Innovation Vineyard Project Report

Title: Blue Sky Innovations. Integrape Data Management and Decision-Making Platform – Measure to Management.

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Abstract

The project started as a simple exploration of new technologies for the purpose of assessing their merit and benefit to vineyard data capture and better vineyard decision making. Were their Blue-sky technologies that would help our businesses do what we do better?

Three individual organisations were initially contacted; AgriOptics, GCH-UAV and Integrape. All three were engaged to measure and capture data from our Innovation Vineyard. Each source of data collection had its unique parameters that were measured; from one off static capture of subsoils, surface terrains, to individual multispectral vine capture, to the dynamics of multiple passing satellite imagery.

All this data was interesting, but what was more valuable was when we were able to work with Integrape and their dynamic integrated data management platform. We now had a tool that allowed layering of all this GPS'ed positioned information onto vineyard maps, allowing a clear impression of the impact of soil and seasonal variability on the individual vineyard blocks.

What this project has accomplished to date is open the door for other useful parameters to be assessed and incorporated into the platform. It is still evolving. Going forward, we hope to see additions like pest and disease outcomes overlaid with vineyard management, localised weather forecasting, and yield and harvest data also captured. More valuable measurables will also be identified.

All of this platform evolution initially developed to capture and manage nutritional data; now it is becoming more versatile and useful to overall vineyard management.

The next step we hope to see cost effective management benefits demonstrated for the cooperatives, both from an overarching management perspective, as well as that of the individual Owner-growers. If so, this could be a tool that we will adopt into everyday use.

Introduction

The Innovation Vineyard set out for V2019 to explore some Blue-sky innovations. The essence was to identify potential relevance for our membership - data capture and data organisation, to aid smarter decision making. We then hoped to be in a position to advise our memberships on the practical and beneficial applications, having taken some of the risk out of any purchase decisions.

Several cutting-edge organisations were engaged to capture and record data from 10 of the Innovation Vineyard blocks. In reality, we had no hard plan, but the process and contacts began to evolve as we explored opportunities. Eventually, three key players emerged;

1. **AgriOptics** - with their EM (electromagnetic) Survey of the vineyard topography, and soil profile,
2. **GCH UAV -** utilization of drones for multispectral data capture, and
3. **Integrape** - with their Decision Support Software platform that would capture and hold data for decision making on;
    - Nutrition maps, and fertilizer inputs
    - Satellite imagery

Integrape started out as a platform for the automated collection, collation and management of nutritional records and fertilizer inputs. Such a site eases the assessment of historic records and inputs to better plan and implement cost effective management for the future.
Progressively, the Innovation Vineyard team realised that the Integrape platform had the potential to capture and present a multitude of data layers in a single user-friendly site. Significant development would be necessary moving forward, and we would unlikely have a polished outcome to present by the end of V2019. We were encouraged that working with and supporting this development with Integrape management could lead to a very versatile platform the one day would have many cost benefits for the cooperatives in general, and individual members.

Integrape has become incredibly supportive of the project; recognising and releasing the potential of their Measure to Manage platform.

In the process, other organisations came to the forefront. We made contact and forwarded their details onto Joris Besamusca to look at dovetailing into his Integrape platform.

- **NIWA**, looking for a platform to provide very localised weather forecasting,
- **Fruitfed Supplies Crop Monitoring** – capturing data from Fruitfed Scouting,
- **Crop estimation** – the ability to capture and calculate crop levels,
- **Harvest data** – capture and record quantity and quality parameters.

Opportunities still exist moving forward, such as having the ability to incorporate spray diary data. Such a facility could be overlaid with pest and disease outcomes from crop monitoring to assess the effectiveness of the grower's vineyard management.

Materials and Methods

The Blue-sky project started with a simple concept of looking at new technologies and seeing how they could potentially benefit decision making members within the cooperatives. Several organisations were asked to provide services for us. The project began to evolve.

- **Integrape** – This is a Service (SaaS) Decision Support software that has been evolving as management tool to contain and utilise emerging technologies in a single integrated platform.
    - Integrape facilitates the comparison of remote sensors, laboratory results and vineyard data, giving time lined overviews to help make informed decisions.

  Our initial interests with Integrape were;
    - Individual blocks could be captured, and mapped.
    - Data input could be automated.
    - Data from various sources could be overlaid for better management comparisons.

- It would provide a platform for collecting and managing nutritional records and inputs. All data could be collated into maps that were GPS coordinate referenced to support accurate interpretation, and have the potential to spatially address tailored vineyard requirements for nutrition.
- The satellite imagery which would capture up to 80 cloud free passes a year would augment this data with what was visually happen throughout the canopies of the IVP vineyard blocks through the season; giving an early warning system, and management tool to help with smart decisioning making.

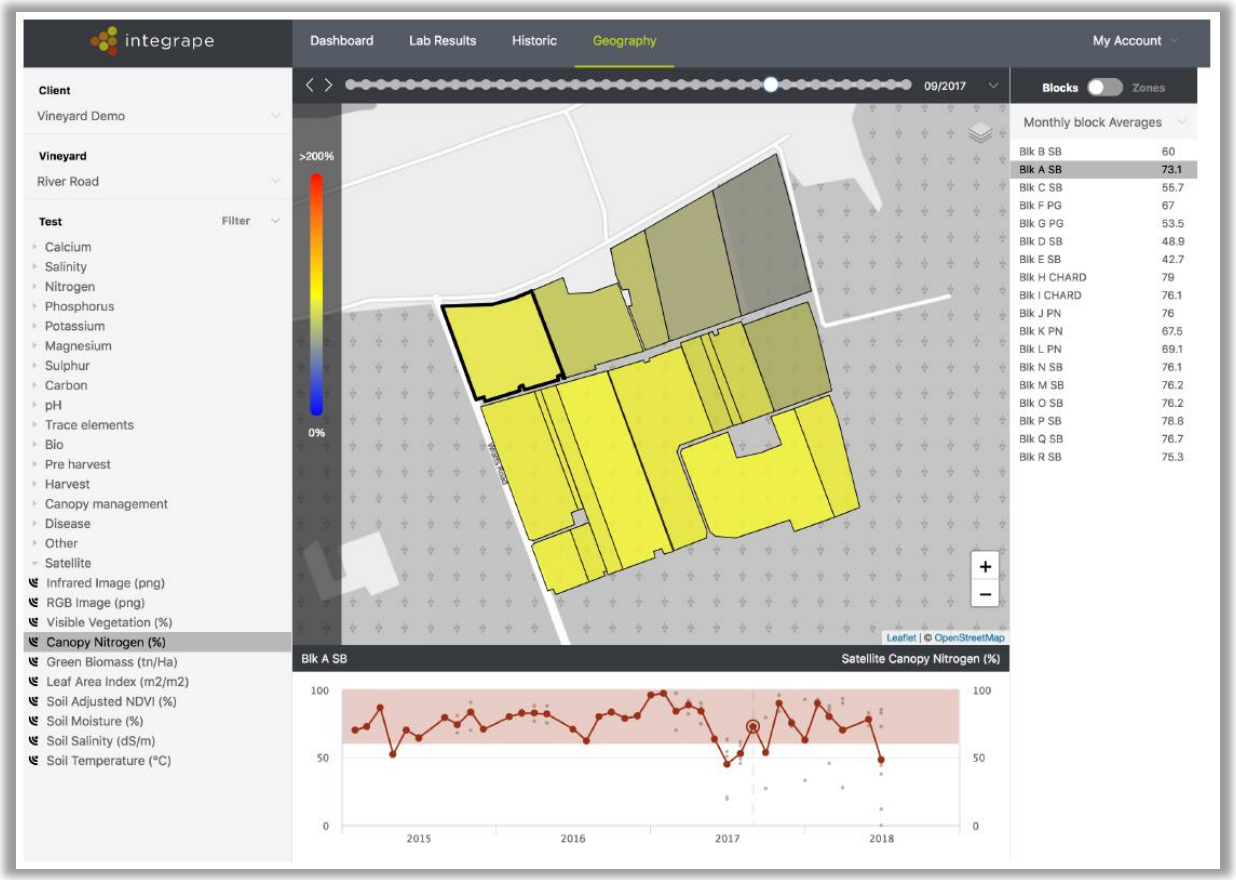

FIGURE 1. EXAMPLE OF NUTRITIONAL DATA PRESENTATION SPECIFICALLY LOOKING AT CANOPY NITROGEN % IN THE HOUSE BLOCK.

We then learnt that Integrape could capture other inputs;

- Drone survey data. So, we captured drone imaging of the House Block to assess how extra detail to the vine level could deliver a management benefit.
- Crop monitoring data per block from the Fruitfed Scouts. Still in progress.

And moving forward, we hope to capture:

- Localised NIWA weather forecasting for the vineyard.
- Spray diary inputs to overlay with pest and disease outcomes.
- Crop estimation data
- Harvest quantity and quality data.

At the moment, the IVP Team are looking at how the platform will deliver cost benefits for our data capture and management; both for the overarching MGG Cooperative and individual Cooperative vineyard Owners, as well as Farmland's and their members.

Now to look in more detail at several of the technologies that are being captured on the Integrape platform;

- **AgriOptics -** EM surveying is carried out by towing an EM machine on a wheeled frame 25cm off the ground across the soil surface, using their light-weight Polaris, usually at a swath width of 12m, although this can be varied to suit the project. The EM soil electro-magnetic conductivity readings are then logged five times every second at two depths simultaneously-using Trimble RTK GPS to 2cm accuracy. This gives comprehensive data on soil characteristics at 0 to 50cm and 0 to 125cm depths. The RTK GPS also collects elevation, slope angles and other topography details so a 3D surface map can be built if required. This information can be very useful in determining avoidance zones or other areas that may require a different management strategy rather than only in accordance with soil type and soil water holding capacity.

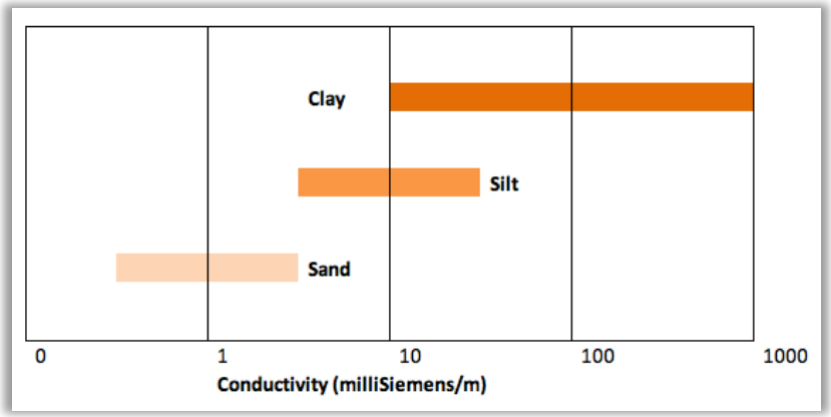

FIGURE 2. SOIL CONDUCTIVITY STEMS FROM THE FACT THAT SANDS HAVE LOW CONDUCTIVITY, SILTS MEDIUM AND CLAYS HIGH CONDUCTIVITY. THEREFORE, CONDUCTIVITY GIVES A GOOD MEASURE OF SOIL GRAIN SIZE AND TEXTURE.

In addition to its ability to identify variations in soil texture, electrical conductivity has proven to relate closely to other soil properties that often determine a field's productivity.

  - **Cation exchange capacity (CEC)** – this is a measure of a soils ability to hold or release various elements and compounds. We are mostly concerned with the soil's ability to hold and release plant nutrients.
  - **Bulk density** – this can be an indicator of soil compaction. Generally, loose, porous soils and those rich in organic matter have lower bulk density. Sandy soils have relatively high bulk density since total pore space in sands is less than that of silt or clay soils.
  - **Water holding capacity/drainage** – drought prone areas or areas of excess moisture typically have distinct textural differences; these can be identified using electrical conductivity. Soils in the middle range of conductivity which are both medium textured and have medium water-holding capacity may be the most productive.
  - **Salinity** – An excess of dissolved salts in the soil is readily detected by electrical conductivity, but not usually an issue in New Zealand. (AgriOptics website).
- **GCH-UAV Drone Surveying** – The perceived benefits of UAV technology for the IVP vineyard was to capture greater detail from an aerial perspective. We wanted to see if there were

benefits that would be additional to what we were able to see and monitor with the satellite data that was regularly being collecting in Integrape.

- The concept of precision "viticulture" says GCH-UAV, refers to the way growers manage crops to ensure efficiency of inputs such as water and fertilizer, and to maximize productivity, quality, and yield. The term also involves minimizing pests and disease.
  - GCH-UAV have invested heavily in leading edge UAV technology, scientific grade sensors and backend data processing systems to deliver precise, accurate and meaningful data.
  - They specialize in aerial solutions for;
  - Mapping and Surveying
  - Soil and Field Analysis
  - Crop Monitoring
  - Irrigation
  - Health Assessment

FIGURE 3. COLIN AITCHISON FROM GCH-UAV FLYING ONE OF HIS DRONES IN THE VINEYARD.

Details have been captured from the GCH-UAV website.

Discussion and Conclusion

Initially we envisioned exploring a few data capturing technologies like drones, satellites and sub-ground surveying. What was the potential of these technologies, and could they provide relevant, useful decision-making information to help grow better and more cost-effective wine grapes?

We soon discovered many technologies that could capture data. But was one better then another, did we need them all, or could there be benefits to capture it all and overlay information in one place for enhanced decision making?

What we envisioned as being a simple project consisting of a few isolated silos of information capture, soon morphed into a complex network of one-off, as well as ongoing automated data capturing exercises; all could be centrally gather, stored, filtered and displayed on a single platform – Integrape.

Integrape. For the vineyard owner/manager to have all of their historic vineyard data collected and held in one place, and in a format that can be dynamically overlaid to reference with other parameters could be a very effective, efficient and valuable tool. We began to look at and work more closely with this platform. Capabilities and potentials were still being realised.

EM Surveying was a one-off opportunity to capture the essence of the Intergrape vineyards soil footprint and topography. The parameters measured are relatively static; this is a one-off report delivering the inherent properties of the vineyards soil profile. This has given a comparative picture of many good and difficult to manage vineyard characteristics and variabilities brought on by the soil and its inherent properties. With this new knowledge and detail, management plans can be tailored to better address these variations.

The **GCH-UAV** survey of the House block gave us a single capture of detailed vineyard information. It was a tool to capture detail to the single vine level, at a particular point in time. This overview allowed for individual vine segregation, and the ability to determine whether there were isolated vines of interest, or sub-regions that may have similar parameters impacting on them; pests, disease, nutrition, crop load, soil moisture etc. Again, management plans can be better formulated. The main drawback being, that this is a one-off data capture of a single place and time, but for a specific exercise, it could prove to be very useful.

Integrape is continuing to morph. As more measurables are added to the platform, the dynamics and capabilities continue to increase.

Currently we are exploring the cost benefits of the program for the overarching management of cooperative blocks.

Going forward, Integrape is likely to be a very valuable tool for individual Owners, both in the now, and for succession planning due to the historic data captured for future generations.

Appendix

For further details, the following links can be opened;

- Integrape. Integrated data collecting, decision making platform. www.integrape.co.nz
- AgriOptics. For Electromagnetic (EM) soil mapping. www.agrioptics.co.nz
- GCHUAV. Garden City Helicopters – Unmanned Aviation Vehicles. For aerial mapping and surveying, soil and field analysis, crop monitoring, irrigation monitoring and vineyard health assessment. www.gchuav.com