Yield mapper developed for almonds

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There are many factors that need to be right for optimum almond yield. Growers spend all year trying to get these right. Yield mapping is a way to see how that effort turned into producing a high yielding crop.

For continual improvement growers can use a yield map to see the areas of high and low yields and corelate how their past interventions affected yield. Yield maps can also help decide upon future actions.

For many years researchers have been looking at methods to measure almond yield and create a map showing the high and low yield areas in an orchard. Several attempts have been made with on-the-go weighing of the reservoir cart towed by the harvester.

Whilst load cells on the reservoir cart may seem a logical method, they are: expensive, complex, measure a small weight addition to a heavy cart, the cart bounces as it moves and the load cell method or yield mapping doesn't allow on-the-go unloading.

To solve these problems Ag-IQ Australia has developed a method using a lidar (LIght Detection and Ranging) sensor to measure the volume of flow of almonds from the almond harvester into the reservoir cart. The lidar fits onto the underside of the rear of the harvester discharge conveyor.

The lidar uses a low power rotating laser and its performance is independent of day or night operation. This rotating laser scans the flow of almonds 10 times per second and provides an average of the flow from the harvester into the cart. The Ag-IQ Yield Mapper also has an in-cab console, a ground speed sensor fitted to one of the wheels and a GPS receiver.

The Ag-IQ Yield Mapper can be retro fitted to conventional style almond harvesters in a few hours and involves mounting the sensors, in-cab console and running the wires. Nothing interferes with the operation of the harvester or harvesting activities.

The in-cab console has a 50mm coloured LCD screen and a typical running display is shown in Figure 1. As multiple varieties are planted in an almond orchard at various row spacings the Ag-IQ Yield Mapper allows the operator to set the variety name and row spacing.

It has been found that averaging the flow for every five seconds of harvester movement gives a useful yield map with a data point spacing of 4.1m when travelling at 3 km/h.

Figure 1. Example of Ag-IQ Yield Mapper in-cab console display.

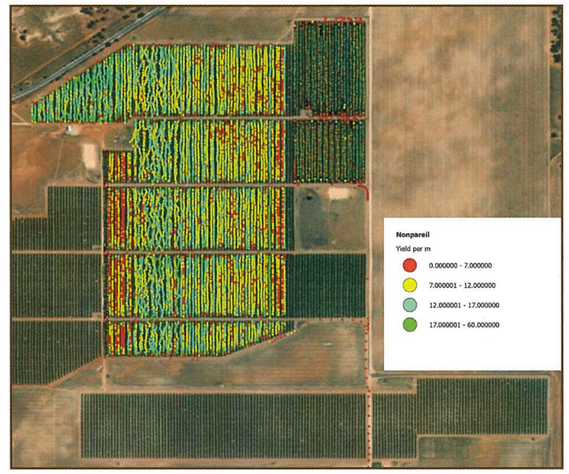

Figure 2. Nonpareil yield map (22/2/2023 to 4/3/2023).

The current version of the Ag-IQ Yield Mapper has the data saved to a micro-SD card and hence does not need cell phone coverage. It can hold over 10 years of harvest data. The recorded data (position, yield, speed, date and time, variety, row spacing, etc) is in CSV format and is open to import into any geographic information system (GIS) analysis software.

Some recent maps from the current 2023 harvest are shown in Figures 2 to 4.

The examples of 2023 yield maps show data as relative yield per meter. The analysis shown was undertaken with ArcGIS software.The maps shown use four colour bands:

- Red = harvester movements and very low yield
- Yellow = below average yields
- Blue = above average yields
- Green = very high yielding areas.

Work is continuing to translate the current relative yields to a kg/ha calibrated yield with the choice of total harvested mass or kernel mass. Using the Ag-IQ Yield Mapper, almond growers can create their own maps and analyses, or Ag-IQ Australia can provide a service to create the maps to a grower's own needs.

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Figure 3. Carina yield map (4-7/3/2023).

Figure 4. Rhea yield map (18-19/3/2023).