2019 SOUTH EAST ASIA SUGARCANE SUMMIT

JULY 7-10, 2019 | KHAO YAI, THAILAND

75 years AUSTOFT

CASE IH AGRICULTURE

How plant and row spacing can affect yield

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75 years AUSTOFT

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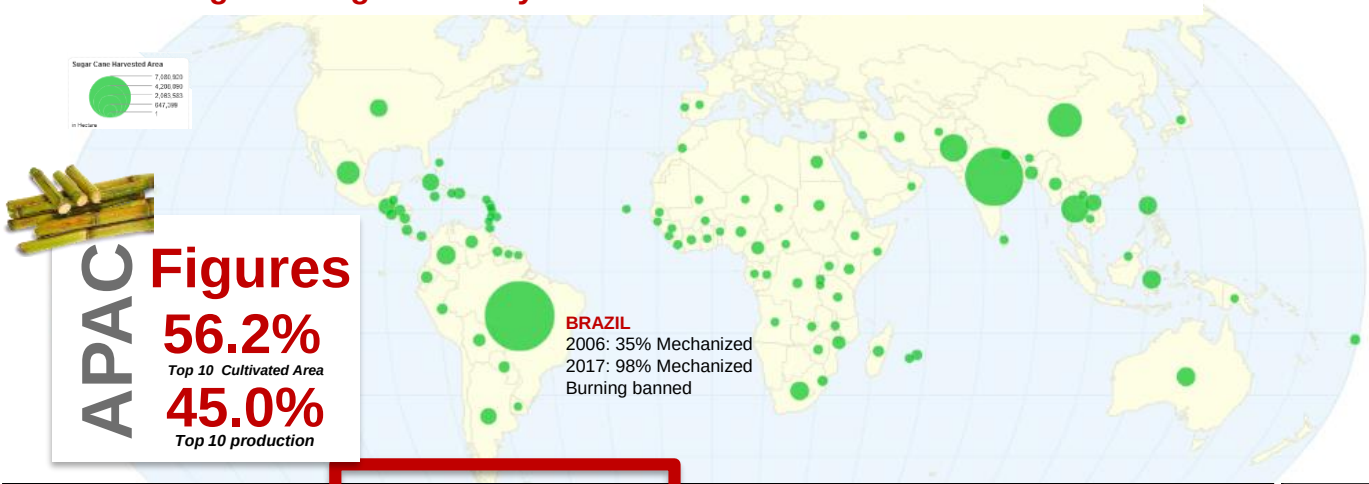
Sugar business in Asia Pacific and opportunities

Global Sugarcane Production Overview

Grown in over 100 Countries, but "Top 10" harvest more than 85% of World Crop

4 Countries drive the global sugar industry: 3 are in APAC



Top 10 Producers	BRA	INDIA	CHINA	THAI	PAK	MEX	COL	INDO	PHIL	USA	AUS
*Production (M ton)	739	350	126	103	64	61	35	34	31	29	27
*Yield (Ton/Ha)	75	67	71	76	56	78	86	85	73	76	82
*Cultivated area (M Ha)	7.0	5.0	2.0	1.5	1.0	.75	.40	0.4	.45	.40	.30
% Mechanized (est.)	98%	~2%	~1%	30%	>1%	20%	15%	>1%	2%	100%	100%

Growth Opportunity

** 2018 – United Nation Food and Agriculture Organization*

Global Sugarcane Planting Overview

Row Spacing: As markets mature and expand, row spacing changes

Narrow

Varies from 0.6 – 1.4m

- Common in emerging markets
- Below 1.0 m is only hand cut
- Yield often lower than 1.5 m
- Perceived benefit of more rows is a barrier to mechanization

Conventional

Varies from 1.5 – 1.9m

- Less competition between plants
- Majority of mechanized harvest is 1.5 m
- Yield often increases with 1.6 – 1.8 m
- 1.8m optimum for Flagship harvesters

Double Alternate

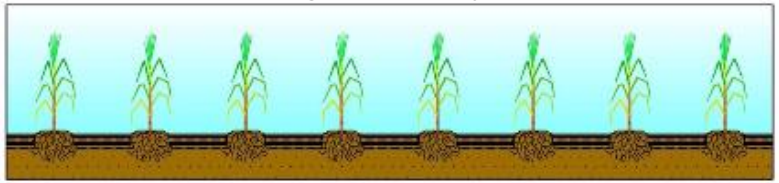
0.9m 1.5m 0.9m

- Maximize efficiencies in poor soils
- Reduces soil compaction
- 25% of Brazil crop has this row spacing.
- GPS guidance and good field prep are needed to control losses.

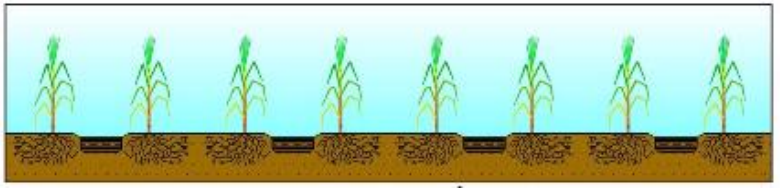
Understanding Multiple-row harvesting

- We define the term '**Multiple-Row Harvesting**' as one machine harvesting more than one row in a single pass.
- It is different from '**Single-Row Harvesting**' in that the harvesting machine is wider in order to accommodate multiple rows of crop.
- Case IH multiple-row harvesters are *only* available on tracks and the distance between the tracks is greater than the distance between the tracks (or wheels) on the Single-Row harvesters.
- Case IH offer **'multiple-row'** harvesters **in 'Dual Alternate'** and **'Multi-Row'** configurations

'Single-row' layout



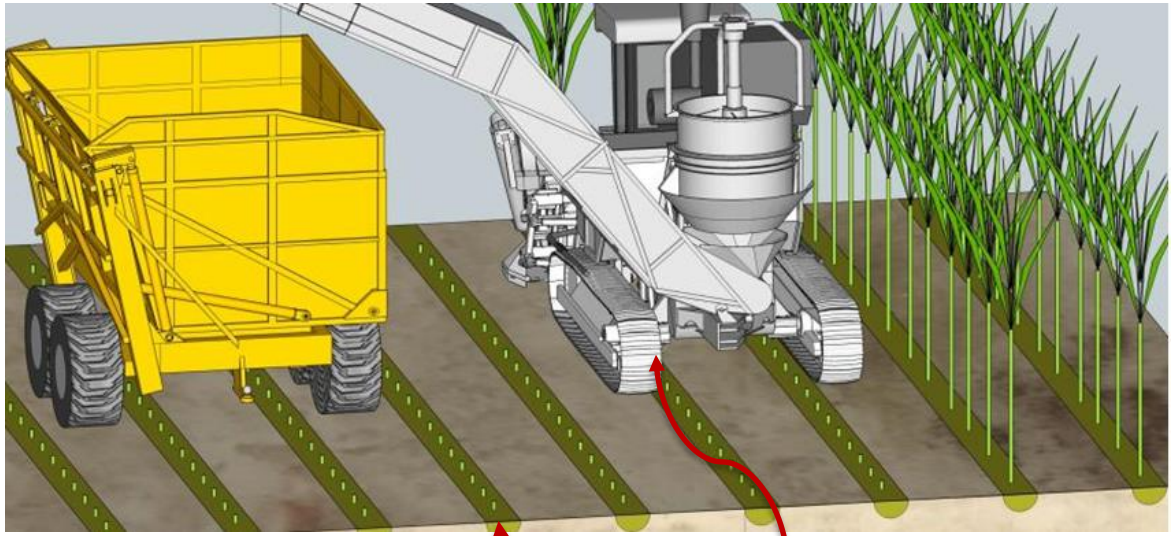
'Multiple-row' layout



Why you may want to switch to Multiple-Row harvesting

- To increase yield
- To increase total recoverable sugars
- To decrease the compaction of the soil
- To increase the health of the ratoon
- To decrease the volume of traffic in the field
- To increase income
  - ✓ More farmable area
  - ✓ More productivity
  - ✓ Less fuel usage

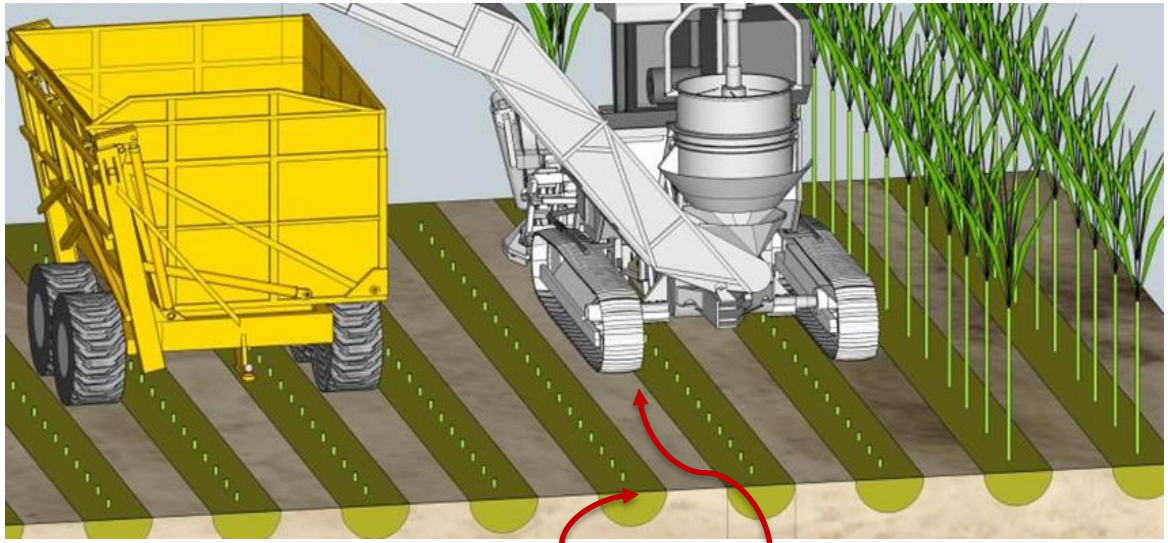
‘Single-Row’ harvester in ‘Multiple-Row’ crop spacing (2 x 1.5m)



Small root zone ‘bucket’.
Roots do not develop much

Track partly running over the ratoon
Track **is compacting** the soil around roots

‘Multiple-Row’ harvester in ‘Multiple-Row’ crop spacing (2 x 1.5m)



Large root zone ‘bucket’.
Roots develop well

Track not running over the ratoon.
Track **is not compacting** the soil around roots

The advantages of lower soil compaction

A stronger plant

- Allows roots to explore deeper and wider, anchoring the plant, helping it to stay upright

A healthier plant

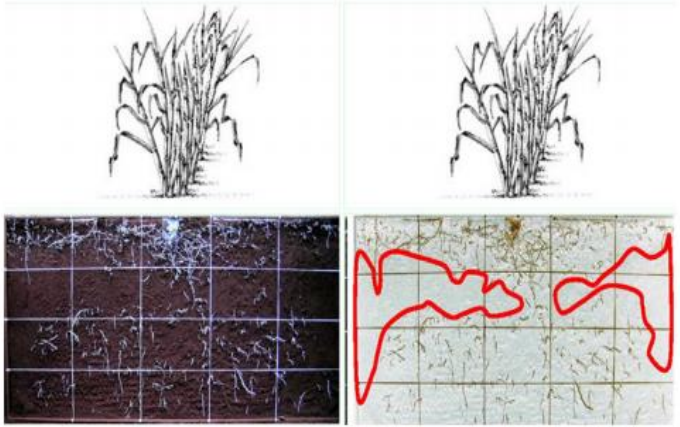
- Deeper and wider root spread means more opportunity for plant to absorb water and nutrients

A more productive plant

- Studies show that soil compaction hinders root exploration, therefore restricting the availability of nutrients and water to the plant

Less risk of waterlogging

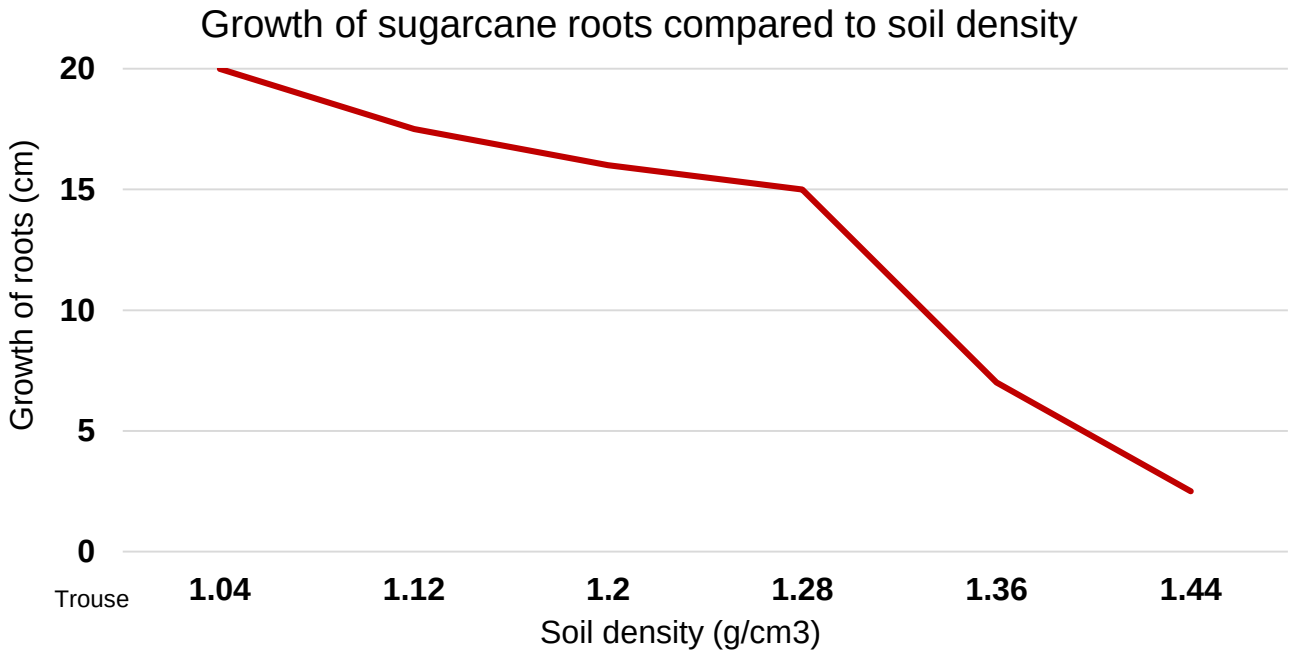
- Studies show that waterlogging can decrease cane productivity by 15-45% (Gomathi, et al., 2014)



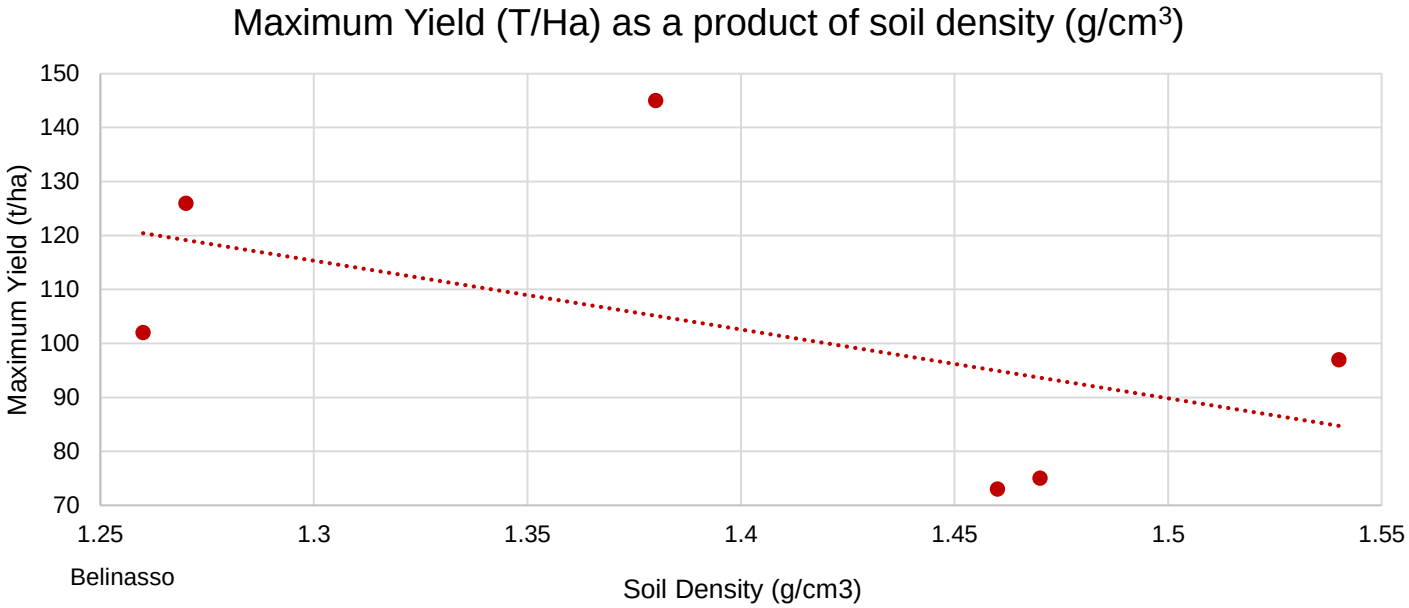
Absence of roots in the trafficked area

Vasconcelos et al.. 2006

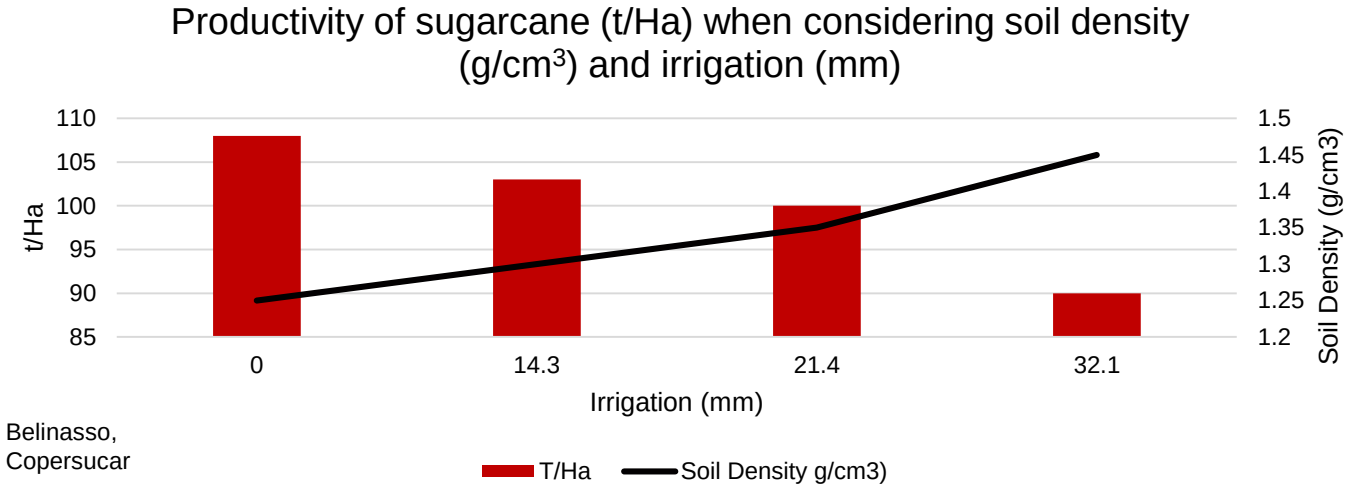
Soil compaction and root growth



Soil compaction and achievable yield



Yield when considering soil density and available moisture



Even though water availability is increased, yield decreases *as* soil density (compaction) increases.

Reducing compaction caused by machinery

‘Standard’ gauge (1850 – 2200mm) puts more risk of compaction and tramlining near the crop even on ‘standard’ single-row spacing of 1.5m

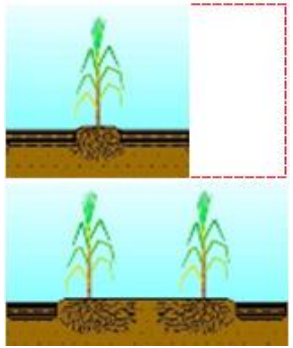
Leading to…

‘Wide’ gauge (2800-3000mm) puts less risk of compaction and tramlining near the crop even on ‘standard’ single-row spacing of 1.5m

Points to consider – Compaction of Soil

- Moving wheels father from the ratoon should decrease soil compaction around the ratoon. Compaction causes soil density to increase which leads to an increase in soil density
- The limit value of the density in majority-clay soil is 1.35 g/cm3; above this value there is a marked **decrease in yield**.
- **Compaction** of the soil does not only **restrict root growth but also the water capacity of the soil.**
- Compaction of the soil around the ratoon and the roots is often caused by **traction of sugarcane harvester and/or in-field collection trucks/transport**
- **Multiple-Row harvesters from Case IH have a wider gauge, moving the tracks further from the ratoon and roots, meaning less soil compaction around them.**
- **Switching to a 'multiple-row' field system could help to decrease compaction and increase yields on your farm**
- ***Whatever your row spacing, your wheel/track spacing should match!***

Reduced traffic and increased productivity



Area worked in 1 pass with ‘Single-row’ harvester

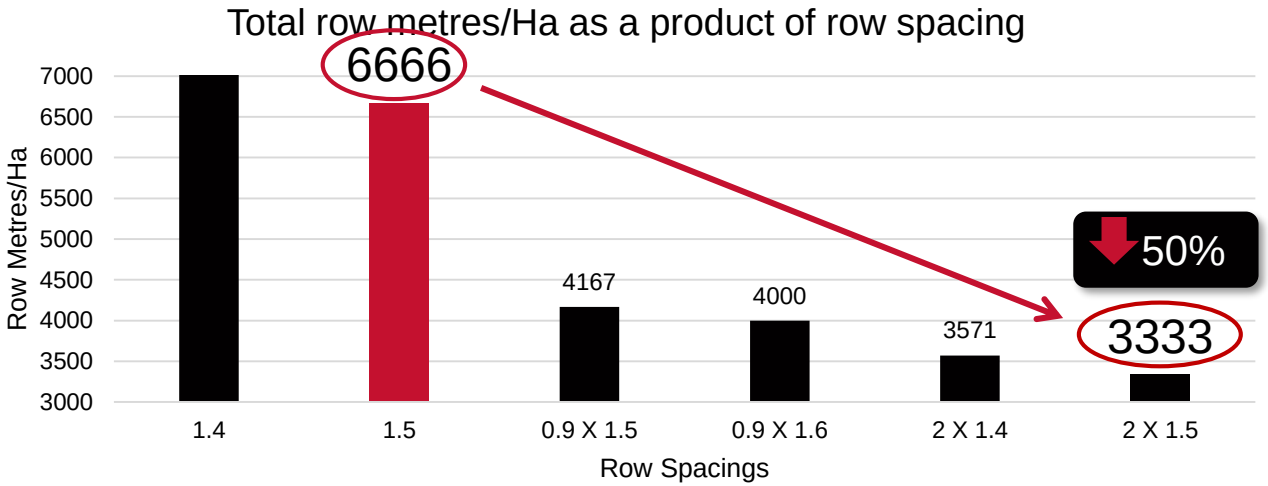
Area worked in 1 pass with ‘Multiple-row’ harvester

=

- Fewer passes over the field
- Lower compaction by the harvester
- More crop harvested per pass
- Less fuel used per Ha

‘Multiple-Row’ harvester covers almost 55% more area per pass

Reduced traffic and increased productivity



Changing row spacing from 'single-row' to 'multiple-row' decreases total number of row meters per hectare

Fewer row meters per hectare means fewer passes up and down the field with machinery

Case IH ‘Flagship’ Harvester Offering

A8010

Type	Single-Row
Propulsion	Wheels
Row spacing	> 1.4m
Engine HP	358
Throat Width	1.08m
Working Width	1.08m

A8810

Type	Single-Row
Propulsion	Tracks
Row spacing	> 1.4m
Engine HP	358
Throat Width	1.08m
Working Width	1.08m

A8810 DA

Type	Multiple-Row
Propulsion	Tracks
Row spacing	2 plants no more than 0.9m apart
Engine HP	358
Throat Width	1.37m
Working Width	1.37m

A8810 MR

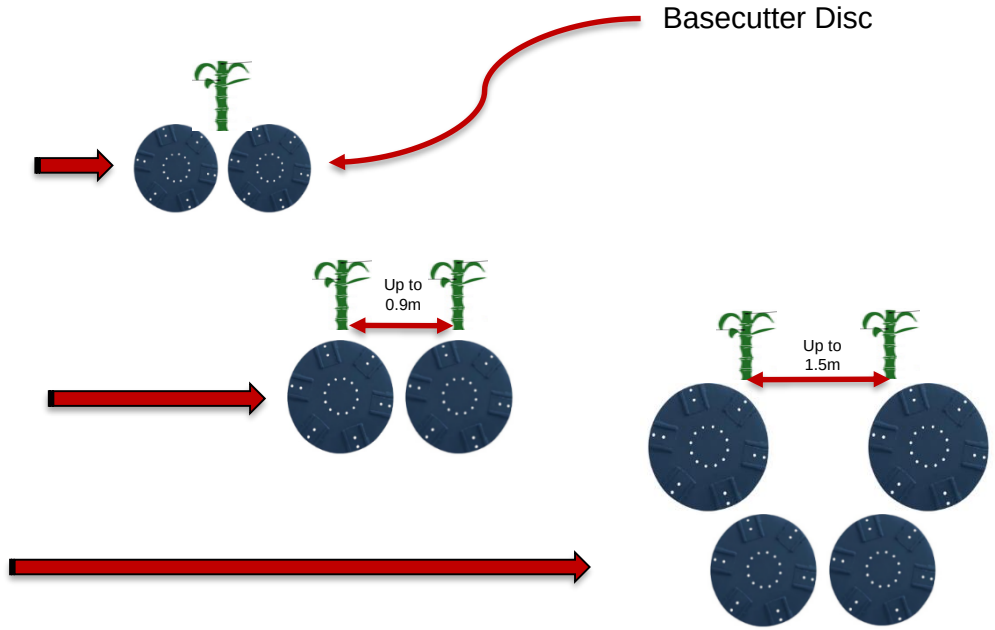
Type	Multiple-Row
Propulsion	Tracks
Row spacing	2 plants no more than 1.5m apart
Engine HP	358
Throat Width	1.08m
Working Width	1.9 – 2.65m

Case IH ‘Flagship’ Harvester Offering

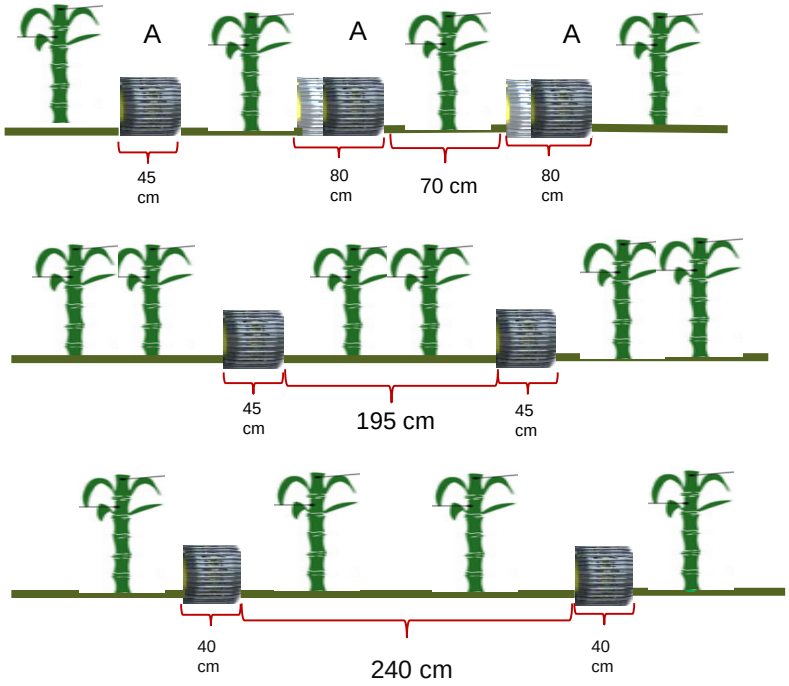
A8010/8810 ‘Single Row’ SR
- 1 Row
- 2 Discs for 1 Row

A8810 ‘Double Alternate’ DA
- 2 Rows
- 2 Discs
  - 1 Disc for 1 Row

A8810 ‘Multi Row’ MR
- 2 Rows
- 2 External Discs
- 2 Internal Discs
  - 2 Discs for 1 Row



Compaction Comparison – SR, DA & MR



‘Standard’ ‘Single’ Row
- 1.5m between plants
- 1.88m between tracks
- 55% compaction

‘Standard’ ‘Double-Alternate’ Row
- 1.5m between plants spaced 0.9m apart
- 2.4m between tracks
- 19% compaction

‘Standard’ ‘Multi’ Row
- 1.5m between plants
- 3.0m between tracks (16 inches wide)
- 13% compaction

A8810 MR – Development of the leader

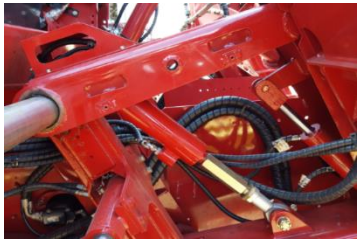
Launch

Horizontally-Extending Dividers

Vertical Feeder Rollers

+ 27% Operating capacity

Autofloat – Automatic row dividers floating system



But what does this mean....

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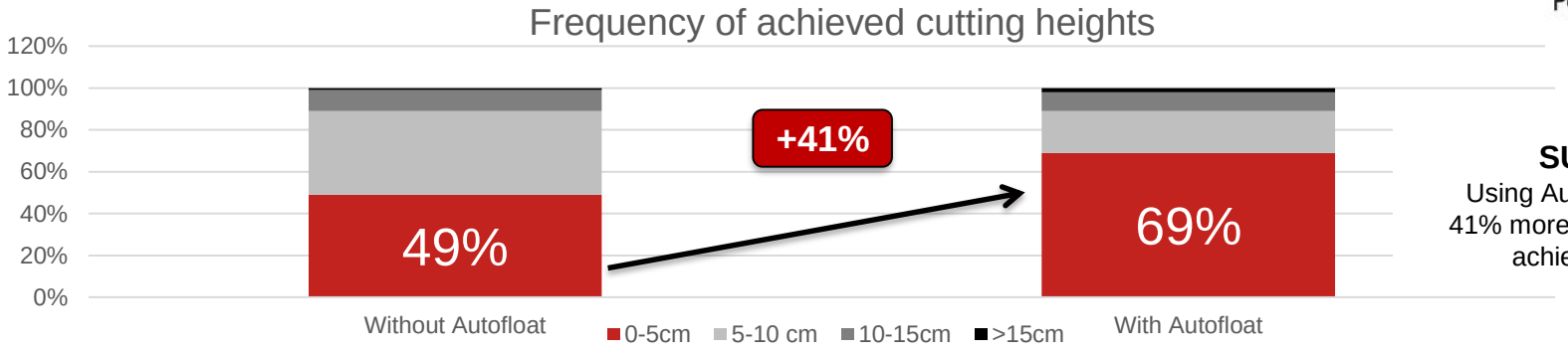
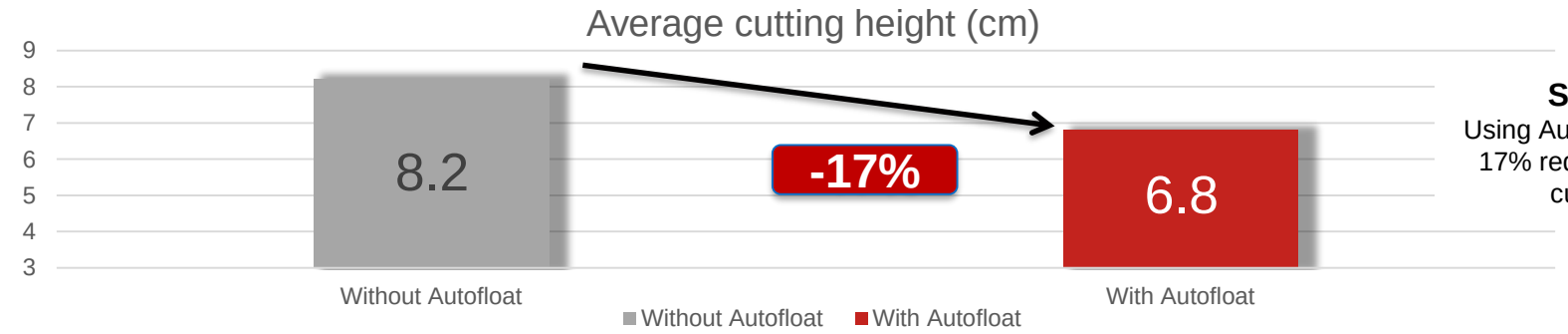
Luiz de Queiroz College of Agriculture field tests – Autofloat

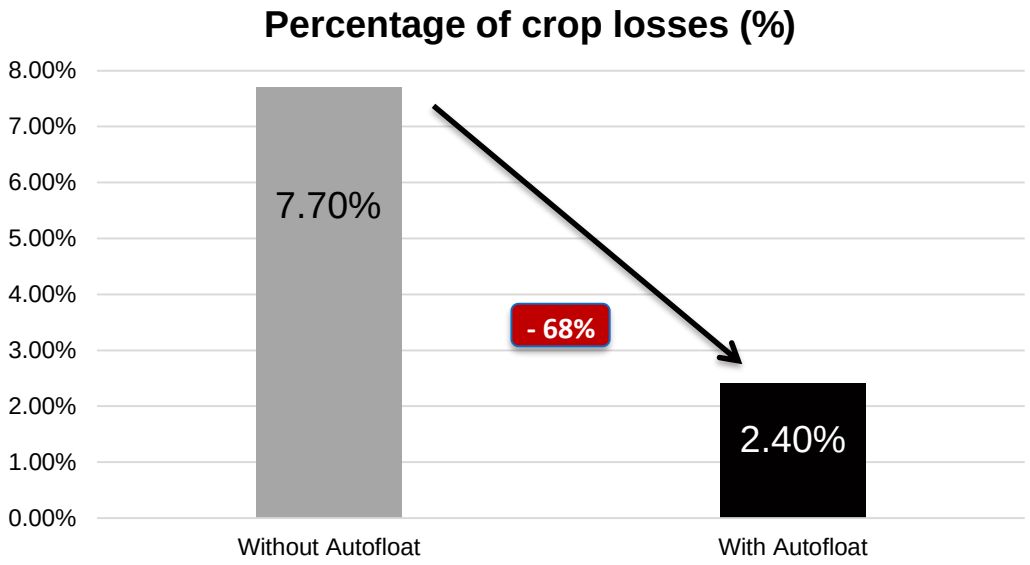


SUMMARY
Using Autofloat resulted in 41% more basecutting being achieved at 0-5cm



SUMMARY
Using Autofloat resulted in a 17% reduction in average cutting height

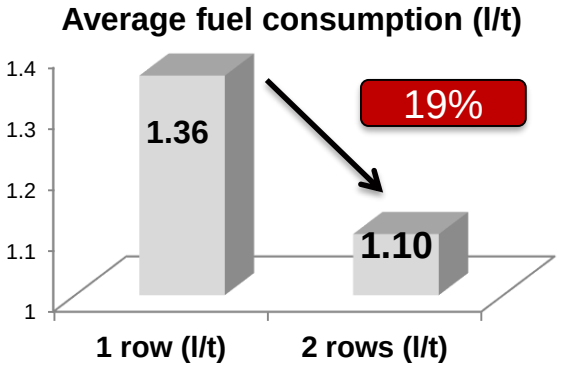
Luiz de Queiroz College of Agriculture field tests – Autofloat

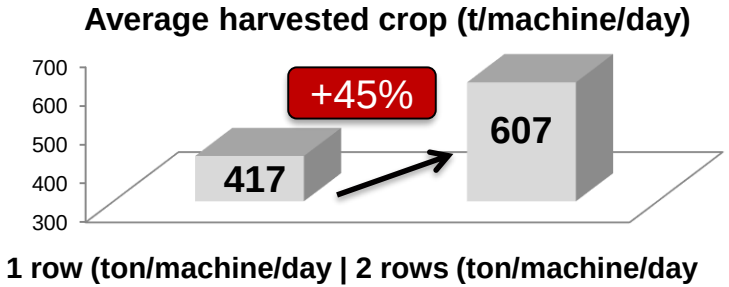


SUMMARY

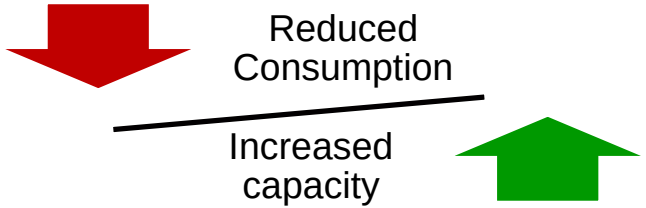
Using Autofloat resulted in 68% less crop loss from the crop dividers

A8810 MR Harvester Benefits





1. Case IH ‘multiple-row’ harvesters use the same efficient Cursor 9 engine as ‘single-row’ harvesters. But as they cut more cane per pass, they use less fuel per tonne of cane harvested.



2. Because the ‘multiple-row’ harvesters cut more cane per pass, they can harvest up to 45% more cane per day than a ‘single-row’ machine

A8800 MR

Customer with 18 units A8800MR in Brazil

A8800 MR Performance Results

UNIT	T/year	Avg. T/day	Hrs/year	Fuel/year (L)	Avg. Fuel/T (L)
40313	226,816	777	3,416	164,150	0.72
40013	218,891	750	3,770	152,448	0.70
40413	208,878	720	3,649	162,764	0.78
40213	206,386	707	3,607	144,508	0.70
40113	195,500	701	3,557	143,866	0.74
40513	190,557	858	3,187	143,609	0.75
40211	160,754	609	2,902	118,458	0.74
40410	156,937	539	3,094	124,685	0.79
40210	152,220	521	2,609	105,156	0.69
40014	148,365	738	2,638	117,129	0.79
40711	147,338	524	2,893	117,698	0.80
40811	146,583	504	2,580	99,505	0.68
40511	145,533	525	2,903	109,485	0.75
40011	142,164	490	2,819	108,917	0.77
40613	135,424	684	2,577	116,946	0.86
AVG	172,156	643	3,080	128,621	0.75

Average 172,156 tonnes/ machine/year → **Average 643 tonnes harvested/day** → **Average 0.75 litres of fuel/tonne**

A8800 MR - Harvest record over 24 hours

07/05/16: Harvest record over 24hrs:

- **3383 tonnes of cane harvested**
- **1488.52 litres of fuel used**
- **91% of time spent harvesting**

Meaning:

- **140.95 tonnes harvested per hour**
- **62.01 litres of fuel used per hour**
- **0.44 litres of fuel used per tonne!!!**

São Martinho

Elevator hours (h)	22
Consumption (L/ton)	0.44
Losses (t/ha)	2.05

‘Multiple-Row’ Harvesting - BENEFITS

1. **Lower travelling to harvesting ratio** (engine hours to elevator hours ratio)
   - ✓ Fewer manoeuvres and more harvesting
2. **Increase in productive field area**
   - ✓ Changing field layout can give more row spacing
3. **Lower consumption of diesel (L/t)**
   - ✓ Harvests more cane per pass, engine working more efficiently
4. **Higher yield (t/h) & greater preservation of ratoon**
   - ✓ Decreases plant competition & compaction of soil around roots due to wider track spacing
5. **Lower machinery requirement**
   - ✓ Fewer harvesters required to cut same area of cane as SR
6. **Lower harvesting speed, same harvesting rate**
   - ✓ Operator can respond to environment better, less risk of accident or damage

‘Multiple-Row’ Harvesting - DISADVANTAGES

1. **Increase in yield not guaranteed**
   - ✓ Depends on local conditions
2. **Fleet change**
   - ✓ Requires new harvesters & planters suitable for multiple-row harvesting
3. **More susceptible to harvester losses**
   - ✓ Harvesting more crop at one time, more precision is required to maintain low losses.
4. **Logistics challenges**
   - ✓ DA and MR harvesters are track-only and are wider than a SR harvester.
5. **Requires changes to farm layout that cannot happen all at once**
   - ✓ Transition period of multiple seasons may be required.

‘Multiple-Row’ harvesters compared to ‘Single-Row’ Harvesters

“Multiple-Row” harvesters:

- **Are wider** – more stable across slopes
- **Travel slower** when harvesting – more time to react
- **Leave a better stool** – horizontal basecutter discs
- **Require more attention to operate** – less margin for error
- **Have more wearing parts** – 2nd basecutters, larger topper (MR)
- **Share** a common cab, controls, engine, chassis and elevator with Case IH SR models