Research in Plain English (RIPE)

Determining which vegetative index is best for your vineyard

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Am J Enol Vitic. July 2021 72: 279-283; published ahead of print April 23, 2021; DOI: 10.5344/ajev.2021.20042

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The Takeaway

- Canopy sensors are optical devices that use reflectance at different wavelengths to differentiate between healthy, vigorous plants and unhealthy, stressed plants. The information gathered using the sensors can help vineyard managers identify and address vineyard issues.
- Optical sensors used in canopy sensing have improved a lot over the 45+ years since the introduction of normalized difference vegetation index (NDVI). NDVI was one of the first vegetative indexes (VI), and uses satellite-based optical sensors. It is still the most commonly used vegetative index in viticulture.
- Other vegetative indexes use combinations of different wavelengths to measure canopy attributes. This may not only indicate leaf area “quantity” but may also identify information about leaf healthy or quality, and may add additional information to the vine size prediction.
- More recently, affordable tractor-mounted sensors have provided close-range metrics of canopy density and health.
- In this study of different VI, there was no clear overall winner. Researchers suggested the development of a multi-VI application that would allow vineyard owners to customize to their unique vineyard traits may offer a future potential for innovation.

A NDVI sensor and GPS unit are mounted on a vehicle and used early in the grape season to assess the vineyard.

Background

Canopy sensors are used to differentiate between healthy, vigorous plants and unhealthy, stressed plants. The sensors used in canopy sensing have improved over the 45+ years since the introduction of normalized difference vegetation index (NDVI). NDVI was one of the first vegetative indices (VI), and uses satellite-based optical sensors. Currently, vineyards use proximal reflectance sensors (e.g. CropCircle) to collect spatial information on grapevine canopy NDVI. The information gathered can help vineyard managers identify and address vineyard issues. Most previous studies use NDVI, but there are many new modes available.

When used, sensors are aimed at the actively growing region of the canopy throughout the season to determine leaf area "quantity" (i.e. are there a lot of leaves in the region of interest or not?) Could researchers identify the most effective VI currently available?

Methods

In this study, researchers used the Taylor et al. (2017) protocol of sensing surveys to review a variety of commonly utilized vegetative indices and see if the most effective combination or approach to vineyard analysis could be identified. Using this method, the researchers showed that strong vines will have a high NDVI signal and weak vines will have a low NDVI signal and this correlates with vine size (measured as vine pruning weight in dormancy[1]). Therefore, we can use NDVI sensors to spatially map vineyard vine size and use it in our spatial crop load (Y:PW) calculation[2]. Each VI was ranked, and the paper contains a useful table of rankings. The researchers found there was no overall winner VI, each performed well in at least one area.

A NDVI sensor is used to assess a Concord grape vineyard.

Conclusions and Practical Considerations

No individual VI was found to be 'best' at predicting pruning weight. Ideally, operators would have access to a fully automated modeling software that would allow them to select the best fit for their vineyard from single or multi-VI applications. Further studies would be needed to adapt an automated modeling software to a wider variety of vineyards, trellis systems, soils and other vineyard traits. The authors add that there are several active projects that are looking to identify reflectance wavebands and/or Vis to identify other leaf "quality" attributes like nutrient or pest status.

References

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