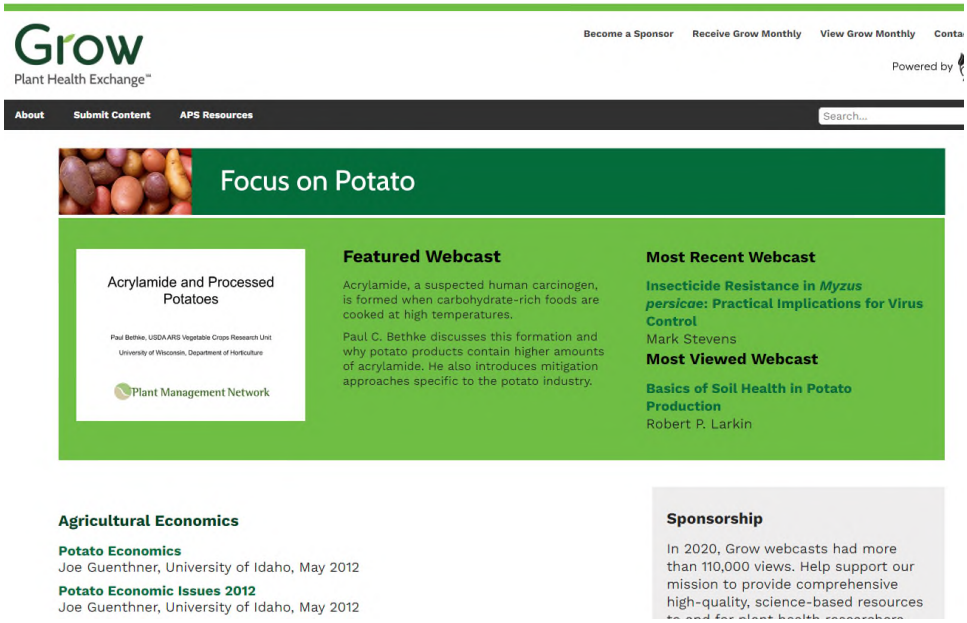
Management of Verticillium and the Early Die Complex in Potatoes

Jeff Miller

From University of Florida Extension



Verticillium Wilt: Potato Early Dying

June 2013 | 19 min., 50 sec.
by Dennis A. Johnson
Washington State University
https://doi.org/10.1094/GROW-POT-06-13-036

Summary

This presentation provides an overview of Verticillium wilt of potato. It is intended to help growers, consultants, and students to better understand the epidemiology and management of the disease. The presentation shows representative color images of disease symptoms, describes the disease cycle, and discusses disease management strategies. Sources of initial inoculum, development of the pathogen within plants, and development of the disease in fields are discussed. A distinction is made between Verticillium wilt and potato early dying.

About the Presenter

Dennis A. Johnson is a professor and Extension plant pathologist at Washington State University. He received a BS degree in botany from Brigham Young University and MS and PhD degrees in plant pathology from the University of Minnesota. Dr. Johnson was on the faculty and did research on small grain diseases at Texas A&M University before joining the Department of Plant Pathology at Washington State University in 1980. His research has been directed at developing practical management strategies for diseases of mint and potatoes.

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Optimizing Shank Injection Fumigation Using Metam Sodium

September 2015 | 43 min., 23 sec.
by Neil C. Gudmestad
North Dakota State University
https://doi.org/10.1094/GROW-POT-09-15-060

Summary

The soil fumigant metam sodium continues to be important in managing soilborne pests of potato such as *Verticillium dahliae*, the primary cause of early dying, and the root lesion nematode (*Pratylenchus penetrans*). Recent label changes resulting from the reregistration of metam sodium by the EPA have made the application of the fumigant through water applications very difficult due to the requirement of large buffer zones to reduce human and animal exposure to the chemical. As a result, there has been a dramatic increase in the application of metam sodium via shank injection, which is not as efficacious as water applications. This presentation will discuss the most recent research conducted at North Dakota State University on improving the efficacy of shank injection of metam sodium.

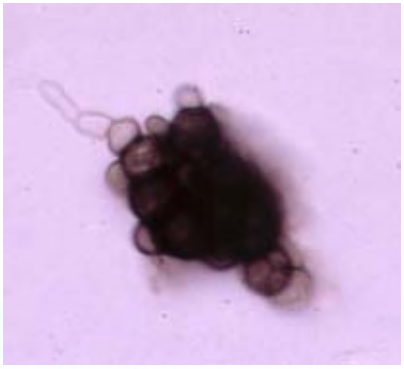
About the Presenter

Neil C. Gudmestad obtained a PhD in plant pathology in 1982 and joined the Department of Plant Pathology at North Dakota State University in 1985. His research career at NDSU has focused on pathogen biology and diversity and on potato disease management. He has made significant research contributions on potato diseases caused by 10 fungal or fungal-like organisms, four viruses, and three bacteria. Most recently, he has focused on invasive pathogens affecting the potato industry in the United States, such as zebra chip and potato mop top. All of his efforts are aimed at solving real-

Potato Early Dying

- Primarily Verticillium wilt
  - *V. dahliae*: wide host range, microsclerotia, wide temp adaptation
  - *V. albo-atrum*: narrow host range, no microsclerotia, narrow temp
- Contributing pathogens
  - Root lesion nematodes (*Pratylenchus penetrans*)
  - *Pectobacterium* species
  - *Colletotrichum coccodes*
  - *Alternaria* pathogens (??)

Verticillium wilt disease cycle



V. dahliae microsclerotia
Survival up to 10 years

V. dahliae infect roots,
move into vascular system

Wilting and flagging

Wind, soil, seed

Verticillium wilt symptoms - leaves

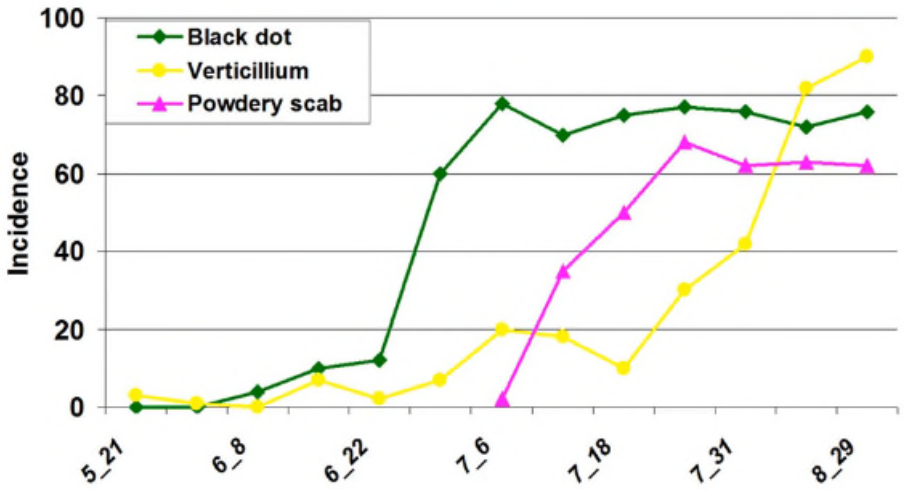
Photo from Randy Rowe

Comparison of sclerotia/microsclerotia

Photo from Dennis Johnson

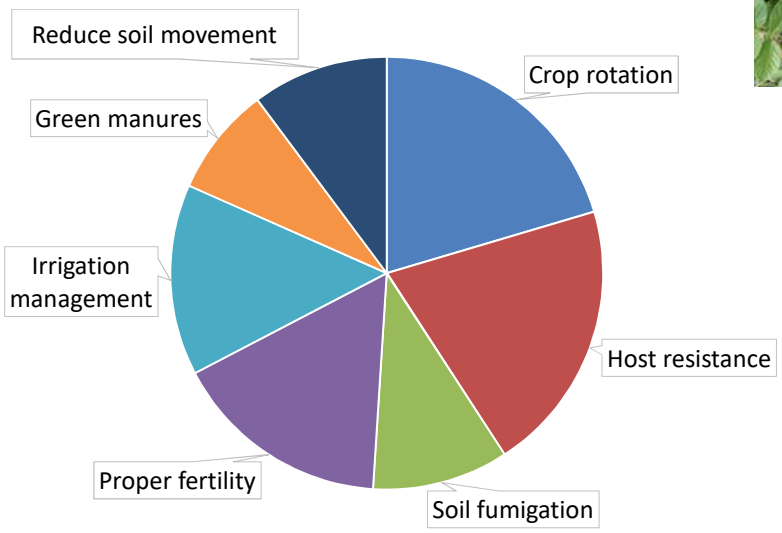
Verticillium dahliae *Colletotrichum coccodes*

Disease incidence in fields



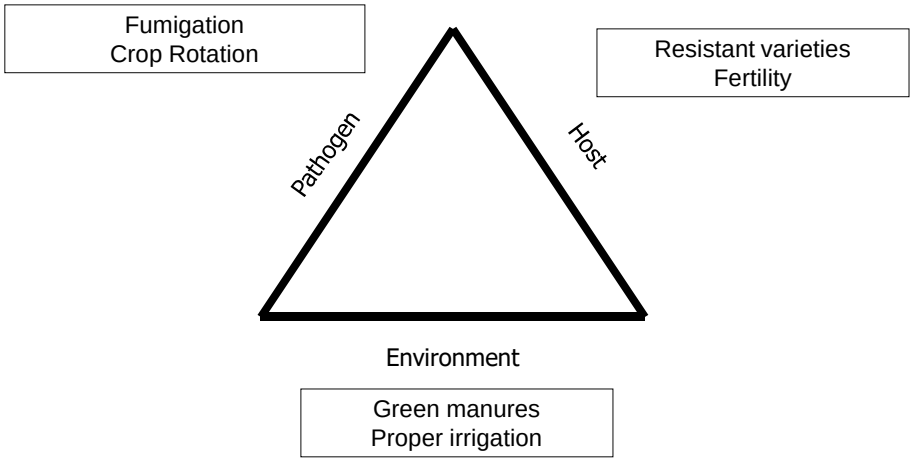
Data from Dennis Johnson, Washington State University

Managing Potato Early Dying



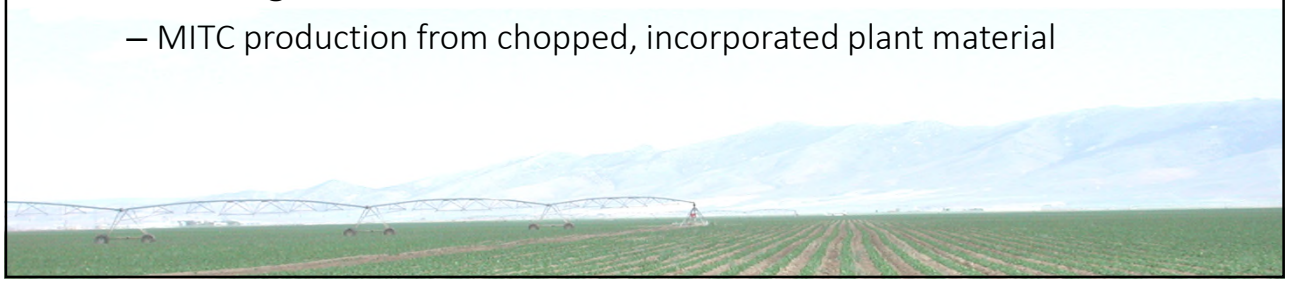
Theoretical representation only

Managing Verticillium Wilt (The Disease Triangle)



Green Manures

- Suppression of wilt without a reduction in *V. dahliae* numbers
  - Incorporation of green biomass
  - Not bio-fumigation
  - May take multiple years to establish this effect
- Bio-Fumigants
  - MITC production from chopped, incorporated plant material



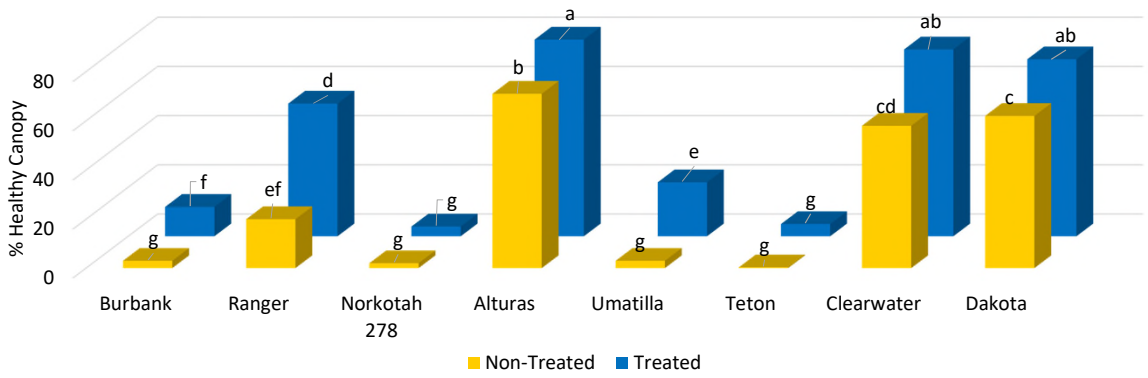
Irrigation Management

- Increased irrigation frequency may increase *Verticillium* pressure.
- Minimize watering prior to tuber initiation.

Resistant or Tolerant Varieties

- Ranger
- Alturas
- Clearwater
- Dakota
- Goldrush
- Chipeta
- Century Russet
- Targhee

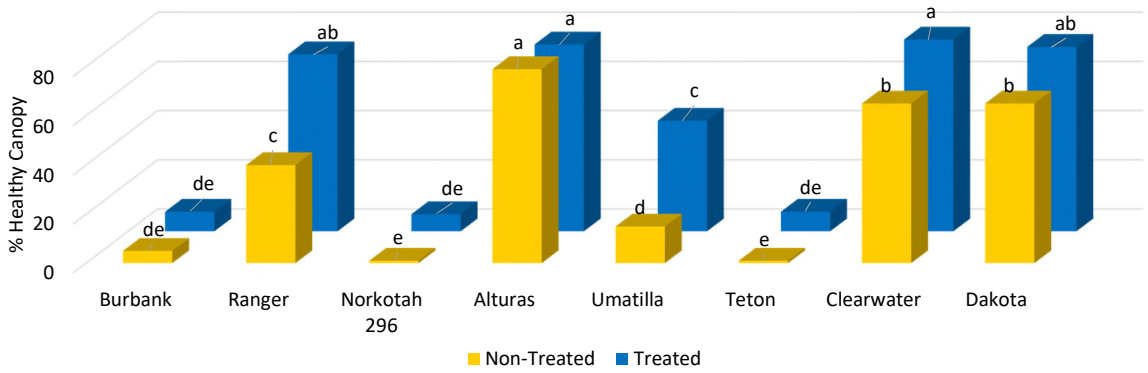
Plant Vigor – September 6, 2019



Treatment:

Dime size tubers:	Resist 57 (10 pt)
Row closure:	Resist 57 (10 pt) + Luna Tranquility (11.2 fl oz) + Bravo WS (1.0 pt)
Row closure + 2 wks.:	Resist 57 (10 pt) + Luna Tranquility (11.2 fl oz) + Bravo WS (1.0 pt)
Row closure + 4 wks.:	Bravo WS (1.5 pt)
Row closure + 6 wks.:	Bravo WS (1.5 pt)

Plant Vigor – August 27, 2020



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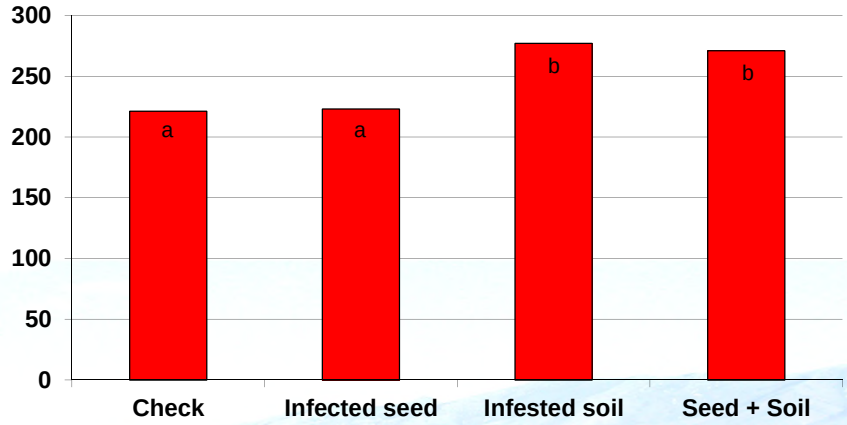
Sources of Inoculum

- Infected seed
- Dirt adhering to potato seed
  - Seed tare dirt (55% > 10 cfu/g, 30% > 50 cfu/g)
  - Loose tare dirt (52% > 10 cfu/g, 19% > 50 cfu/g)

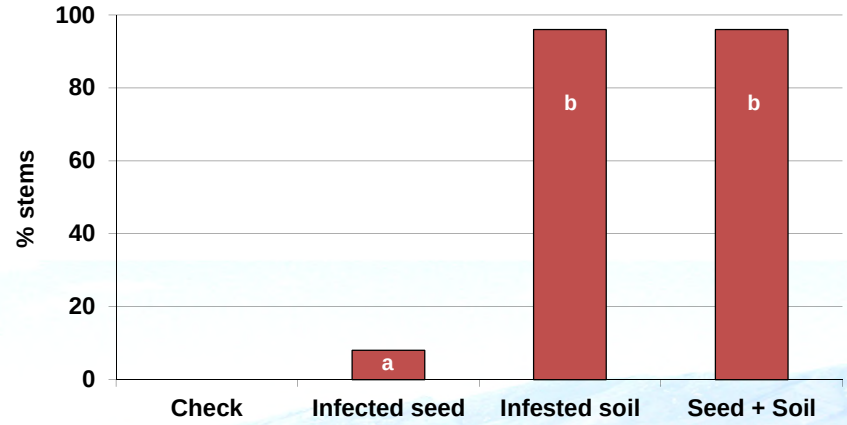
Phytopathology (2013) 103:55-63

Impact of Inoculum Source on Verticillium Wilt Cumulative Disease Severity (AUDPC)



Data from Dennis Johnson, Washington State University

Stem Colonization 12" Above the Soil



Data from Dennis Johnson, Washington State University

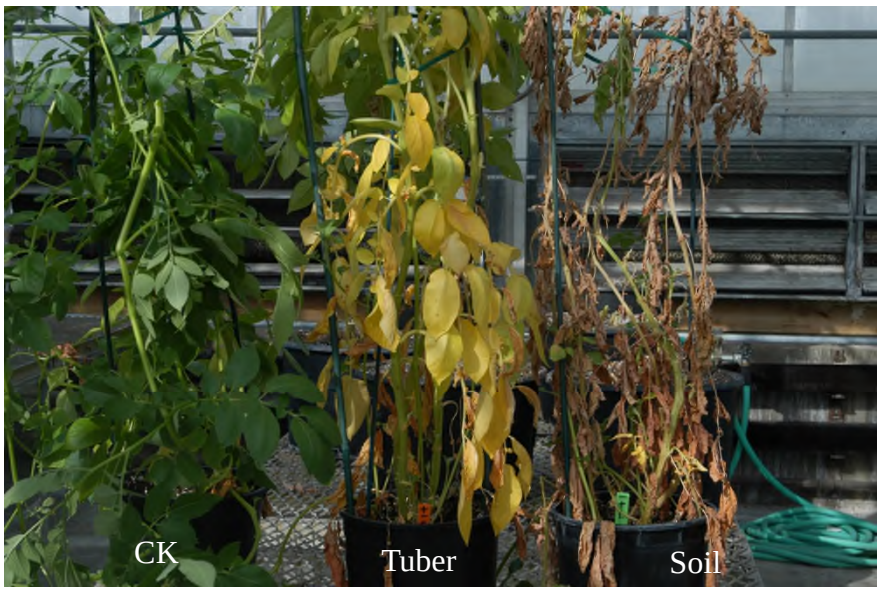


Photo from Dennis Johnson, Washington State University

Interaction between *P. penetrans*/*V. dahliae*

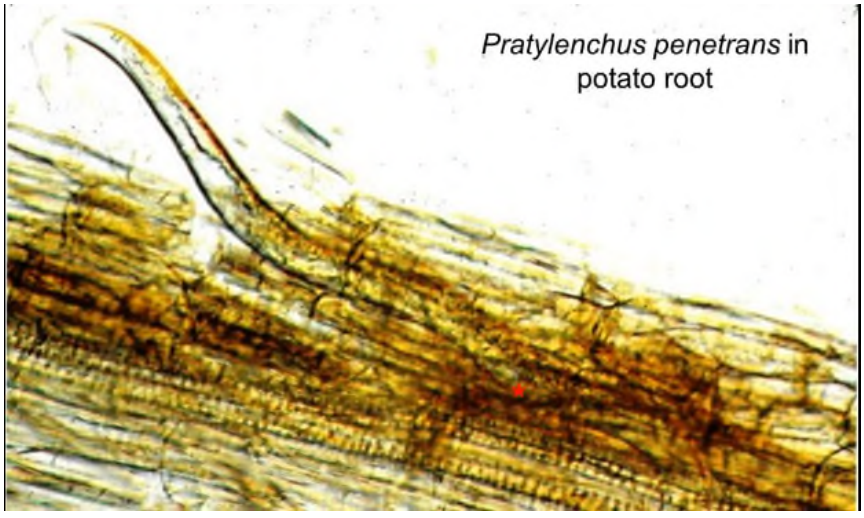


Photo from Dennis Johnson, Washington State University

Metam Sodium and Potassium

- Effective against *Verticillium dahliae*.
- Some nematicide activity
  - **Root lesion**
  - Root knot
- Some weed control
- High active ingredient load
  - 40 gallons/acre = 170 lb a.i.
- Expensive
  - $4.90/gallon x 40 gallon/acre = **$196/acre**
- Restricted use due to regulation

vapam HL SOIL FUMIGANT

Sectagon®-42 Agricultural Fumigant

k-pam HL

Sectagon-K54® Agricultural Fumigant

Optimizing Shank Injection Fumigation Using Metam Sodium

Focus on Potato

Dr. Neil Gudmestad

- Cooler temperatures are better (< 50 F)
  - 39 F was better than 59 F or 55 F
  - MITC movement in soil is slower
- Single injection depth just as effective as two
  - 10" vs 6 + 10"
- Metam rate more critical at higher temps
  - Rate response (40, 50, 60, 70 gallons) at 55 F
    - Higher (70 gal) can be more effective than lower (40 gal)
  - All rates similar at 39 F
- Marketable yield higher at 39 F fumigation

What will we do without fumigation?

- Can we use less?
- What are some alternatives?

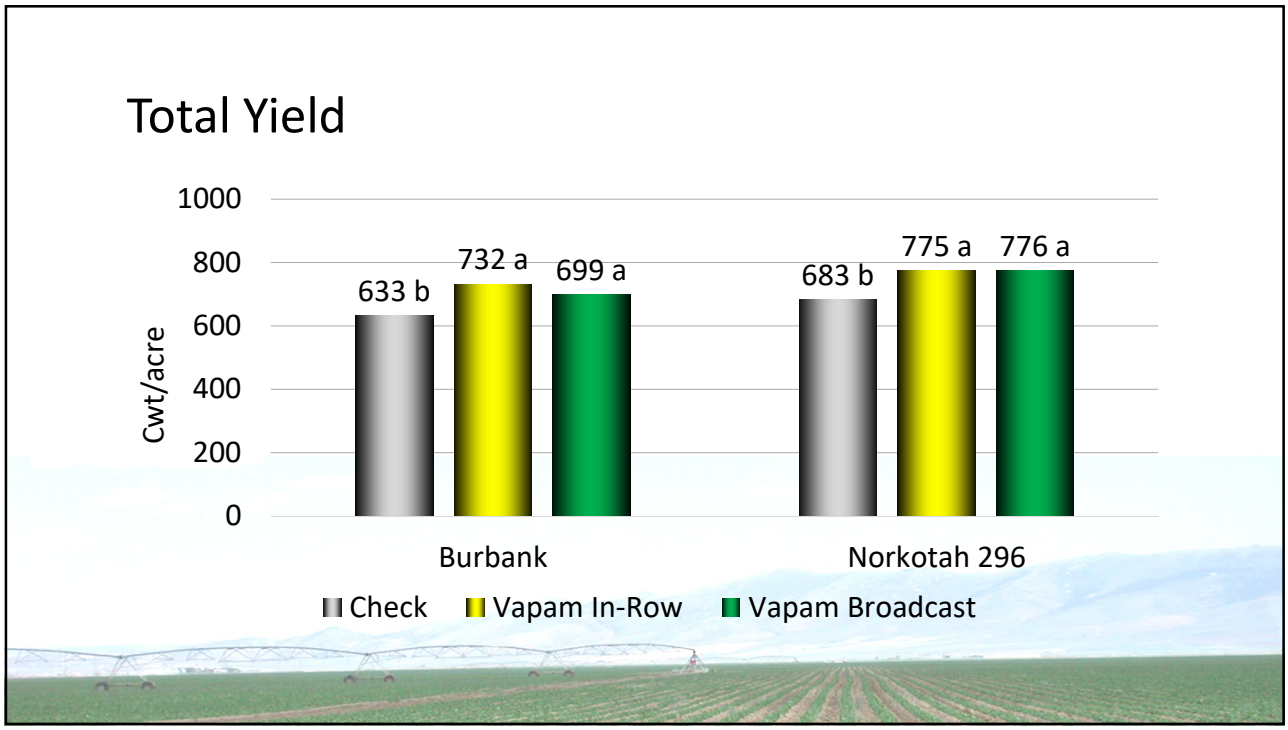
Non-fumigated

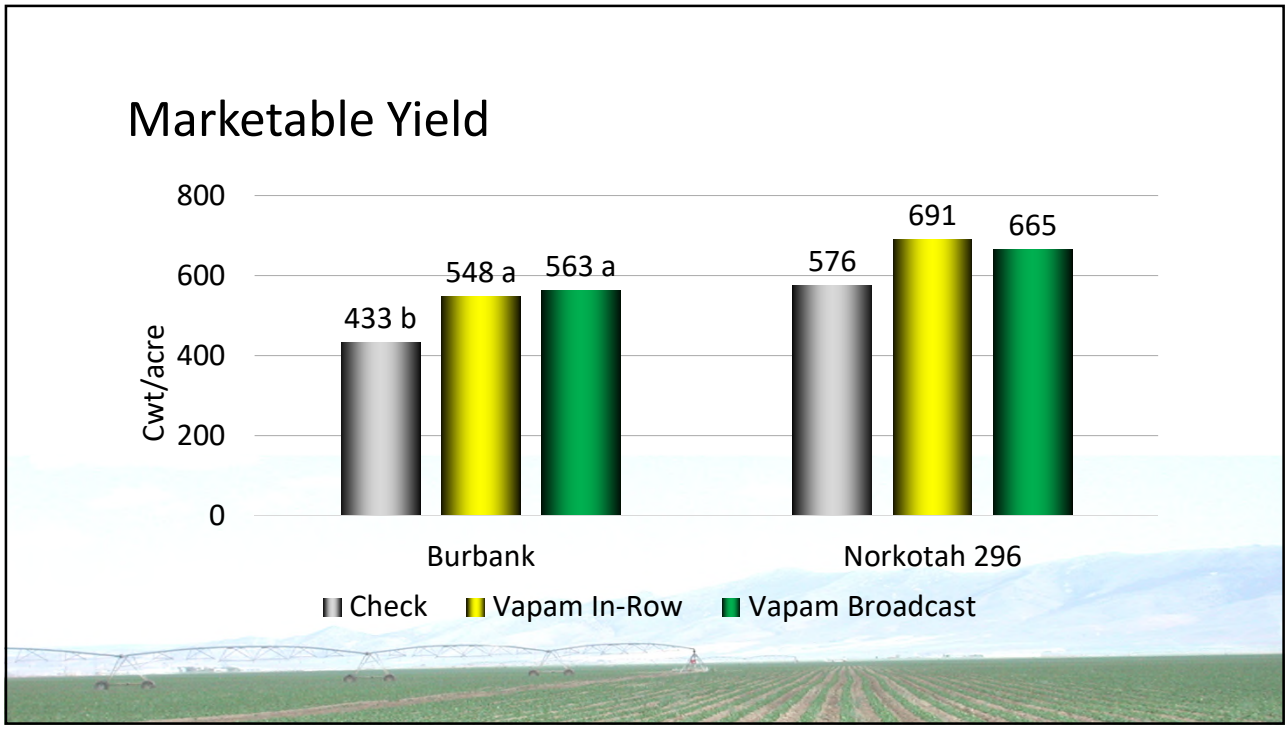
128 lb a.i./acre

In-Row Vapam

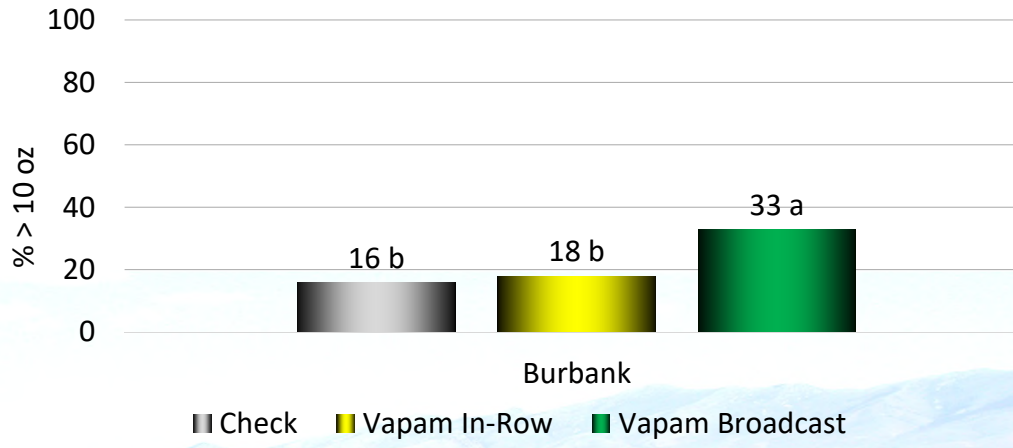
170 lb a.i./acre

Broadcast Vapam

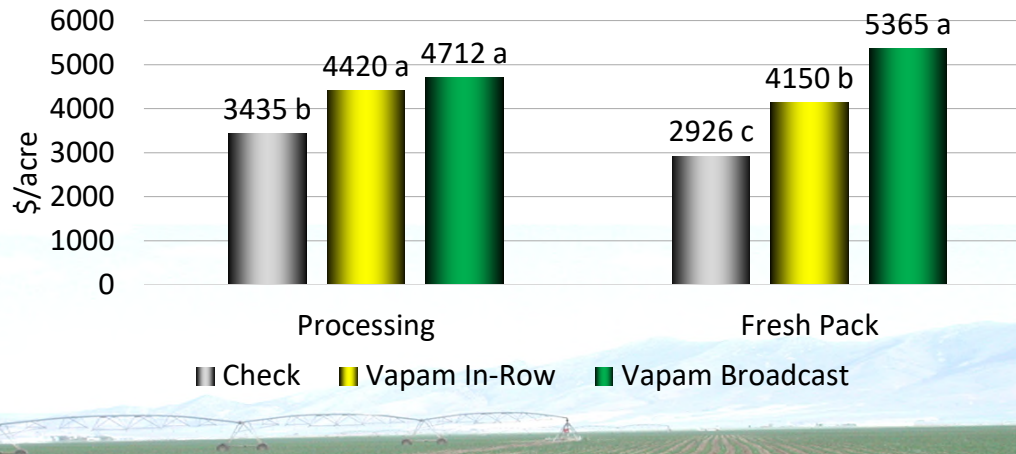

Total Yield
1000
800
600
400
200
0
Cwt/acre
633 b
732 a
699 a
683 b
775 a
776 a
Burbank
Norkotah 296
Check
Vapam In-Row
Vapam Broadcast


Marketable Yield
800
600
400
200
0
Cwt/acre
433 b
548 a
563 a
576
691
665
Burbank
Norkotah 296
Check
Vapam In-Row
Vapam Broadcast

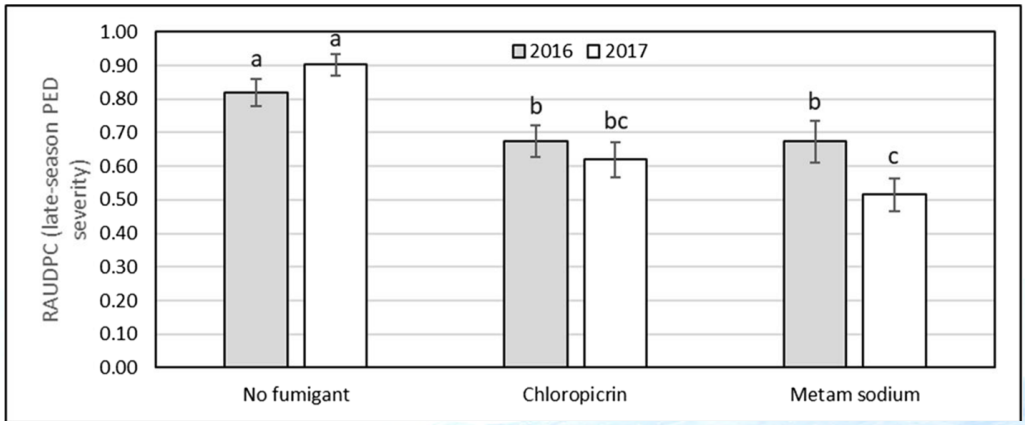
Percent > 10 oz



Gross Return Burbank

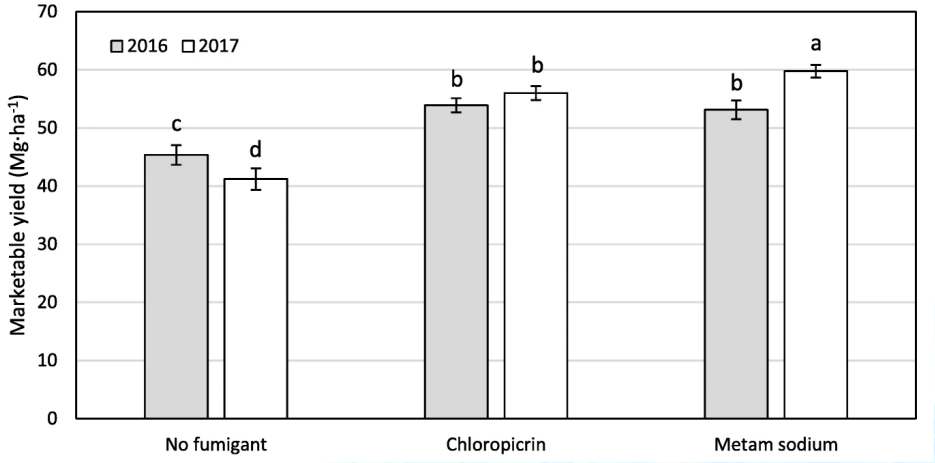


Effect of Fumigation on Potato Early Dying



Crants et al., 2021, AJPR

Effect of Fumigation on Potato Yield



Crants et al., 2021, AJPR

Where do we go from here?

- In-row worked and was cost-effective. However, it generally was not as profitable as broadcast.
  - We could use less metam, but there would be a cost.
- Use of green manures has been varied in southern Idaho.
  - Dedicated season for growth?
  - Availability of water?
- Combination of methods
  - Other products? (e.g. Velum Prime, Elatus, Dominate)

Time for break!