



Information Sheet

12. RIPENING

12.2 Determining crop maturity for purposes of ripening decision-making

Basic concepts

Under good crop management, lack of soil moisture and low temperatures are the main factors that reduce crop growth rate, and hence, accelerate sucrose storage (crop maturity) through natural ripening (refer to Information Sheet 12.1). With an increase in crop maturity (increase in whole-stalk juice purity), the benefits from applying chemical ripeners diminish.

At the time of ripener application, juice purity should be below 75% if applying ETHEPHON (Information Sheet 12.3) and below 85% if applying FUSILADE FORTE (Information Sheet 12.4) and, MODDUS (Information Sheet 12.5). These thresholds apply to annual and longer-cycle crops under both irrigated and rainfed conditions.

This Information Sheet provides details on how whole-stalk juice purity can be determined analytically through laboratory testing or estimated on the farm with a hand-held refractometer in combination with the smartphone application **PurEst™** (developed by SASRI). In addition, guidance is provided on how spray-to-harvest intervals can be fine-tuned with data obtained using refractometers for achieving optimal ripening responses.

Laboratory determination of juice purity

Juice purity can be determined analytically in a cane testing laboratory from stalk samples collected from the target field a week or less before planned ripener spraying. Sixteen randomly selected stalks (of uniform length), collected from a number of positions within the field, must be stripped of all leaves, topped at the natural breaking point, and bundled together into a single sample. These clearly-labelled samples should be submitted to the Cane Testing Service (CTS) at the mill, or submitted to your local Extension Specialist, who will make arrangements for submission to the SASRI cane testing laboratories (Pongola or Mount Edgecombe). Although this is the most accurate method to determine juice purity, it is often not logistically possible due to distance from the laboratory or during the off-season when the CTS laboratories are not operational. Hence SASRI has developed a quick method by which growers can estimate juice purity on their farms. This method is explained in the next section.

Estimation of juice purity with **PurEst™**

***PurEst™** is a smartphone application that estimates whole-stalk juice purity from Brix% readings taken with a hand-held refractometer by applying a mathematical relationship between these readings and laboratory-determined juice purity. This relationship has been established through research on over 1 500 cane samples submitted to the SASRI cane testing laboratories.*

PurEst™ provides practical ripener recommendations based on the known juice purity efficacy thresholds of the various ripener chemicals.

PurEst™ can also assist with harvesting decisions by estimating RV% and stalk moisture%, which enable growers to prioritise fields according to harvest readiness.

***PurEst™** estimates these quality parameters in unburned stalks, stripped of all leaf material and topped at the natural breaking point. As such, **PurEst™** cannot account for changes in cane quality that occur because of burning, variable topping height, presence of leaf residue, stalk desiccation, presence of extraneous matter (e.g. soil) and burn to crush delays. **PurEst™** is meant for on-farm use to assist growers in ripening and harvest decision-making and cannot replace the accredited analytical testing provided by CTS on cane consignments delivered to the mill.*

Obtaining and using the **PurEst™** smart phone app

In order to get started with **PurEst™** the user requires a handheld-refractometer for taking Brix% readings and an Android or iOS smartphone/tablet. Contact your local Extension Specialist for advice on which type of handheld-refractometer to purchase.

You can download the application via the App Store on your device. **PurEst™** can then be used in the absence of a cellular signal since data is stored on the device. A cellular signal is however required to download the application and to export data.

The steps to obtain Brix% data from a target field and entry of the data into **PurEst™** are explained next, followed by two examples on interpretation of ripening recommendations.

Step 1: Sample Collection

Randomly cut three stalks of uniform height from different positions within the target field. If crop growth is not uniform across the field, it might be necessary to collect sets of three stalks from more than one location within the field.

It is important that the chosen stalks are healthy and not damaged by eldana, sour rot, frost, or any other factor.

Step 2: Sample Preparation

Remove all leaves and top the stalks at the natural breaking point. Then divide each of the stalks into three equal sections (top, middle and bottom thirds).

Step 3: Measuring Brix% with handheld-refractometer

Using a knife, make an incision at the midpoint of each stalk section. With a pair of pliers, squeeze a small amount of cane juice from the midpoint of each section onto a handheld-refractometer and record the Brix% value. Repeat the process until you have recorded all nine Brix% values.

Step 4: Data input into PurEst™

Open the PurEst™ app and enter the nine Brix% values into the CALCULATOR page of the application and select CALCULATE. This will bring up the RESULTS page displaying the following:

- Estimated whole-stalk juice purity (%)
- Estimated RV%
- Estimated stalk-moisture (%)
- Estimated Uncertainty Values (\pm % value in brackets next to each estimate). This represents the maximum range by which the estimated values could potentially deviate from laboratory-determined analytical values.
- Ripening Recommendation. These recommendations are colour-coded as follows:

RED - indicating high crop maturity (unsuitable for ripening).

GREEN - indicating that the crop is suitable for ripening (with the indicated chemical).

AMBER - indicating very immature crops (consider delaying the harvest if possible).

If you select PROCEED at this point, you will be taken to the DETAILS page which displays previously entered GROWER and CROP details. You may amend details as required. To delete all grower or crop details, select the appropriate CLEAR button.

When you select SAVE, the RECORDS page will be displayed. Records are sorted by calculation date (newest at top) and then sub-sorted by sampling date (oldest at top).

The RECORDS page provides the option to DELETE record/s and to EXPORT records in CSV format to a user-specified email address.

To add a new record, use the PLUS (+) button which takes you back to the CALCULATOR page.

Step 5: Interpretation of PurEst™ ripening recommendations

In order to describe how to interpret ripening recommendations, two examples are provided.

Example 1:



Screen shot showing Brix% input values on the calculator screen of the PurEst™ app.

As can be seen above, the Brix% values in the top third of the stalks are much lower than those in the middle and bottom thirds of the stalks. The presence of a steep Brix% gradient indicates high potential to store more sugar, which is typical of immature cane.

Screen shot showing calculated values and recommendation on the results screen of the PurEst™ app



The PurEst™ estimates for this sample are 82.7% (juice purity), 10% (RV %) and 72.8% (stalk moisture %). Because the estimated juice purity is above 75% (threshold for ETHEPHON) but below 85% (threshold for FUSILADE FORTE and MODDUS), the ripening recommendation provided is: "Crop should respond favourably to Moddus and Fusilade Forte (and generics)".

It is important to verify that low juice purity estimates, resulting in positive ripening recommendations, are the result of vigorous growth and not introduced by limiting factors such as severe drought stress. Visual inspection of the crop for number of green leaves (8 or more) and long upper internodes (see Information sheet 12.1 for more details) during sample preparation (step 2) can

be conveniently used to confirm growth vigour. Vigorous growth is typically accompanied by a steep Brix% gradient in the stalk, hence the refractometer readings can also be used as an indicator.

From this example, it should be clear that a very steep Brix% gradient is required to result in a juice purity of below 75%. Typically the Brix% values in both the top and middle thirds of the stalk need to be much lower than those in the bottom third. In these crops the ripening recommendation would be: *“Crop should respond favourably to Moddus, Ethephon and Fusilade Forte (and generics)”*. For these crops MODDUS, ETHEPHON or FUSILADE can be used as individual treatments. Alternatively, ETHEPHON and FUSILADE FORTE or MODDUS and FUSILADE FORTE in combination (piggy-back) treatments could be considered.

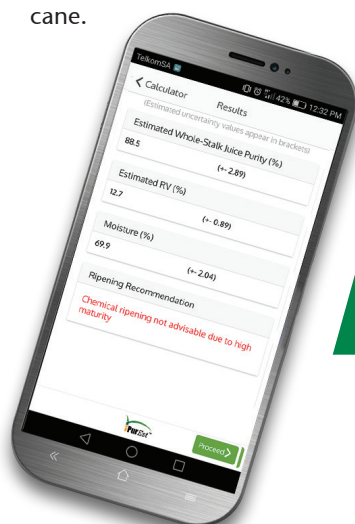
It is important to verify if the individual ripener treatments or the combination treatments are recommended for the variety in question (as specified in the Variety Information Sheet). If in doubt, contact your local Extension Specialist.

Example 2:

Screen shot showing Brix% input values on the calculator screen of the PurEst™ app



The Brix% values in the top third of the stalks in this example are much closer to those in the middle and bottom thirds. The absence of a notable Brix% gradient indicates low potential to store more sugar, which is typical of mature cane.



Screen shot showing calculated values and recommendation on the results screen of the PurEst™ app

The PurEst™ estimates for this sample are 88.5% (juice purity), 12.7% (RV %) and 69.9% (stalk moisture %). Because the estimated juice purity is above 85% (threshold for FUSILADE FORTE and MODDUS), the ripening recommendation provided is: **“Chemical ripening not advisable due to high maturity”**. Financial investment of ripener applications in a mature crop, with little potential for additional sugar storage, is unnecessary.

In cases where PurEst™ estimates juice purity to be marginally above the 85% threshold, some logical reasoning could be applied before making a final decision to ripen or not. For example, if the soil profile is filled with water because of unseasonal good rainfall during winter, and the crop is entering good growing conditions (e.g. because of warmer temperatures after winter), ripening could perhaps be considered to prevent the crop from losing cane quality during the late-season before mill closure. On the other hand, if entering winter, natural ripening due to cooler temperatures will in all likelihood negate the need for ripeners.

Fine-tuning of ripener spray-to-harvest intervals

The time response of a crop to chemical ripeners is complex and can easily vary within a season or between seasons, regions and varieties.

The Brix% gradient concept, introduced with the two examples in the previous section, can be utilised for fine-tuning the spray-to-harvest interval after a ripener application. Ripeners are typically applied to crops with steep Brix% gradients within the stalks. Upon application, the ripener is expected to eliminate the steep Brix% gradient as far as possible, transforming the crop from an immature (Example 1) to mature state (Example 2). If the crop is harvested prematurely (Brix% gradient not yet eliminated) the full benefit of the chemical will not be realised. On the other hand, if the ripener has already eliminated the Brix% gradient there would be no added advantage of delaying harvest any further.

By measuring the Brix% gradient with a handheld-refractometer at intervals between ripener spraying and harvest, a grower can determine optimal spray-to-harvest intervals on the farm and maximise return on investment.

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