Sugar Research Australia

SRA GUIDE TO MODERN HARVESTING

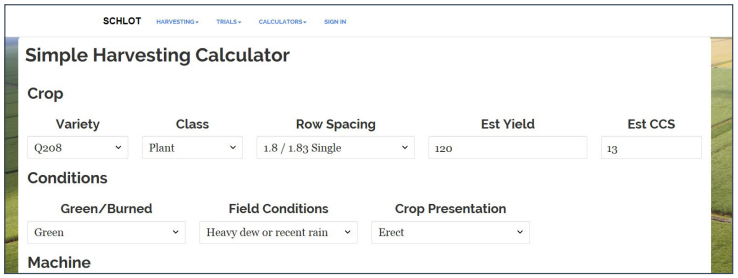
BILLET LENGTH

There will always be sugar loss associated with mechanical harvesting but the magnitude of this loss depends on:

- Billet length
- Feedtrain roller speed
- Condition of chopper knives.

Harvesting losses cannot be eliminated completely however, trials have shown that these can be reduced significantly if the harvester is set up and operated correctly. The harvesting operator has a crucial role in ensuring that the harvester is set up and operated in such a way that performance is optimised, cane quality is maximised and losses are minimised.

Even under optimum operating conditions, losses associated with the short billet lengths, high pour rates and or high fan speeds can be significant and contribute to the overall harvesting losses the combined value of which can be greater then the combined cost of harvesting. Finding the right balance between harvesting losses and the direct cost of harvesting makes everyone more money. Tools such as SCHLOT, shown to the right, *(http://calcs.schlot.com.au/)* allow all sectors to understand those losses and costs to make an informed decision on the best way to minimise both.

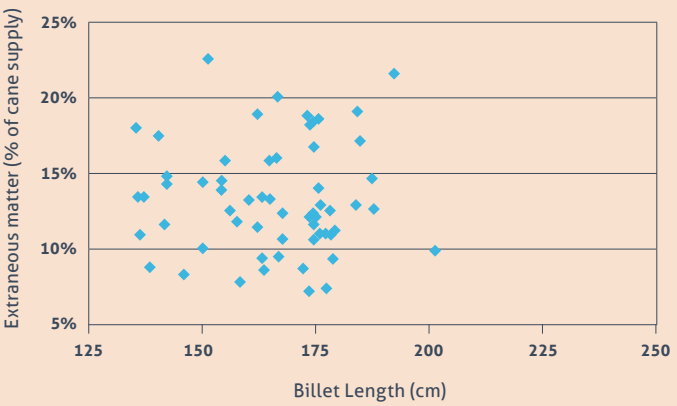


Reducing billet length is increasingly used as an 'easy fix' for load density (shorter billets = higher load density) and cleaner cane.

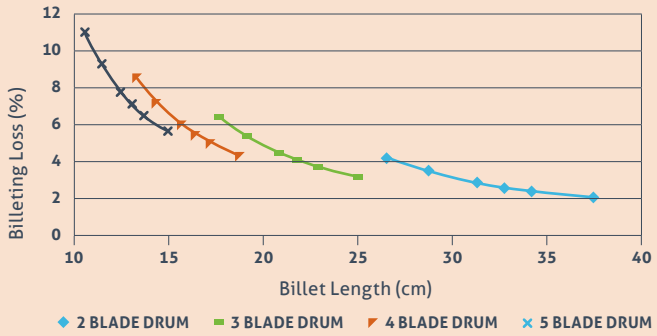
Shortening billet length:

- Increases juice loss (more cuts per stalk)
  - Juice loss of >10% is supported by data
  - A cane stalk is about 85% juice and some juice escapes every time the stalk is cut.
- Increases fibre levels (due to juice loss)
  - 1 unit of fibre associated with shorter billet length (due to juice loss)
  - Increased fibre = lower CCS = lower cane price.
- Increased cane extractor losses (basic aerodynamics: shorter billets weigh less and are easier to suck out)

The theory that shorter billets clean better is not correct. As shown in the graph below there is no correlation between billet length and extraneous matter.



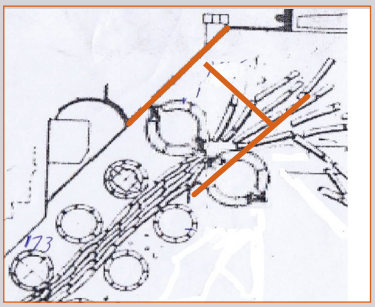
Cutting shorter billets increases billeting losses and increasing the number of chopper blades shortens the billet and increases losses as shown in the graph below.



Billet length is also determined by feedtrain speed. Research has shown that the ratio of the surface speed of the feed rollers and the average blade speed is the most important driver of the amount of juice lost per cut. Loss per cut is optimised when this ratio is around 55-60% (optimised feedtrain). *As this ratio gets below 50%:*

- the loss per cut and the number of cuts increases
- there is greater variability in billet length
- there is more billet damage, and
- power consumption and blade wear increase.

The figures below show how to calculate the Feed Ratio. Best results will also be achieved by operating the butt-lifter at a tip speed of 80-90% of the tip speed of the other rollers in the feedtrain.



Feed Roller (example)

Measured diameter = 250mm
Circumference = 250mm * 3.14 = 785mm (0.785m)
Measured roller speed = 175 rpm
Surface speed = 175 rpm * 0.785 metres per rev = 137 meters per minute

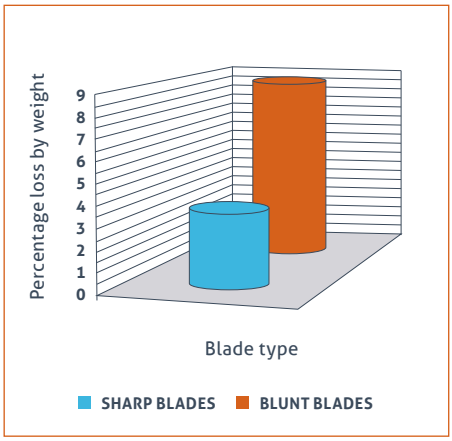
Choppers

Distance Between Centres = 15 inch = 381mm (this is the same as the average diameter of both drums)

Average Circumference = 381mm * 3.14 = 1,200mm (1.2 metres)
Measured chopper speed = 210 rpm
Blade speed = 210 rpm * 1.2 metres per rev = 252 metres per minute.

Feed Ratio = Feed Roller Surface Speed / Chopper Average Blade Speed
= 137 metres per minute / 252 metres per minute
= 54%

Blade condition also affects chopper losses. Badly worn or damaged blades triple sugar loss compared to new blades. Attention to blade maintenance is important.



Summary

Billeting mass loss is:

- loss per cut x number of cuts/m length of stalk

The minimum loss per cut is achieved at the maximum billet length setting for the harvester.

Lowest losses and lowest billet damage occurs when feedtrain roller tip speed is 60% of chopper blade tip speed.

Losses from blunt chopper blades are at least twice as high as from sharp blades

As pour rate increases, losses increase.

- Increased pour rate (flow rate) means increased cane density (stalks) between top and bottom drums resulting in increased juice losses as billets are squeezed between drum surfaces.

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