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2020 Update Mtg: Optimizing Current Cultural Practices and Evaluation of Novel Fungicides for Fruit Rot Management

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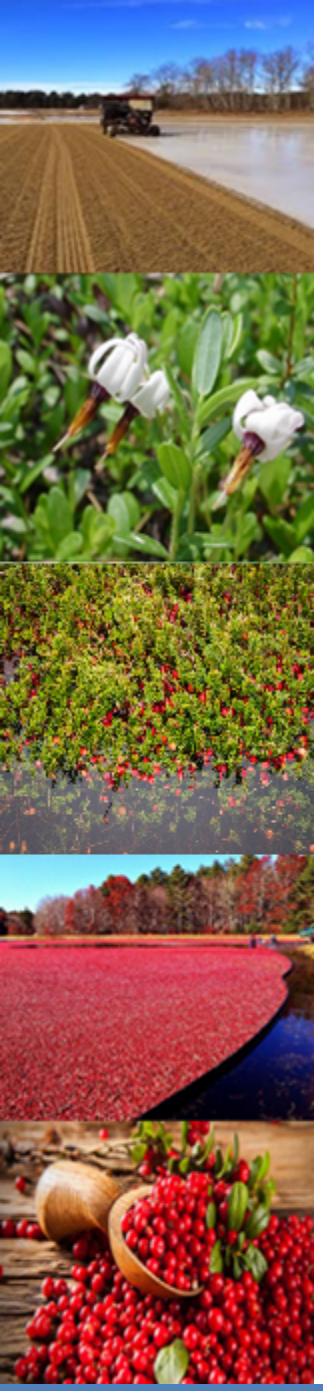


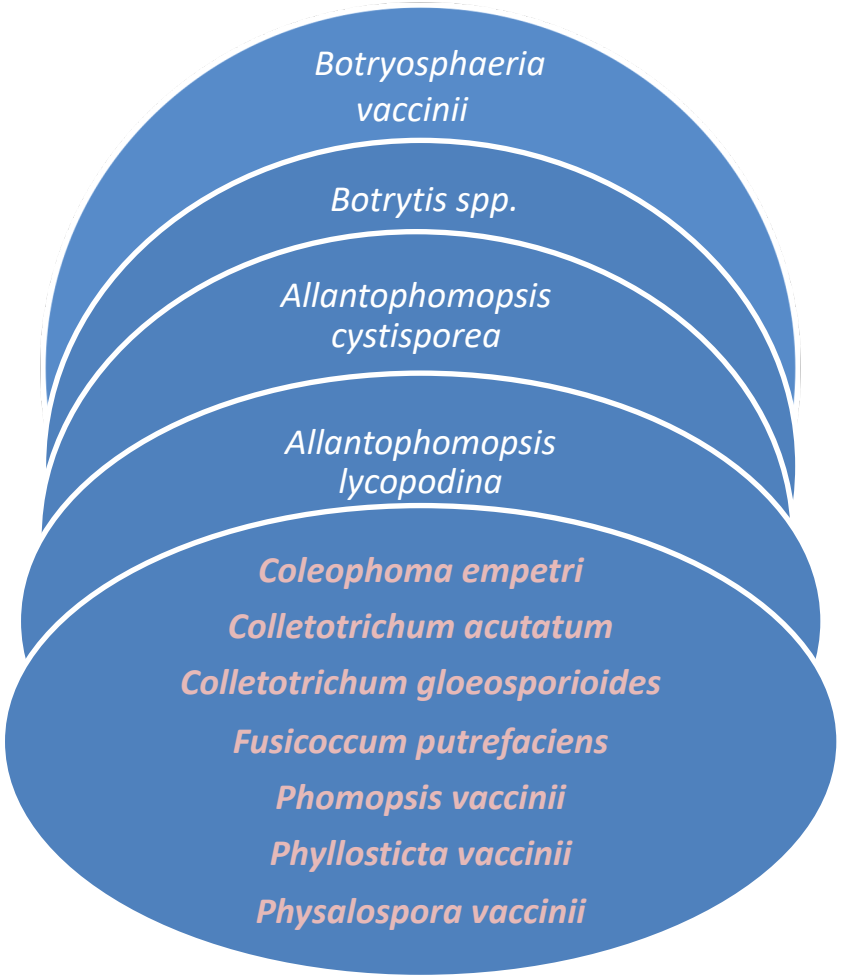
Optimizing Current Cultural Practices & Evaluation of novel fungicides for fruit rot management

Leela Saisree Uppala
UMass Cranberry Station
January 30, 2020

UMass Amherst
The Commonwealth's Flagship Campus

UMass Cranberry Station
Research & Extension

Fruit Rot



Field Rot

- Fungal populations known to vary from season to season &
- from region to region

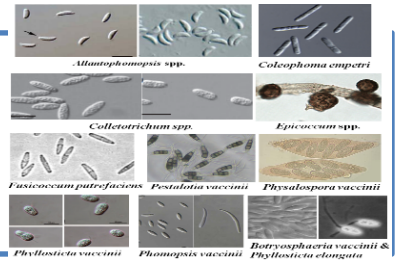
Factors affecting cranberry fruit rot incidence & management

Plant or Bog factors

- Canopy density
- Air circulation
- Vine health
- Level of resistance

Pathogen related/Fruit Rot Inoculum

- Fungal pathogen inoculum

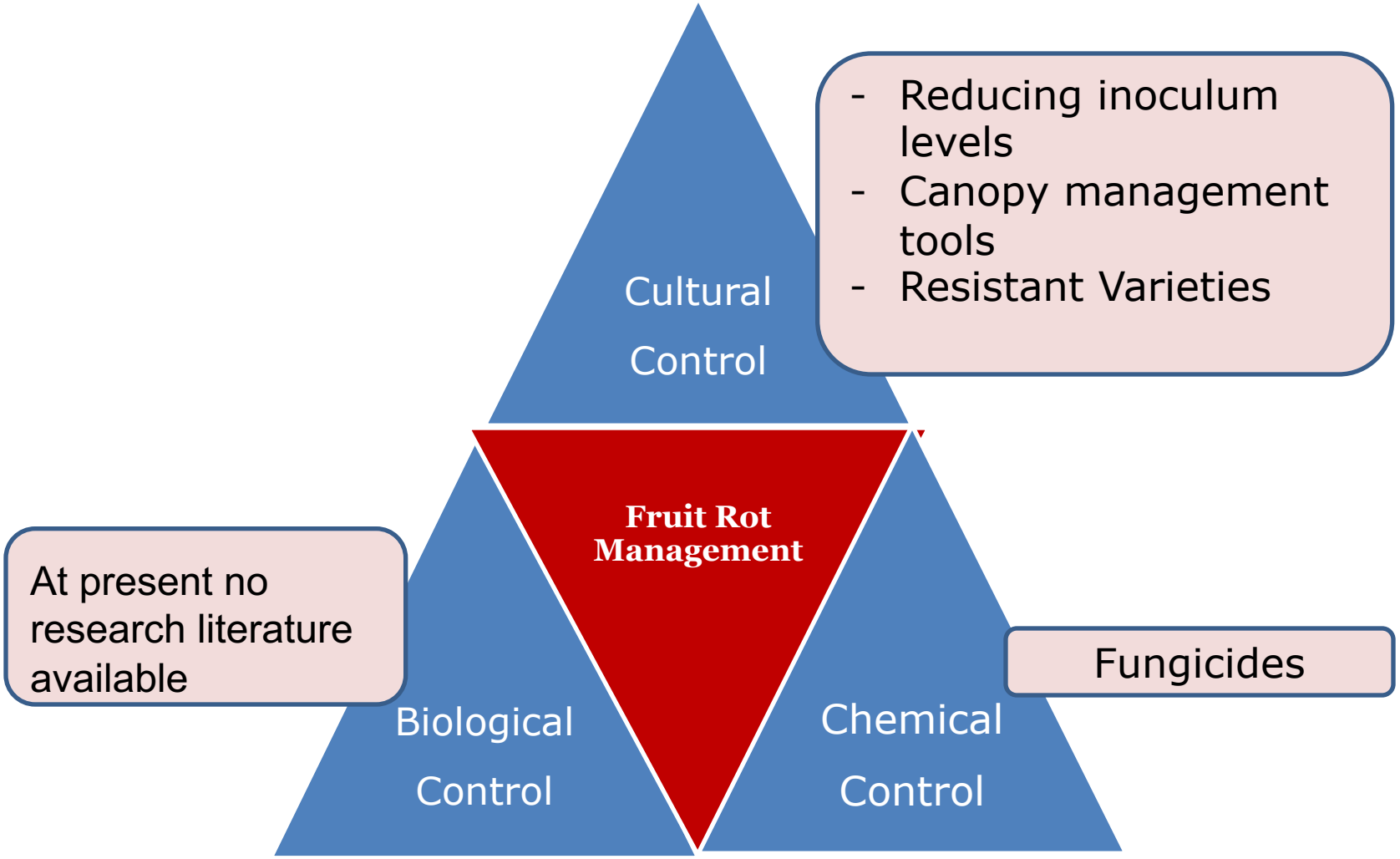


Cultural/Management practices

- Fertilizer rates
- Implementation of Late water, pruning, sanding & mowing
- Timing of fungicides
- Selection of fungicides
- Fungicide coverage
- Harvest practices

Integrated Disease Management –

a cost effective, sustainable fruit rot management



Cultural Control

- Canopy management –
  - pruning
  - sanding
  - improved air circulation
  - rapid drying
- sanitation
- minimize plant stress or lush growth
- minimize mechanical injury to fruit during dry harvesting

Cultural Control

Late Water –

- Mid April to Mid May.
- Once in three years.
- Bloom will be compressed into a shorter time period.
- Fungicides may be eliminated on processed-fruit beds if keeping quality is forecast to be good.
- Use reduced recommended rate and less number of applications during the late water year and the following year.
    - If one application to be made- apply at 50% bloom.
    - If two applications are to be made- at 10% bloom and two weeks later.

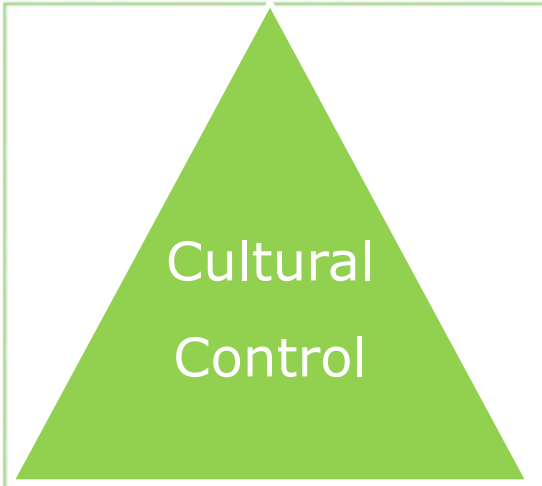
Cultural Control

Second year after LW has been held:

No. of fungicide applications and rates should be increased to a normal schedule

Late Water in Newly Planted Beds: (one or two year old bogs)

- will help prevent inoculum buildup
- help the vines spread over the surface of the soil
- slow down weed growth



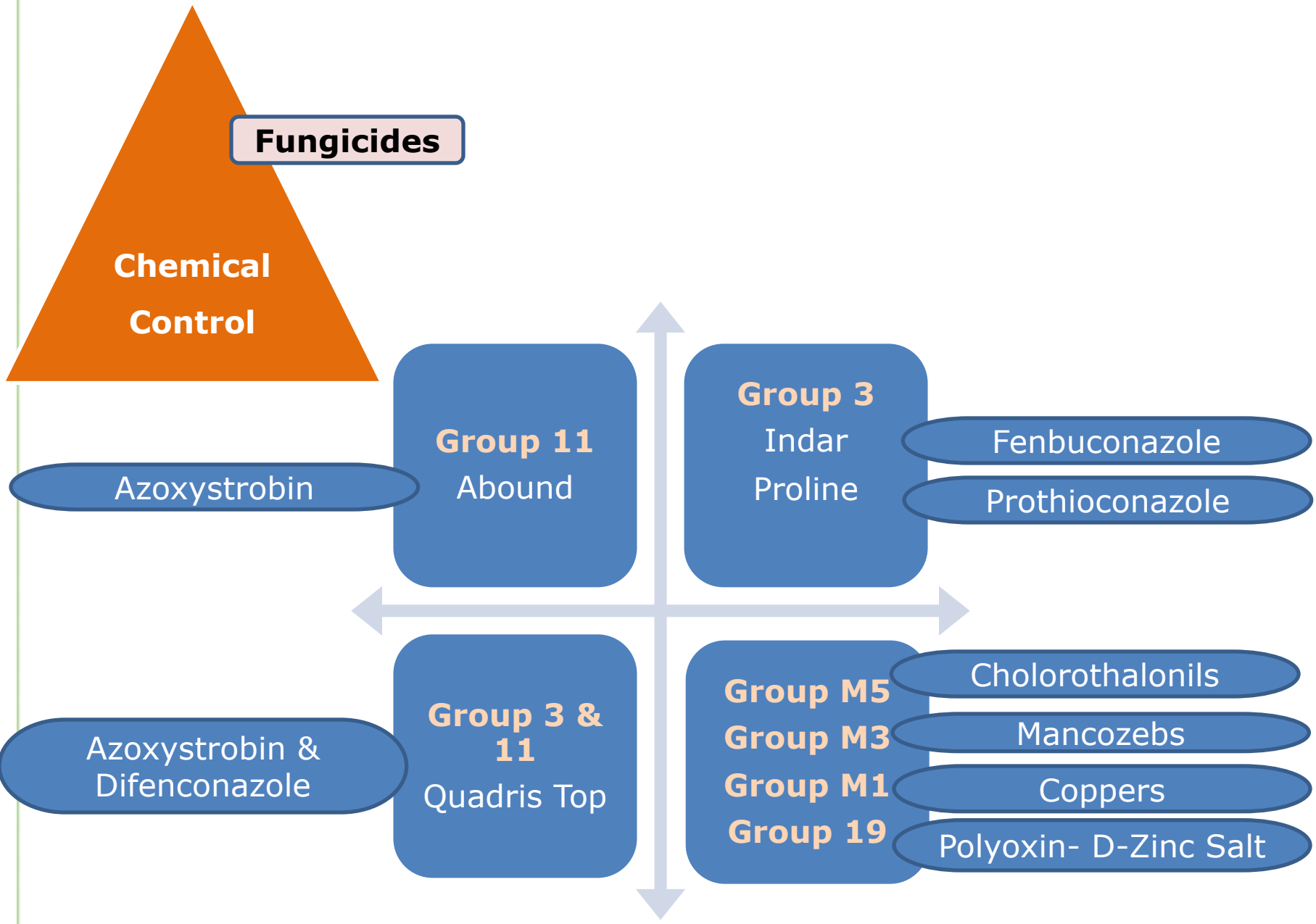
Select Resistant Varieties

For Field Rot

Stevens
Early Black
Howes
Beckwith
Black Veil
Foxboro Howes
Holliston
Paradise Meadow
Randall
Shaw's Success
Stankovich
Wilcox

For Storage Rot

Stevens
Early Black
Howes
Bergman
Black Veil
Foxboro Howes
Matthews
Paradise Meadow
Perry Red
Randall
Shaw's Success
Stankavich
Vose's Pride
Wilcox


Fungicides
Chemical Control
Group 11
Abound
Azoxystrobin
Group 3
Indar
Proline
Fenbuconazole
Prothioconazole
Group 3 & 11
Quadris Top
Azoxystrobin & Difenconazole
Group M5
Group M3
Group M1
Group 19
Cholorothalonils
Mancozebs
Coppers
Polyoxin- D-Zinc Salt

FRUIT ROT FUNGICIDE EFFICACY

	Fungicide	Trade Names	Comments
High efficacy	Chlorothalonil	Bravo, Echo, Equus, etc.	Check with handler for market restrictions.
	Mancozeb	Dithane, Manzate, Penncozeb, etc.	May delay fruit color. Efficacy comparable to chlorothalonil. Low risk of resistance. Should be used as a resistance management tool if using 'newer' fungicides (see resistance management section). Restricted by some handlers.
	Prothioconazole Fenbuconazole	Proline Indar	Moderate risk of resistance. No more than 2 applications recommended. For best results and resistance management, use during bloom and combine with azoxystrobin.
	Azoxystrobin	Abound, Satori	High risk of resistance. No more than 2 applications. For best results combine with prothioconazole or fenbuconazole.
	Polyoxin-D zinc salt	Oso and Ph-D	Moderate risk of resistance. Maximum of 3 Oso applications or 6 Ph-D applications. Limited research on efficacy of polyoxin-D fungicides in MA. For best results alternate or incorporate into a program with other fungicides for fruit rot.
Low efficacy	Ferbam, Coppers, SDHI, plant extracts	Champ, Kocide, Kenja, Regalia, etc.	Limited research on efficacy of Kenja and Regalia in MA. These products were not effective against rot in 2016 trials. It is possible that better results could be obtained if alternated with other fungicide products with higher efficacy ratings.

Success of a chemical control program depends on

- **Choice of fungicide options**
- **Number of fungicide applications**
- **Application Timings**
- **Uniform coverage**
- **Resistance managment**

Chemical Control

Fungicides

In a typical commercial setting, 3 to 5 fungicide applications are made during the growing season- resultant field rot levels range from <1-15%.

Risk

High- Moderate	Moderate	Low
4 to 5 applications	3 applications	0 to 2 applications
- High prior fruit rot incidence. - Susceptible Varieties. - Newly established bed	- Moderate fruit rot incidence. - Resistant varieties.	- Low fruit rot incidence. - Resistant varieties.

How to preserve the effectiveness and durability of registered fungicides

- Repeated and infective use leads to resistance.
- Follow all label instructions.
- **Alternate or mix fungicides** with different modes of action.

Efforts to expand our tool box:

Group 2, Group 7, Group 9 and Group 12

2019 Plant Pathology Research Highlights

1) Multi-state evaluation of Bravo alternative fungicide regimes for their effect on fruit rot, firmness, fruit color, fruit size, and yield.
2) Evaluate the effects of mancozeb fungicide application timings on fruit color, size and firmness.
3) Evaluation novel fungicides for fruit rot management
4) Studying Overwintering Sources of Pathogen Inoculum
5) Preliminary studies on the role of late water
6) Preliminary studies on the role of pruning, mowing and sanding on fruit rot incidence.
7) Determination of optimum fertilizer rates for various cultivars and their effects on fruit rot

2019 Research Studies

1) Multi-state evaluation of Bravo (Chlorothalonil) alternative fungicide regimes for their effect on fruit rot, firmness, fruit color, fruit size, and yield.
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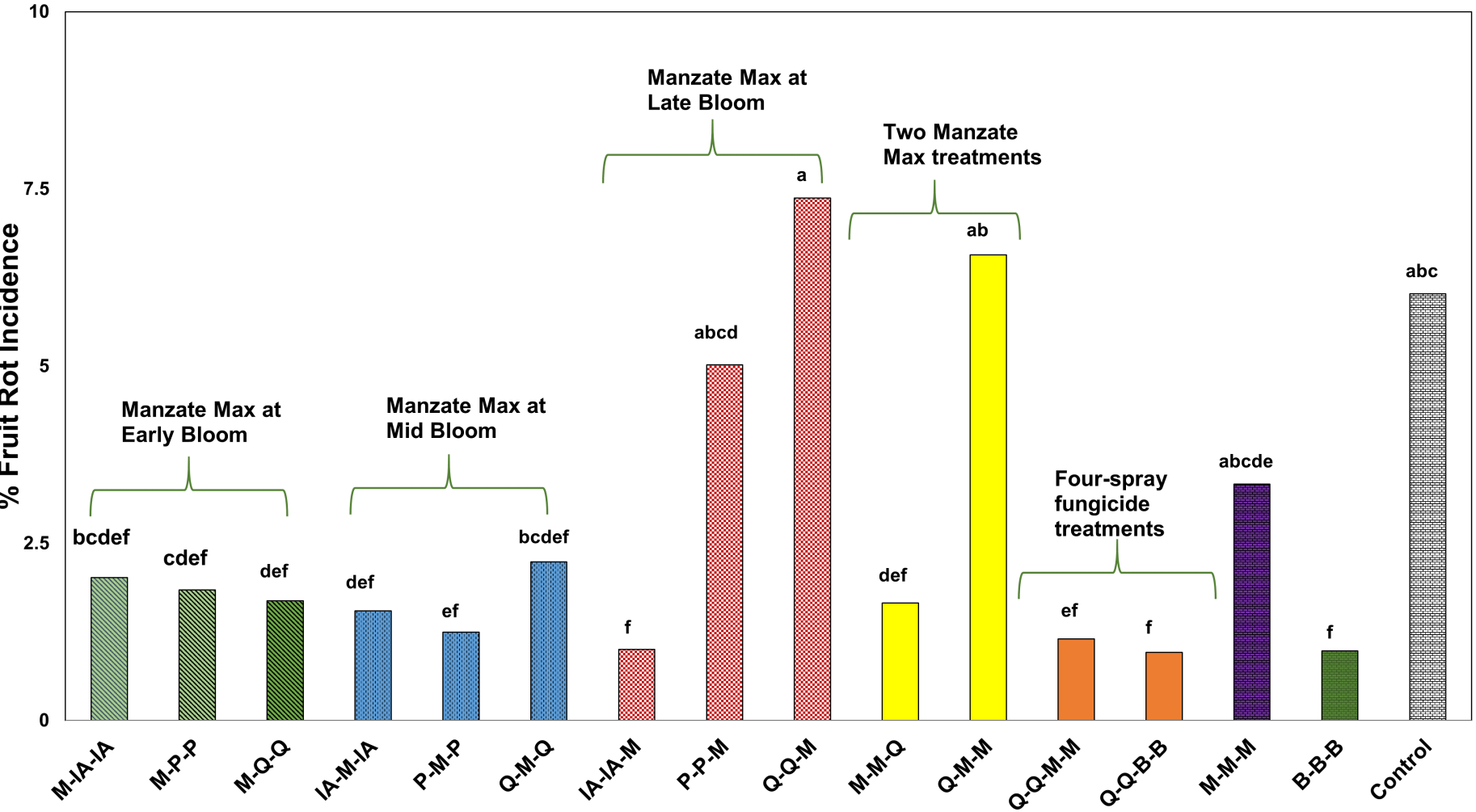
	Timing of Applications			
Treatment	Early-Bloom	Mid-Bloom	Late-Bloom	10 days after Late-Bloom application
1	ManzateMax	Indar/Abound	Indar/Abound	
2	ManzateMax	Proline	Proline	
3	ManzateMax	QuadrisTop	QuadrisTop	
4	Indar/Abound	ManzateMax	Indar/Abound	
5	Proline	ManzateMax	Proline	
6	QuadrisTop	ManzateMax	QuadrisTop	
7	Indar/Abound	Indar/Abound	ManzateMax	
8	Proline	Proline	ManzateMax	
9	QuadrisTop	QuadrisTop	ManzateMax	
10	ManzateMax	ManzateMax	QuadrisTop	
11	QuadrisTop	ManzateMax	ManzateMax	
12	QuadrisTop	QuadrisTop	ManzateMax	ManzateMax
13	QuadrisTop	QuadrisTop	Bravo Weather Stik	Bravo Weather Stik
`14	ManzateMax	ManzateMax	ManzateMax	
15. Positive Control	Bravo Weather Stik	Bravo Weather Stik	Bravo Weather Stik	
16.Non-Sprayed Control	-	-	-	-

Conducted in collaboration with

- Dr. Erika Saalau Rojas and Dr. Lindsay Wells-Hansen (Ocean Spray).
- Dr. Peter Oudemans (Rutgers University)

Figure 1: Effect of various fungicide regimes on % fruit rot incidence



Conclusions

- Among the three-spray fungicide regimes, late bloom application of ManzateMax is not ideal for fruit rot management.
- Four-spray fungicide regimes applied at Ealrybloom-Midbloom-Latebloom-10 days after late bloom stages did not result in any further statistical reduction of fruit rot compared to the effective three-spray fungicide regimes.

Conclusions

- **Yield** data did not differ significantly among various fungicide regimes.
- **Weight per berry** data did not differ significantly among various fungicide regimes.
- **Total Anthocyanin Content** data did not differ among the fungicide regimes.
- **Berry firmness values** did not differ among the fungicide regimes.

2019 Research Studies

1) Multi-state evaluation of Bravo alternative fungicide regimes for their effect on fruit rot, firmness, fruit color, fruit size, and yield.
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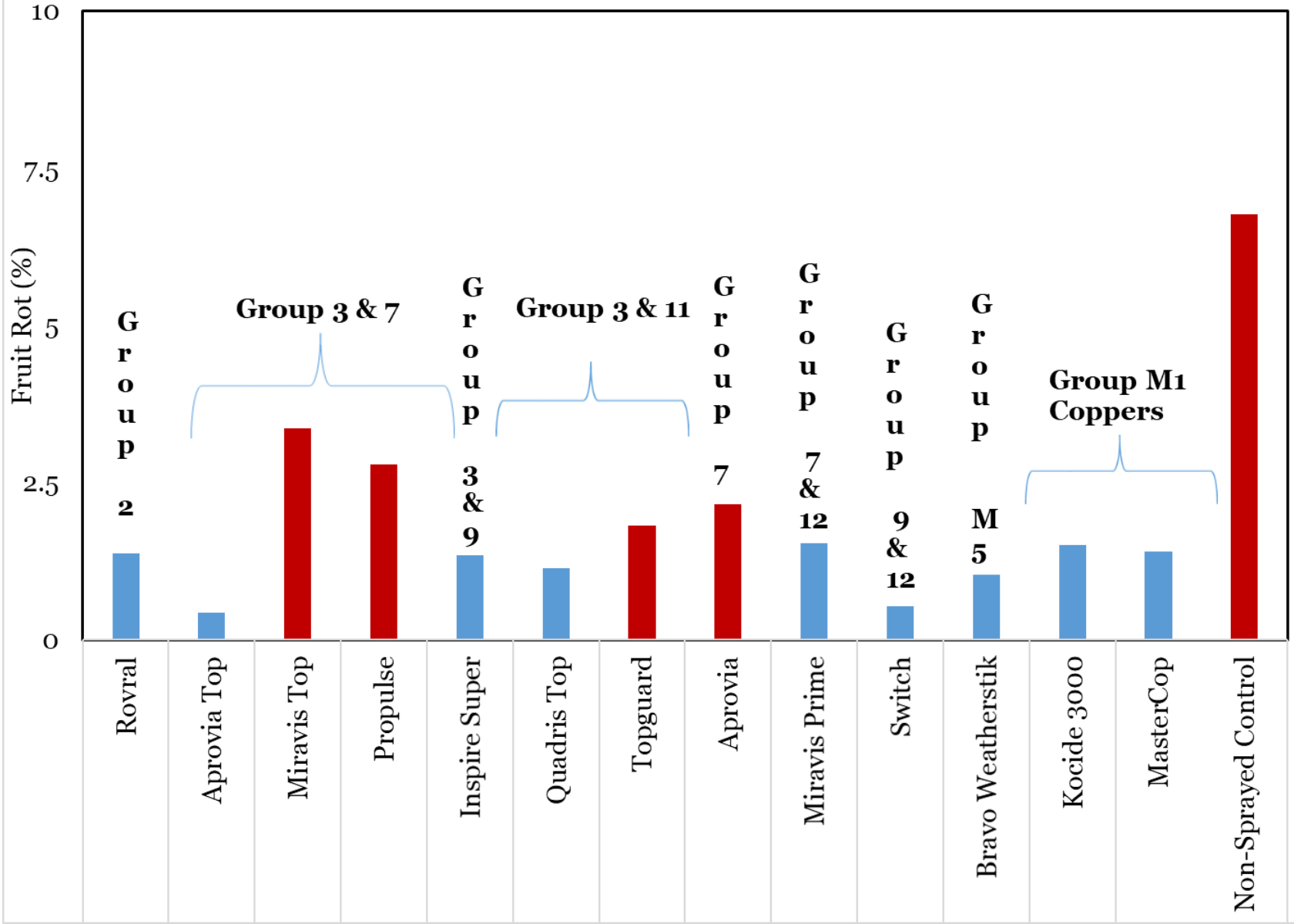
Evaluation novel fungicides for fruit rot management



Evaluation novel fungicides for fruit rot management

- Except MiravisTop, Propulse, TopGuard and Aprovia, all other fungicide treatments consistently resulted in lower fruit rot compared to the non-sprayed control.
- **Yield** data did not differ significantly among the fungicides evaluated.
- **Weight per berry** data did not differ significantly among the fungicides evaluated.
- **Berry firmness values** did not differ among the fungicides evaluated

2019 Research Studies

1) Multi-state evaluation of Bravo alternative fungicide regimes for their effect on fruit rot, firmness, fruit color, fruit size, and yield.
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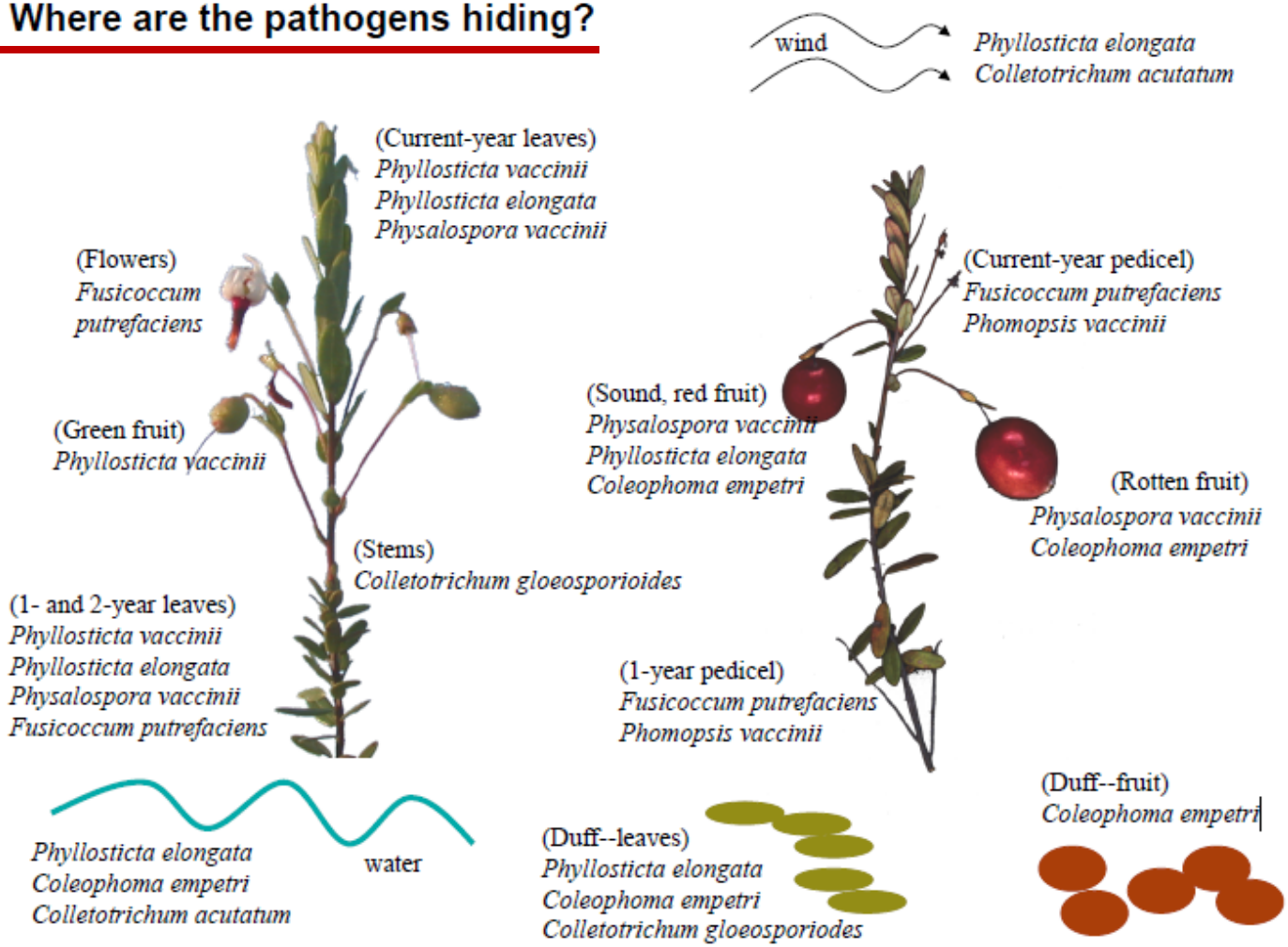
Investigation of Potential Sources of Overwintering Inoculum for Fruit Rot

- At present, there is no research literature on the sources of overwintering for fruit rot inoculum.
- We hypothesized that fungal pathogens survive in detached host structures (leaves, stems, rotted berries) or debris left near the bogs after harvest (called trash piles), and then serve as inoculum for fruit rot.
- Debris (fruits, uprights and leaves) from 9 different bogs left on the bog and within 100 ft from the bog (from trash piles) were studied for fruit rot fungi

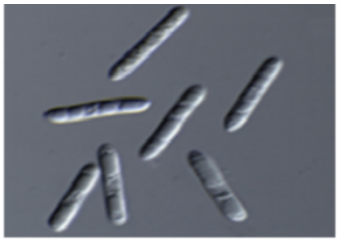
Studying Overwintering Sources of Pathogen Inoculum

Where are the pathogens hiding?

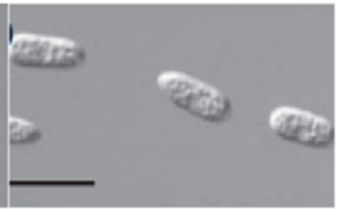


Conidia of Cranberry Fruit Rot Fungi

Allantophomopsis spp.

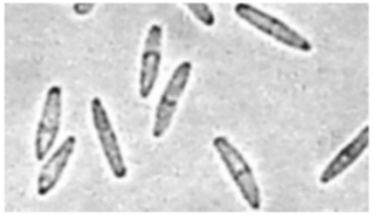


Coleophoma empetri

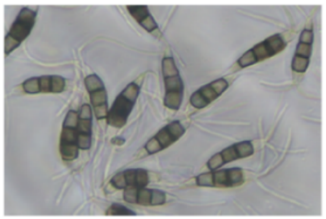


Colletotrichum spp.

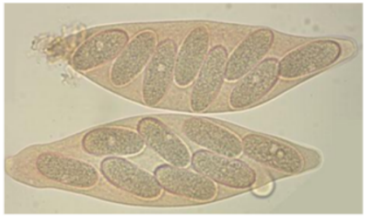
Epicoccum spp.



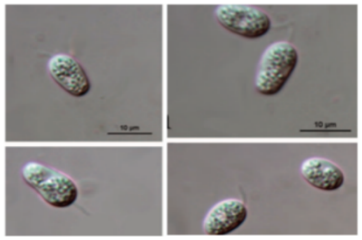
Fusicoccum putrefaciens



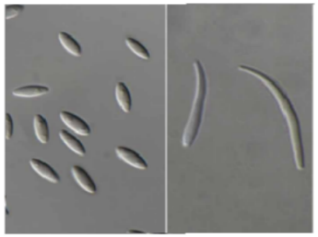
Pestalotia vaccinii



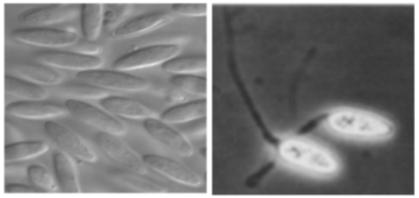
Physalospora vaccinii



Phyllosticta vaccinii



Phomopsis vaccinii



Botryosphaeria vaccinii &
Phyllosticta elongata

Results

- Prevalence and distribution of fruit rot pathogens differed among the bogs and tissue samples.
- Except for *Epicoccum* spp. and *Phyllosticta vaccinii* all other pathogens were more prevalent in Berries followed by uprights. Percent positive samples were low among leaf samples.
- *Phyllosticta vaccinii* is more prevalent in uprights followed by berries then in leaves.
- Very few samples presented *Epicoccum* spores.
- Results indicate the importance of post-harvest cleaning of the debris from cranberry bogs and surrounding areas as they could serve as over wintering sources for fruit rot inoculum.

Reduce Overwintering sources of fruit rot inoculum – Trash Removal

- Remove trash from water harvested beds during harvest or as soon after as possible
- If beds are dry harvested – remove trash with a post-harvest flood in the fall or from the winter flood before it is withdrawn
- Trash piles should not be left next to the bed – should be moved at least a quarter mile away.

2019 Research Studies

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2019 late water studies

- 6 late water held, grower bogs were monitored from bloom to harvest.
- Late water beds were treated the same as control beds except for one month flood from mid April-mid May.
- In all late water held beds, bloom got synchronized.
- Fruit rot results were variable.
- Yield reductions were observed at three sites.
- Application of full rate fertilizers might have contributed to excess vegetative growth and yield reductions.
- Planning on including more sites and controlled studies in the upcoming growing seasons.
- Pursuing funding sources to develop a late water decision making model that could predict ideal cropping seasons or conditions for holding late water.

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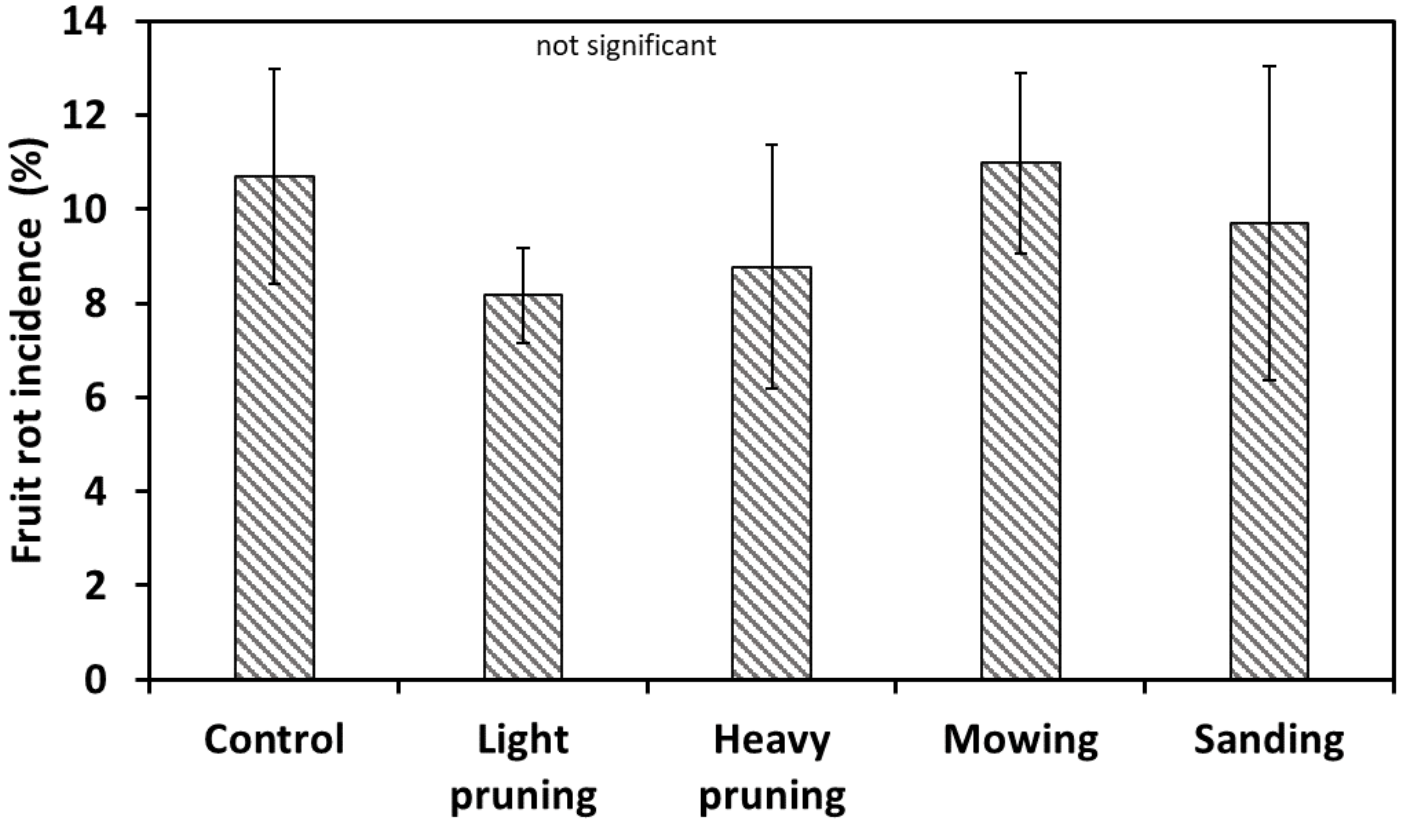
6. Canopy management studies- Effect of pruning, mowing and sanding on fruit rot in cranberry



PI: Dr. Giverson Mupambi.

Conclusions

- Fruit rot incidence was not affected by canopy management treatments.
- Yield got reduced- due to reduced flowering uprights.
- Fruit quality parameters got improved.
- Planning to conduct these studies at multiple locations in the coming cropping seasons.

2019 Research Studies

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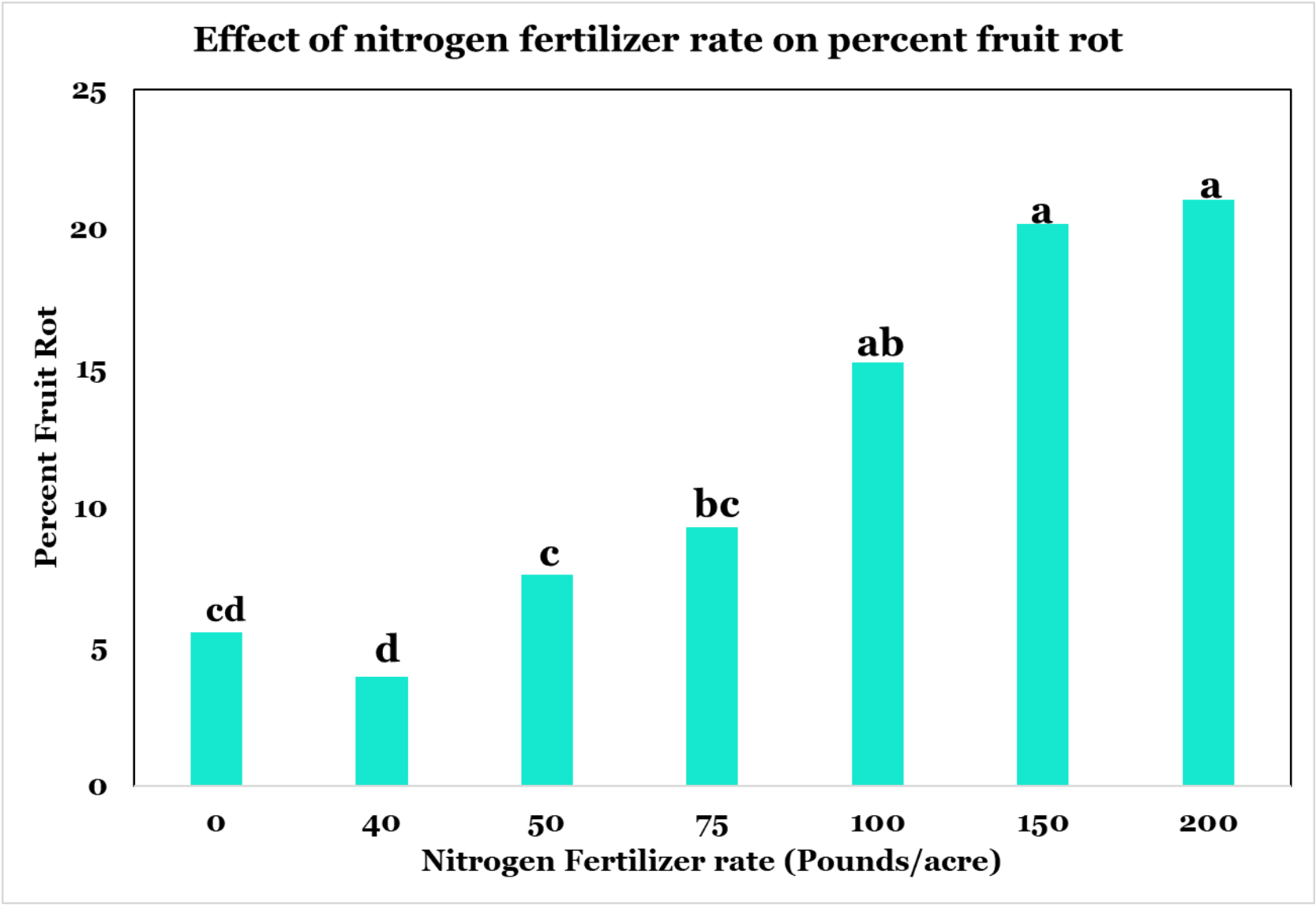
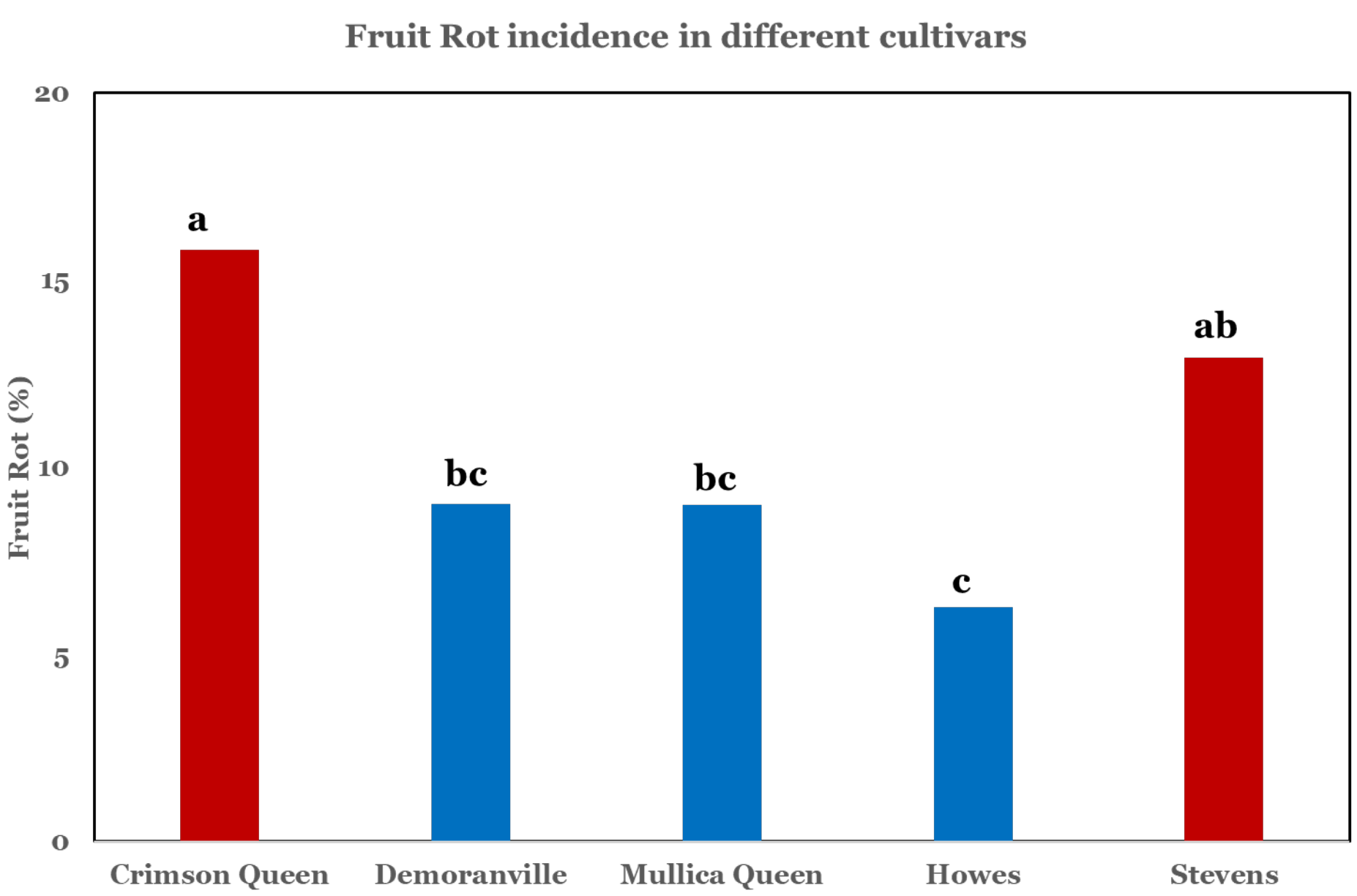


PI: Dr. Peter Jeranyama


Fruit Rot incidence in different cultivars
Fruit Rot (%)
20
15
10
5
0
a
bc
bc
c
ab
Crimson Queen
Demoranville
Mullica Queen
Howes
Stevens

Summary

1 & 2. Among the various Bravo (Chlorothalonil) alternative fungicide regimes evaluated, late bloom application of ManzateMax is not ideal for fruit rot management.

Four-spray fungicide regimes did not result in any further statistical reduction of fruit rot compared to the effective three-spray fungicide regimes.

Yield, fruit color, firmness and fruit size did not differ among the various fungicide regimes evaluated.

3. Among the 11 new (9 unregistered and 2 coppers) fungicides evaluated for fruit rot management, 7 (5 unregistered and 2 coppers) consistently showed efficacy in reducing fruit rot compared to non-sprayed control.

4. Results of the fruit rot overwintering sources investigation indicate the importance of post-harvest cleaning of the debris from cranberry bogs and surrounding areas as they could serve as over wintering sources for fruit rot inoculum.

Summary

5 & 6. Preliminary studies on late water and canopy management gave variable results. They will be pursued further in multiple locations for better understanding of their role in fruit rot management and fruit quality improvement.

- Possibility of developing a Late Water decision making model is being pursued.

7. Increased N-fertilizer rates correlated with increased fruit rot incidence.


Thank You
HOLLISTER
HIGH 'N DRY