The facts and myths concerning farming systems

Presentation by L.Di Bella - HCPSL

Mound planting/ Furrow planting

Legume fallow/ Mixed species fallow/bare fallows/ spray out fallows

Herbicide control/ cultivation during fallow

Mounded fallows/ flat fallows

There is constant debate concerning what practices make a good farming system?

Soil amendments: Lime/gypsum/dolomite/mill mud/ mill ash

Min tillage/ Full tillage

Granular fertilizer/ Liquid fertiliser

Row spacing

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Principles of a good farming system

- Good farm layout and drainage;
- Application of chemicals based on an soil characteristics;
- Nutrient inputs based on soil types and analysis;
- Improving soil biological properties and organic matter status
  - Breaking weed, pest and disease cycles through the fallow period;
  - Selection of varieties based on disease pressure and soil types;
  - Conserving organic matter;
  - Minimise compaction

THESE PRINCIPLES ARE STILL APPLICABLE TODAY AS THEY HAVE EVER BEEN!

This approach is consistent throughout sugarcane growing regions globally.

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Farm layout and drainage

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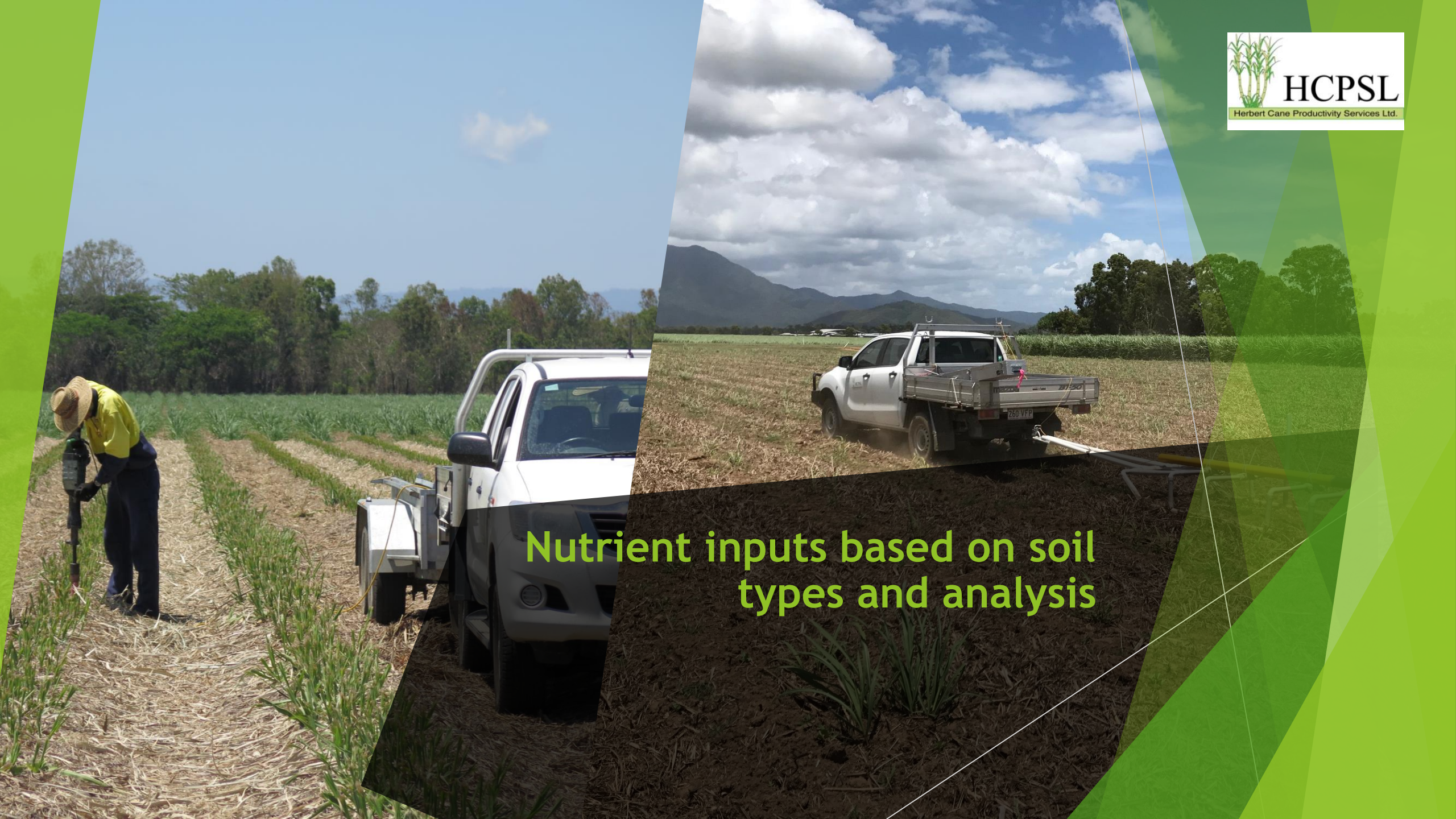
Application of chemicals (pesticides) based on an soil characteristics



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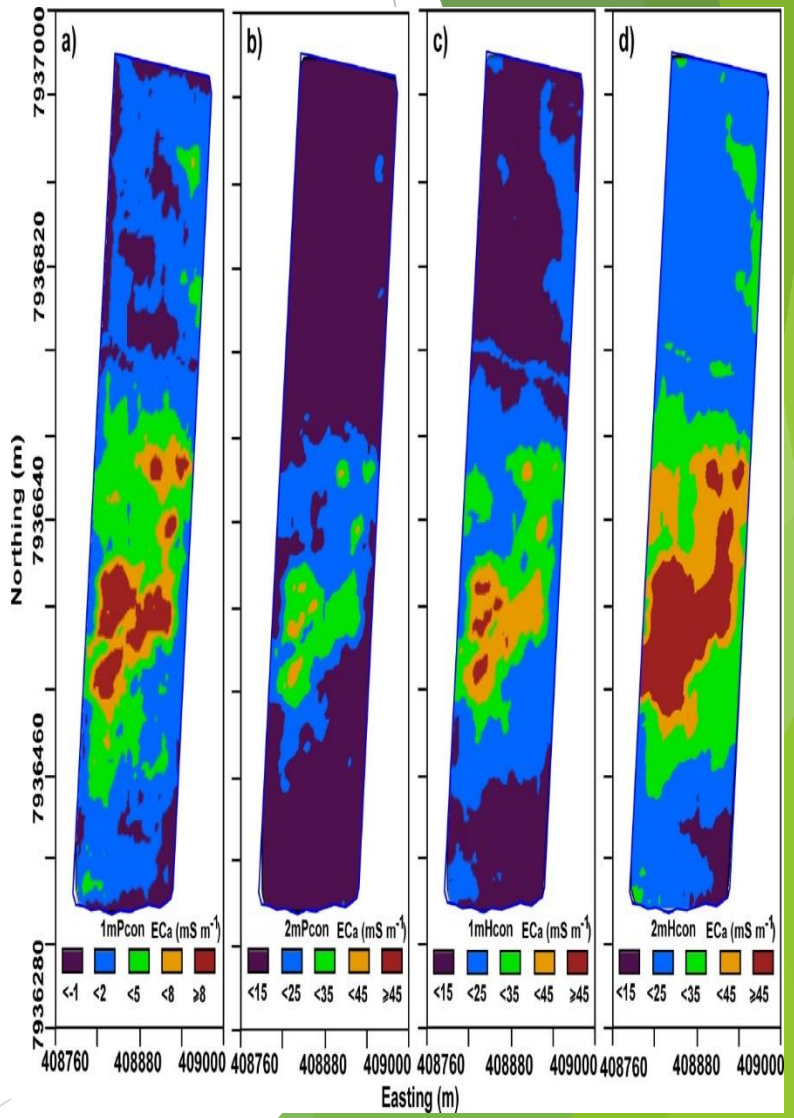
Nutrient inputs based on soil types and analysis

Nutrient inputs based on geospatial data, soil types and analysis

HCPSL has purchased a Dualem to allow for soil mapping in the Herbert.

HCPSL has partnered with UNSW to develop the techniques required.



Managing specified areas within paddocks

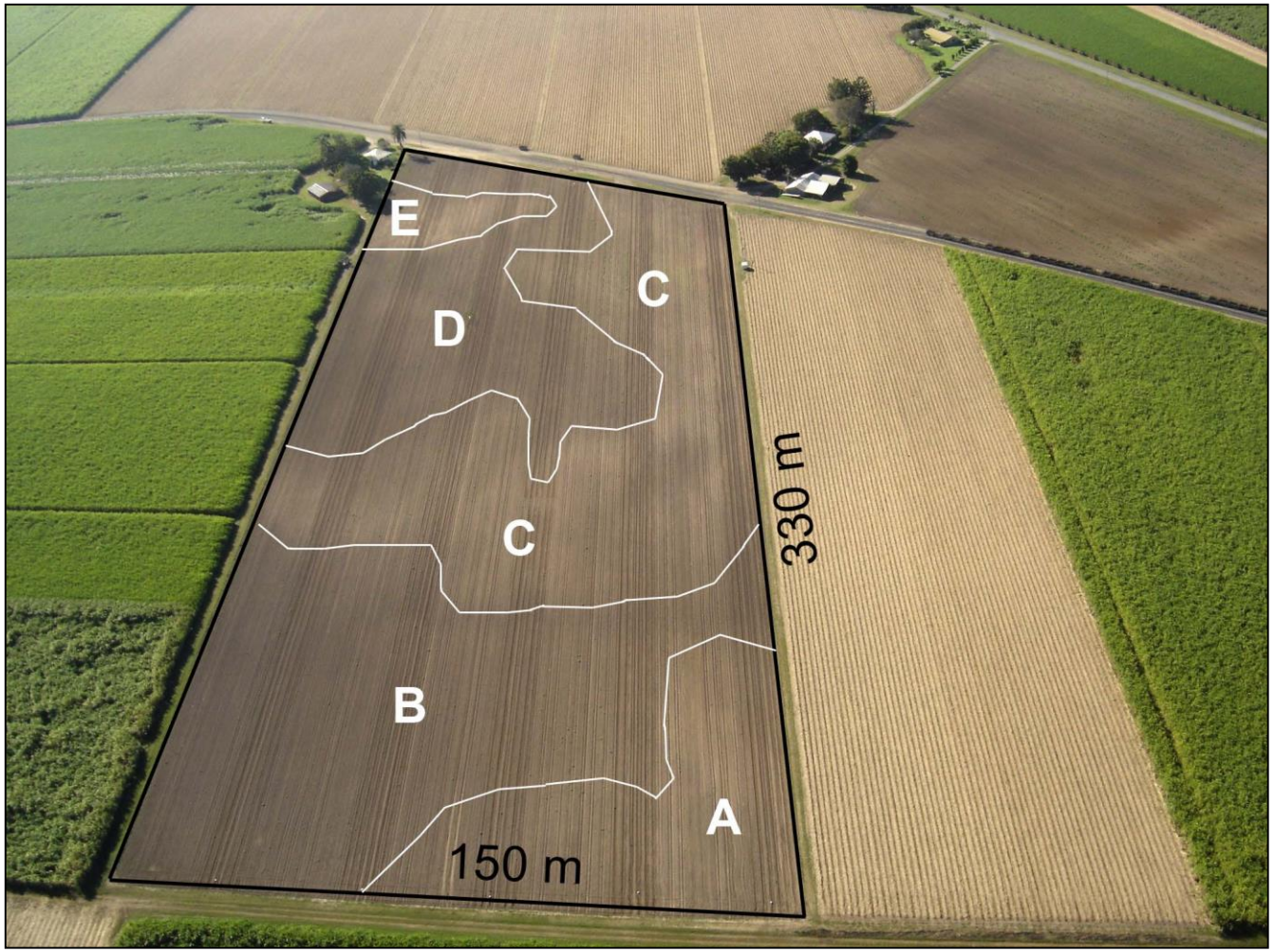


Photo: J.R. Hughes, QDAF

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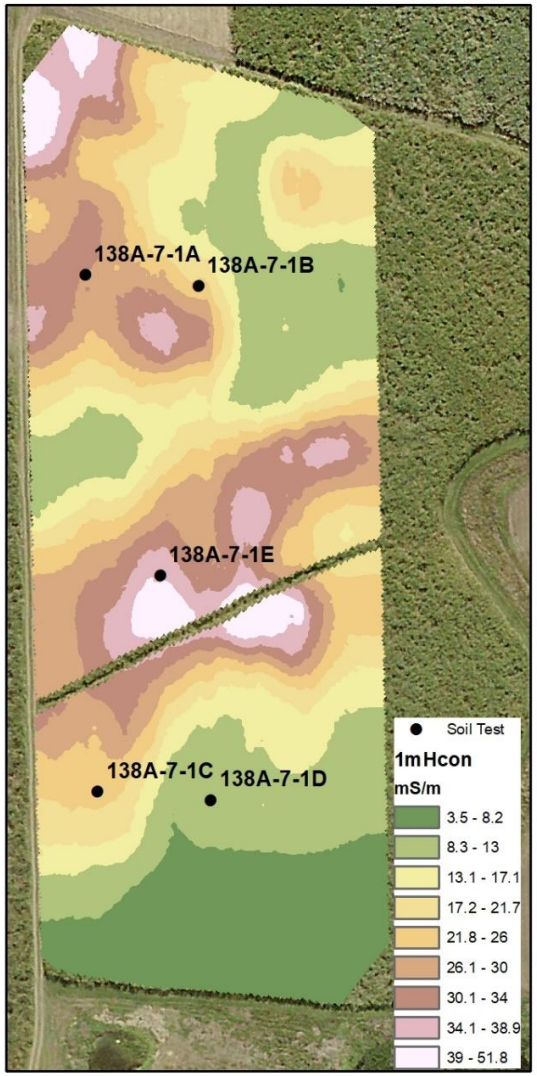
Lynn
BLOCK 0138A-07-01

Electromagnetic Condictivity

1mHcon EC measurements in millisiemens per metre (mS/m)

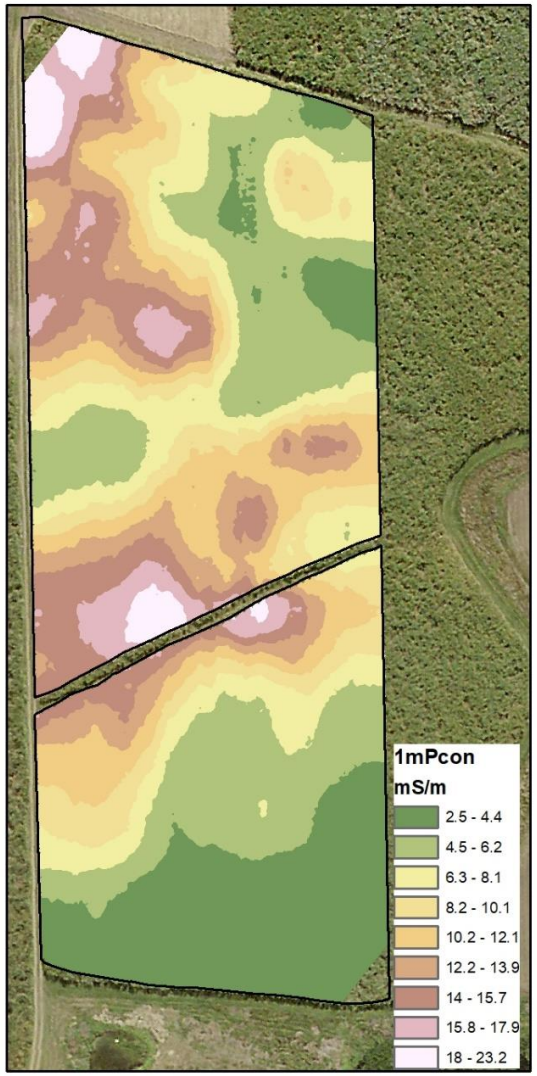


Scale All Maps - 1:2,000

0 50 100

Metres

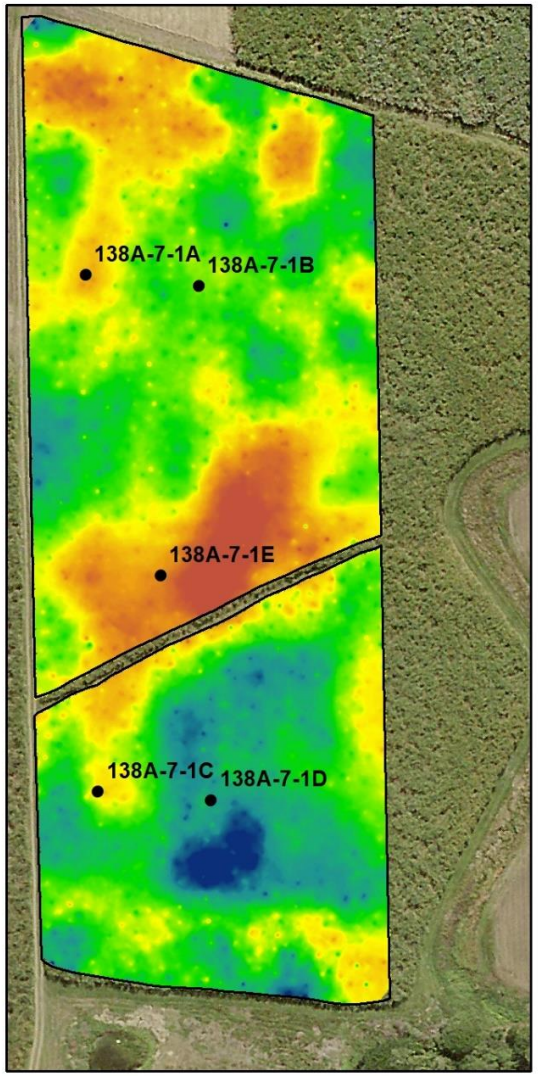
1mPcon



Soil Sampmes
1. 415732.101E, 7939394.174N
2. 415762.134E, 7939414.254N
3. 415627.799E, 7939521.269N
4. 415658.28E, 7939540.727N
5. 415705.375E, 7939460.635N

Above Avg
Avg
Below Avg

Yield 2015 5th Ratoon



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Conserving organic matter and organic carbon

- Organic carbon levels in Herbert soils have halved since the land was in its virgin state.
- Tillage (especially excessive tillage) reduces OM.
- The use of nitrogenous fertilisers assists in the break down of organic matter.
- The decrease of total organic C and reduction in aggregate stability and plastic limit after 2 years of sugarcane cultivation rendered the soil more susceptible to compaction (Silva data, Brazil).
- OM is essential for:
  - conserving moisture for the crop
  - holding onto nutrients applied (like nitrogen, sulphur and potassium)
  - reduce the impacts of compaction

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Conserving soil structure and organic matter:

- *reduced tillage, as much as possible*
- *soil ameliorants (i.e. lime, gypsum, dolomite, mill mud and mill ash)*
- *trash blankets (avoid burning off trash)*

Photos taken by L Di Bella

Breaking pests, weeds and disease cycles through fallow cropping.

Issues of concern in the Herbert:

- Weeds
- RSD control
- Smut control
- Nematodes
- Other minor species

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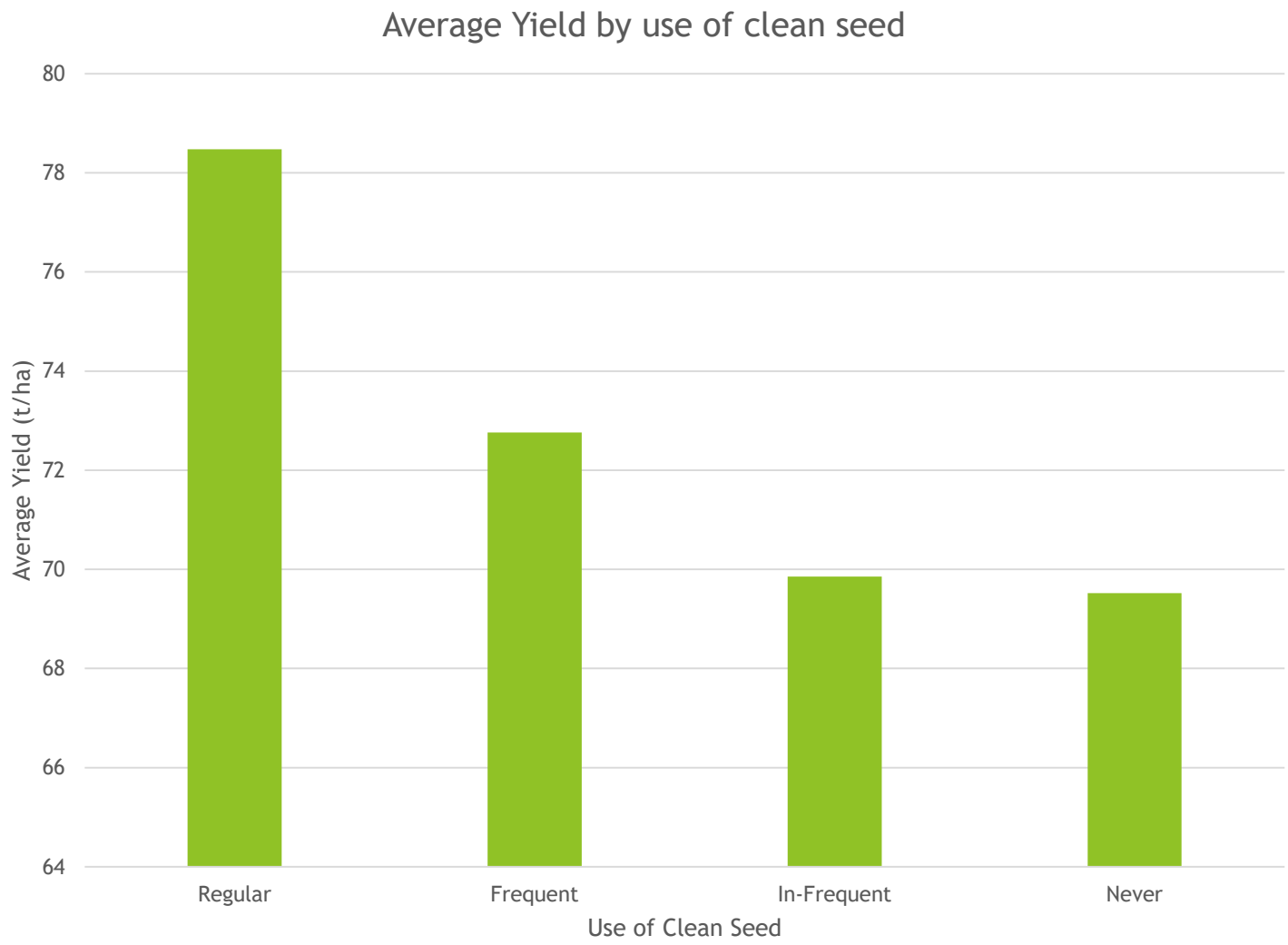
Selection of varieties based on disease pressure and soil types

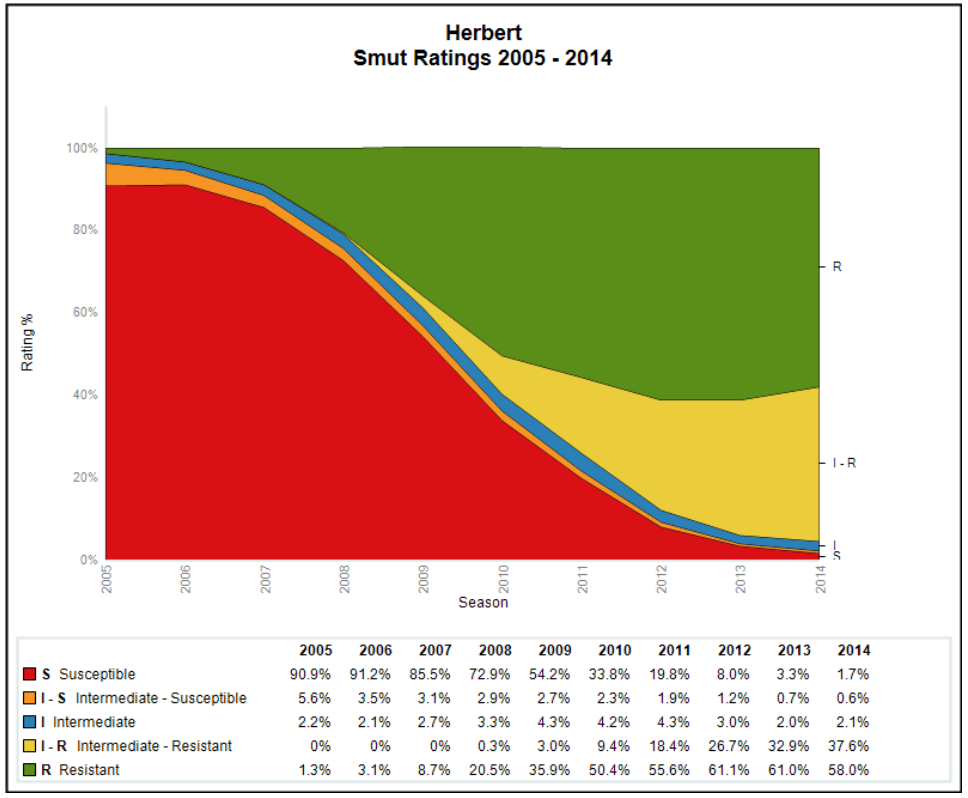
Disease of importance in the Herbert:

- RSD
- Pachymetra root rot
- Smut
- CSD
- Orange rust
- YCS- this is not a disease, but there is variety differences.

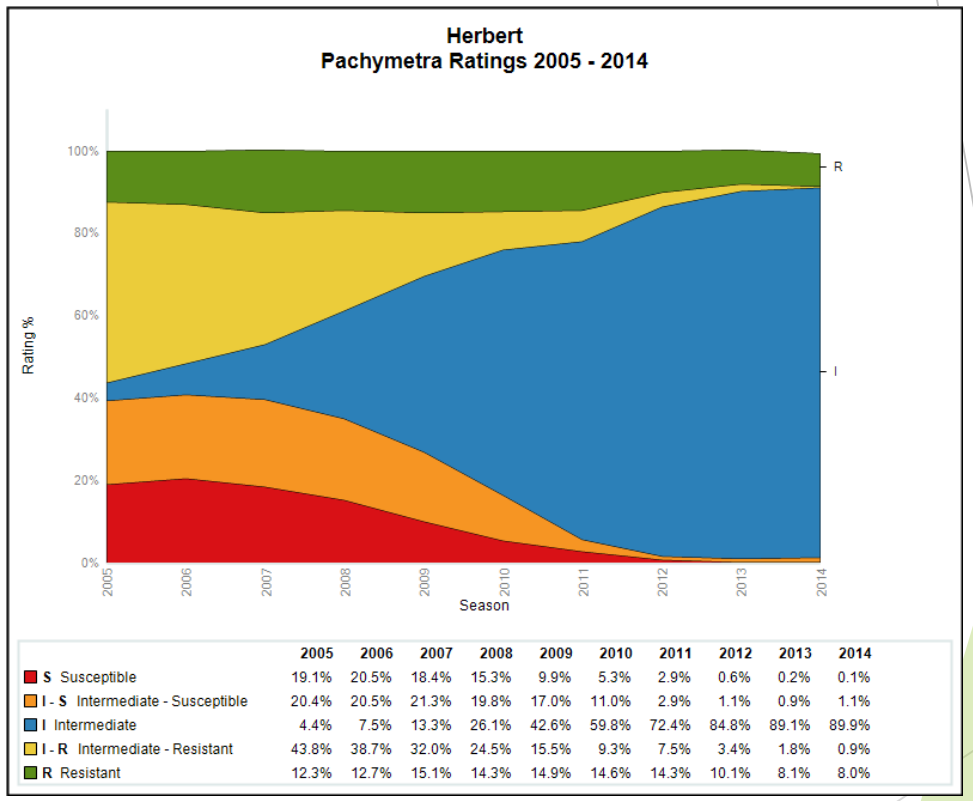
Productivity Benefits of Clean Seed: 2010-2014



Smut/Pachymetra ratings 2005-2014



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
S Susceptible	90.9%	91.2%	85.5%	72.9%	54.2%	33.8%	19.8%	8.0%	3.3%	1.7%
I - S Intermediate - Susceptible	5.6%	3.5%	3.1%	2.9%	2.7%	2.3%	1.9%	1.2%	0.7%	0.6%
I Intermediate	2.2%	2.1%	2.7%	3.3%	4.3%	4.2%	4.3%	3.0%	2.0%	2.1%
I - R Intermediate - Resistant	0%	0%	0%	0.3%	3.0%	9.4%	18.4%	26.7%	32.9%	37.6%
R Resistant	1.3%	3.1%	8.7%	20.5%	35.9%	50.4%	55.6%	61.1%	61.0%	58.0%

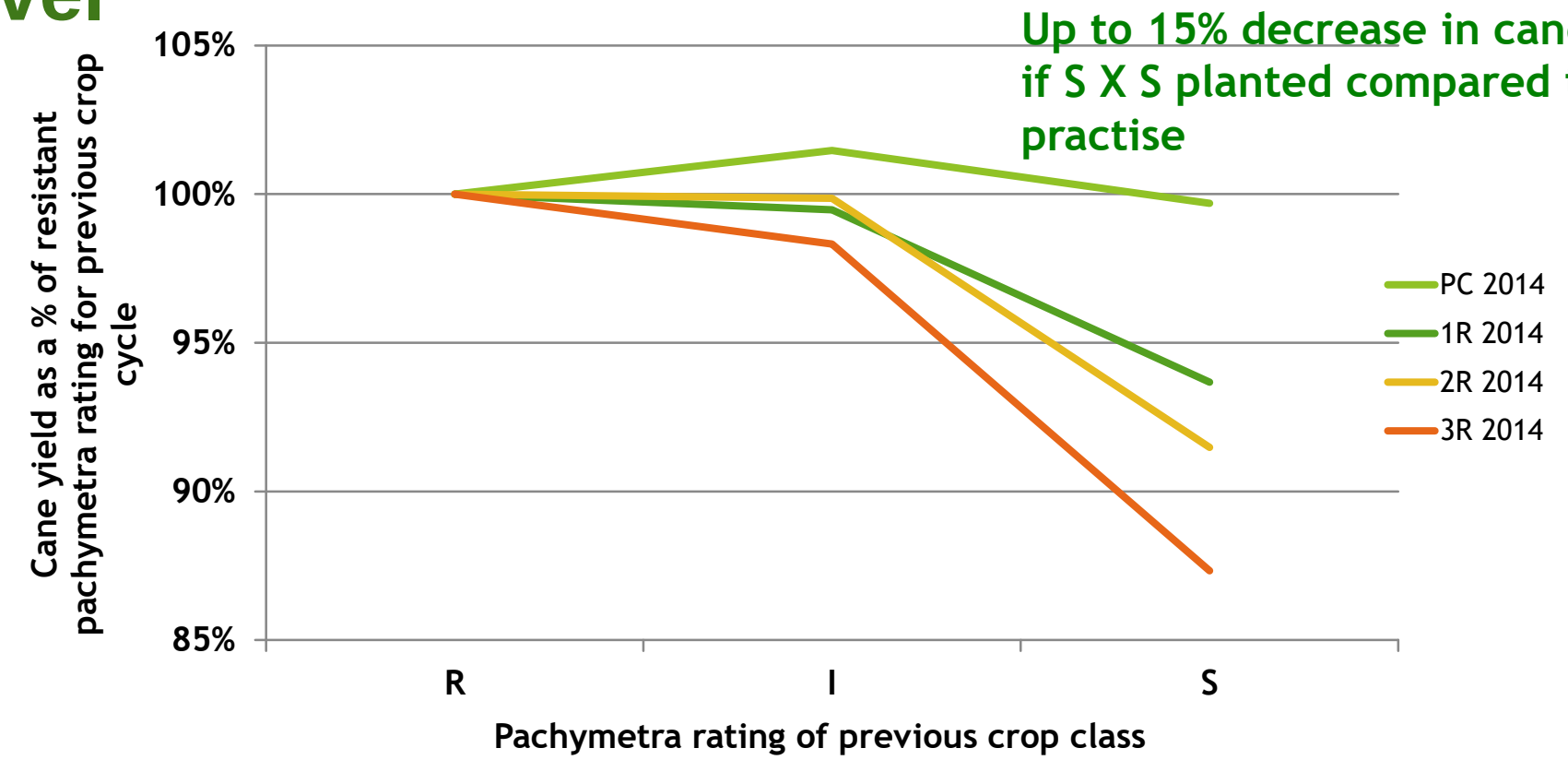


	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
S Susceptible	19.1%	20.5%	18.4%	15.3%	9.9%	5.3%	2.9%	0.6%	0.2%	0.1%
I - S Intermediate - Susceptible	20.4%	20.5%	21.3%	19.8%	17.0%	11.0%	2.9%	1.1%	0.9%	1.1%
I Intermediate	4.4%	7.5%	13.3%	26.1%	42.6%	59.8%	72.4%	84.8%	89.1%	89.9%
I - R Intermediate - Resistant	43.8%	38.7%	32.0%	24.5%	15.5%	9.3%	7.5%	3.4%	1.8%	0.9%
R Resistant	12.3%	12.7%	15.1%	14.3%	14.9%	14.6%	14.3%	10.1%	8.1%	8.0%

Susceptible varieties: 90% to 2% over time

I-R varieties: 44% to 1% over time

Effects of previous variety on Pachymetra level



Note: mean of all crops

- Previous variety grown has effect on ratoon cane yield
- 90% of current crops are intermediate (I)
- "I" varieties have large yield losses when following "S" varieties
- Less yield loss if they follow "I" varieties
- Impact is much greater in older ratoons
- *Pachymetra* may be a major factor contributing to poor ratooning in Herbert

Managing soil compaction

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Managing compaction

- The best ’cure’ for soil compaction is preventing it from happening in the first place;

- After the damage is done, compaction remediation treatments do not provide 100 per cent soil recovery;

- Any tyre, be it from a tractor, a harvester, a truck, a fertiliser box, a haulout bin or any other machine traversing your field, has the potential to cause compaction.

- Be aware of the direct relationship between tyre pressure and soil compaction and adjust pressure accordingly; and,

- An in-cabin tyre pressure management system can assist in minimising soil compaction.

- Match your row spacing to machinery wheel tracks.

J.Taylor (2016).

An in-cabin tyre pressure management system used to minimising soil compaction- in Brazil.

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Compaction in cane is a global problem

- Brazil- Results of a trial found that field traffic significantly increased soil compaction. There was a significant reduction in yield on the clay soil, while there was no significant difference on a sandy soil, due to harvesting practices. (De Paula and Molin, 2013).

- Thailand-It was found that the highest bulk density (compacted soil) was with mechanized farming, while the lowest value was in the fields cultivated using manual labour.

  The average value of soil bulk density samples under mechanized farming was 12.6% significantly higher than under manual labour.(Usaborisut and Niyampa, 2010).

- Mauritius- The mechanically harvested soils had significantly lower water infiltration rate than the manually harvested soils. (Cheong, 2009).

Compaction in cane is a global problem

Souza (2015) from Brazil reported that sugarcane crops managed with controlled traffic had:

- Improved soil porosity and more plant available water.
- Had better soil physical quality traits (easier to till later).
- Had an increased sugarcane root dry biomass of up to 44 %, which was concentrated in the planting row and seedbed region.

Compaction the Australian experience

The effect of soil compaction on cane growth has also been variable, with little or no effect in some instances and dramatic decreases in others.

Overall as bulk density increased, the yield of cane decreased. The compaction effect depends on the soil water content at the time of impact.

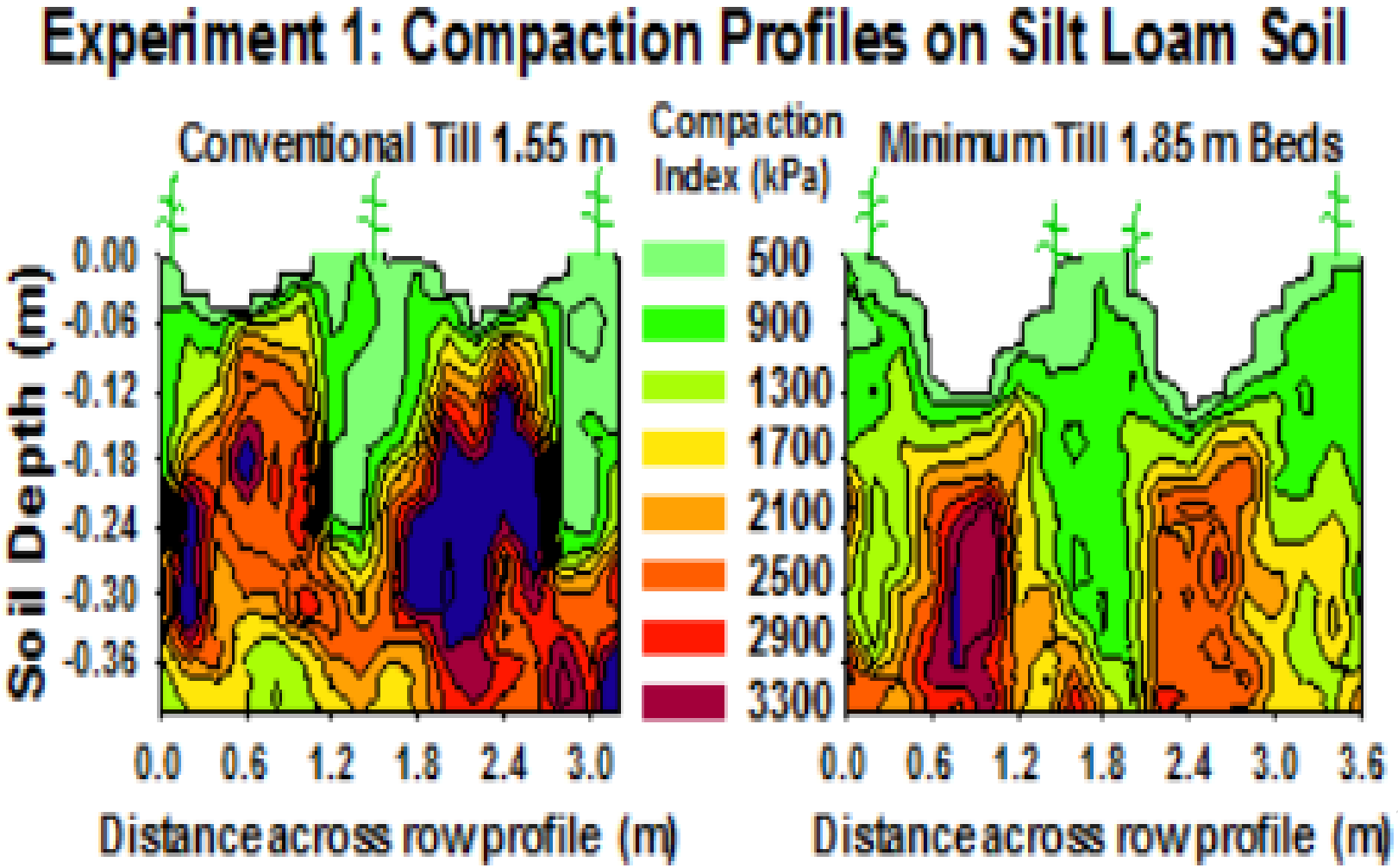
A major concern in the sugar industry is the trend to larger and heavier equipment and the effect this will have on the soil resource.

A system of controlled traffic should be investigated to determine the effect of field traffic on cane production and to manage compaction for benefit.

(Braunack, 1991).

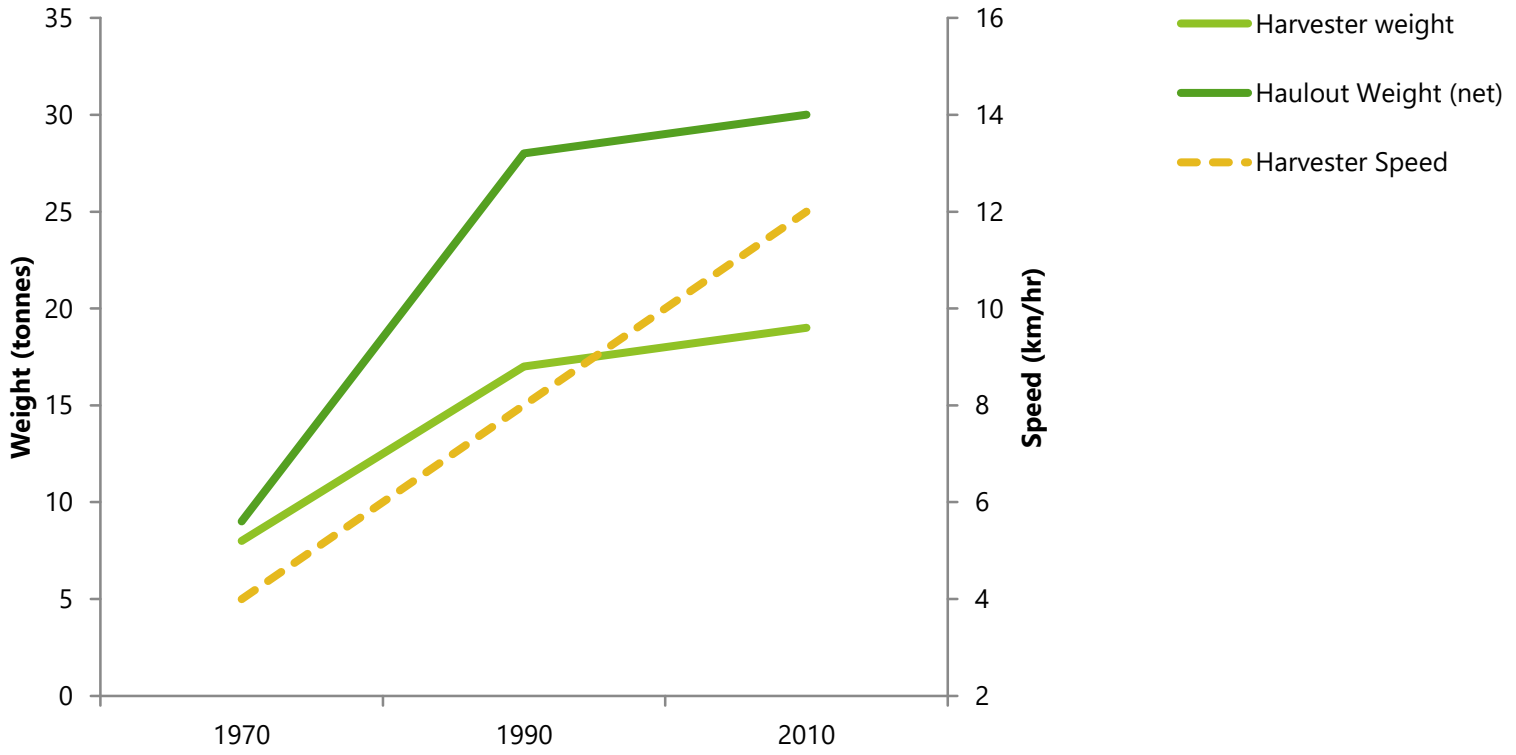
AS AN INDUSTRY ARE WE GOING TO CONTINUE TO IGNORE THAT COMPACTION IS REAL AND WE GOING TO DO SOMETHING TO ADDRESS THE ISSUE?

Compaction the Australian experience



Source: Glen Park- SRA

Harvesting equipment- weight and speed over time



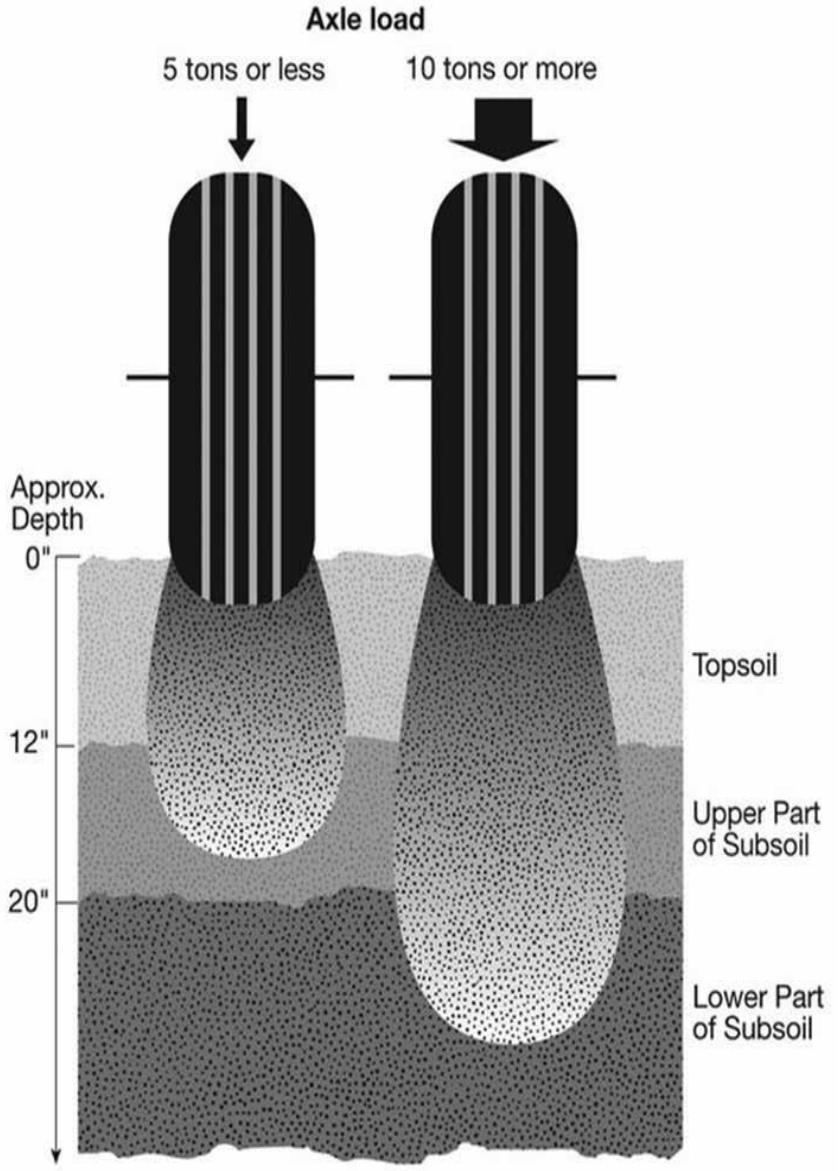
Source: B. Robotham

In-field axle loadings- Australia

Operation	Tonnes Km ha-1year-1
Ratoon crop (harvest/haul out, fertilise and spray)	450-600
Harvest /haul out sugarcane crop	380-520
Grain crop (spray, harvest and haul out under min till)	52

Source: BSES

Compaction the Australian experience



Axle loads are the key issue-

- Low axle load causes compaction in the topsoil and upper part of subsoil only, whereas high axle load causes compaction in the lower subsoil as well.
- Flotation reduces localised compaction and also gives mobility, but compaction is related to axle loads.

THE ONLY WAY TO MANAGE COMPACTION IS TO CONSTRAIN IT.

(Taylor, 2015-2016).

Traffic Areas under different systems

System	Assumptions	Driving Error	%Area compacted
1.5m (conv) Not controlled traffic	Tyre width = 622 mm, wheel centres 1.9m	With GPS +-200mm	68% 95%
1.8m	As above	With GPS +-200mm	28% 55%
2.1m	Haulout Tractor tyres (14.9*32)	With GPS +-25mm	18% 20%

Source: BSES

Row spacings around the world

Brazil:

- The Brazilians have identified soil compaction and harvesting as the biggest cause of yield decline in their industry.
- The country is transitioning from 1.4/1.5m to 1.8-2.4m rows because mechanisation.
- Snr. Agronomist at Coscan noted a 3% reduction in yield for every 10cm increase in row spacing over 1m in the Centre South and drier areas on a single (narrow planted) row. No effect in higher yielding areas.
- There is now over 1.5 million hectares on a 2.4m double row system.
- The 2.4m system gave the industry a 30% increase in harvester productivity.
- The industry has found that the 1.8-1.9m did not work unless all equipment was on GPS (including haulouts). Wandering haulouts a significant issue.

Source: Chris Norris- Norris ECT

Row spacings around the world

Sri Lanka (new estate):

- 6000ha on 1.8m dual on 0.4m centres.
- Hand cut and moving to mechanisation.

Source: Martin Eweg Consulting

Cameroon:

- A major sugarcane estate has gone from 60 tcph to 85 tcph since the introduction of green cane trash blanketing and controlled traffic CT.

Trials indicate that increase in yields are due 50% to CT.

All equipment entering the field is on GPS.

Source: Chris Norris- Norris ECT

Ecuador:

- Sunny side of the estate , fully irrigated high yields, limited impact on yields between 1.5 and 1.8m singles and 1.9 duals. Cloudy side of the estate 30% increase in yield of 1.9 duals over 1.8m singles and about 20% increase for 1.9m duals compared to 1.5m rows.

Source: Nunes et.al

PNG (Ramu Sugar):

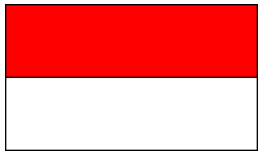
- They found a 0-20% yield increase in yield for different varieties when they transitioned from 1.5-1.9m
- Was on a 1.9m dual row and now transitioning to 1.8m wide row.
- Major issues with confining traffic (haulouts) to traffic zones (no GPS).

Source: Chris Norris- Norris ECT

Row spacings around the world

Colombia:

- Have transitioned from 1.5m to 1.75m with no yield reduction in irrigated crops. Later trials showed no difference out to 2m.
  Source: Chris Norris- Norris ECT



Indonesia:

- 3.2% reduction in yield for every 10cm over the standard (narrow furrow planted)1.3m row spacing. The region is light limited in wet season and moisture limited in dry season. Source Eastwood pers com: trials in Sth. Sumarta

Swaziland (RSSC):

- Have transitioned from 1.4m to 1.9m dual rows with no yield reduction. Source: Chris Norris- Norris ECT

Philippines (Negros area):

- 2.4m wide single row with an average yield of ~120tcph- plant cane crop and no ratoon crops. Source L.Di Bella-HCPSL

Row spacings around the world

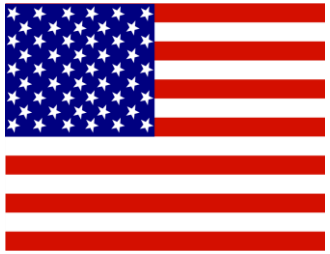
- South Africa (Komati) and large mill estates:
  Have transitioned from 1.4/1.5m to 1.9m dual row.
  They have maintained yields with CT and GPS systems on all equipment entering the field.
  Source: Chris Norris- Norris ECT and Martin Eweg Consulting

- Trial results show that intra-row interception of solar radiation peaked at the same time for all row spacing (0.63-2.79m) and coincided with the occurrence of peak tiller population and peak green leaf number. (Smit and Singles, 2006)

- As row spacing increased the number of tillers per row increased. (Smit and Singles, 2006)

- Cane is largely a self-regulating population crop at spacings between 1 and 2 metres. Source: Martin Eweg Consulting

Row spacings around the world



USA- Louisiana

- Have been on a 6 foot (1.83m) system since the commencement of the industry.
- Harvest under extreme wet conditions (at times), hence the wider row.
- Some double row (1.83m x 2 row) harvesters operating in the industry
- Very high plant populations

USA- Florida

- Still on 1.5m row
- Considering double row harvester option (3m system)- did have 3m harvesters before.

Source: L.Di Bella- HCPSL

Row spacing data- Queensland

Site	Variety*	Crop	Row configuration		
			1.5 m single	1.8 m single	1.8 m dual
Meringa	Q186, Q200, Q201, Q220	Plant	114	107	116
		1st ratoon	116	102	114
Meringa	48 clones	Plant	85	77	83
		1st ratoon	91	86	86
Meringa	Q187, Q200, Q201, Q218	Plant	124	118	125
		Plant	127	133	135
Ingham	Q135, Q174, Q183, Q200	1st ratoon	101	95	103
		2nd ratoon	97	93	97
		Plant	121	112	114
Ingham	Q200	1st ratoon	130	119	130
		2nd ratoon	122	121	122
Mackay	Q190, Q200, Q208, Q209	Plant	113	96	114
		Plant	119	119	129
Mackay	Q208	1st ratoon	106	114	106
		2nd ratoon	92	91	92
		Plant	118	116	127
Mackay	Q208	1st ratoon	121	120	113
		2nd ratoon	104	105	107
Bundaberg	Q151, Q190, Q208, Q232	Plant	135	134	142
		1st ratoon	127	121	119
Bundaberg	Q138	Plant	103	99	119
		1st ratoon	134	125	120
Bundaberg	Q138, Q188, Q205, Q222	Plant	118	116	117
		Average	114	109	114

- Overall, current sugarcane varieties have been shown to produce similar yields across numerous row spacings.
- If there is a yield reduction on wide single rows, it is a small effect, may not occur in commercially planted crops and is compensated for by higher planting densities.
- Dual row or wide shute systems maintain yield on wide row spacings.

Note: These trials were planted using stick planters.

Source: BSES

Row spacing adoption- MSF Maryborough Mill area

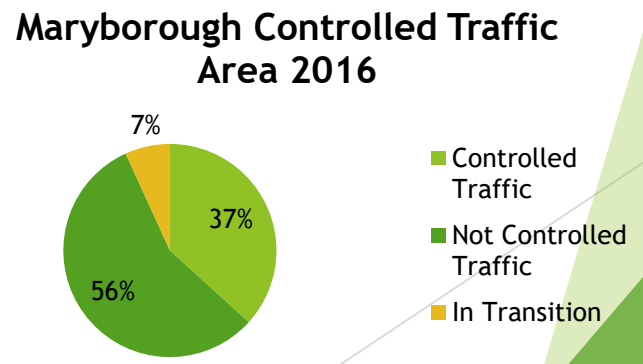
Tonnes Cane/Ha				
	2013	2015	2016	Average
Dryland not controlled traffic	54.1	67.6	55.4	59.0
Dryland controlled traffic	67.4	69.5	57.5	64.8
Dryland contolled traffic for 2 or more crop cycles	67.4	69.4	56.0	64.3
Irrigated not controlled traffic	61.1	78.8	75.1	71.6
Irrigated controlled traffic	74.7	83.2	79.2	79.0
Irrigated contolled traffic for 2 or more crop cycles	74.1	84.2	83.4	80.6

Actual CCS				
	2013	2015	2016	Average
Dryland not controlled traffic	15.1	13.5	14.2	14.2
Dryland controlled traffic	15.1	14.2	14.2	14.5
Dryland contolled traffic for 2 or more crop cycles	15.1	14.4	14.1	14.5
Irrigated not controlled traffic	14.7	13.8	14.0	14.2
Irrigated controlled traffic	14.7	13.5	14.3	14.1
Irrigated contolled traffic for 2 or more crop cycles	14.6	13.4	13.4	13.8

Tonnes Sugar/ha				
	2013	2015	2016	Average
Dryland not controlled traffic	8.1	9.1	7.7	8.3
Dryland controlled traffic	10.2	9.9	8.3	9.5
Dryland contolled traffic for 2 or more crop cycles	10.2	10.1	7.9	9.4
Irrigated not controlled traffic	9.0	10.8	10.5	10.1
Irrigated controlled traffic	10.9	11.2	11.3	11.1
Irrigated contolled traffic for 2 or more crop cycles	10.7	11.2	11.2	11.1

Comments:

- CT has out performed no CT in every year.
- The difference is largest in the non irrigated areas.
- Most common row spacing 2m x 2 rows 0.8m apart.



Source: Andrew Dougall- MSF

Row spacing data- Mackay

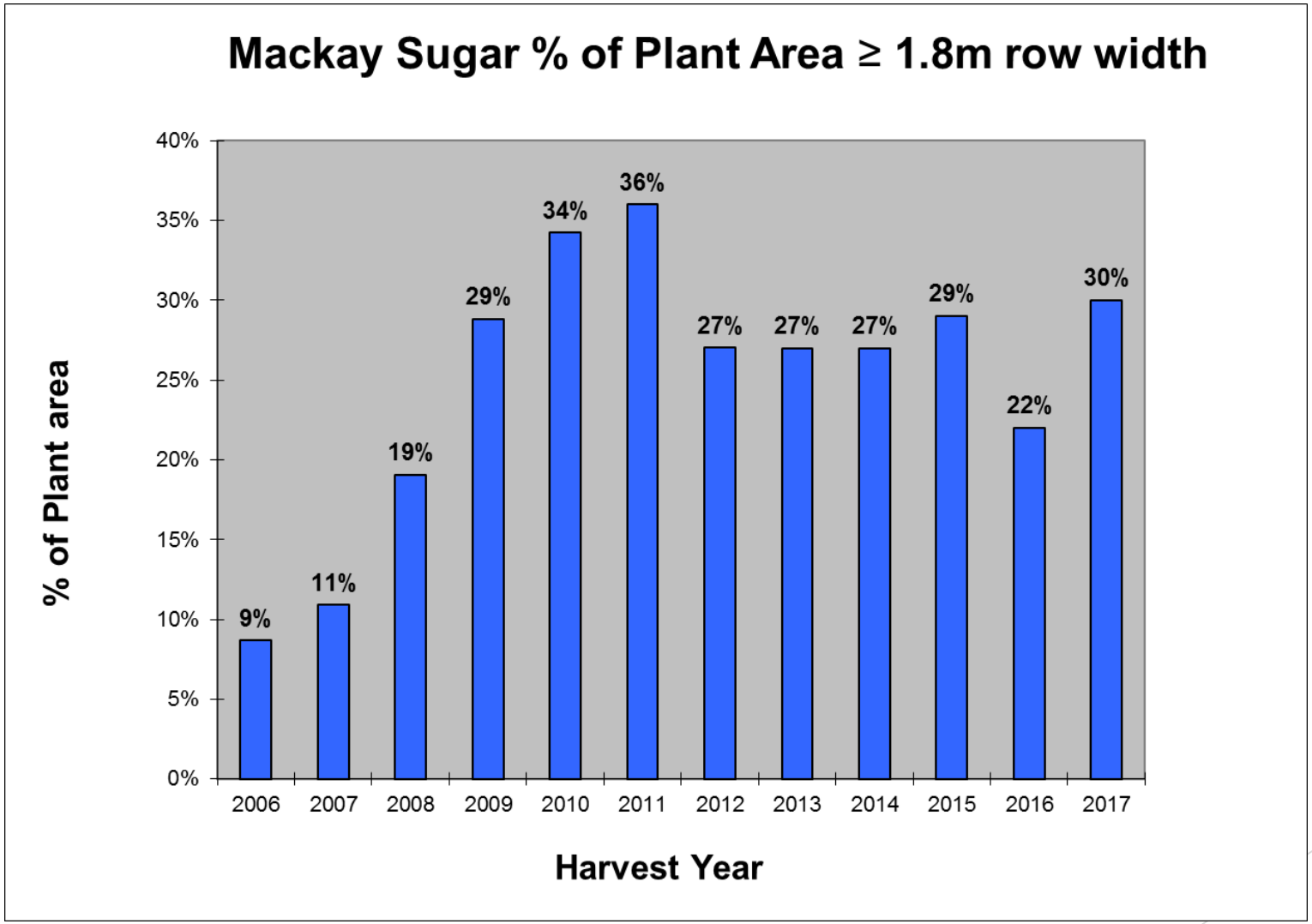
Results from all grower strip trials in the Central region (SRDCGGIP's, FutureCane, Extension projects) showed the following:

- 1.8 m singles not suffering any yield loss when planted at high planting rates (exceeding 10t/ha)
- There was no significant difference in PRS or cane yield for any row spacing.

Table supplied by Brad Hussey (AgriServ- Mackay)

	1.5 m single rows		1.8 m single rows		1.8 m dual rows	
Crop class	Cane yield (t/ha)	PRS	Cane yield (t/ha)	PRS	Cane yield (t/ha)	PRS
Plant	140	13.7	117	13.7	142	13.6
1st ratoon	90	15.1	94	14.9	83	14.5
Plant			139	15.8	133	15.9
1st ratoon			119	15.3	111	15.5
Plant			129	15.5	111	15.8
Plant	101				118	
1st ratoon	160				166	
2nd ratoon	119				111	
Plant	65	12.3			72	12.8
1st ratoon	88	13.0			98	13.6
2nd ratoon	100	15.4			100	15.2
Plant	128	14.5	133	14.2		
1st ratoon	103	16.0	113	15.6		
2nd ratoon	105	16.0	108	15.4		
3rd ratoon	99	14.9	108	14.1		
4th ratoon	95		90			
Plant	141	15.5	136	15.4	138	14.7
1st ratoon	121	15.0	123	15.0	124	14.4
2nd ratoon	104	14.4	108	14.4	111	14.1
3rd ratoon	85	15.7	91	15.6	90	15.4
Plant	120		130			
1st ratoon	128		132			
Plant	140	14.8			141	14.0
1st ratoon	107	14.4			103	14.5
2nd ratoon	107	14.4			103	15.0
Plant	117	14.9	120	15.2		
1st ratoon	97	15.7	98	15.8		
Plant	97	13.3	78	12.9		
1st ratoon	82	14.5	76	14.5		
Plant	113	13.5	109	13.1		
1st ratoon	93	15.3	98	15.3		
Plant	126	17.0			121	16.3
1st ratoon	121	13.9			109	12.6
1.5 single vs 1.8 single average	108	14.9	109	14.7		
1.5 single vs 1.8 dual average	113	14.6			114	14.3
1.8 single vs 1.8 dual average			117	15.1	116	14.9

Row spacing adoption- Mackay



Source: John Agnew- MAPS

Row spacing adoption- Proserpine

Fig 1. 2014					
2014	Ha	TCH	CCS	TSH	Percent
1.5-1.59	7920.80	78.57	14.80	11.63	36.4
1.6-1.79	8424.96	78.23	14.81	11.57	38.7
>1.8	5433.84	78.35	14.90	11.60	24.9
ave	21779.60	78.10	14.81	11.56	

Fig. 2 2015	Ha	TCH	CCS	TSH	Percent
1.5-1.59	3922.50	77.90	14.50	11.30	18.3
1.6-1.79	10686.90	75.00	14.20	10.60	49.9
>1.8	6810.70	82.40	14.50	12.00	31.8
ave	21420.10	78.32	14.43	11.32	

Fig. 3 2016	Ha	TCH	CCS	TSH	Percent
1.5-1.59	3676.65	93.40	12.5	11.74	17.6
1.6-1.79	10623.42	92.15	12.47	11.50	50.9
>1.8	6553.19	97.36	12.74	12.41	31.4
ave	20853.26	94.89	12.62	12.00	

Comments:

- Cane yield highest with CT
- Most row configuration is super single and dual row <1.8m

Source: P.Sutherland PCPS

Row spacing adoption- Burdekin

- There is very limited adoption of rows greater than 1.8m in the Burdekin.
- DAVCO farms on a 2.4m double row system (1m apart)
- 10-12 other farms on CT system. These farms have noticed 1-2 additional ratoons compared to traditional system.
- Issues:
  - Water penetration into the mound area (huge issue)
  - Increased water infiltration rates causing issues for flood irrigation systems (can't get water to the other end of the field)
  - Opposition from the harvesting sector to wider rows
  - Sunlight and plentiful amounts of water mask differences between farming systems.

Source: R.Milla- BPS

Row spacing adoption- Tully

Controlled traffic is changing in Tully.

The amount of dual row is declining but overall controlled traffic is being maintained through single wide row (450-500mm planting row) on 1.8-1.9m row centres.

This is partly due to a lack of dual row set up contract planters but also cane quality aspects in some parts of the district. Eg. bin weight, soil levels.

The estimated area under controlled traffic (1.8-1.9m dual and wide single row)=28%.

Source: Greg Shannon- TSL

Row spacing adoption- MSF Sth. Johnstone mill area

Examples of commercial yields across varieties and crop classes

Zone 4	Variety	Crop Class	Tonnes Cane/Ha
Controlled Traffic Farming System	Q208	Plant	88
Average	Q208	Plant	72
Controlled Traffic Farming System	Q183	1st Ratoon	101
Average	Q183	1st Ratoon	74
Controlled Traffic Farming System	Q200	2nd Ratoon	86
Average	Q200	2nd Ratoon	78
Controlled Traffic Farming System	Q183	3rd Ratoon	79
Average	Q183	3rd Ratoon	63
Controlled Traffic Farming System	Q200	4th Ratoon	102
Average	Q200	4th Ratoon	74

Comments:

- Tractor operations reduced by 27%
- Harvester fuel and labour can be reduced by 14%

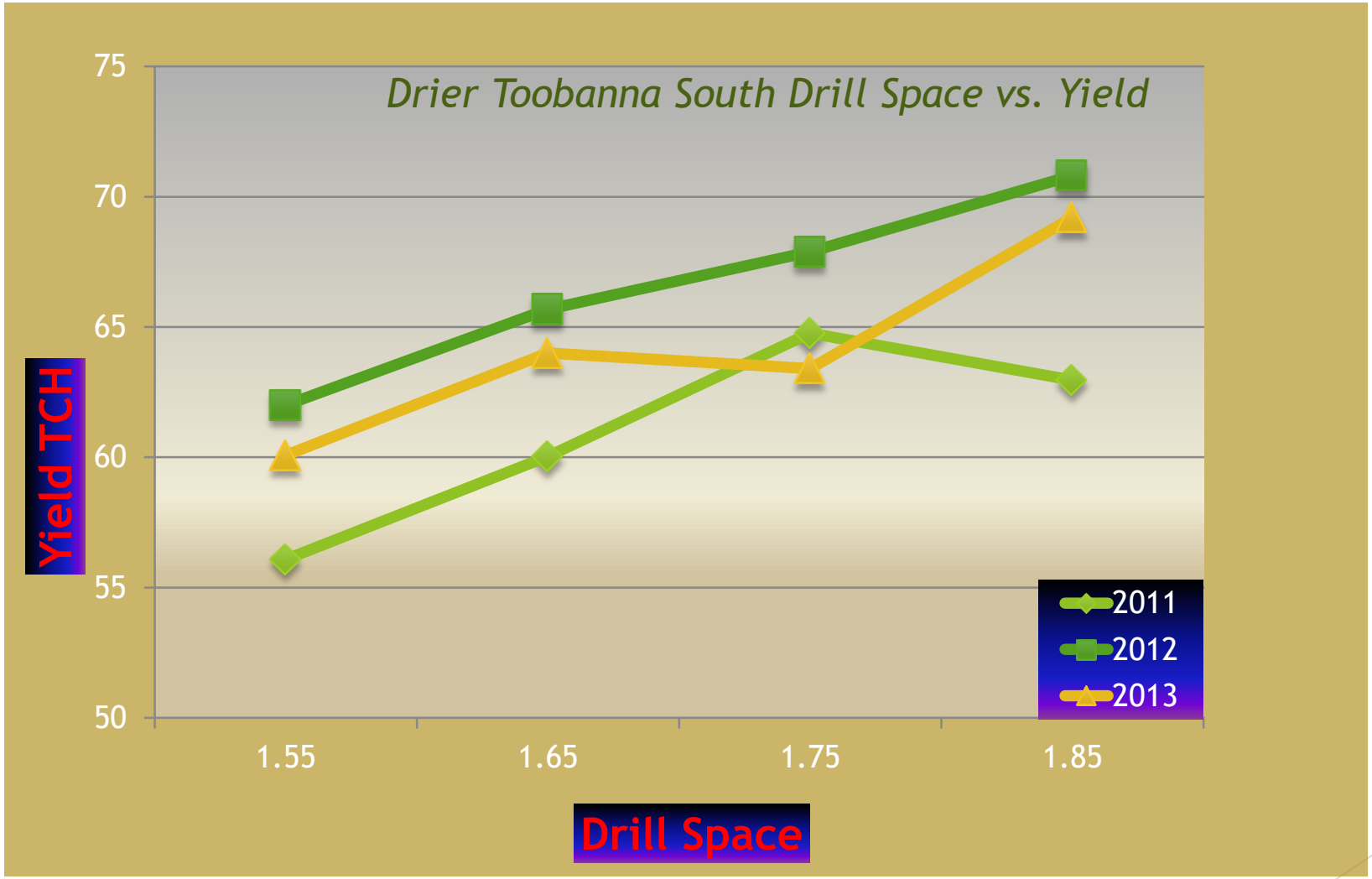
Source: Michael Porta- MSF

Row spacing adoption- MSF Sth. Johnstone mill area

Zones 7 - 11	Variety	Crop Class	Tonnes Cane/Ha
Controlled Traffic Farming System	KQ228	Plant	98
Average	KQ228	Plant	77
Controlled Traffic Farming System	Q208	1st Ratoon	93
Average	Q208	1st Ratoon	86
Controlled Traffic Farming System	Q230	2nd Ratoon	102
Average	Q230	2nd Ratoon	96
Controlled Traffic Farming System	Q183	3rd Ratoon	86
Average	Q183	3rd Ratoon	82
Controlled Traffic Farming System	KQ228	4th Ratoon	117
Average	KQ228	4th Ratoon	87
Controlled Traffic Farming System	Q200	5th Ratoon	86
Average	Q200	5th Ratoon	72
Controlled Traffic Farming System	Q200	6th Ratoon	82
Average	Q200	6th Ratoon	72

Source: - Michael Porta- MSF

Row spacing adoption- Herbert



Note:
Predominately dual or wide shute planters in CT systems

Source: HCPSL

Row spacing trials in the late 1980's- Herbert

- BSES undertook trials in the Herbert in the late 1980's and found that **no yield losses** were experience out to 1.7m. Only 1.5-1.7m row spacing were assessed in the trials.

- Farming and harvesting equipment was narrower then.

Source- Mike Smith (BSES).

Row spacing data- Toobanna

No variety x row spacing interaction

Yield similar on all row spacings

Q183 performed poorly at this site

Ingham			Variety				
Crop	Yield	Row config.	Q135	Q174	Q183	Q200	*Mean*
Plant	TCH	1.63 m single	135.8	140.0	111.4	119.3	*126.6*[a]
		1.83 m single	131.9	136.8	125.0	138.3	*133.0*[a]
		1.83 m dual	159.0	126.0	118.3	138.0	*135.3*[a]
		Mean	*142.2*[b]	*134.3*[b]	*118.2*[a]	*131.9*[b]	
	TSH	1.63 m single	21.8	22.2	17.9	19.4	*20.3*[a]
		1.83 m single	21.5	21.9	20.3	22.2	*21.5*[a]
		1.83 m dual	25.0	20.0	19.4	22.6	*21.8*[a]
		Mean	*22.8*[b]	*21.4*[ab]	*19.2*[a]	*21.4*[ab]	
1st ratoon	TCH	1.63 m single	104.6	103.4	92.9	101.4	*100.6*[a]
		1.83 m single	99.1	96.6	87.5	97.7	*95.2*[a]
		1.83 m dual	113.0	104.0	82.6	113.2	*103.2*[a]
		Mean	*105.6*[b]	*101.3*[b]	*87.7*[a]	*104.1*[b]	
	TSH	1.63 m single	16.0	17.2	15.3	16.7	*16.3*[a]
		1.83 m single	15.6	15.5	13.8	16.1	*15.2*[a]
		1.83 m dual	17.5	17.4	13.6	18.7	*16.8*[a]
		Mean	*16.3*[b]	*16.7*[b]	*14.2*[a]	*17.2*[b]	

Varieties for wide row spacings
- BSS296 Evaluation of genotypes for a controlled traffic farming system trial results- BSES data

Row spacing data- Abergowrie

Variety- Q200
Soil type- red soils
Reps- 4
Narrow shute billet planter used, with GPS
No significant difference for row spacing

Treatment	TCPH	CCS	$/HA
1.64m-P	104.42	16.1	2165
1.85m- P	108.8	16	2260
1.64m-1R	104.55	16.6	2781
1.85m-1R	104.97	16.6	2800

Source- L.Di Bella (Two in One Project- BSES)

Row spacing data- Ingham

Variety- Q174
Soil type- clay
Reps- 3
Harvested wet in plant cane
No significant difference for row spacing

Results from the controlled-traffic trial

Treatment	Cane yield (t/ha)		CCS		Sugar yield (t/ha)	
	Plant	1 R	Plant	1 R	Plant	1 R
1.63m single row - conventional	66	71	15.4	14.8	10.12	10.54
1.63m single row- DD planted	74	79	14.9	14.4	11.04	11.39
1.85m dual row- DD planted	82	74	14.5	14.1	11.95	10.48

Source- L.Di Bella (BSS264 SRDC funded project)

Row spacing data- Trebonne

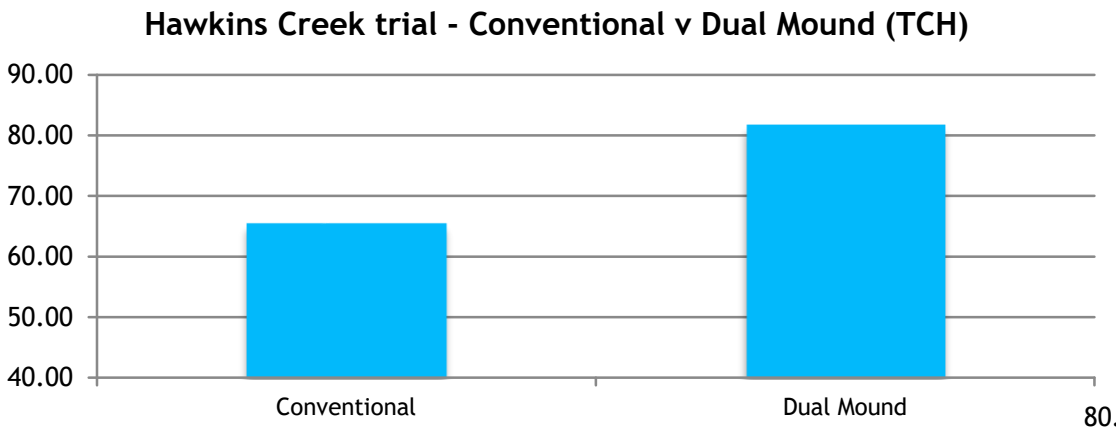
Variety- Q208
Conventional- 1.64m
Improved- 1.83m

	Conventional	Improved
Plant cane (ts/ha)	9.71	8.19
1st ratoon (ts/ha)	10.99	12.41
2nd ratoon (ts/ha)	12.20	13.80
Average (ts/ha)	10.97	11.46

Source- L.Di Bella (Demo Farm Project- HCPSL)

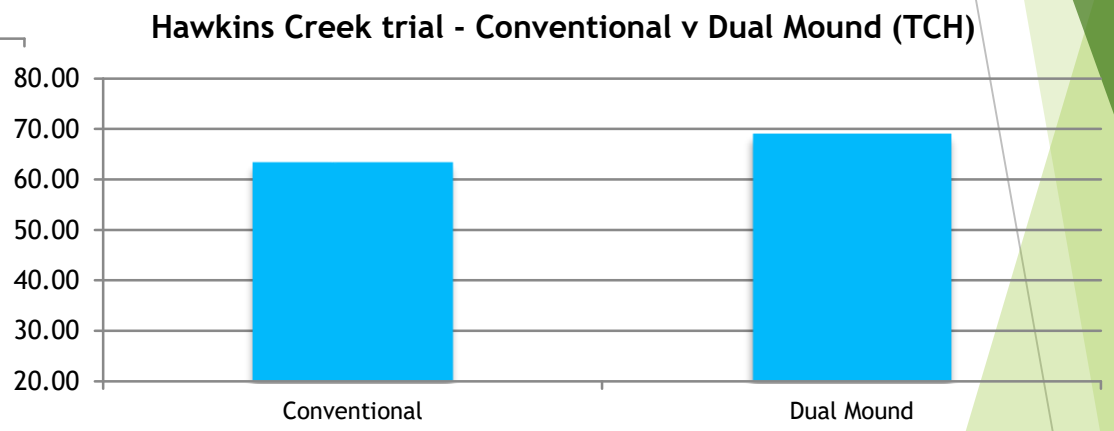
Row spacing data- Hawkins Creek

Plant cane

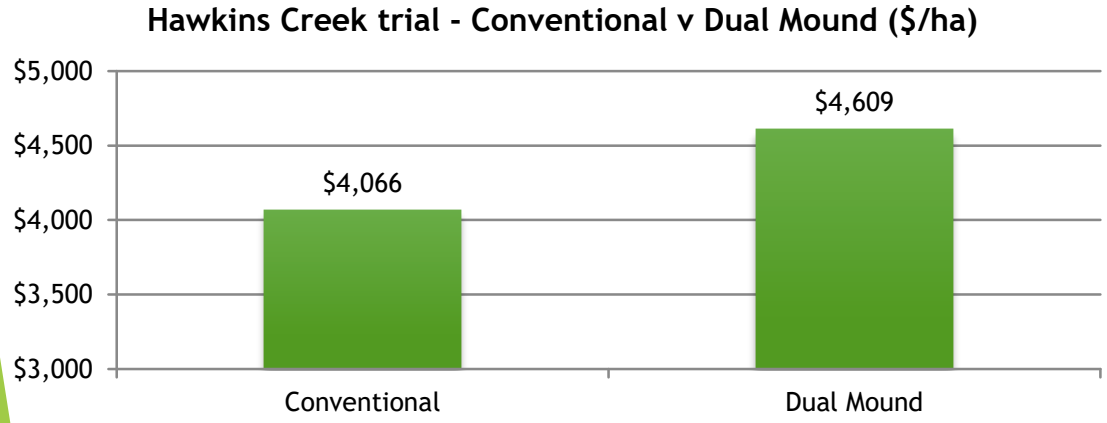


Variety- Q242
Conventional row- 1.64m
Dual row- 1.83m

1st ratoon cane



Plant and 1st ratoon combined



Source- A.Royle (Project NEMO- HCPSL) 2016-17 data.

Herbert- benchmarking study.

- Growers must have fully transitioned to wider rows to be included.
- Transitioned rows spacing must be 1.7m+

Growers who transitioned to wider rows					Growers who have not transitioned past 1.68m				
Year	Ha Cult	Ha Harv	Yield		Ha Cult	Ha Harv	Yield		Mill Av
2015	12421	10557.99	79.96		54856	46063	78.66		78.77
2016	12490	10438	89.76		54634	45728	84.8		85.67
2017	12472	10635	90.1		54644	46338	88.11		88.18
Av			**86.60667**				**83.85667**		**84.20667**
2006	12050	10418	90.12		56175	46914	85.56		84.98
2007	12104	10450	79.04		56175	46914	76.31		75.00
2008	12257	10362	87.12		52875	44699	85.52		85.15
Av			**85.42667**				**82.46333**		**81.71**

Plant populations

Rice- The fields having 225,000 plants per hectare produced the highest paddy yield of 4.6 ton/ha that was about 41 percent higher than the field with 175,000 plants per hectare. The plant population in farmer fields were found in the range of 80,000 to 200,000 plants per hectare.

Wheat- Chances of optimal yields are improved by establishing at least 700,000 plants/ ha (70 plants/m2) even in seasons of low rainfall. With irrigation, high yielding dryland conditions or very early and very late plantings, populations of at least 1,000,000 plants/ha are recommended. Plant populations below 600,000 plants/ha may result in a reduction in yield and increased weed competition.

All other industries use plant population to determine and maintain yields- why not cane?

Planting methods

- It appears that plant population and the crops ability to maximise sunlight is critical (Sandu, 2017).
- **Row spacing is irrelevant if plant populations are considered.** Dual rows/ double rows and wide shute planting methods are ways to overcome plant population issues.

Comparison of wide shute (left) and narrow shute (right) planting methods in the same field (same time planted)- near Ingham, 2018. Variety- Q240.

The benefits of wider rows

- Improved machinery & harvester efficiencies
- Less rows to travel per year
- Less turning around
- Less wear on track gear and tyres
- More cane in a linear row

MORE MONEY IN THE BANK?

The costs to the harvesting sector:

- Elevator extension or flipper roller
- Widening of the fronts to accommodate the wider rows (can be ordered with new machines)
- GPS (there are benefits to the harvester operator here also)

Hand out given out now

Dual row harvesting is coming

Quote from Jeff Freyou- John Deere Global Product Marketing Manager, Sugar; USA:

“John Deere are developing a two row cane harvester and our direction of focus will be on 1.5m and 1.8m row spacing.”

Date of comment- late 2017 during his Australian visit.

This means that the Australian industry will need to transition to a row spacing that will accommodate the double row harvester.

The logical step would be a 3m controlled traffic system or a 3.6m controlled traffic system. The challenge will be the haulout equipment.

John Deere have two prototypes already operating in the USA and Brazil.

Funding opportunities

Growers who are interested in transitioning to wider row spacing- **it must be a systems approach**

Harvesters who are interested in:

- Modifying harvesters to harvest wider rows
- GPS systems to harvest wider rows

Please contact the Leanne Carr or Jarrod Sartor (WTSIP Extension staff) at HCPSL.

Conclusion

Sugarcane is an “elastic” crop in relation to row spacing and it appears the row spacing is not as critical as:

- Good varieties perform well on all row spacing.
- Plant population requirements need to be met.
- Leaf area index in relation to light interception is a driver of cane yield- capture the most sunlight, therefore crop architecture is important.
- Plant available water for crop growth is very important.

Conclusion

Continued:

- Adequate crop nutrition is essential.
- Management of weeds and pests essential to achieve maximum yields regardless of the row spacing.
- Compaction of the root area can limit yield potential of a crop.
- GPS is critical to manage compaction and confine machinery to traffic zones
- Farm management practices –

A good farmer will be a good farmer at any row spacing and a bad farmer will be a bad farmer regardless of row spacing.

The facts and myths concerning farming systems

Presentation by L.Di Bella - HCPSL

Thank-you for your time today.