Downy mildew and black rot management reminder *plus* Research updates: Grape Path, Plant Disease Clinic, Sentinel Vineyards, and Cultivar Trial

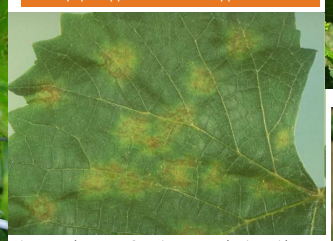
Mizuho Nita
Tremain Hatch
Lina Rodriguez Salamanca
Beth Chang
Dana Acimovic

VIRGINIA TECH

Downy Mildew

- It can infect leaves and berries, berry infection can cause serious damage
- Heavy leaf infection can cause defoliation

Oily spot appearance on the upper surface



Picture on the center: Organic grape production guide: OSU, Ellis and Nita 2004

Downy Mildew Disease Cycle

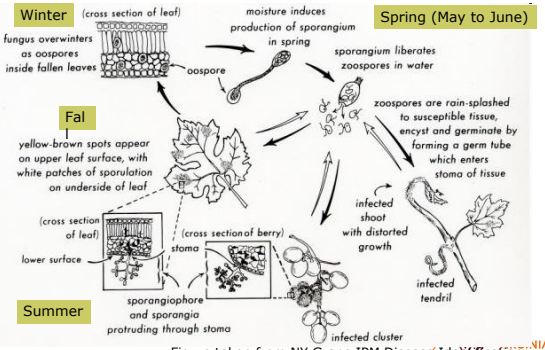
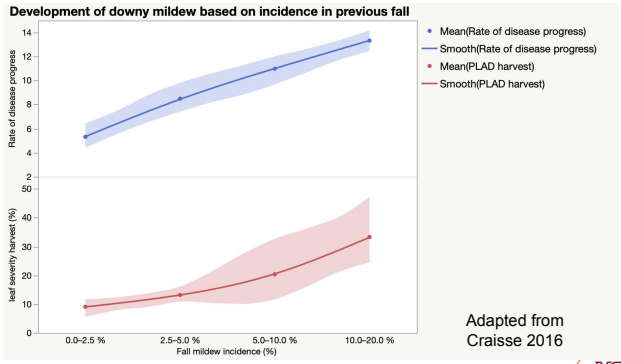


Figure taken from NY Grape IPM Disease Identification Sheet

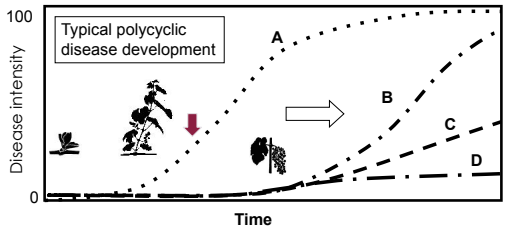
Level of downy mildew in the previous fall will impact next year.



Adapted from Craisse 2016

VIRGINIA TECH

We cannot eliminate grape diseases, but we can manage by protecting healthy tissues.



- Line A: a disease development without any management strategies.
- Idea of disease management is to increase the lag period to the point that the development of the disease is not economically significant (lines B and C).
- In the case of berry protection for BR, PM and DM, you can push the lag period to the point when the berries become resistant, then you could suppress these diseases on berries to the end of the season (line D)

The grape downy mildew pathogen is active from the beginning of the season

- Overwintering Oospore become active at ~160 Degree Days with base temperature of 8C, and remain active for 30-60 days (Rouzet and Jacquin 2003).
  - It reaches by mid-April in Winchester, and another study indicated oospores can ready before the threshold.
  - Some refer to the three-tens rule, 10 cm shoots, 10 mm rain, and 10 C in temperature (4 in, 0.4 in, and 50F) for the initial spray timing, which basically means that we need to spray soon after bud break for us.
- A single infection event can result in an outbreak (Gobbin, et al 2027)
- = Need to protect growing shoots.
- Keep your eyes on warm and humid nights (>60F, 80-90%) that promote spore production (e.g., 2009, 2013, 2018…)

Provide protection against downy mildew throughout the season.

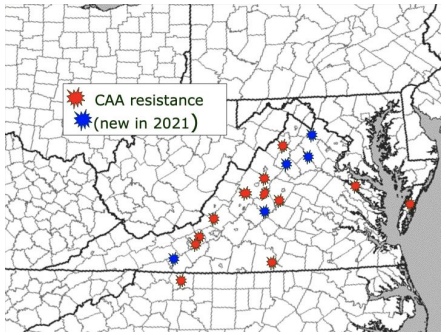
- Critical time runs ~4-6 weeks from bloom, protect the cluster.
- After critical time: Clusters become resistant; however, leaves remain susceptible to the infection!
- **Canopy management is critical**
- You may need to change your spray plan based on cultivars
  - e.g., Chardonnay vs Chardonel

Downy Mildew
Timing: all season
Clusters are susceptible from bloom to 4-6 wks after bloom

- Preventative fungicide application
  - Mancozeb, ziram (Dithane, Penncozeb, Gavel, etc. Group M3), , captan (Group M4), copper (Group M1), Ranman (Group 21), **Revus/Forum (Group 40 - resistance)**, Zampro (Group **40** + 45)
  - Lifeguard and Zonix (defense activator) - inconsistent reports, please use them with a caution (can be a good rotation or tank mix partner)
- Curative fungicide application (after the rain, not after you see downy!)
  - Phosphonate (Prophyt, Phostrol, etc. Group P07 (used to be 33)), Ridomil products (Group 4), Tanos (Group 11 + 27) note: we did not find a good result with Tanos in VA), Tanos need a mixing partner
  - QoI fungicides (Flint, Sovran, Abound, etc.) are no longer effective in VA.

Group 40 (Revus, Forum, and part of Zampro)

- Dr Anton Baudoin's lab has been tracking resistance isolate against dimethomorph (the a.i of Revus), and results are not promising…
- If you suspect that Revus is not working for you, it is better not purchase in the future.
- Ues it as **protectant** and **mix** with captan, mancozeb, or copper.



Black rot

- It is a fungal disease caused by *Guignardia bidwellii (= Phyllosticta ampelicida)*
- The fungus produces two types of spores: ascospores (airborne and rain splashed) early in the season and conidia (rain splashed) in later.
- It can infect leaves and berries, berry infection can cause serious damage

Black Rot Disease Cycle

(Polycyclic cycle = multiple disease cycle due to new spore production in the same season)

Summer

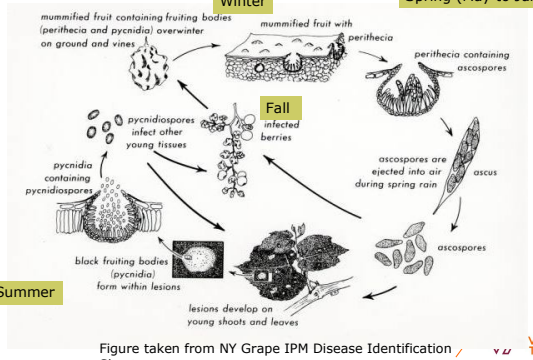


Figure taken from NY Grape IPM Disease Identification Sheet

Black Rot Infection Conditions

Temperature in °F	Temperature in °C	Minimum Leaf Wetness Duration (hr) for Light Infection
50	10	24
55	13	12
60	16	9
65	18	8
70	21	7
75	24	7
80	27	6
85	29	9
90	32	12

- Data represent a compilation from several experiments with the cultivars Concord, Catawba, Aurora, and Baco noir (Ellis et al., 1989, Spotts 1980 etc)
- Leafwetness is the period when leaves are wet (moist). It is not the same as the duration of rain.

Black Rot: Cultural Management

- Sanitation by removing old bunches from the vines
  - The fungus survives in crop debris, hanging berries from the last year is known to be the best source of inoculum.
  - Plus, these berries will produce airborne spores (ascospores) too.
- Good air circulation

- All wine grape varieties are susceptible to black rot
- No strong biological management options

VIRGINIA TECH.

Black rot management, Timing of fungicide application

- Berries become resistant (ontogenic resistance) after a certain period.
- The critical timing of protection (i.e., infection) is from bloom to 5-7 weeks after bloom (probably 2-3 sprays)
  - 3-4 weeks for American and hybrid cultivars
- Once infection takes place, it takes about 2 weeks to produce spores at an average temperature above 70F (21C)
  - takes about 3 weeks at 60F (15C)

VIRGINIA TECH.

Black rot Timing: Clusters are susceptible from bloom to 4-5 wks after bloom

- Preventative fungicide options
  - Mancozeb, Sterol-inhibitors (DMI: Rally, Mettle, Rhyme, Luna Exp., Top Guard EQ, etc., Group 3), Strobilurins (QoI, Pristine, Abound, Flint, Intuity, Group 11), SDHI (Pristine, Luna Experience, Aprovia, Kenja, Miravis Prime, etc. Group 7)
  - **Note: Captan and copper do not work against black rot**
  - **Group 3 may have resistance issue (please contact me)**
- Curative fungicide options
  - Myclobutanil (Rally) is known to have a good curative (kick-back) activity against black rot fungus. It has an efficacy up to 6 days after infection.
  - Azoxystrobin (Abound) does have some curative activity against black rot fungus; however, the efficacy is not as good as that of myclobutanil.

VIRGINIA TECH.

Research updates: K-9 project

TEXAS TECH UNIVERSITY SYSTEM

VIRGINIA AGRICULTURAL RESEARCH AND EXTENSION CENTERS

Evaluating Spotted Lanternfly (Lycorma delicatula) detection dog Capability and Limits of detection.

USDA

USDA/ AFRI program

16

APPLIED ANIMAL BEHAVIOR

Edgar O. Aviles-Rosa, PhD
Nathaniel J. Hall, PhD
Erica Feuerbacher, PhD
Mizuho Nita, PhD

VIRGINIA TECH.

Evaluate dogs' capability to detect and discriminate SLF egg from different environmental distractors and to quantify their limits of detection

Study 1: Evaluating Training progression

N = 7

Training Phases
1. Initial training
2. SLF eggs
3. Bark
4. BMSB
5. Different sources
6. SLF Eggs on bark
7. Cricket and bark
8. Grasshoppers
9. Validation

Olfactometer

17

VIRGINIA TECH

Dogs can detect SLF eggs with high sensitivity and specificity.

Study 1: Conclusions

- ✓ Dogs can readily detect SLF eggs
  - ✓ Sensitivity and specificity > 95 %
- ✓ Relevant distractors

2022 update

- We will be working with "Nosework" group to have a training session(s) in VA.
- https://www.nacsw.net/
- The schedule will be posted on my blog

18

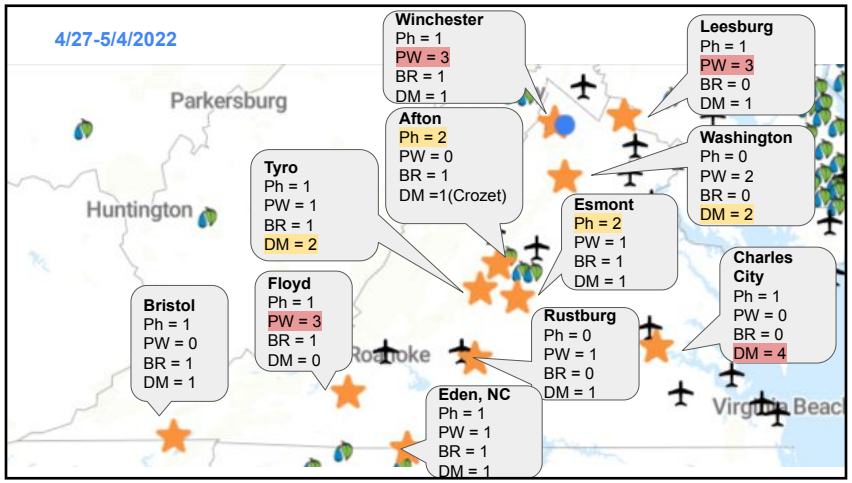
VIRGINIA TECH

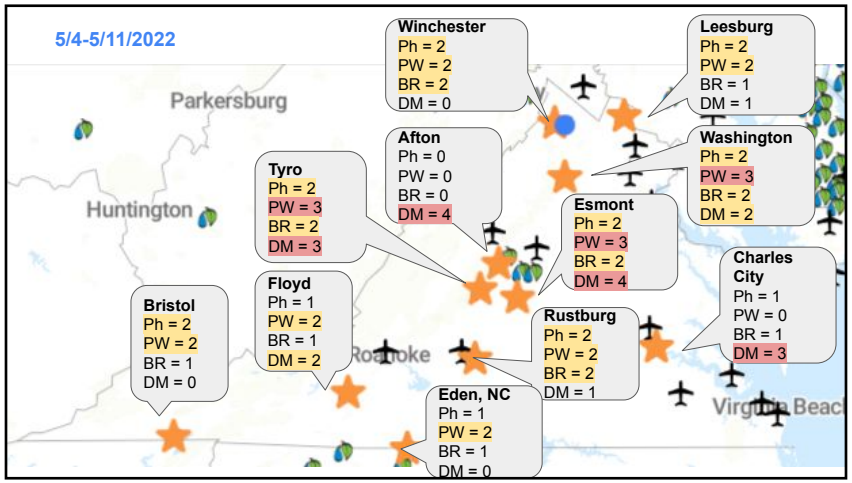
Sentinel vineyard concept

- Our effort to provide informative seasonal updates to growers by collaborating with experienced growers throughout the state.
  - A snapshot of the season
- We have ~ 20 participants as the core group who contribute monthly to report viticulture and enology related information on two target cultivars, Chardonnay and Cabernet Franc.
  - Growth stage, pests and diseases, harvest parameter, frost, etc.
- Information has been delivered through our extension outlets
  - Monthly viticulture meetings, Viticulture notes, Mizuho's blog, Beth's web page, *plus* seasonal newsletter

NEWA weather station

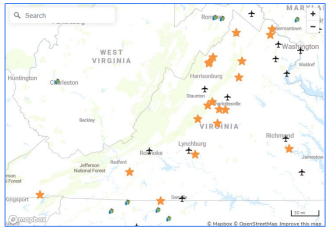
- As a compensation to the time and effort the core group members, we are installing weather station that are compatible with the NEWA, Cornell University's Ag-weather network.
- So far we have added eleven, and three more this year.
  - The total will be 14 in 2023.

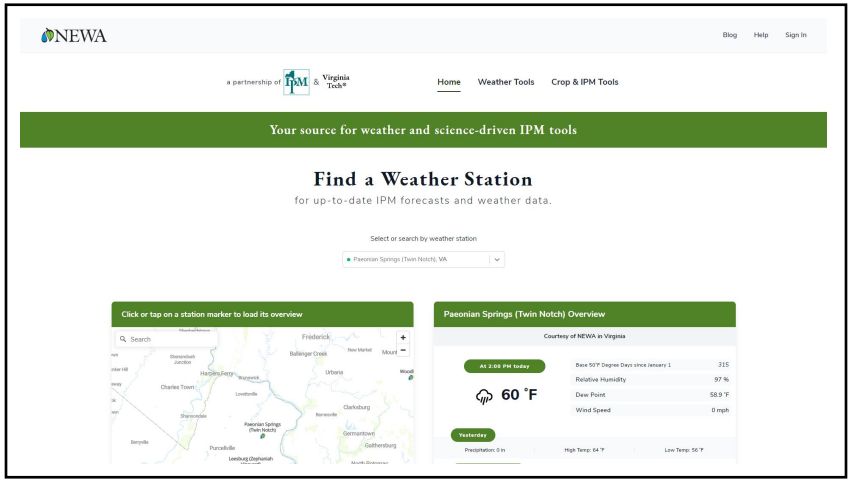


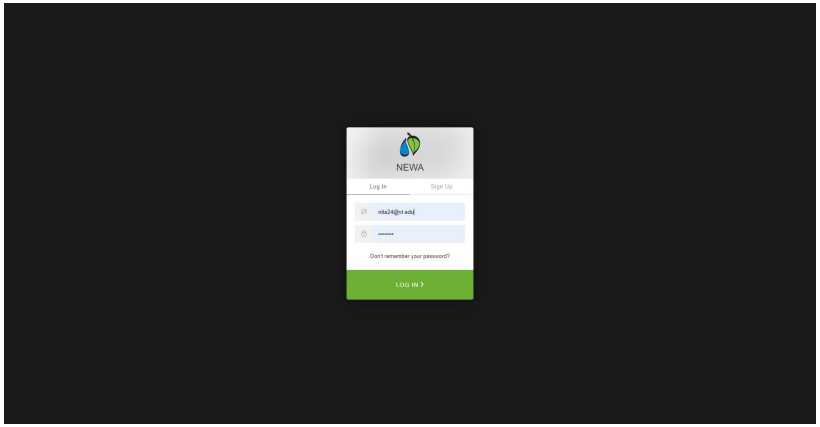


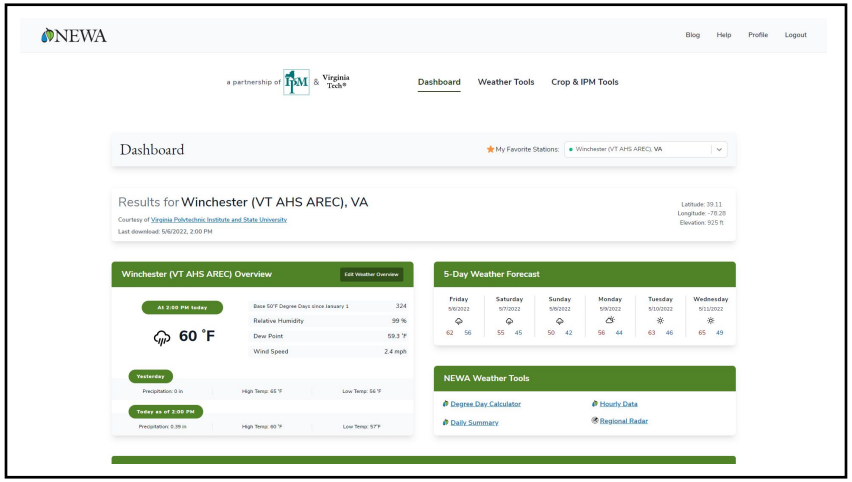
A quick introduction to NEWA

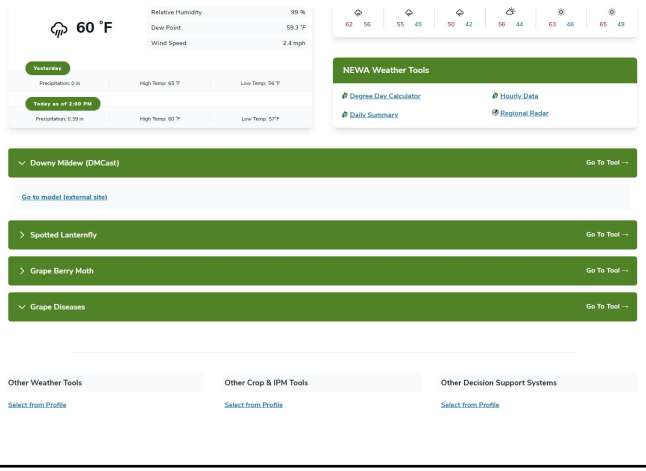
- NEWA provides weather information related to agriculture
  - Temperature, relative humidity, leaf wetness, precipitation, wind, and solar
- Currently we have 18 stations in Virginia
- It is “Free” for growers in Virginia
  - My program is contributing the annual fee
- They changed the interface in 2021, and now you have to create an account
  - The only information you need to submit is your email.

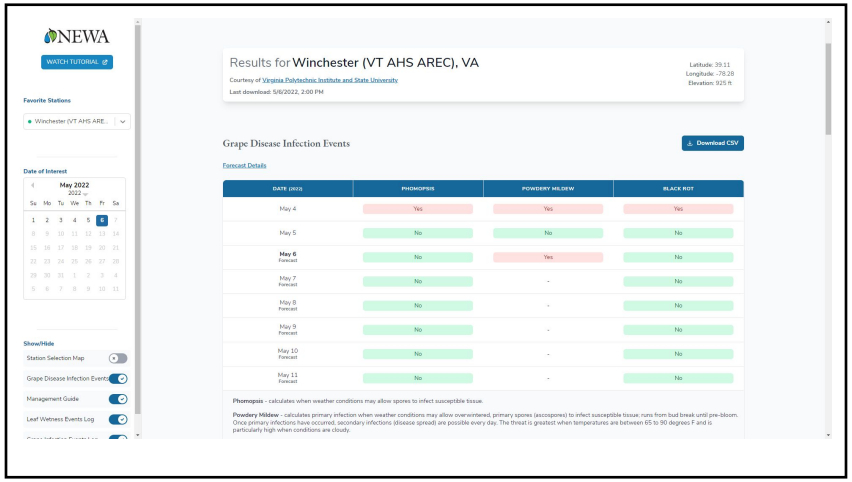


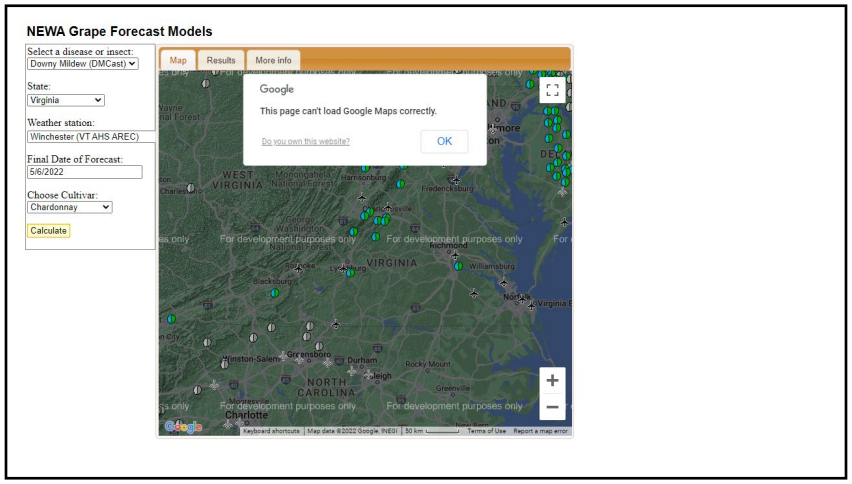


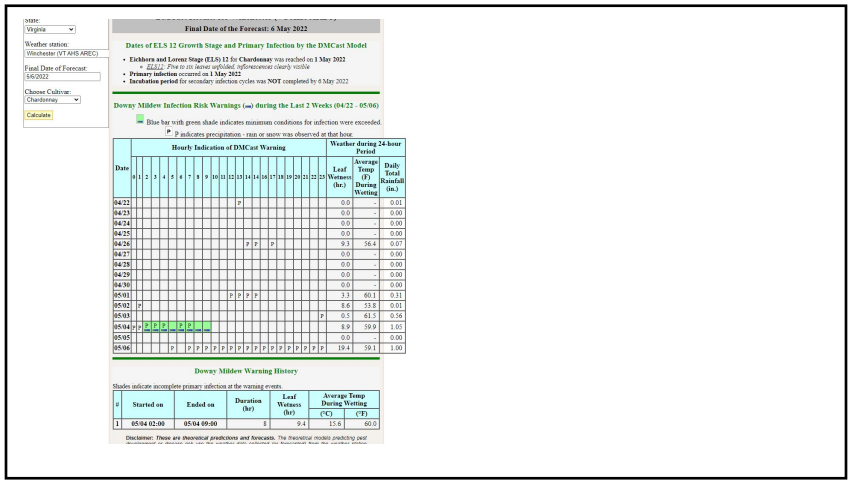

NEWA
Log In
Sign Up
Don't remember your password?
LOG IN


NEWA
Blog
Help
Profile
Logout
a partnership of
Virginia Tech
Dashboard
Weather Tools
Crop & IPM Tools
Dashboard
My Favorite Stations:
Winchester (VT AHS AREC), VA
Results for Winchester (VT AHS AREC), VA
Courtesy of Virginia Polytechnic Institute and State University
Last download: 5/6/2022, 2:00 PM
Latitude: 39.11
Longitude: -78.28
Elevation: 925 ft
Winchester (VT AHS AREC) Overview
Edit Weather Overview
At 2:00 PM today
60 °F
Base 50°F Degree Days since January 1 324
Relative Humidity 99 %
Dew Point 59.3 °F
Wind Speed 2.4 mph
Yesterday
Precipitation: 0 in
High Temp: 65 °F
Low Temp: 56 °F
Today as of 2:00 PM
Precipitation: 0.39 in
High Temp: 60 °F
Low Temp: 57°F
5-Day Weather Forecast
Friday 5/6/2022 62 56
Saturday 5/7/2022 55 45
Sunday 5/8/2022 50 42
Monday 5/9/2022 56 44
Tuesday 5/10/2022 63 46
Wednesday 5/11/2022 65 49
NEWA Weather Tools
Degree Day Calculator
Hourly Data
Daily Summary
Regional Radar


60 °F
Relative Humidity 99 %
Dew Point 59.3 °F
Wind Speed 2.4 mph
Yesterday
Precipitation: 0 in
High Temp: 65 °F
Low Temp: 56 °F
Today as of 2:00 PM
Precipitation: 0.39 in
High Temp: 60 °F
Low Temp: 57°F
62 56
55 45
50 42
56 44
63 46
65 49
NEWA Weather Tools
Degree Day Calculator
Hourly Data
Daily Summary
Regional Radar
Downy Mildew (DMCast)
Go To Tool →
Go to model (external site)
Spotted Lanternfly
Go To Tool →
Grape Berry Moth
Go To Tool →
Grape Diseases
Go To Tool →
Other Weather Tools
Select from Profile
Other Crop & IPM Tools
Select from Profile
Other Decision Support Systems
Select from Profile


NEWA
WATCH TUTORIAL
Favorite Stations
Winchester (VT AHS ARE...
Date of Interest
May 2022
2022
Show/Hide
Station Selection Map
Grape Disease Infection Events
Management Guide
Leaf Wetness Events Log
Results for Winchester (VT AHS AREC), VA
Courtesy of Virginia Polytechnic Institute and State University
Last download: 5/6/2022, 2:00 PM
Latitude: 39.11
Longitude: -78.28
Elevation: 925 ft
Grape Disease Infection Events
Download CSV
Forecast Details
DATE (2022)
PHOMOPSIS
POWDERY MILDEW
BLACK ROT
May 4 Yes Yes Yes
May 5 No No No
May 6 Forecast No Yes No
May 7 Forecast No - No
May 8 Forecast No - No
May 9 Forecast No - No
May 10 Forecast No - No
May 11 Forecast No - No
Phomopsis - calculates when weather conditions may allow spores to infect susceptible tissue.
Powdery Mildew - calculates primary infection when weather conditions may allow overwintered, primary spores (ascospores) to infect susceptible tissue; runs from bud break until pre-bloom. Once primary infections have occurred, secondary infections (disease spread) are possible every day. The threat is greatest when temperatures are between 65 to 90 degrees F and is particularly high when conditions are cloudy.





Sentinel Vineyard, phase II

- Phase I focused on establishment of partnership, deployment of weather station, and development of workflow to deliver information in timely manner
- Phase II will focus more on harvest parameters and more enology-related topics

Crown gall research

We validated that a new biological control strain, ARK-1:

- inhibits gall formation against the US isolates,
- is effective against upto four times higher cell number
- performs better when applied as preventatively, but have some effect if you apply within 24 hours.

Crown gall research: what's new

- Method of application
  - Spray, soil drench, root soak, and at grafting wound protection
  - So far root soak is most promising, but need more experiments.
- We are developed a method to track where ARK-1 and the pathogen stays after inoculation.
  - Help us to identify how and when to apply ARK-1
- Obtained VAR03-1, which is another biological strain.

Mr. Mahadi Redoy joined our lab in January to pursue his Ph.D. degree.

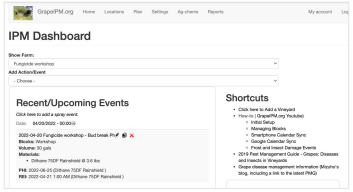
Ripe rot research

- We have identified we need to protect clusters from bloom to harvest…
- Found a few conventional materials that provide some level of protection (more on that later).
- Our focus right now is to find alternative materials that can assist spray programs.
  - Biological agents
  - Plant defense activators
  - Nutrients

Mr. Manoj Subedi joined our lab in January to pursue his MS degree.

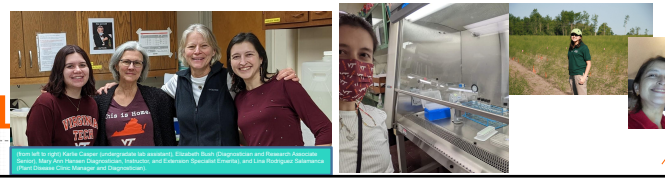
GrapeIPM.org

- More than 200 users with 22K pageviews in 2022.
- We believe we added nearly all functions that we planned to have and workflows within the app have been improved.
- We will have training session on 4/1 and 4/7.



Lina Rodriguez Salamanca

- Plant pathologist (M.S. and Ph.D)
  - Vegetable and ornamental plants
- MSUE commercial vegetable educator for ~ 2 years
- Extension Plant Pathologist- Iowa State University 7 years. Ornamental and Horticulture Diagnostician
- Instructor, Manager & Diagnostician, Virginia Tech |Plant Disease Clinic ~5 months



(from left to right) Karli Casper (undergraduate lab assistant), Elizabeth Bush (Diagnostician and Research Associate Senior), Mary Ann Hansen (Diagnostician, Instructor, and Extension Specialist Emerita), and Lina Rodriguez Salamanca (Plant Disease Clinic Manager and Diagnostician)

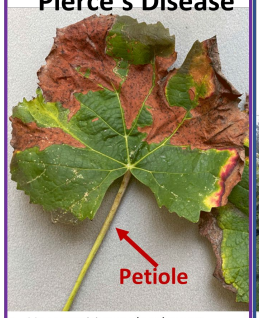
NPDN NATIONAL PLANT DIAGNOSTIC NETWORK

Plant Disease Clinic

Sample fee $35, contact VCE County office or clinic@vt.edu

SPDN SOUTHERN PLANT DIAGNOSTIC NETWORK

Pierce's Disease



- Very sensitive molecular test
- Need 1 dozen leaves with petioles to diagnose
- Submit late summer/early fall

Trunk Diseases

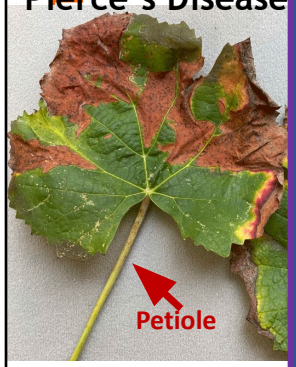
- ~10" to 12" sections
- Main root/crown, Graft union, Trunk, Cordons

Fungal Diseases

"symptoms alone can be deceiving, test don't guess"

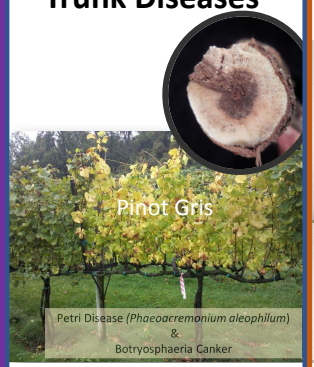
VIRGINIA TECH.

Pierce's Disease



- Very sensitive molecular test
- Need 1 dozen leaves with petioles to diagnose
- Submit late summer/early fall

Trunk Diseases



- ~10" to 12" sections
- Main root/crown, Graft union, Trunk, Cordons

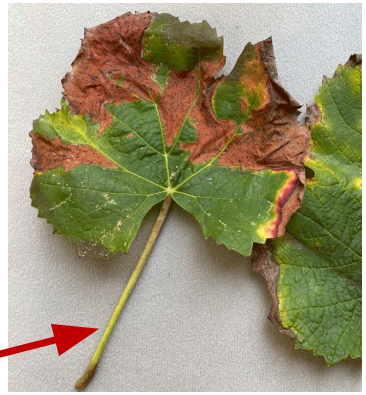
Fungal Diseases

"symptoms alone can be deceiving, test don't guess"

VIRGINIA TECH.

Pierce's Disease

- Very sensitive molecular test
- Need 1 dozen leaves with petioles to diagnose
- Submit late summer/early fall



VIRGINIA TECH.

Trunk Diseases Best Sample

- ~10" to 12" sections
- Main root/crown
- Graft union
- Trunk
- Cordons

Petri Disease *(Phaeoacremonium aleophilum)*
&
Botryosphaeria Canker

VIRGINIA TECH.

Various Fungal Diseases

VIRGINIA TECH