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Fungicide Spray Guidelines for Non-bearing Vineyards

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Introduction

The approach to non-bearing vines is different from baring vines because you do not need to protect berries. Also, some diseases such as Phomopsis cane and leaf blight tend to appear in the vineyards that are established for several years. This guide intends to provide examples to aid in building your spray program.

For vineyards in Virginia, we have to deal with multiple diseases due to our environmental conditions. The development of diseases depends on vineyard history, cultivar, proximity to the existing vineyards and wild grapes, weather conditions, and other factors. Thus, you need to adjust your spray program to account for all of these conditions. For example, I need to protect vines from powdery mildew for my Chardonnay vineyard from nearly the beginning to the end. Still, with my Cabernet Sauvignon vineyard, located less than 100 feet away, I can skip some powdery mildew sprays.

Fungicides Used in this Guide

In this guide, mancozeb, captan, sulfur, and fixed copper are used as a backbone of the spray program. The reason is that these products work well and very cost-effective. There are other very effective fungicides; however, for 1st- and 2nd-year vines, you should be able to protect vines without extensive use of many materials.

There are many different products available on mancozeb, sulfur, and copper. The product's rate depends on what the label suggests, so please make sure to read the label, which is a legal document.

Option A

This is probably the most commonly used approach.

1. Mancozeb, such as Dithane, Penncozeb, etc., FRAC = M3
2. Sulfur, such as Microthiol, liquid sulfur, etc., FRAC = M2
3. Fixed copper: newer formulations, such as Kocide and Cueva, are probably easier to use (have a lower risk of causing phototoxicity), FRAC = M1
4. Phosphorous acid such as Prophyt and Phostrol, FRAC = P07 (I will refer to it as "phosphonate" in this guide.)
5. DMI (De-methylation Inhibitor) fungicide such as Rally, tebuconazole, Mettle, etc., FRAC = 3

Option B

In this option, mancozeb is not used.

1. Captan, FRAC = M3
2. Fixed copper, FRAC = M1
3. Sulfur, FRAC = M2
4. Phosphonate such as Prophyt and Phostrol, FRAC = P07
5. ~~A~~ DMI (De-methylation Inhibitor) fungicide such as Rally, tebuconazole, Mettle, etc., FRAC = 3

Option C

In this potion, sulfur is not used.

1. Mancozeb, FRAC = M4
2. Fixed copper, FRAC = M1
3. Phosphonate such as Prophyt and Phostrol, FRAC = P07
4. DMI (De-methylation Inhibitor) fungicide such as Rally, tebuconazole, Mettle, etc., FRAC = 3.
5. JMS stylet oil, FRAC = M (cannot use it within two weeks of captan or sulfur spray)

These 4 to 5 materials will get you through the season. Mancozeb, captan, and fixed copper are broad-spectrum fungicides that are less prone to cause fungicide resistance issues. The fungicide resistance is the condition where pathogens become resistant to a particular mechanism of the fungicide, which is often called the mode of action.

Fixed copper is effective against downy mildew and powdery mildew, which are two primary targets for 1 to 2 years old vines. Copper materials tend to be better in a rainy season to control downy mildew. However, please check your cultivars since some are sensitive to copper. Plus, coppers are not compatible with phosphonate acid products.

You can use both mancozeb and captan in the same program. For example, if you have a copper-sensitive cultivar, you can substitute fixed copper with captan in option A. I created separate options with mancozeb and captan because some growers prefer one over the another. Many growers use both mancozeb and captan in the same program. However, you do not need to spray both mancozeb and captan at the same time (i.e., spray together in one application) since they are somewhat similar in terms of the target pathogen and efficacy, and both are less prone to have the fungicide resistance issue.

Captan is less toxic to predatory mites than mancozeb. Depending on the product, captan may have a 48- or 72-hours REI (restricted entry interval = the length of time you need to wear personal protective equipment (PPE) to be in the field), which may determine when and how you want to use captan.

Copper and captan are not effective against a disease called black rot; thus, if you want to use copper or captan as the primary tool, you need to add a DMI fungicide that is effective against black rot and powdery mildew, especially around bloom when pathogens are active and grape clusters are susceptible (even though you probably remove them during the first two years).

I also include one alternative, option C, where you substitute sulfur with either copper or stylet oil. Option C may come in handy, if you have a sulfur-sensitive cultivar. For example, Concord and some red-fruited French-American hybrids, are sensitive to sulfur. Also, compared with sulfur, Stylet oil, the DMI, and other materials (which I am not listing in the guide to keep it simple) might be preferable when planning canopy management tasks, as some people are sensitive to sulfur residues.

Stylet oil works against powdery mildew. There are some limitations, though. You cannot use stylet oil within two weeks of captan or sulfur application because the combination will cause phytotoxicity. Also, some cultivar may be sensitive to Stylet oil.

Phosphonate materials are excellent against downy mildew. You can apply after the rain event to manage downy mildew. It is not after you see a lot of downy mildew on leaves, but you use it to stop the on-going infection before it becomes visible. The ideal timing for a phosphonate application is when you receive unexpected rain, and you are not sure the previous spray is still effective or not. Some phosphonate-like materials are available as a nutritional supplement; however, the specific chemical composition may differ, and thus, they most likely do not provide efficacy against downy mildew. Choose the product that is registered as a fungicide. Please consult the label for the correct rate since higher concentration can cause phytotoxicity.

If you wish not to spray either mancozeb or captan, or sulfur, please contact me. We need to come up with an alternative program.

FRAC Groups and Fungicide Resistance

Rather than remembering all the different chemical names, there is a convenient coding system developed by the Fungicide Resistance Action Committee or FRAC. Each chemical in the same FRAC group essentially works in the same manner. I.e., they are the same in terms of how to manage pathogens. You should be able to find the FRAC group on the fungicide label, our Pest Management Guide, or you can visit (https://www.frac.info/) to download their table.

If you look at the FRAC groups in the examples above, you notice that some FRAC groups start with a letter M or P, and others start with a number. Products grouped into one of the FRAC groups staring with M have multiple modes of action by default, and they are less prone to have fungicide resistance issues. Thus, I often recommend growers to use these materials as the backbone of the spray program. Then, we add fungicides with the FRAC code starting with a number or a letter P to enhance your spray's efficacy. My recommendation is to limit the number of sprays to twice a season for the "number" FRAC groups (e.g., 1, 3, 7, 9, 12, etc.), regardless of the number.

The P FRAC group indicates the mode of action is to enhance or activate the plant's natural defense mechanisms. The plants do not have the immune system as the animals, but they have a set of tools to defend themselves from the infection. These groups are less prone to have the fungicide resistance issue, but we do not know whether it is as robust as the M FRAC groups. Thus, it is better to limit the number of sprays to 3 to 4 times per season.

If you are wondering if you need to be concerned about the fungicide resistance, the answer is "YES." Historically, we have seen several cases of fungicide resistance, and we have lost several fungicides which were very effective at the time of their introduction. The common cause of the fungicide resistance are the misuse and overuse of the material. Please keep in your mind that:

1. Tank mix the "number" or P FRAC group material with M FRAC group material (e.g., spray mancozeb (M3) and a DMI (3) together).
2. Limit the use of the "number" FRAC group material to twice a season.
3. You need to limit based on the FRAC group. If you apply products A and B with the same FRAC group, it will count as two applications. For example, Luna Experience (7 plus 3) and Miravis Prime (7 plus 12) are combined materials with FRAC group 7. If you rotate between Luna Experience and Miravis Prime, you are applying FRAC group 7 twice already.
4. Keep the labeled rate. Do not spray less than the recommended rate.

Spray Intervals and Number of Applications

Most fungicides we have for grapevines act only as protectants. They must be on the shoot, leaves, clusters, or other tissues before fungal spores arrive, and they do not move through the tissues to the new growth. Sprays must protect new development at regular intervals.

For young vines, recommended spray interval is every 10 to 14 days for the first part of the season, and you may be able to extend to 14 to 21 days during the latter part. However, it depends on the weather conditions and how fast the vines grow. E.g., with many rain events, fungicides will be washed off, and vines grow faster; thus, you need to re-apply. The rule of thumb is either two weeks or 2 inches of rain for a reapplication. If you experience frequent rains during the season, the risk of downy mildew will increase. You can apply phosphonate products, such as Prophyt and Phostrol. You can mix a phosphonate with mancozeb or captan, but not with coppers.

If you are lucky and/or well prepared, you may protect young vines with just 6 to 8 applications. Please scout your vineyard often to see any development of diseases.

Also, you need to keep in mind that you need to increase spray volume as the canopy fills out to ensure thorough coverage.

What to do After a Disease Outbreak?

If you are casually driving around your vineyard and you can see leaves with downy or powdery mildew, then it is most likely an outbreak. (i.e., you can find them without looking for them.) It happens. Sometimes you don't have much control when there were two weeks of continuous rains.

When the outbreak happens, please do not use the "number" FRAC groups.

Downy mildew: Stick with the M FRAC group. Use captan or mancozeb or copper.
Powdery mildew: The same rule applies here. Use sulfur or stylet oil (but not at the same time) or copper. Also, you can apply one of potassium salts (Nutrol, Armicarb 100, or Kaligreen). Potassium salts provide moderate to reasonable control of developing PM colonies. Potassium salts need through coverage and tend to be expensive. Nutrol is more economical than Armicarb or Kaligreen but comparable in effectiveness, according to research in New York. Consult labels for usage rates and other recommendations. Use a high enough spray volume to ensure thorough coverage.

Seasonal Fungicide Spray Guideline for Non-bearing Vineyards

Growth stage or timing	*Material and rate/Acre*	*Comments*
New shoots The first spray **Target diseases** Phomopsis cane and leaf spot and downy mildew **Timing** Begin at ~ 3- to 5-inch shoot  Grape illustrations are adapted from Eichhorn and Lorenz, 1977	**Option A** mancozeb at 3 lb/A **Option B** captan at 2 to 3 lb/A **Option C** mancozeb at 3 lb/A	In non-bearing vineyards (1st and 2nd year), you may use a simplified program to control black rot, Phomopsis, downy mildew, and powdery mildew. The main focus will be on downy and powdery mildew during the first year. A protection program starts when shoots are about 3 to 5 inches in length. The target disease is Phomopsis cane and leaf spot, which should not appear in a new vineyard, but it may happen if you have a vineyard nearby. Both mancozeb and captan control downy mildew. Powdery mildew is less likely active at this time of the season.
12" – 18" shoots 2nd and 3rd sprays **Target diseases** Downy mildew and Powdery mildew **Interval** Spray every 10-14 days till pre-bloom **Note:** If rain is predicted between 7 and 10 days after your last spray, make another application **before** the rain. 	**Option A** Fixed copper *plus (if necessary)* sulfur 3 lb/A (for powdery) *Alternatively,* Mancozeb 3 lb/A plus sulfur 3 lb/A (see the comment) **Option B** Captan 2 to 3 lb/A plus sulfur 3 lb/A Or Fixed copper **Option C** Fixed copper	For option A, fixed copper is listed as the first option for this spray, and mancozeb is listed as the second option. We need to conserve the number of mancozeb applications because you can apply mancozeb products up to 19.4 lb per acre per season (please check the label for product-specific rate). This equates to about 5 to 6 applications per season. Thus, I want to keep mancozeb for the latter in the season when we need it. · **Do not** • Combine sulfur with oil or spray them within 14 days of one another. • Combine captan with oil or spray them within 14 days of one another. • Combine copper and phosphorous acid products within 14 days of one another

Growth stage or timing	*Material and rate/Acre*	*Comments*
Pre-bloom to post-bloom 2 to 3 sprays **Target diseases** Downy mildew, Powdery mildew, Black rot **Timing** Begin at pre-bloom or early bloom until about a month after bloom. **Interval** Spray once or twice more at 10 to 14-day intervals  **Note:** You will not see or want to remove clusters, in the first year. You may want to keep some clusters in the second year, but make sure not to over-crop!!	**Option A** mancozeb at 3 lb/A *plus* sulfur at 3 lb/A *plus (if necessary)* a DMI fungicide (for powdery mildew and black rot) *and/or* a phosphonate (for downy mildew) Alternatively, Fixed copper *plus* a DMI fungicide **Option B** Captan at 2-3 lb/A *plus* sulfur at 3 lb/A *plus (if necessary)* a DMI fungicide (for powdery mildew and black rot) *and/or* a phosphonate (for downy mildew) **Option C** Mancozeb 3 lb/A *plus* JMS Stylet Oil @ 1% concentration *plus (if necessary)* a DMI fungicide (for powdery mildew and black rot) *and/or* a phosphonate (for downy mildew)	In addition to downy mildew and powdery mildew, we need to manage black rot on leaves during this period, and this is where mancozeb is useful. Thus, the first recommendation is mancozeb plus sulfur. At bloom application is probably when you want to use a DMI to manage powdery and black rot better. If copper or captan is used, you need to mix it with a DMI fungicide to manage black rot. If you experience frequent rain events or expecting rain in the forecast, add a phosphonate to the mix BEFORE you see downy mildew symptoms. Application of sulfur when the temperature exceeds 85°F may cause injury to your vines. Spray in the morning to ensure that the material on the leaf is dry when the temperature gets high. Note: around this time, you may see some vines struggle, i.e., leaves are wilting, shoots are not growing well, etc. The first- and second-year vines tend to have insufficient root development; thus, some vines struggle to support all the green tissues. Some growers use the irrigation system to help young vine development.

Growth stage or timing	*Material and rate/Acre*	*Comments*
Cover sprays 3 to 4 sprays, depending on weather conditions **Timing** Begin 30 days after the last post-bloom spray **Interval** Spray at 14- to 21-day intervals, depending on weather, until frost 	**Option A** Fixed copper Alternatively, mancozeb at 3 lb/A *plus* sulfur at 3 lb/A *plus* (if necessary) a phosphonate (for downy mildew) **Option B** Captan at 2-3 lb/A *plus* sulfur at 3 lb/A *plus (if necessary)* a phosphonate (for downy mildew) or Fixed copper **Option C** Fixed copper or Mancozeb 3 lb/A *plus* JMS Stylet Oil @ 1% concentration	If you have managed powdery mildew at this point, downy mildew will be the main target. This is where fixed copper comes in handy because it is effective against both downy and powdery. Especially toward the end of August, make sure to look for any sign of downy mildew at the top of the canopy. Humid and warm nights are triggers for downy mildew development. Make sure to keep you vines clean until the hard frost. Young vines need as much carbohydrates stored to survive the winter.

References

Wilcox W.F., Gubler, W.D., Uyemoto, J.K ed. 2015 Compendium of Grape diseases, Disorders, and Pests, APS Press

Additional Resources

Nita, M. Virginia Grape Disease Updates, http://grapepathology.blogspot.com/, Twitter (@Grapepathology), and Facebook (GrapePathVATech)

Nita, M. grapeIPM.org: online pesticide management tool, http://grapeIPM.org

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2021 SPES-315NP