

DECISION SUPPORT TOOLS FOR SMALL-HOLDER FARMERS AND AN AVOCADO PROCESSOR IN THE CENTRAL HIGHLANDS OF KENYA

**Brent Clothier¹, Steve Green¹, Roberta Gentile¹, Michael Gitahi², Sarah Murigi²,
Lydia Nduta², Brenda Lumumba², and Merrie Mosmarck².**

¹ Plant and Food Research, Palmerston North

² Olivado EPZ, Murang'a, Kenya

Email: brent.clothier@plantandfood.co.nz

The Kenya Avocado Project, funded by the New Zealand Aid Programme, aims to increase the incomes of small-holder farmers in the Central Highlands. It is a public-private partnership between PFR and the New Zealand company, Olivado, for improving on-farm practices for growing avocados and creating post-harvest protocols for Olivado for quality fresh fruit for export, and higher yields of oil from the pressing of fruit.



Figure 1. Peter Maina (right) is a typical small-holder farmer in the Kenyan Highlands. He grows intercropped plants, including avocados. A new Hass seedling is in the left foreground with undersown beans on the right, and the older Fuerte avocado trees in the background are behind the bananas and macadamia on the right. Sarah Murigi and Michael Gitahi from Olivado are on the left, and PFR's Steve Green at the back

We are developing Decision Support Tools (DST).

The first DST for the private partner, Olivado, is a PC-based application to predict the Time-to-Harvest (TTH) for both fresh avocados and avocados for oil across the 2400 farmers who supply Olivado. Timely harvesting will maximise the value of the avocados and ensure good returns for farmers.



Figure 2. Managing the on-farm practices of avocado growing and assessing the time-to-harvest (TTH) is complex, as the crop goes through the different phenological stages of flowering (left) through fruit filling (right), and eventually to maturity. Predicting TTH for either fresh or processing is a challenge.

From our network of weather stations we know the growing degree day (GDD_{10}) accumulation is inversely related to altitude despite the complex geography (Figure 3).

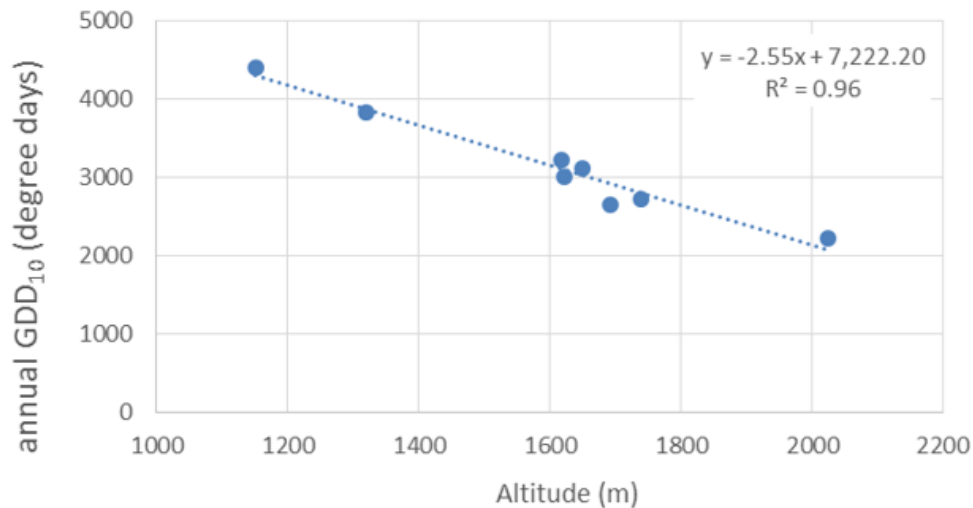


Figure 3. The accumulation of growing degree days (base 10C) GDD_{10} in relation to altitude across a network of temperature stations

Four years of sampling for the accumulation of dry matter (DM) shows the rise in DM to maturity is directly related to GDD_{10} (Figure 4).

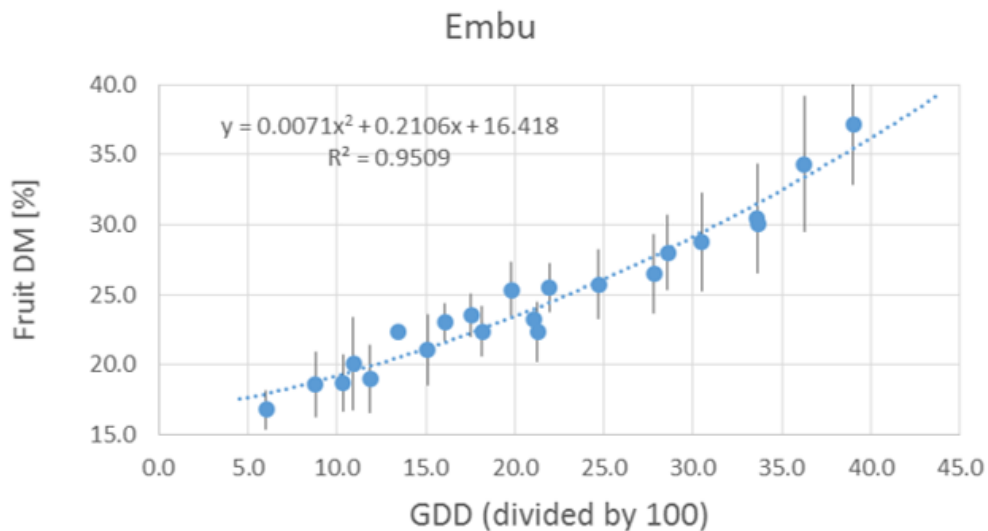


Figure 4. The rise in avocado fruit dry matter (DM %) with growing degree days (GDD) for Embu.

The optimum DM for picking fruit for fresh export is 23%, for oil processing it is 30%. From our knowledge of the altitudes of all farms, by using the DST we can predict the local rise in GDD (Figure 3) and predict the local TTH for both fresh and oil (Figure 4). From historical data we can forecast the yield of avocados for each farm, so the DST forecasts the inflow of fruit to the packhouse for fresh, and for processing (Figure 5).

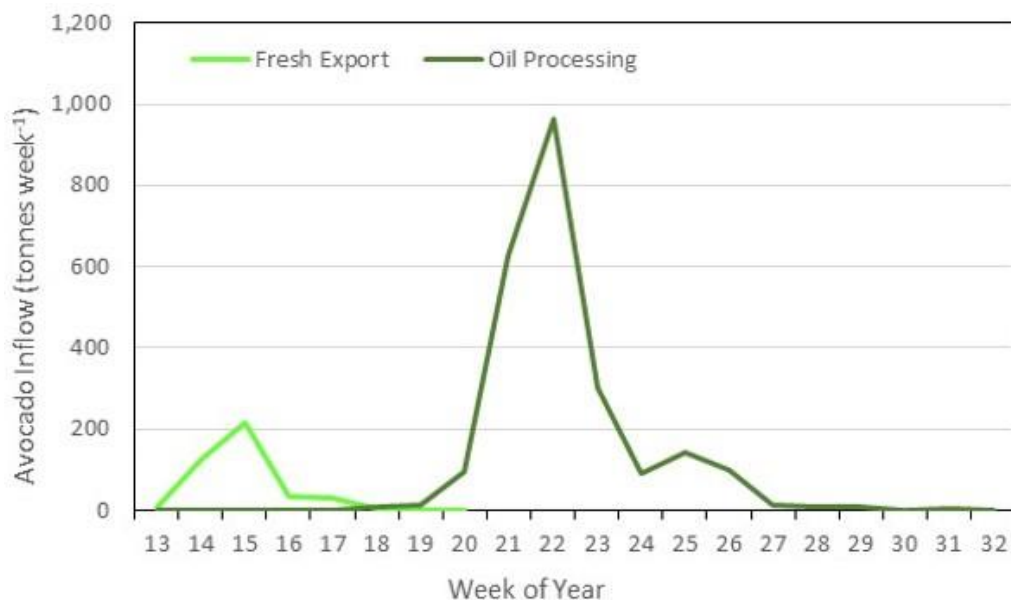


Figure 5. Our Decision Support Tool (DST) can predict the inflow to the Olivado factory at Murang'a of fresh avocados for export, and avocados for oil processing

The second DST will deliver to all farmers, via SMS text messaging.

There will be a weekly weather-update based on the weather station at the Murang'a factory. This will indicate whether the year-to-date is warmer, or cooler than normal, and either wetter, or drier, than normal. This will adjust the DST for TTH and alert the farmers when to expect harvesting.

The other component will be regular SMS messaging, every 1-3 weeks, to advise what farm practices and actions should be carried out. This will also cover information on other crops, and advice for assessing pest and disease risks. We have drafted a schedule of SMS messages, and these will be despatched to farmers in either Swahili (the East African lingua franca), or the local language of Kikuyu. We first drafted the messages in English for translation by Olivado staff.

In Figure 6 we show the weekly schedule of numbered messages (top), and an example of SMS texts 6 and 7 (bottom) about the preparation and application of composted manures to meet the nutrient needs of their trees - if there is a cow, as farms have.



Figure 6. Top. The weekly schedule of numbered SMS texts that will be sent out to all farmers. Bottom. An example of two messages (6 & 7) in relation to the quantity and application of composted manure to the avocado trees in Swahili and Kikuyu. The original English text is also shown.

Synopsis

- Our Kenya Avocado Project is a public-private partnership to increase the incomes of small holder farmers in the Central Highlands.
- Our Decision Support Tools (DST) will outlive our involvement, as the private partner, Olivado, will continue to use them
- Our time-to-harvest DST can be used to plan the logistics of harvesting, and schedule the factory operations for fresh-fruit and avocados for pressing.
- Our SMS-texting DST provides information and guidance to the farmers growing avocados, and other crops, in the Highlands.