Information Sheet

4.7 Determining crop maturity for purposes of cane quality management

Basic concepts

Under good crop management, lack of soil moisture and low temperatures are the main factors that reduce crop growth rate, thereby accelerating sucrose storage (crop maturity) through natural ripening (refer to Information Sheet 4.6). With an increase in crop maturity (increase in whole-stalk juice purity), the benefits from applying any of the registered products for purposes of improving cane quality (chemical ripening) diminish.

For chemical ripening purposes, whole-stalk juice purity at the time of spraying should be below 75% for Ethephon (and other trade names) and below 85% for Fusilade Forte, Moddus (and other trade names). Refer to SASRI Information Sheets 4.8, 4.9 and 4.10. Possible exceptions may arise if refractometer measurements reveal sufficient immaturity in the top third of stalks despite estimated whole-stalk juice purities being above 85% (caused by very high maturity in lower parts of stalk). These whole-stalk juice purity thresholds apply to annual and longer cycle crops under irrigated and rainfed conditions.

Certain registered products can be applied during August – October to maintain high quality into the late-season (typically crops harvested in November – December under South African conditions). For late-season quality maintenance purposes the crop will mostly have whole-stalk juice purities exceeding 85%, but to warrant spraying, the leaf canopy must be in a good vegetative state (seven or more open and healthy green leaves) and soil moisture reserves (and supply of irrigation water) must be adequate to prevent drought stress for the duration of the treatment period.

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 portable 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 whole-stalk juice purity

Whole-stalk juice purity can be determined analytically in a cane testing laboratory from stalk samples collected from the target field two weeks or less before planned spraying. Sixteen randomly selected stalks (of uniform length), collected from several 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 whole-stalk 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.

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 whole-stalk 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 cane quality management recommendations based on the known whole-stalk juice purity efficacy thresholds of the various registered products.

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 chemical ripening, late-season quality maintenance 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® smartphone application

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 and set the user language to English, Afrikaans or isiZulu. **PurEst®** can be used in the absence of a cellular signal since data is stored on the device. A cellular signal is 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.

Taking stalk samples

PurEst® testing may be used for chemical ripening, late-season quality maintenance (for the South African growing cycle) and harvest decision-making.

Testing must be done as close as possible (not more than one to two weeks) before ripener spraying or harvesting.

Where low Brix% values are caused by factors other than vigorous crop growth, such as eldana and severe drought stress, **PurEst®** estimates will be inaccurate.

A minimum of three stalks of uniform height from the target field is required for **PurEst®** testing. However, to account for potential in-field variability in crop growth the following testing guidelines are recommended.

Guidelines for PurEst® testing in sugarcane fields

- In very small fields (less than 2 ha), it is suggested to test 2 to 3 sets of 3 stalks (6 – 9 stalks) collected from different parts of the field.
- In fields of 2 – 10 ha in size, it is suggested to test 4 sets of 3 stalks, one from each side of the field, giving 12 stalks per field.
- In very large fields (larger than 10 ha), the number of samples can be increased to 18 or 24 stalks. As an example, in a large rectangular field with 2 long sides and 2 short sides one can take 1 set from each short side and 2 sets from each long side (6 positions x 3 stalks = 18 stalks).
- There should be no need to sample more than 24 stalks per field.
- Note that the 3 stalks collected at each position should be taken some distance apart (different cane rows) and also some distance into the field (at least 5 m from the edge of the field).
- If the soils and growing conditions in the field are homogenous, fewer sampling positions will be sufficient but in fields with heterogeneity, more positions should be sampled to cater for the heterogeneity, or the field can be split into two to represent the contrasting growing conditions.

Sample preparation

1. Remove all leaves and top the stalks at the natural breaking point.
2. Divide each of the stalks into three equal sections (top, middle and bottom thirds), taking care not to mix sections from different stalks. You will be extracting juice from the midpoints of each of these stalk sections.
3. Using a knife or secateurs, cut at an angle through the internode situated at the midpoint of each stalk section.
4. Then use a pair of pliers to squeeze cane juice out of each stalk section and obtain a Brix% reading with a refractometer.
5. Enter the sampling date at the top of the CALCULATOR page of the PurEst® smartphone app.
6. Enter the Brix% values into the CALCULATOR page.
7. If you are sampling more than three stalks, use the 'Add Stalk' button to create additional rows to capture stalk Brix% values.
8. Once values from all sampled stalks have been entered, select CALCULATE.

Using the application

When all the values on the CALCULATOR page have been entered and the CALCULATE button has been selected, the RESULTS page will appear, providing the following:

- **Estimated whole-stalk juice purity (%)**

This forms the basis for chemical ripening and late-season quality maintenance decision-making.

- **Estimated RV%**

RV% is a term used in the South African cane payment system. However, RV% is a close representation (proxy) of percent Estimated Recoverable Crystal (ERC%) and can be used for harvest decision-making.

- **Estimated stalk-moisture (%)**

This can be used for harvest decision-making.

- **Estimated Uncertainty (%)**

This represents the maximum range by which the estimated value could potentially deviate from a laboratory-determined analytical value.

- **Recommendation**

These cane quality management recommendations are for ripeners used within South Africa only.

Recommendations

With each calculation, the user will be provided with one of the following colour-coded cane quality management recommendations:

Note: *While specific trade names are used in the recommendations, other products containing the same active ingredient may be used.*

- **Chemical ripening not advisable due to high maturity.** This recommendation is given when estimated juice purities are above 85% and accompanied by Brix% values in the top third of stalks that are very similar (less than 3 percentage unit difference) to the values in the middle third of stalks.
- **Crop has high maturity - however, for the South African growing cycle, the use of Moddus or Fusilade Forte may be considered for cane quality maintenance prior to late-season harvesting, provided the crop is in a good vegetative state (seven or more open green leaves) and soil moisture will not be limiting.** This recommendation is given when testing takes place during August, September and October, and estimated juice purities during this period are above 85% and accompanied by Brix% values in the top third of stalks that are very similar (less than 3 percentage units difference) to the values in the middle third of stalks.
- **Chemical ripening with Moddus or Fusilade Forte could be considered due to immaturity in the top third of the stalks.** This recommendation is given when estimated juice purities are above 85%, but Brix% values in top third of stalks are sufficiently lower (3 percentage unit difference or greater) than the values in middle third of the stalks.

- **Crop should respond favourably to Moddus or Fusilade Forte.** This recommendation is given for immature cane with estimated juice purities between 75 and 85%.
- **Crop should respond favourably to Ethephon, Moddus or Fusilade Forte.** This recommendation is given for immature cane with estimated juice purities between 65 – 75%. Please note that not all varieties are suitable for the Ethephon, Moddus or combination ripener treatments (piggy-back treatments). Refer to the latest variety response table within the application.
- **Crop very immature, consider extending the harvest date, but crop should respond favourably to Ethephon, Moddus or Fusilade Forte.** This recommendation is given for very immature cane with estimated juice purities below 65%. Please note that not all varieties are suitable for the Ethephon, Moddus or combination ripener treatments (piggy-back treatments). Refer to the latest variety response table within the application.

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. Note: 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 EDIT or DELETE record/s and to EXPORT records in CSV format.

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

For purposes of chemical ripening decision-making, **PurEst®** should be used in conjunction with visual inspection of the crop to confirm high growth vigour (stalks with 8 or more open green leaves and long upper internodes). For purposes of late-season quality maintenance decision-making, **PurEst®** should be used in conjunction with visual inspection of the crop to confirm good vegetative state (stalks with 7 or more open green leaves). Eldana-infested fields (exceeding 5e/100) or fields flowering profusely at the planned time of ripener application should not be sprayed.

It is important to verify that the individual ripener treatments or the combination treatments are recommended for the variety in question (as specified in the Variety Information Sheet, the new online SASRI variety guide and the variety response table provided within **PurEst®**). If in doubt, contact your local Extension Specialist.

Fine-tuning of ripener spray-to-harvest intervals

For each harvest month during the season, there are spray-to-harvest interval guidelines for each of the chemical treatments. These spray date guides can be accessed in the following ways:

- Within Information Sheets 4.8 – 4.10
- A convenient spray date guide calculator within the **PurEst®** application
- A poster containing all the spray date guides that can be downloaded from the SASRI website.

The optimal timing of application might very well vary depending on crop growth vigour, which is influenced by many factors including location, climate, variety, crop maturity and management. For precision-agriculture purposes, timing may be adjusted based on information gleaned from handheld-refractometer measurements (as explained in this Information Sheet), recorded at intervals between spraying and the planned harvest date. Ripeners are typically applied to crops with steep Brix% gradients within the stalks (large differences between top, middle and bottom Brix% values). Upon application, the ripener is expected to eliminate the steep Brix% gradient as far as possible, transforming the crop from an immature to mature state. 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.

Important: Always consult the product label to establish the legal withholding period (minimum number of days between application and harvest).

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.

Updated by Riekert van Heerden
(SASRI Senior Scientist: Sugarcane Physiology)

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