A Hitchhiker’s Guide to Precision Viticulture

A Webinar Series brought to you by efficient vineyard
Outline – delete on completion

- Introduction/Bios
- Objective of webinar series/webinar format
- Definition of PV
- History of PV (PA → PV)
- Background on the Efficient Vineyard project
- Key themes/topics
  - Spatial measurements & validation in vineyards
    - GNSS, Soil, canopy, yield, fruit quality – JSS
  - Spatial data analytics
    - Spatial data processing
    - Spatial data layering
    - Geostatistics
  - PV practices
    - VR water and nutrient management
    - VR shoot thinning
    - Crop estimation
    - VR fruit thinning
Meet your host – Jackie Dresser

Education:
• Bachelor of Science in Surveying Engineering Technology, Alfred State College, 2012

Experience:
• 7 years of apprenticeship in Land Surveying
• LSIT certification – intermediate to PLS
  • 4 growing seasons in commercial viticulture, wine production and wholesale sales in New York State
  • 2 years research & extension in Precision Viticulture
  • Research focus on spatial crop load management in vineyards
Objective and Webinar Format

• The intention of the Hitchhiker's Guide to Precision Viticulture is to lead participants on a guided tour of the wide world of PV with a focus on the efficient vineyard project.

• Each webinar will begin at 1:00pm EST on the second Tuesday of each month
  • 15 minutes of open discussion
  • 30 minutes of structured presentation
  • 15 minutes of Q&A
Precision vs. Accuracy

- Precision does NOT mean you hit your target
- Precision DOES have to do with repeatability of measurements
- Accuracy is how close measurements come to the true value, NOT how close they are to each other
- In “Precision” Viticulture, precision AND accuracy are both important
“… a suite of technologies [that] provides grape growers and winemakers with the means to move away from a ‘one-size-fits-all approach to vineyard management.’”

- R.G.V. Bramley, CSIRO Australia

“… a differentiated management approach aiming to meet the real needs of each parcel within the vineyard.”

- A. Matese & S. Filippo Di Gennaro

“The application of Precision Agriculture (PA) techniques in viticulture…”


Basically... Vineyards vary.

How can we use that variation to our advantage as stewards of these vineyards?
Step 1: Measure variation... accurately and precisely
The Precision Viticulture Umbrella

Collection and validation of spatial data in vineyards

Data visualization and interpretation

Prescription mapping and variable rate technology

Spatial data processing, layering and analysis

Decision making/management planning

Management plan implementation

Decision Evaluation
Precision Viticulture Defined

A cyclical management system that uses georeferenced measurements of vineyard attributes to spatially define heterogeneity and adapts vineyard management practices appropriately to optimize whole-vineyard performance.
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$1125 range in profitability across a 20 acre block
History of Precision Agriculture → Precision Viticulture

Past

1980s
- Variable rate electronic controllers developed to integrate with GPS for civilian use
- NAVSTAR GPS opened

1990s
- First workshop on PA held at University of Minnesota in 1992
- First annual ICPA held in USA and AU
- Grape yield monitor used to map yield variation in USA and AU

2000s
- Civilian scramble removed
- Soil EC sensors used to map variation in soil in vineyards
- VRT integrated with V-mech equipment

Future
- Reflectance sensors and vegetative indices used to map variability in vine growth
- Auto-steering for tractors begins
- Precision Agriculture Research, Education, and Information Dissemination Act of 1997 passed by U.S. Congress
- Research on adapting PA techniques begins in Australia
- Grid sampling for precision farming
- Geostatistics and GIS used for precision farming
- Properties of soil chemical properties for variable rate fertilization in row crops
The Efficient Vineyard Project

USDA-NIFA Specialty Crop Research Initiative project undertaken to deliver the tools, techniques, and information for spatial data driven variable rate management in commercial vineyards.

The Efficient Vineyard project is broken into five working themes:
- Precision Vineyard Sensing
- Spatial Data Processing and Decision Support System
- Differential Vineyard Management and Testing
- Economic Evaluation and assessment
- Technology Adoption and Outreach
The Efficient Vineyard Project Goals

1. **Collect Spatial Data:** Use existing sensor technologies, identify technology gaps, and develop novel sensor systems to collect spatial soil, canopy, and crop data in wine, juice, and table grapes.

2. **Transform to Information:** Transform soil, canopy, and crop sensor data into usable viticulture information by relating high density, continuous sensor measurements with stratified manual soil, vine, and fruit sampling and measurement.

3. **Understand Relationships:** Use semi-automated spatial data processing techniques and data fusion to construct vineyard maps showing relevant vineyard management zones.

4. **Apply Variable Management:** Develop a variable-rate crop load management system on a commercial scale that integrates sensing technologies within a feedback mechanism.

5. **Scientific Evaluation:** Evaluate the effect of precision crop load management on vineyard yield, fruit quality, and production economics.

6. **Facilitate Implementation:** In consultation with the grape industry, develop end-user tools for semi-automated spatial data processing and educate practitioners on how to achieve high-resolution, spatio-temporal crop load management.
Key Themes of Webinar Series

• Spatial measurements & validation in vineyards
  • GNSS
  • Soil
  • Canopy
  • Yield
  • Fruit quality – JSS

• Spatial data analytics
  • Spatial data processing
  • Spatial data layering

• PV practices
  • VR water and nutrient management
  • VR shoot thinning
  • Crop estimation
  • VR fruit thinning