

A WORLD FIRST FOR SUGARCANE RIPENING!

Dr Riekert van Heerden

Sugarcane quality management enters a new era with the world's first ripening decision-making mobile application.

In August 2016 the South African Sugarcane Research Institute (SASRI) released its first mobile application to the sugar industry. The application, called **PurEst™**, provides practical ripening recommendations to cane growers and was developed by Dr Riekert van Heerden and a team of SASRI research and knowledge management specialists.

Good crop management, limiting soil moisture and low temperatures are the main factors that accelerate sucrose storage in the cane stalk through a process called natural ripening. These drivers of good cane quality are often not present during periods of high rainfall in spring, summer and autumn. As a consequence, growers are frequently required to use chemical ripeners to increase cane quality to acceptable levels. These chemicals, together with their application by aircraft, can cost

in excess of R700 per hectare. In a normal season, more than 60 000 hectares of sugarcane are ripened throughout the local industry at a cost that could approach R42 million.

SASRI research and commercial demonstration trials have shown that chemical ripeners can increase RV yields by up to 3 tons per hectare (R15 100 per hectare at current RV price), provided sufficiently immature crops are targeted for ripening. However, with an increase in crop maturity the benefits from applying chemical ripeners rapidly diminish. The trick is to identify crops in need of ripening so that the 'nasty surprises' of poor cane quality at the mill are avoided, yet, simultaneously preventing unnecessary use of these agrochemicals as part of environmentally sustainable sugarcane production.

An obvious question is: how can growers identify sufficiently immature crops requiring chemical ripening? For decades, visual assessment was the only practical, yet subjective method. An abundance of green leaves, and long spacing distance between these leaves on the stalk, was used as a rule-of-thumb. However, a much more objective and sensitive measure of crop maturity is the cane stalk's juice purity (sucrose expressed as a percentage of total sugar content). Juice purity increases with crop maturity and typically when above 85% the crop has entered a strong phase of natural ripening making chemical intervention unnecessary. Until recently, juice purity could only be determined through laboratory analysis. This has changed with the release of **PurEst™**.

PurEst™ is an Android and iOS smartphone application that estimates juice purity from Brix% (total sugar content) readings measured with affordable hand-refractometers at three points along the length of a sugarcane stalk. A mathematical relationship, established through research on over 1 500 cane samples in SASRI's cane testing laboratories, is then applied to these Brix% readings to produce an estimate of juice purity. **PurEst™** then converts these estimates into practical ripener recommendations (see examples below). The application uses the known juice

purity efficacy thresholds of registered ripener chemicals as a basis, and can therefore recommend the correct type of chemical to use.

Mathematical relationships have also been established allowing **PurEst™** to estimate RV% and stalk moisture% from the same refractometer readings. This capability enables growers to rank fields according to harvest readiness, so that crops with higher RV% are harvested first, while those with lower RV% and higher moisture% are harvested later to increase profitability because of higher RV yields and lower transport costs (depending on trailer design and distance from the mill).

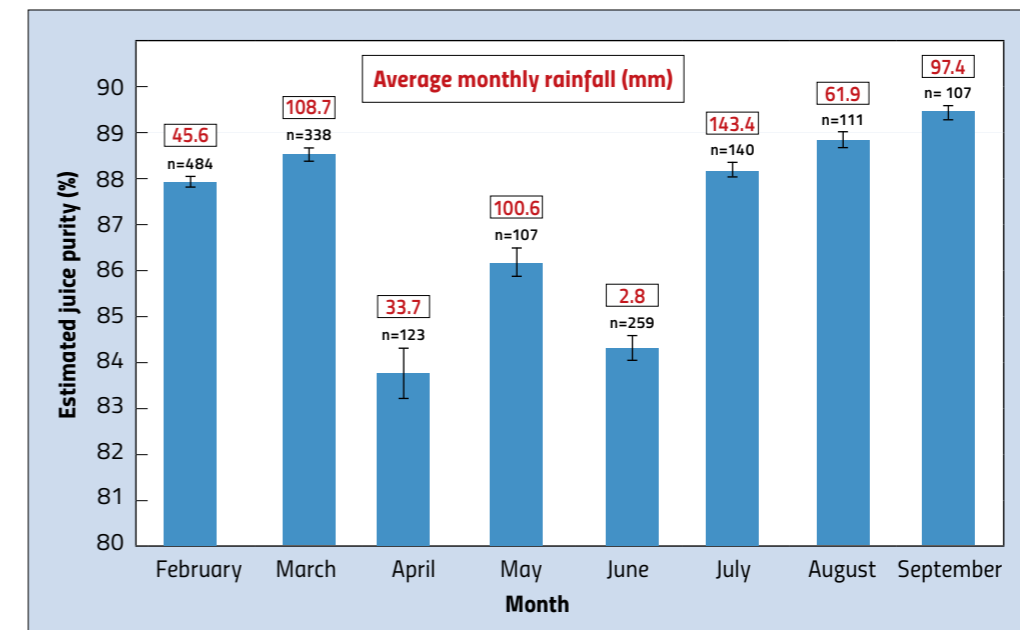
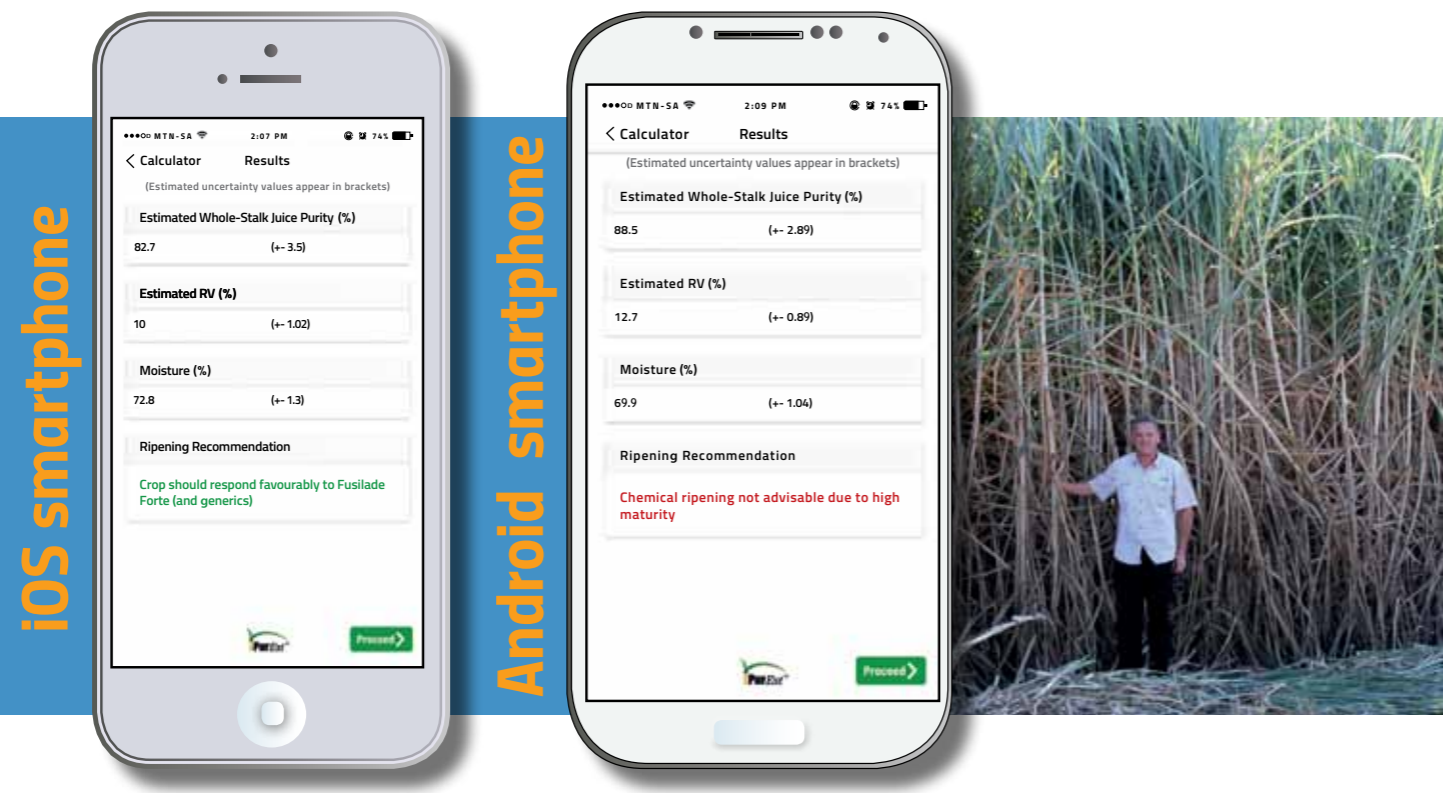
PurEst™ estimates these quality parameters in unburned stalks, stripped of all leaves and topped at the natural breaking point. Hence, **PurEst™** cannot account for changes in cane quality that occurs because of burning, topping height, presence of leaf residue or extraneous matter (e.g. soil), and burn-to-crush delays. **PurEst™** is meant for on-farm use, assisting growers in ripening and harvest decision-making and cannot replace the accredited analytical testing provided by SASA's Cane Testing Services (CTS) on cane consignments delivered to the mill.

Here are two examples of how **PurEst™** has been used thus far in the industry:

PurEst™ was recently used to track crop maturity in a commercial field of N41 in the Midlands-South area. When the cane was tested on 29 January 2016 the estimated juice purity was 87% indicating that the crop was in a mature state. However, this crop responded to good rainfall in January/February with accelerated growth, causing a steep decline in estimated juice purity to 83% when measured on 3 March 2016. The field was scheduled for harvest in 6 weeks' time at a crop age of 24 months. The grower then decided to ripen half of the 7 hectare field, while keeping the other half untreated as a control plot. Harvest data from CTS at the mill revealed that the ripener resulted in a juice purity of 87% and an average RV of 12.45% compared to the control values of only 82% and 9.99% respectively. Although the ripener reduced cane yield slightly, an exceptional RV yield increase of 2.04 ton per hectare (R10 285 per hectare at current RV price) was achieved, on top of some savings in harvesting and transport costs.

PurEst™ was also used on a much larger scale to track crop maturity along the KZN North Coast production region. Between February and September 2016, testing was performed in more than 1 650 commercial fields in the Darnall, Maidstone and Gledhow mill supply areas. Estimated juice purities in the region dropped by approximately 5% across varieties from 88.5% in March to 83.7% in April following the good March rainfall (108.7 mm). Because of the dry conditions in April (only 33.7 mm of rain) the purities again increased to 86.2% in May. However, the good rains during May (100.6 mm) resulted in a drop in purity to 84.3% in June. June was an exceptionally dry month (only 2.8 mm of rain), which, combined with cooler winter temperatures, naturally ripened the crop to 88% purity in July. Noteworthy to point out is that the unseasonal high winter rainfall (exceeding 200 mm) during July and August did not result in a decline in juice purities like what happened after the high rainfall in March. Crop maturity response to rainfall is therefore complex and varies throughout the season as influenced by other factors such as growing temperatures.

Below left: Examples of on-screen chemical ripening recommendations provided by **PurEst™**. Below right: Dr Riekert van Heerden.



PurEst™ estimates of juice purity between February and September 2016 along the KZN North Coast. The number of field observations (n) and the average rainfall (mm) per month for the region is also indicated.

These results demonstrate how **PurEst™** provides us, for the first time ever, 'access at our fingertips' into the dynamic and ever-changing maturity state of the sugarcane crop. This new-found ability sets the scene for a new era of precision cane quality management.

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