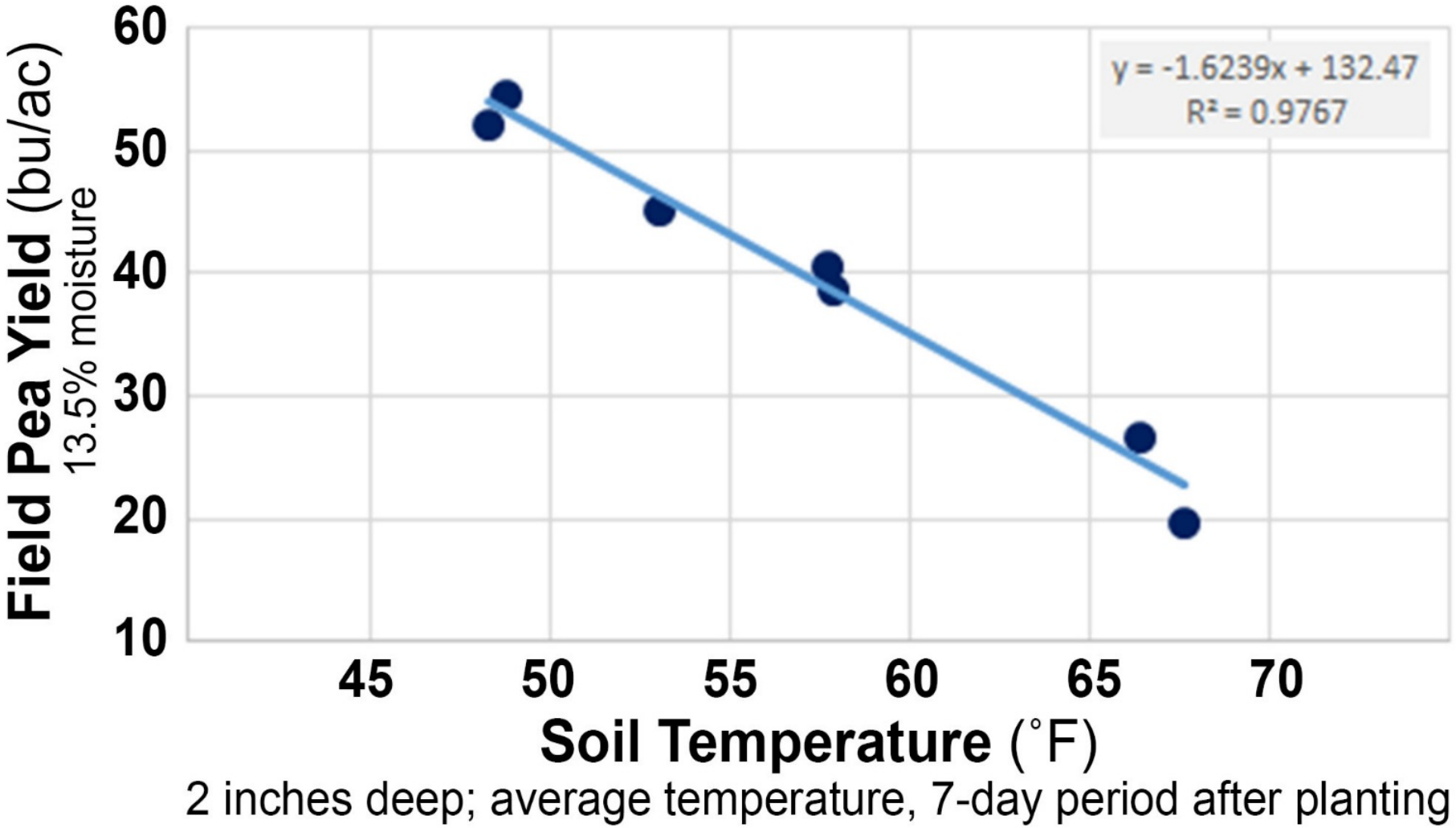
Impact of soil temperature – **field peas**



2 inches deep; average temperature, 7-day period after planting

Aphanomyces

Impact of soil temperature – **field peas**



Aphanomyces
Efficacy of fungicide seed treatments

Seed treatments:

- Metalayxl and mefenoxam: ineffective.
- Ethaboxam (Intego Solo): registered on lentils and chickpeas.

Control of Aphanomyces with seed treatments is difficult:

- Aphanomyces root rot develops during vegetative growth and bloom, when the concentration of fungicide active ingredients in the target tissues (tap root, epicotyl) is low.

Aphanomyces

Efficacy of fungicide seed treatments

Intego Solo

combined analysis across nine **field pea** studies

active ingredient: ethaboxam