Getting the most from the crop

Harvesting losses are a multi-million dollar cost to the Australian sugar industry since mechanical harvesting began. This information could prevent thousands of tonnes of millable cane being left infield.
By Phil-Anthony Patane

Main sources of harvesting losses affecting yield include:

- **Extractor losses (5-25 percent)**
- **Pickup losses (1-10 percent)**
- **Chopper losses (2-8 percent)**

A number of factors can affect harvester performance and losses, including:

- **Cane yield**
- **Whether the crop is erect or lodged**
- **Uniformity of row spacing and row length**
- **Field layout and harvesting conditions**
- **If row spacing and machine are matched**
- **Condition and maintenance of machinery**
- **Operator proficiency.**

How can operators minimise excessive harvest losses

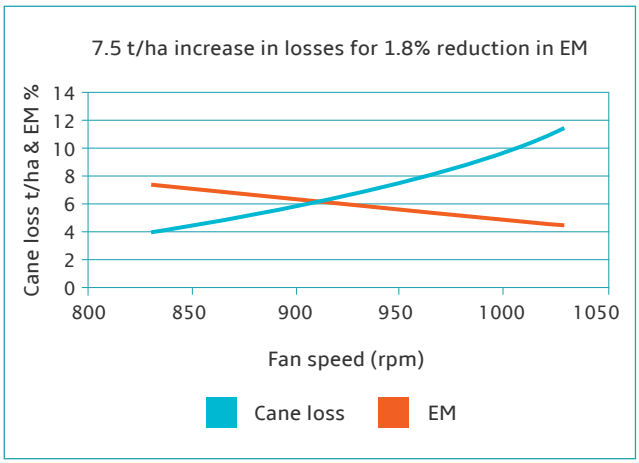
Extractor Losses

The big challenge for industry is trying to achieve a balance between cane cleaning and cane loss.

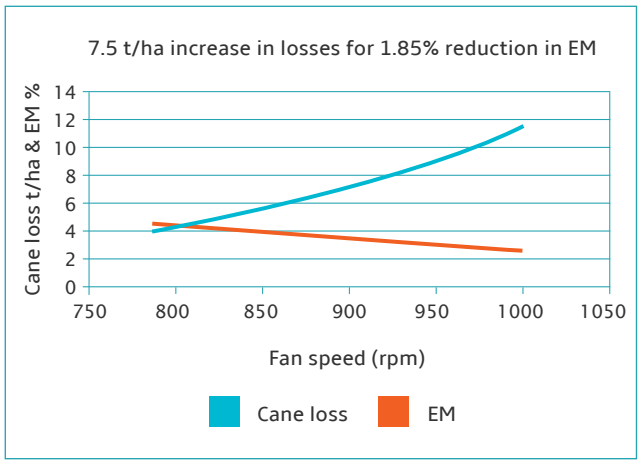
We know from research that high fan speeds cause excessive cane loss but with little improvement to cane quality (see graphs on opposite page).

As fan speed increases over 800 rpm, losses increase dramatically with minimal improvement on cane quality.

However, if operators attempt to reduce losses by running lower fan speeds, EM levels rise to a point where bin weights create a transport/milling issue and the economic benefit of the extra yield gain is eroded by the CCS loss caused by high EM levels.



Above: The effect of John Deere fan speed on EM and cane loss.



Above The effect of anti-vortex fan speed on EM and cane loss.

Topping

Where possible, cane should be topped at the growing point to remove leaf material because tops comprise of 40-45 percent of total EM.

Cane not topped increases EM, depresses CCS and reduces sugar quality through increased colour, ash and starch. Removing tops reduces the load on the extractors, allowing for improved cleaning, reduced cane loss, and less wear and tear on the machine.

This is supported by a trial conducted by Cam Whiteing – SRA engineer – which indicated that although topping reduced yield by 5.5 t/ha, an improvement in CCS of 0.62 units increased growers' income by $165 per hectare.

Pickup losses and stool damage

When a good row profile is produced, operators should aim to 'skim' the surface of the soil with the basecutter blades. This gives a clean cut with minimal soil intake. Operators should also aim to match their basecutter rpm to forward speed.

For a given speed, an overly high basecutter rpm will result in stools being cut by the blades multiple times. This will reduce the ratooning of the stool and increase blade wear.

Far worse than this is when basecutter rpm is too slow for the forward speed – it significantly reduces ratooning by tearing the stalk, and increases soil in cane supply. The disc tears off stalks before a blade reaches the stalk, causing severe damage to the stool.

To minimise the effect of disc-to-stool contact, ideally basecutters should have six blades per disc. The extra blade per rotation leads to less disc-to-stool contact until 8-9 km/h.

Chopper losses

There will always be sugar loss associated with mechanical harvesting, but these losses can be minimised by examining three components:

1. Billet length
2. Feedtrain roller speed
3. Condition of chopper knives.

Billet lengths have decreased over time, from 250 mm+ in the early 1990s, to as short as 100 mm with 6 blades per drum today. As a result, chopper losses have increased from 2 percent up to 6-8 percent.

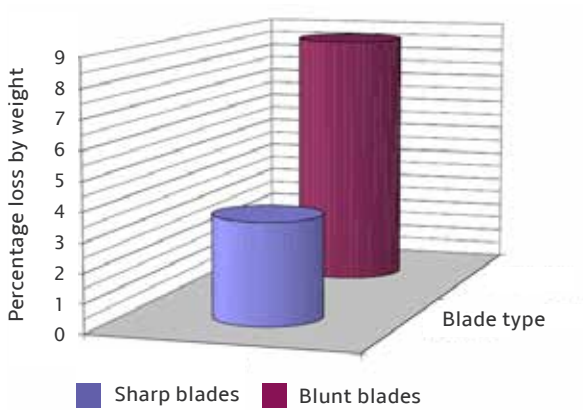
Adjusting the in-cab billet length dial varies roller train speed, which alters billet length. In doing so, the control either hastens or slows the rotational speed of the rollers (hence the cane bundle) relative to the tip speed of the choppers. While this does vary billet length, it also reduces billet quality and increases losses per cut.

How to maximise billet quality and ensure a consistent billet length

- **Run roller tip speed in the range of 55-65 percent of chopper tip speed**
- **Butt-lifter tip speed 80–90 percent of the roller tip speed**

By operating within this range, billet quality is maximised and billets will be a consistent length. Maximising billet quality means that both chopper box and extractor losses are minimised as there are fewer smaller fragments. Improved billet quality means reduced cut-to-crush deterioration, which improves cane quality and sugar quality.

Billet quality quickly reduces as blade sharpness deteriorates. Sharpness of the chopper blade and correct overlap is essential for chopping green leaf and trash, and minimising recycling of billets. Keep the blades as sharp as practically possible with a minimum knife overlap.



Above: Effect of blunt chopper blades on cane and juice loss.

Points to consider:

- **To minimise cane loss there is a compromise between cane cleaning and cane loss.**
- **Topping can improve CCS, bin weight, fibre and dollars/ha.**
- **To minimise chopper losses:**
  - > Set roller/chopper speeds to cut the longest billet.
  - > Have the feedtrain surface speed to chopper tip speed ratio in the ideal 60-70% range.
- **Important to replace chopper blades – worn blades increase chopper losses.**
- **Keep basecutter blades as long and square as practically possible.**
- **Important to discuss with your customers what your needs are and what their needs are.**

How can growers minimise excessive cane loss

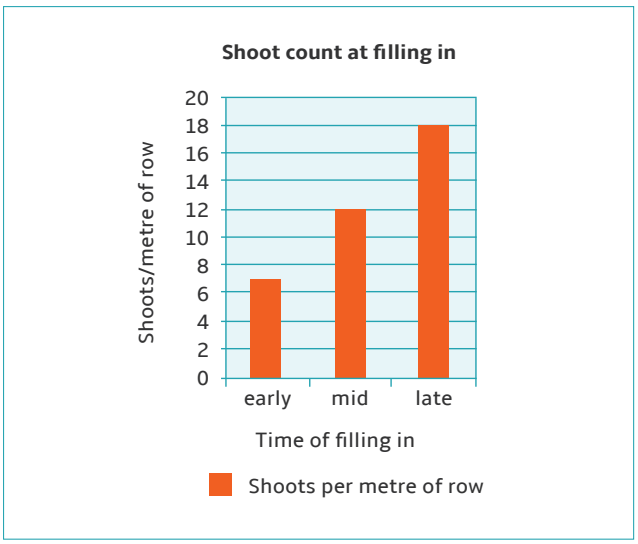
To minimise pick-up losses, stool damage and excess soil levels entering the mill it is important that row profile is consistent and matches the basecutter height and angle. Hill height and shape will vary depending on cultural practices and agronomic considerations, hence the vital importance of grower and operator discussion.

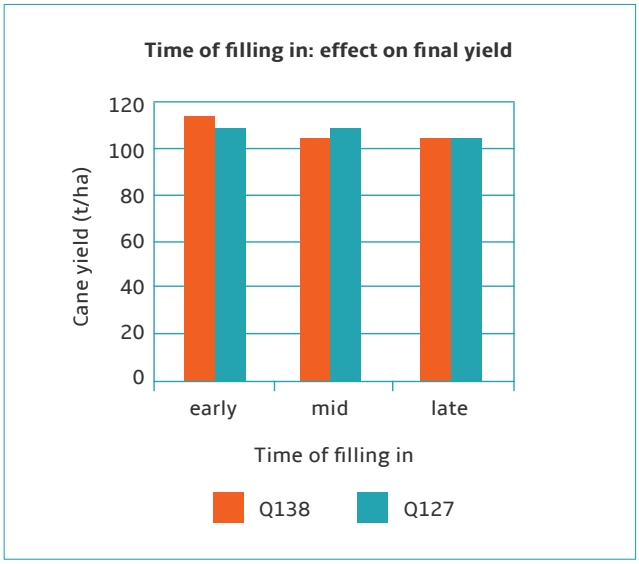
Whilst it is not possible to stipulate one specific height and/or size, some general rules apply:

1. Hill-up must be consistent across the block and, preferably, the entire farm.
2. Ensure that plant cane is properly filled in. Start bringing in soil once there are eight to ten shoots per metre.
3. Flat or hollow profiles are unacceptable. Harvesters cannot pick up cane out of a hollow.
4. Avoid excessive clods in the row as this increases soil in cane.
5. Aim to produce a flat, smooth interspace free of tine marks to give the harvester a level base to work on.
6. Consistent row profile matching the basecutter angle is the key to minimising stool damage.

Above image: Well filled-in and poorly filled-in cane.

Research indicates that there is no yield impact from filling in early versus filling in late however, filling in late leads to increased stool damage and increased pick up losses when harvested. When the filling in operation is left late, soil will not flow properly into the centre of the hill, resulting in a volcano effect. The volcano effect later results in high quantities of soil in the cane supply and increased cane pick-up losses. Stools are more prone to damage as they are not properly supported by the soil.





Above: Shoot count at filling in and time of filling in, effect on final yield.

Improving field efficiency

With the current lack of harvesting capacity machines are cutting large areas every day to fill their bin quota. This can only be achieved by high pour rates which have negative effects on cane quality. One way for industry to minimise soil in cane supply is to have a strong focus on improving row profile/ spacing to suit the harvester.

Another option to reduce pour rate without increasing harvester capacity/cost, involves improving farm efficiency.

Harvester field efficiency is the ratio of time spent cutting cane to the total time spent harvesting. Total harvesting time includes cutting, turning, infield service and maintenance, downtime, waiting for bins and rest breaks.

Research indicates that there is a large variation in harvester field efficiency between farms, blocks and harvester groups as well as between years.

The total cost of harvesting includes two components: variable costs and fixed costs.

Fixed costs related to harvesting include expenses such as depreciation, interest, storage costs, taxation and insurance. Those costs that are variable include fuel, repairs and maintenance and labour.

Variation in harvester efficiency amounts to large differences in the variable cost of harvesting between different farms and harvesting groups. Low field efficiency implies high labour and fuel use per tonne of cane harvested, and vice versa.

The difference in harvester field efficiency and the variable cost of harvesting between farms and blocks is impacted by differences in farm layout.

The Harvest/Transport Model was used to assess the relative impact of farm layout on the cost of harvesting. Modelling shows that turning within blocks accounts for a significant proportion of time spent harvesting. This implies that increasing row length and therefore reducing the number of turns will decrease the variable cost of harvesting. Increased hauling distance was also shown to increase the variable cost of harvesting.

Points to remember:

- **To minimise soil in cane supply and ratooning losses, establish a row profile that matches basecutter setup, discuss this with your operator.**
- **The use of GPS guidance reduces variation in row width.**
- **Improve field efficiency by:**
  - > Joining blocks together (if possible).
  - > Provide adequate headlands to reduce turning time.
  - > Maintain headland and haul roads.
  - > Provide efficient access to blocks (drain crossings in the correct places for efficient hauling).

For more information please refer to *SRA's Harvesting Best Practice Manual*.

This manual is available as an e-book from our website **www.sugarresearch.com.au.** If you would like a hard copy, please contact Phil-Anthony Patane at ppatane@sugarresearch.com.au or on 07 4776 8202.