Assessing risk of Sclerotinia on basis of environmental conditions

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Assessing risk of Sclerotinia

1. Soil temperature and moisture favoring apothecia production.

Sclerotia deposited in soil

Ascospores released into soybean canopy

2. Temperature, relative humidity, and rainfall patterns favoring infection and secondary spread.

Plant-to-plant spread:
Between plants in direct contact

Initial infection:
Spores colonize dead blossoms

Soil moisture

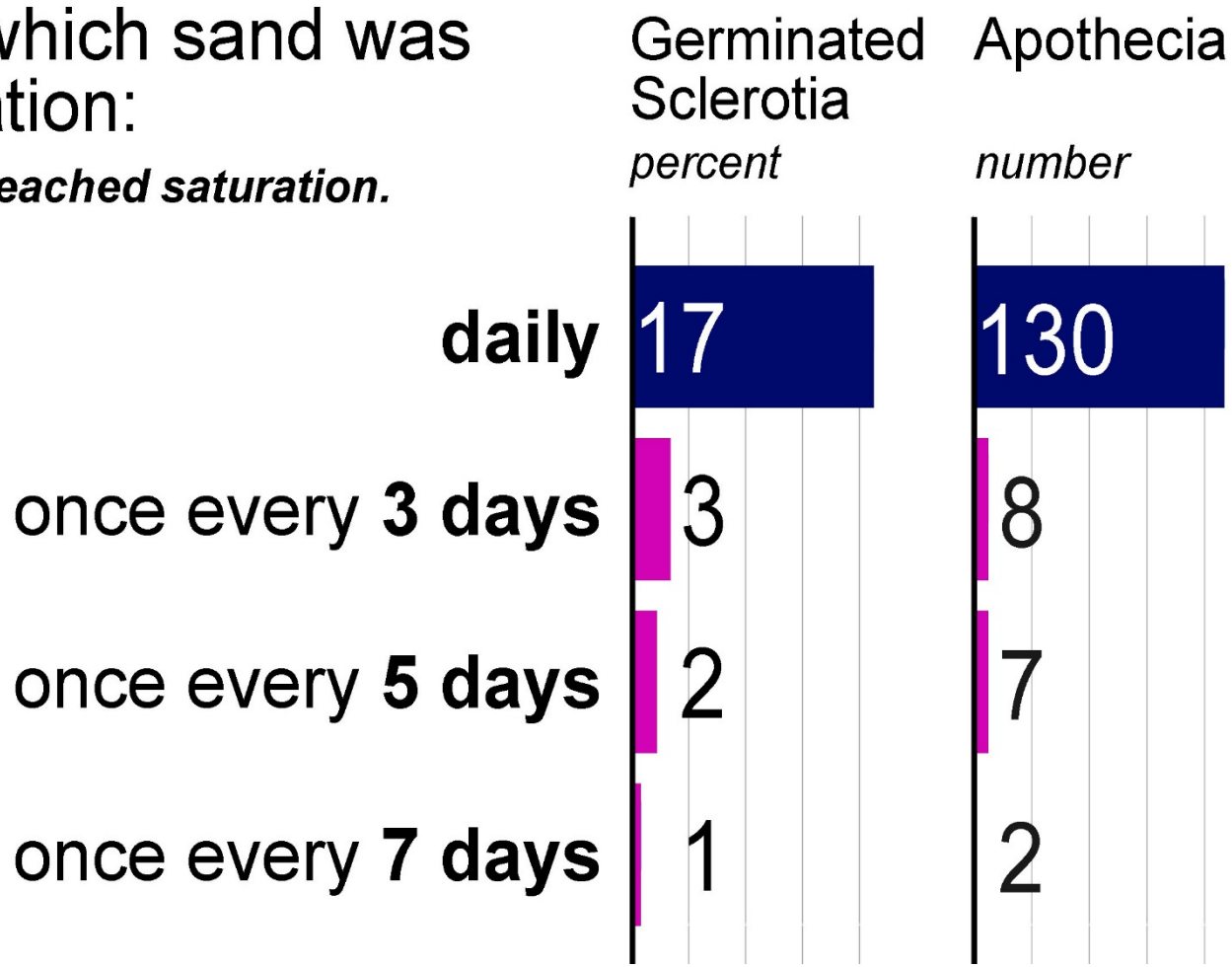
In the laboratory,

Moisture fluctuations sharply reduce apothecia production.

Frequency with which sand was brought to saturation:

Water added until sand reached saturation.

Temperature = 68˚F.



Mila & Yang 2008 Plant Disease 92:78-82

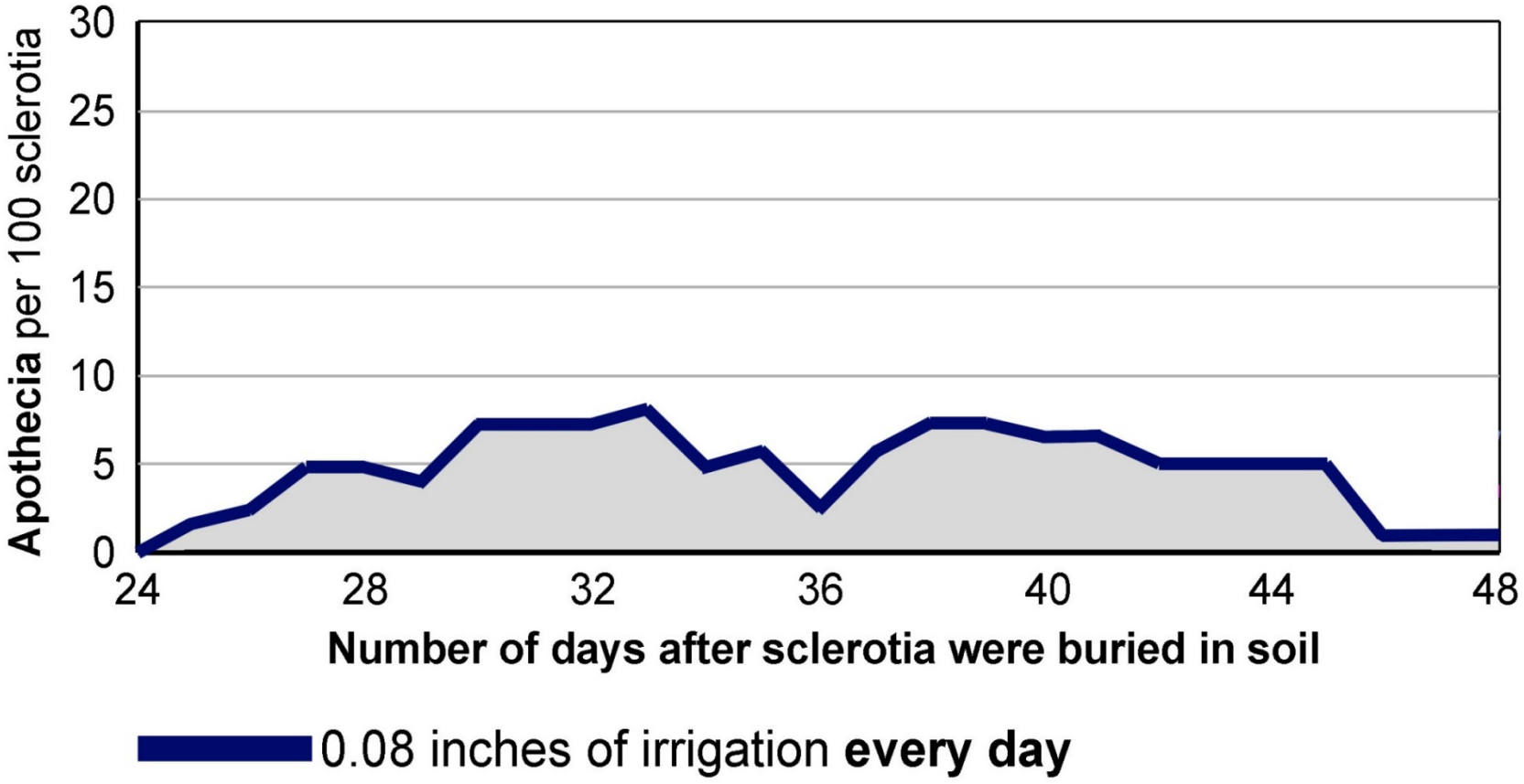
Soil moisture

In the field,

Moisture fluctuations sharply reduce apothecia production.

Experiment #1

UPPSALA, SWEDEN (1991) - Rapeseed (canola); silty clay loam soil



Twengstrom et al. 1998
J. Phytopathology 146:487-493.

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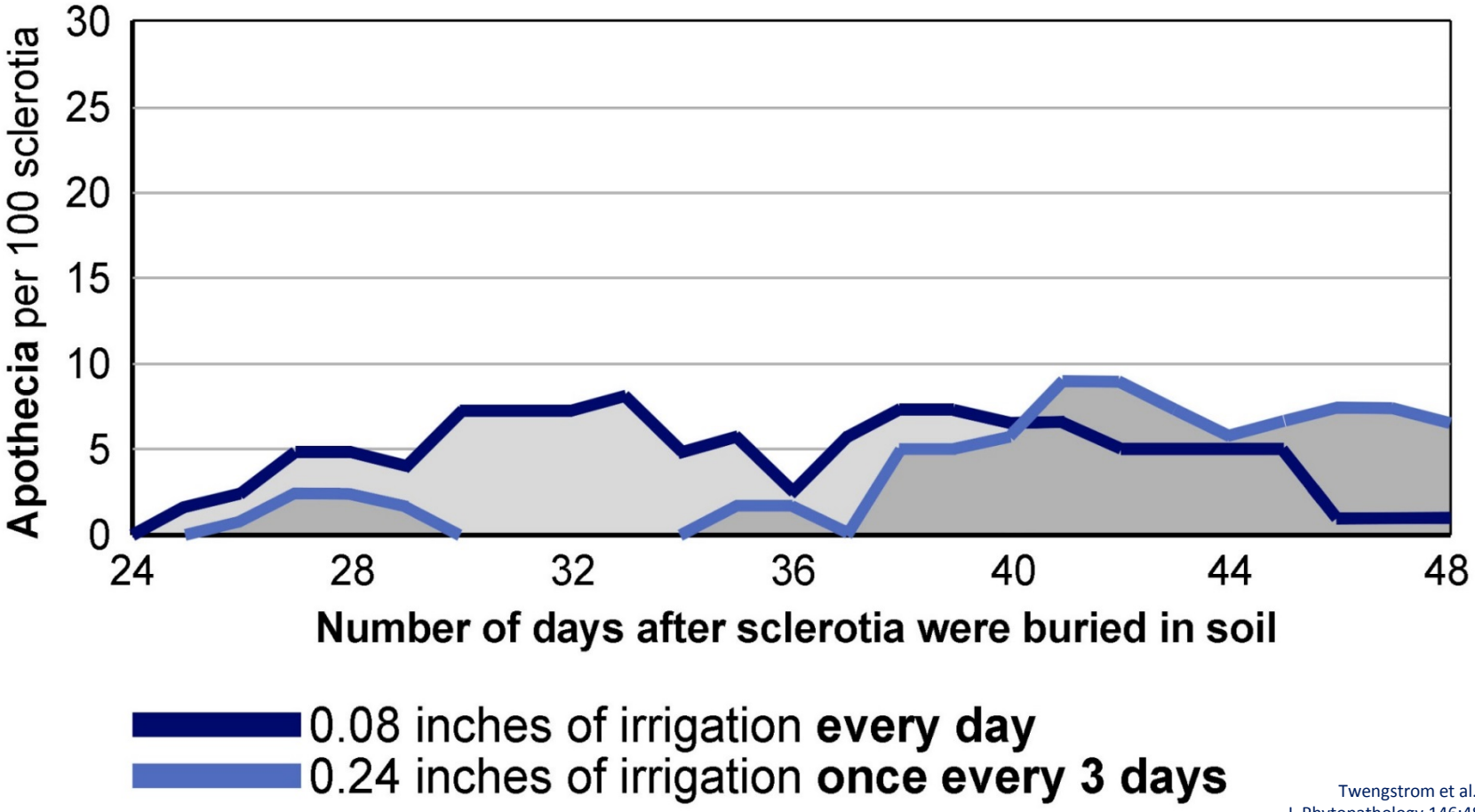

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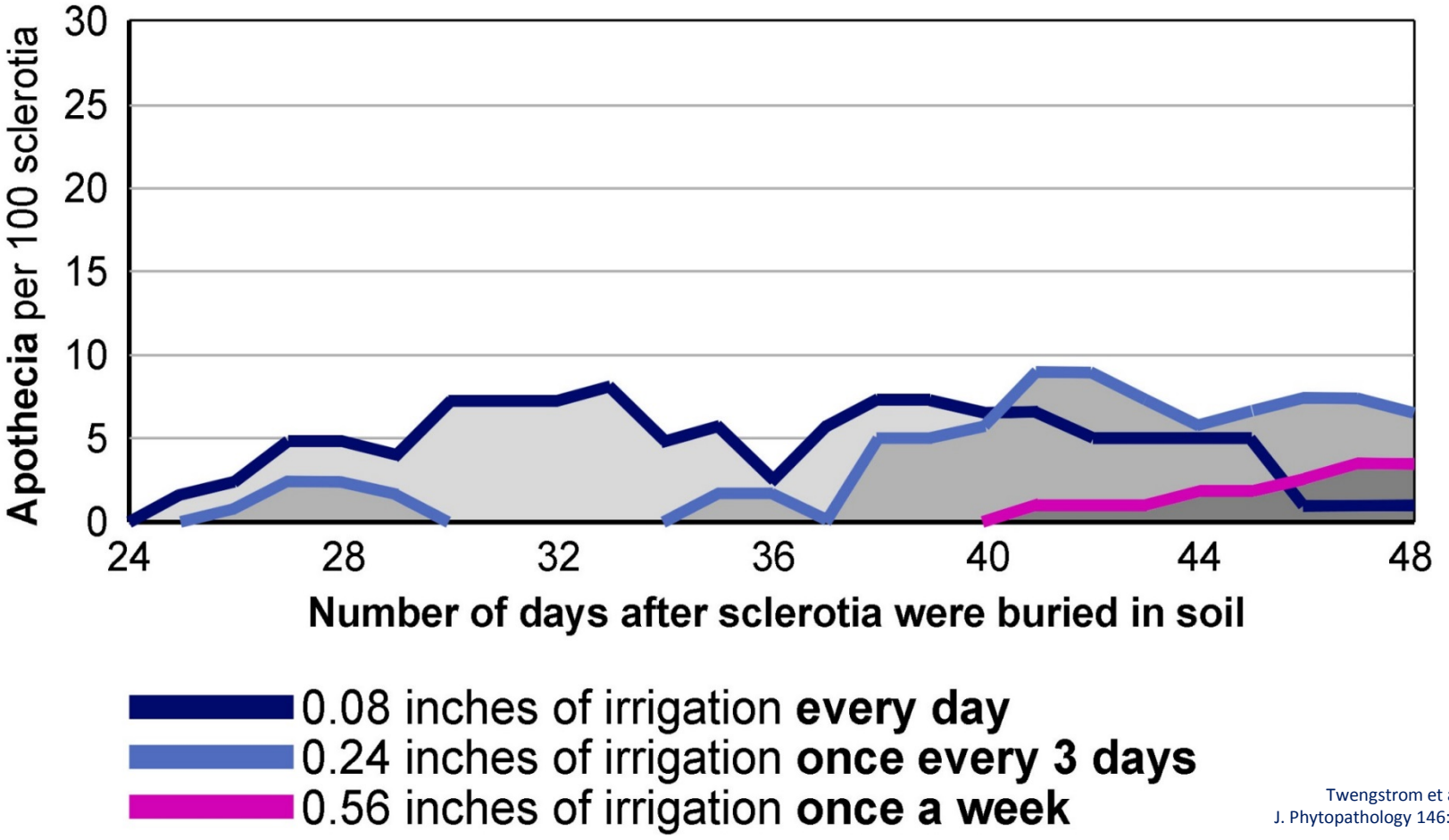

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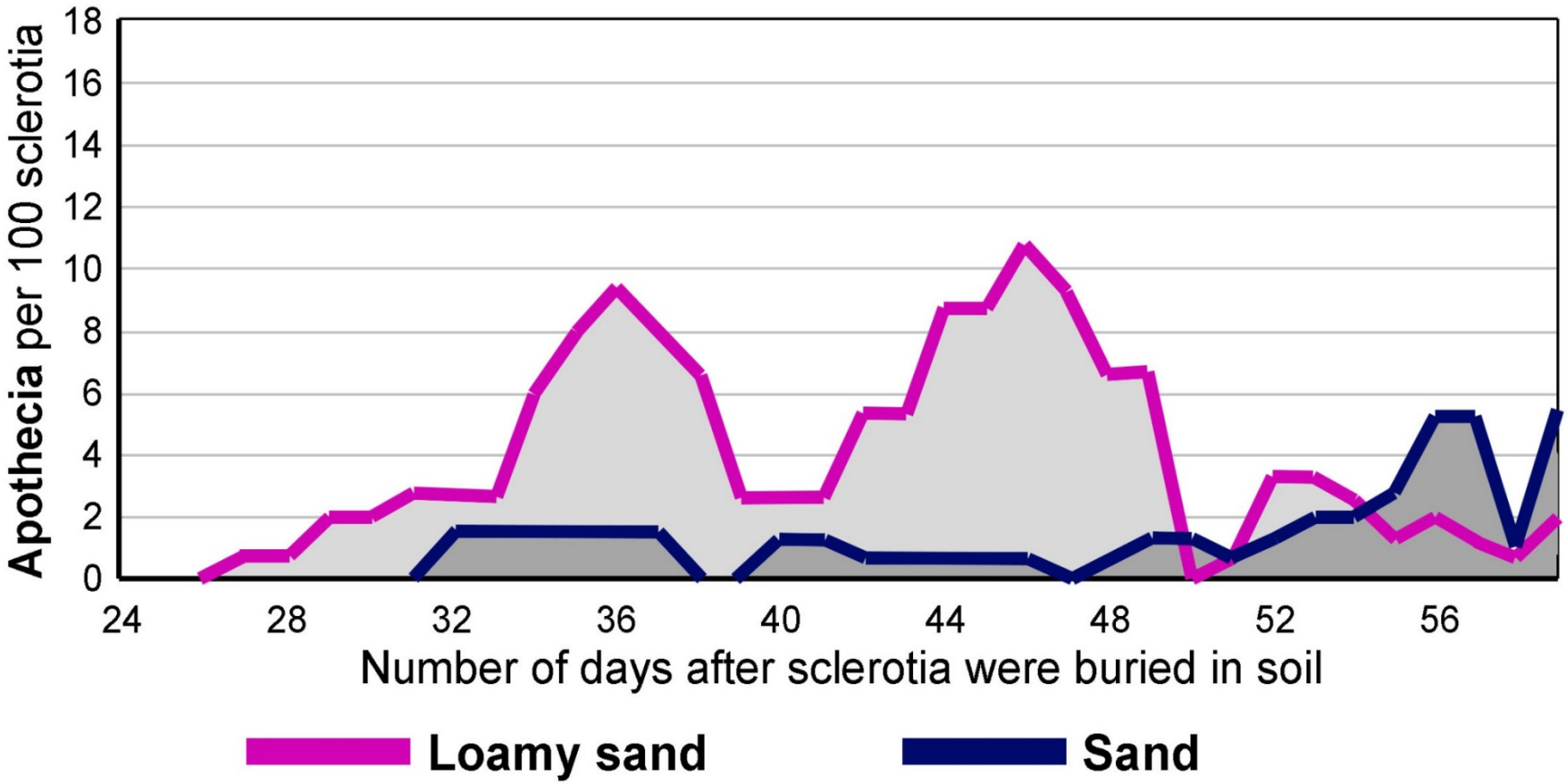
Soil moisture

Under most conditions,

Apothecia production is favored by soils that retain water.

Experiment #3

UPPSALA, SWEDEN (1992) - Rapeseed (canola); **0.08 inches of irrigation per day**



Twengstrom et al. 1998
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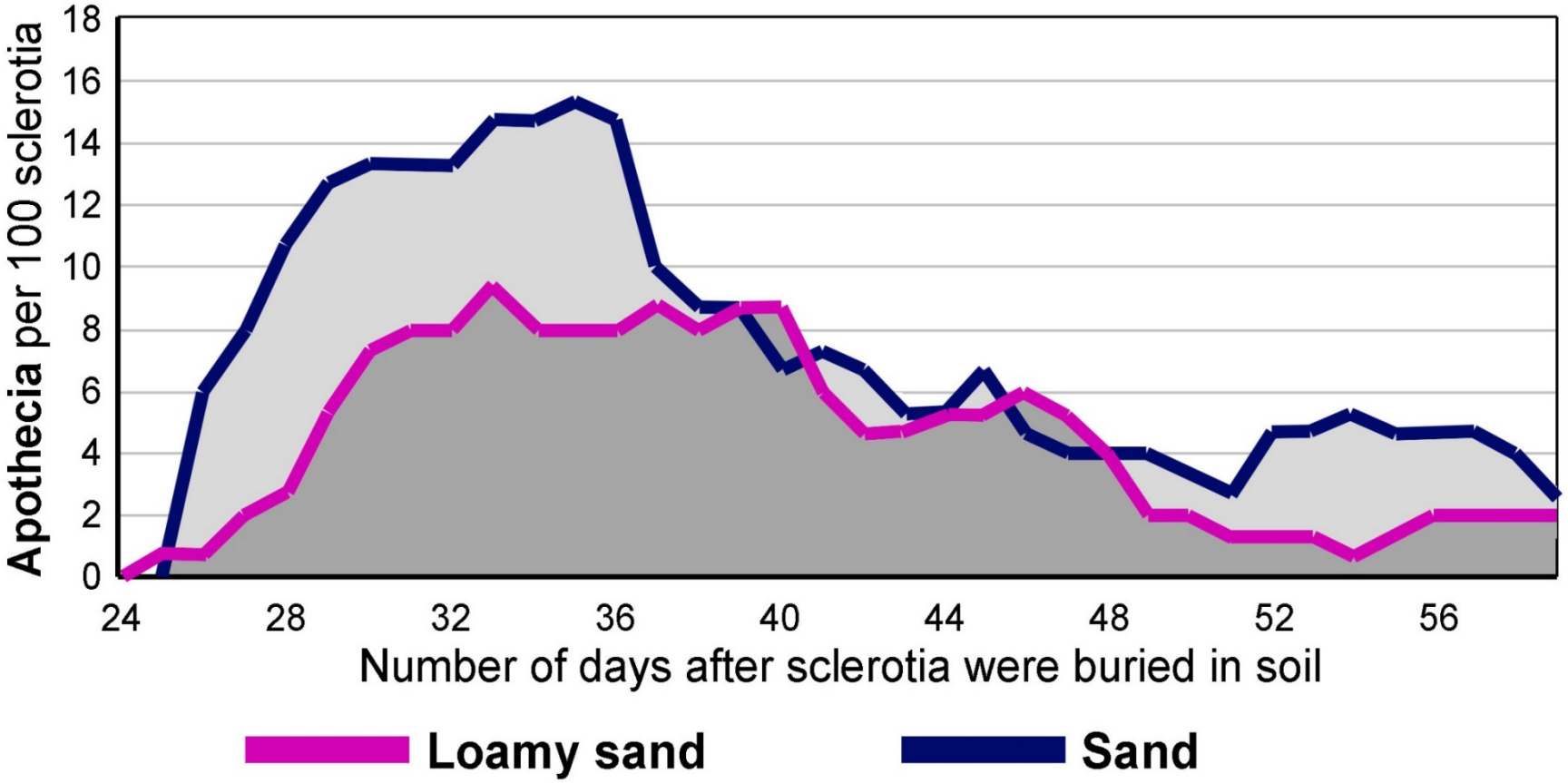
Soil moisture

When high soil moisture is sustained,

Sandy soils can be very favorable for apothecia.

Experiment #3

UPPSALA, SWEDEN (1992) - Rapeseed (canola); **0.2 inches of irrigation per day**



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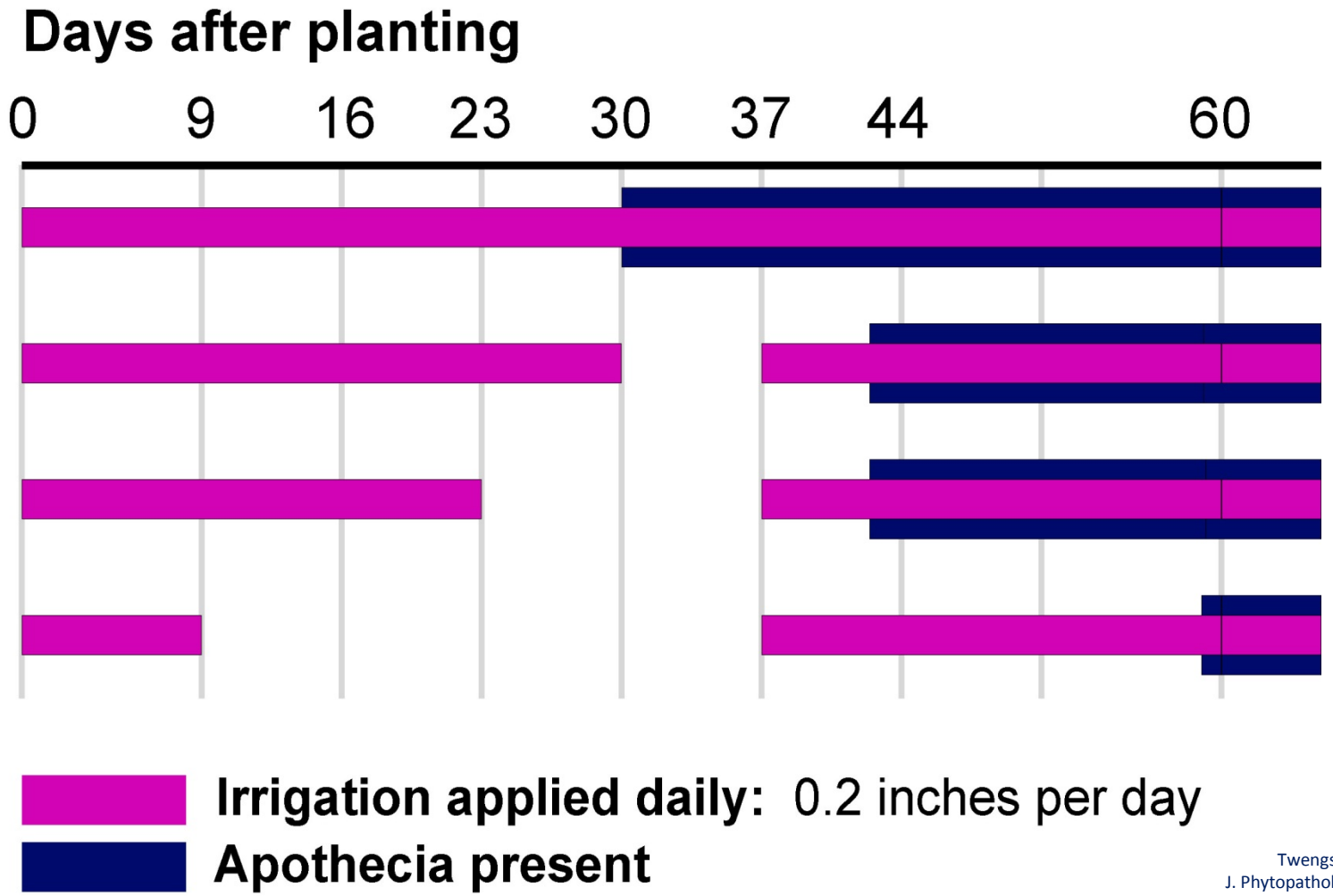
Soil moisture

A period of dry weather delays apothecia production.

UPPSALA, SWEDEN (1992) - Rapeseed (canola); SOIL TYPE = **LOAMY SAND**



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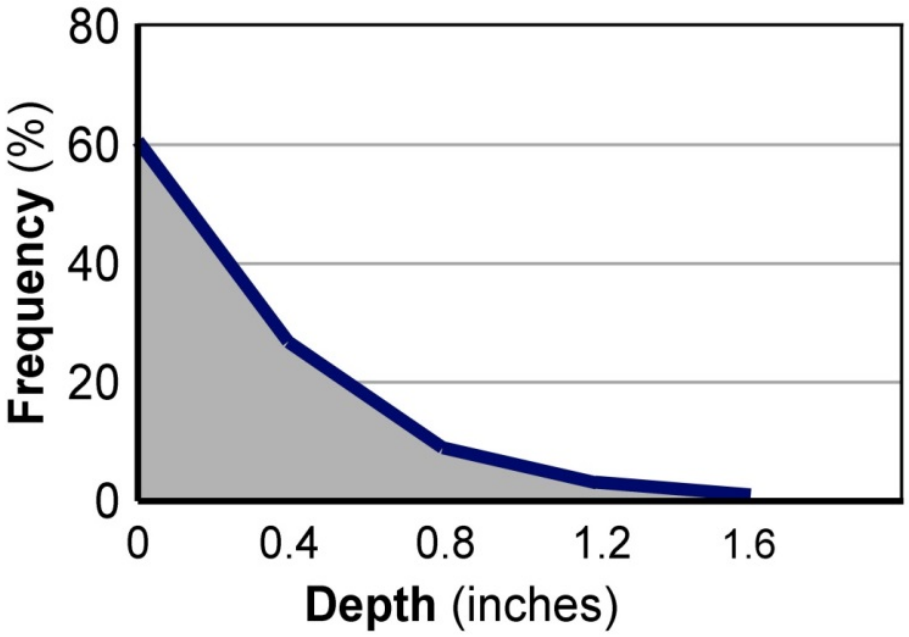
Soil moisture

Critical depth for moisture fluctuations:
first 1 to 2 inches of the soil.

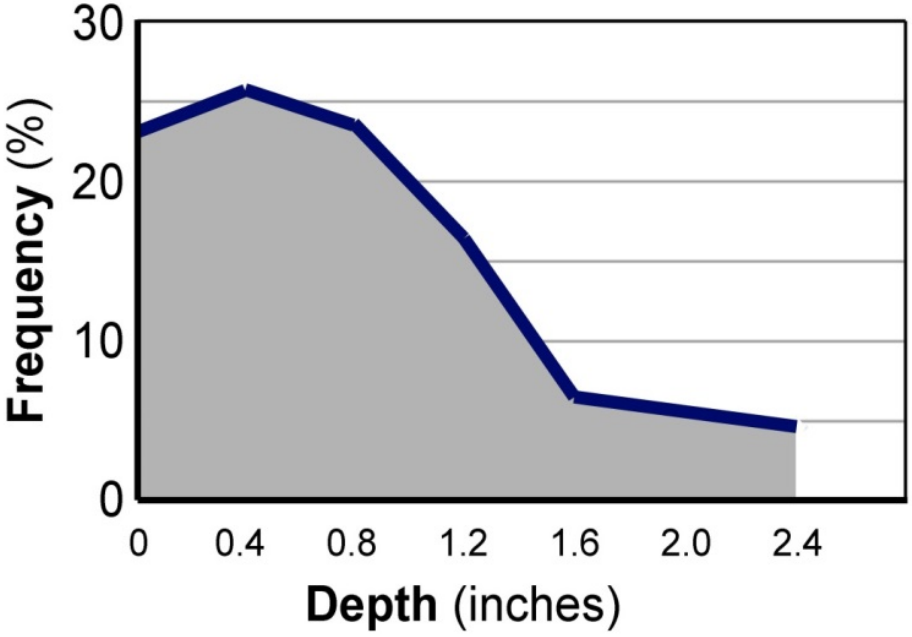
Soil depth from which apothecia of *Sclerotinia sclerotiorum* emerge

California
Lettuce production fields



Wu & Subbarao 2008 Phytopathology 98:1144-1152

United Kingdom
Rapeseed (canola) fields

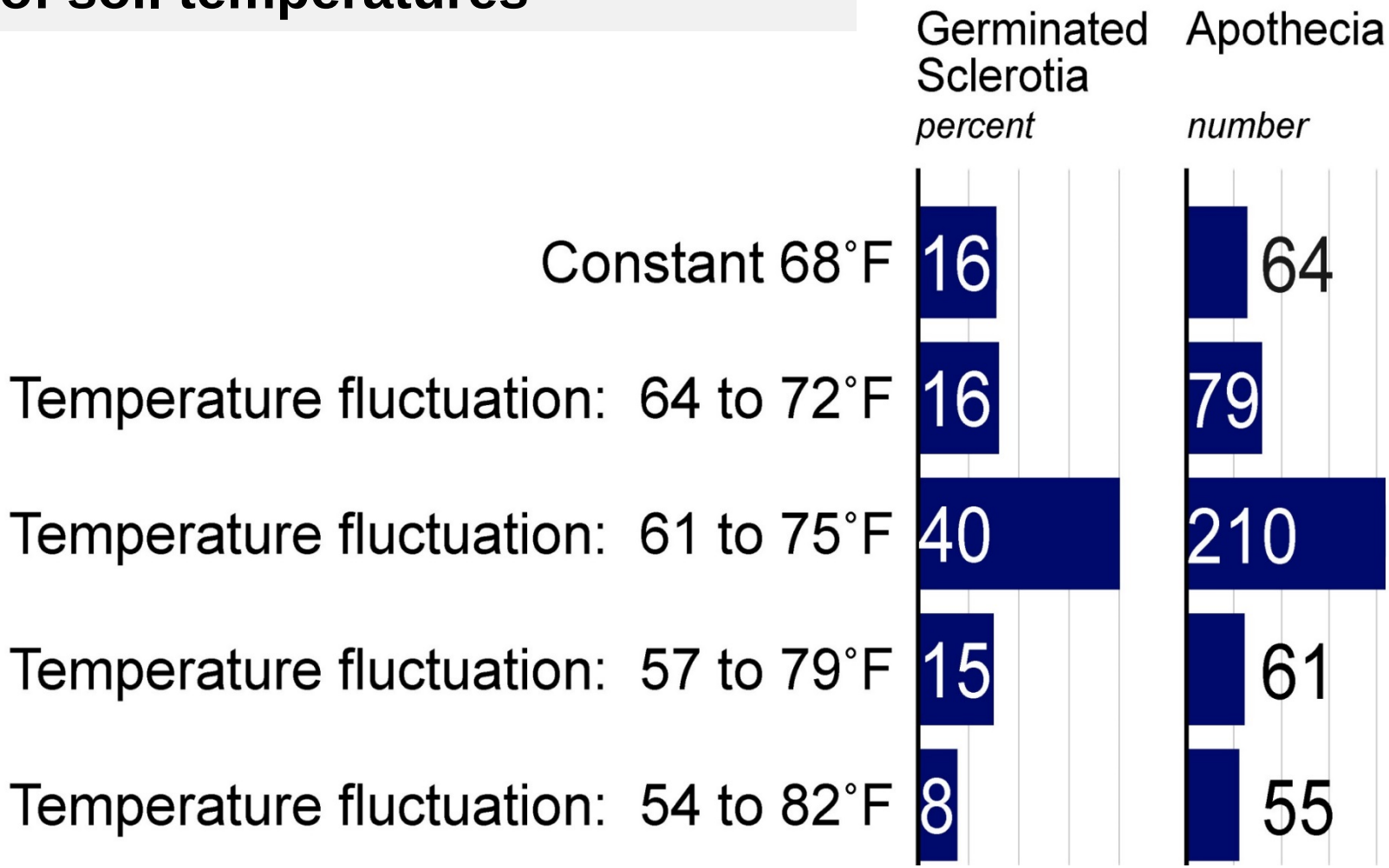


Mitchell & Wheeler 1990 Plant Pathology 39:70-76

Soil temperature

Laboratory studies:

Apothecia are produced at a wide range of soil temperatures



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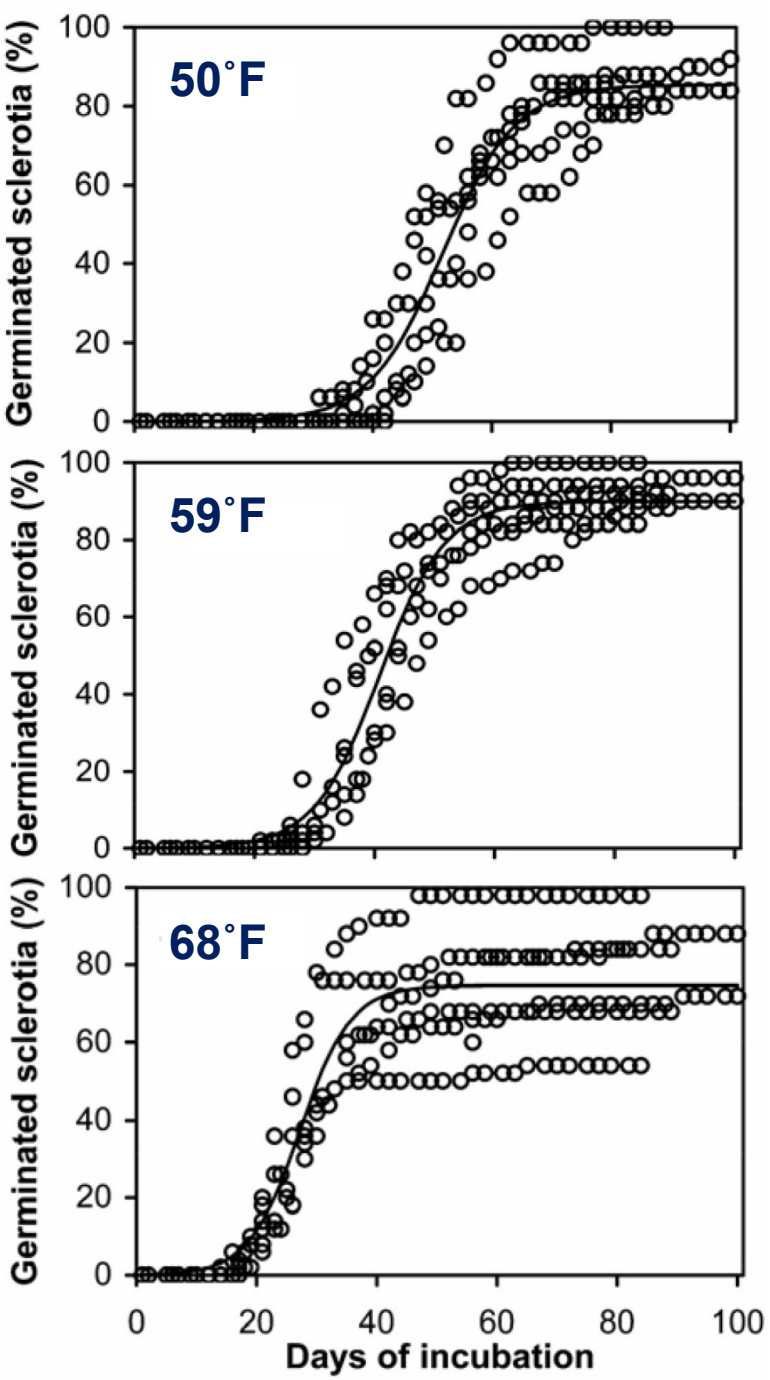


Wu & Subbarao 2008 Phytopathology 98:1144-1152

Apothecia and spore production

CONCLUSIONS:

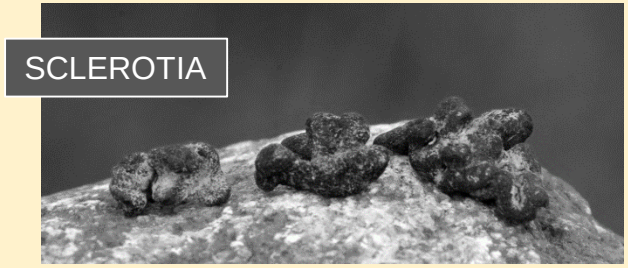
Under most circumstances,

- **Apothecia are likely to be present under the canopy during bloom if high soil moisture has been sustained for the last 7 to 10 days.**

- **The number of apothecia produced will be influenced by the frequency and duration of wet/dry cycles.**

Assessing risk of Scleotinia

1. Soil temperature and moisture favoring apothecia production.



Sclerotia deposited in soil

Ascospores released into soybean canopy

2. Temperature, relative humidity, and rainfall patterns favoring **infection and secondary spread.**

Plant-to-plant spread:
Between plants in direct contact

Initial infection:
Spores colonize dead blossoms

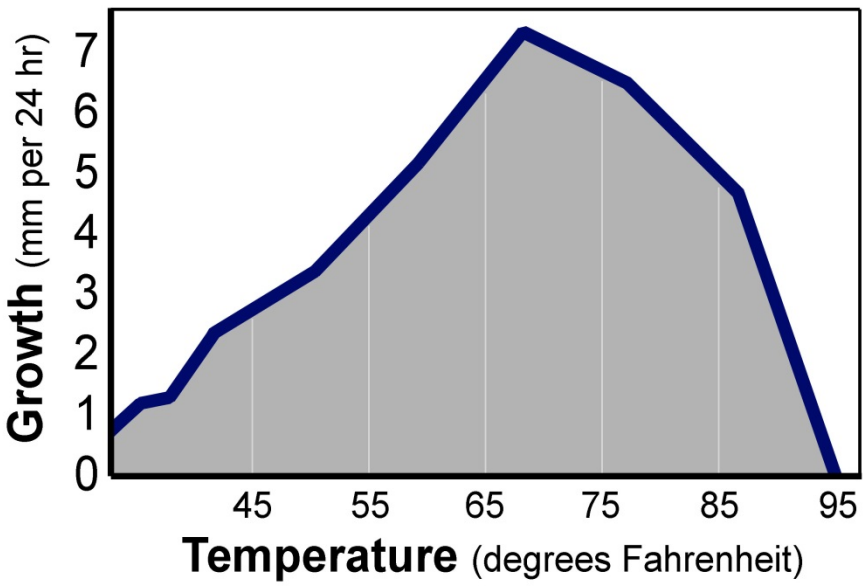
Air Temperature

Cool to moderate air temperatures favor Sclerotinia

Sclerotinia is inhibited as temperatures approach 85 to 90˚F

Sclerotinia growth rates

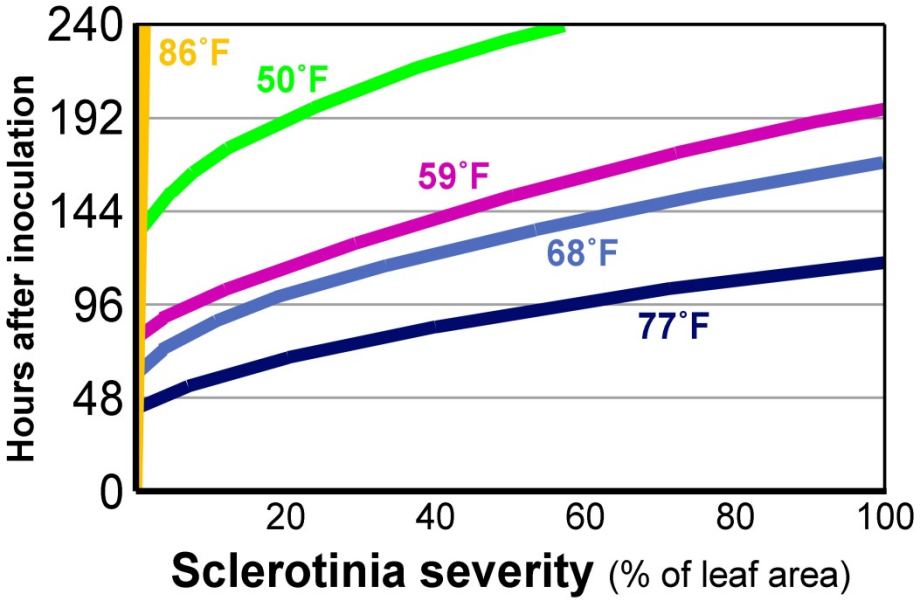
On artificial media in the lab



Berg and Lentz 1968. Can. J. Botany 46:1477-1481

Sclerotinia disease progression

Dry bean plants at 100% relative humidity (greenhouse)



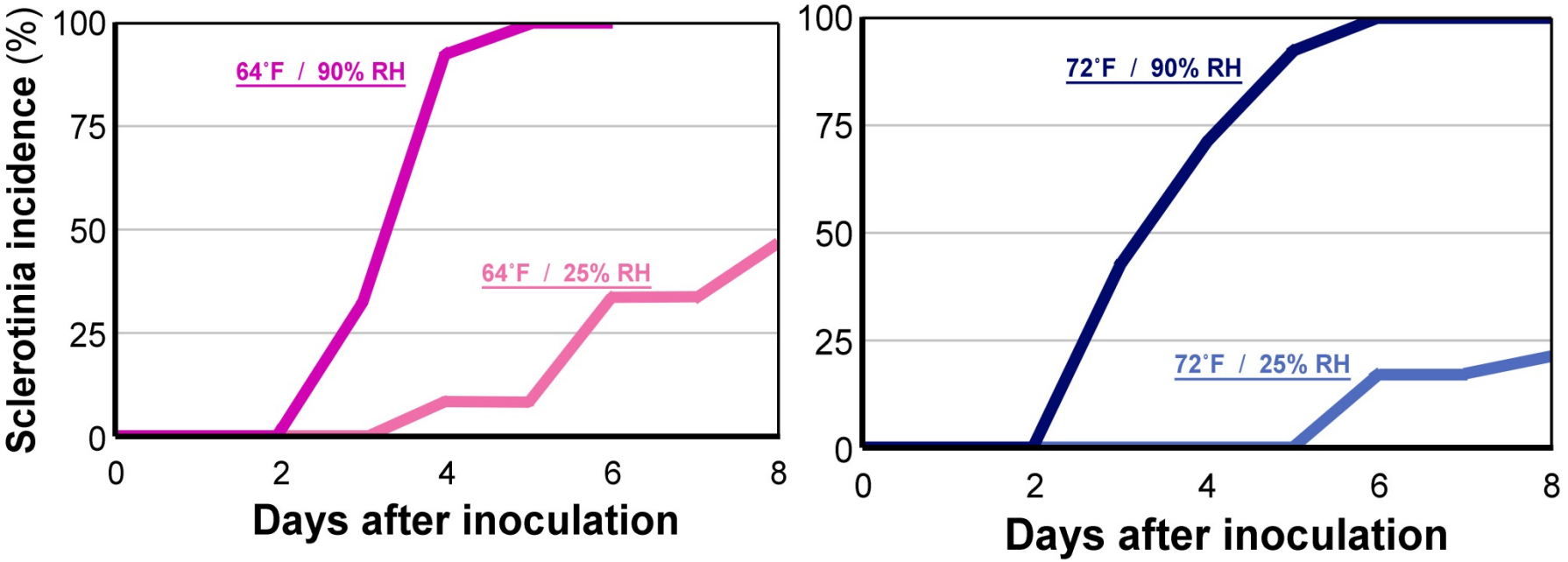
Weiss et al. 1980 Plant Disease 64:757-759

Relative humidity

Under sustained cool temperatures,
Sclerotinia may be able to develop even at low relative humidity

Sclerotinia disease progression

On dry bean plants (greenhouse) - *dead blossom inoculated with spores, placed in lowest node of plant*



Harikrishnan and del Rio 2006. Plant Dis. 90:946-950

Rainfall frequency

Carrington, ND (2014) - SOYBEANS:

Using overhead irrigation as a proxy for rainfall: What is the impact of irrigation frequency on Sclerotinia disease development?

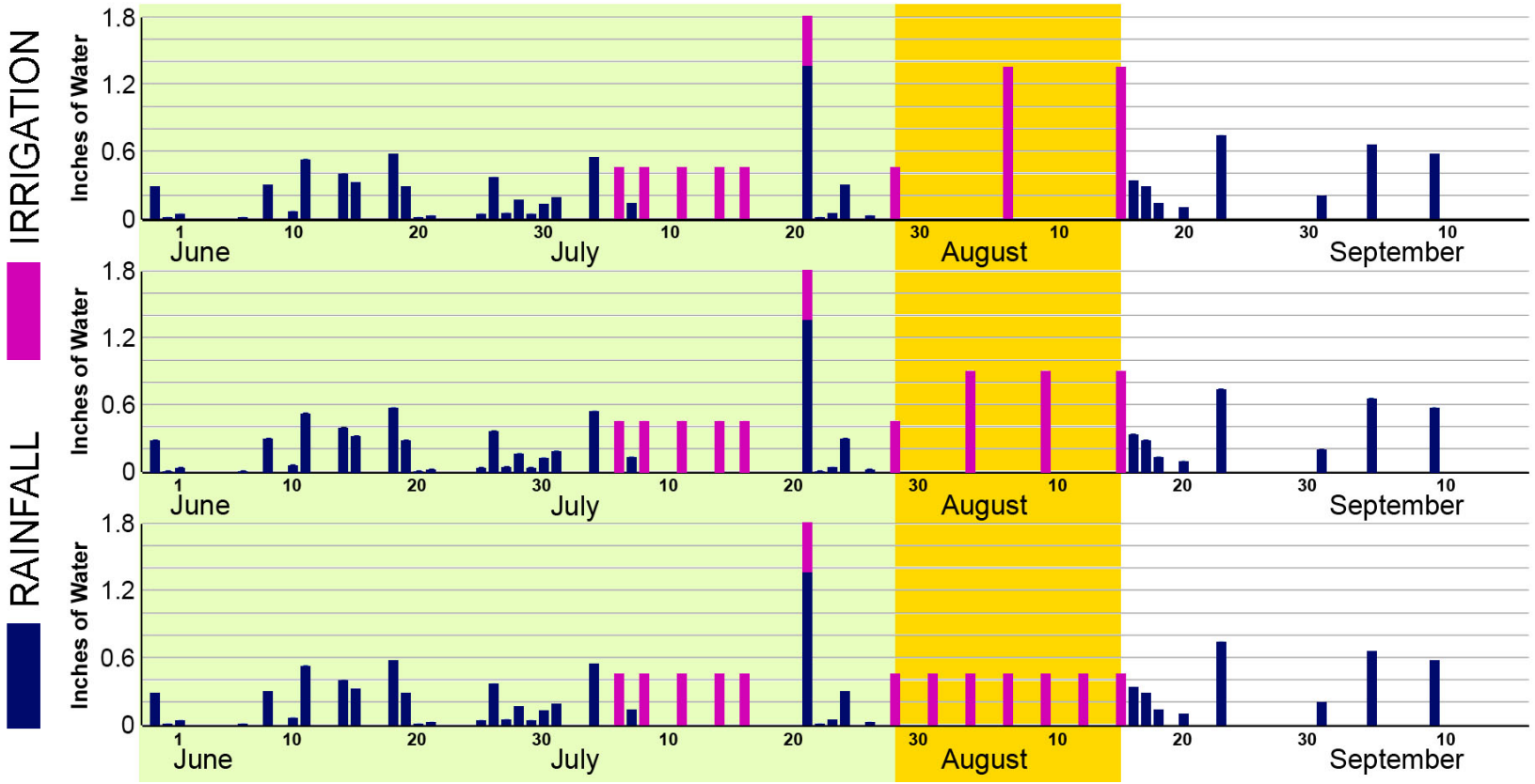
Vegetative growth and early bloom:

All treatments -

- *Rainfall or irrigation every 1 to 4 days*
- *Favorable for apothecia production*

Full bloom & early to mid pod:

- *1.35 in. every 9 days*
- *0.90 in. every 6 days*
- *0.45 in. every 3 days*

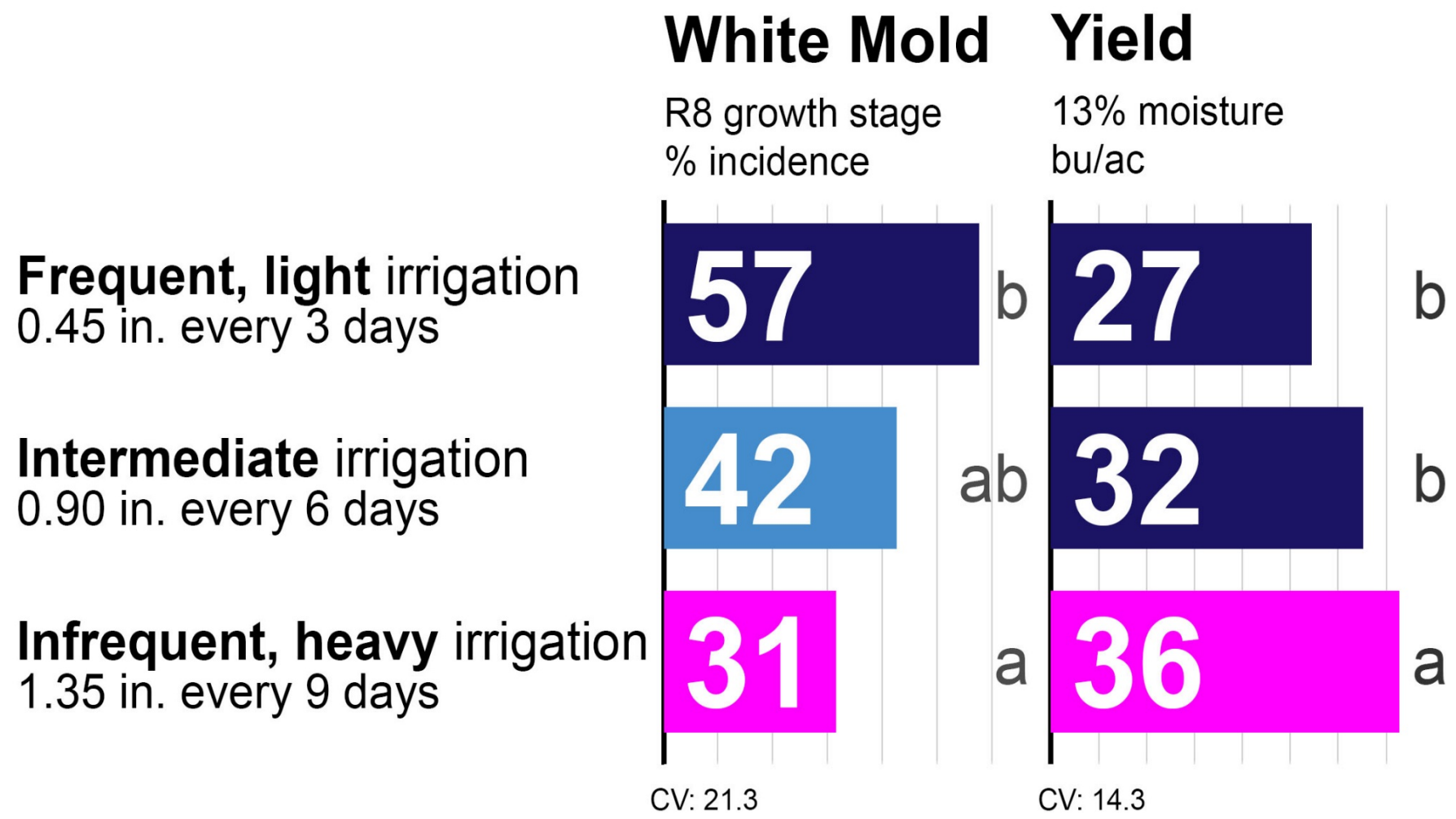


Rainfall frequency

Carrington, ND (2014): combined analysis, 14 soybean varieties (maturity 0.2 to 0.9)

Reducing irrigation frequency sharply reduced white mold.

Total irrigation amount was constant across all irrigation treatments.



Sclerotinia disease development

CONCLUSIONS:

Risk of Sclerotinia is highest when cool temperatures are sustained. When sustained cool temperatures occur, the rainfall and humidity requirements for Sclerotinia disease development are lower.

Sclerotinia is most severe when rainfall events are recurrent. The total amount of rainfall is likely less important than the frequency of rainfall events.




Thank You!

Research funding:
North Dakota Soybean Council
USDA National Sclerotinia Initiative
Northharvest Bean Growers Association
North Dakota Crop Protection Product Registration and Harmonization Board