

Soil compaction

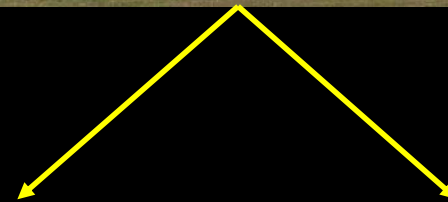
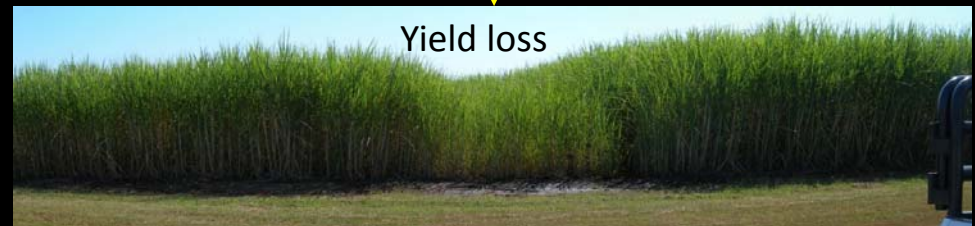
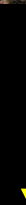
Sorting out the enemy



R van Antwerpen

Soil Compaction vs Stool Damage

- This talk is about soil compaction - a reversible form of land degradation.
- Peter Tweddle's talk will be on stool damage – the effect is permanent.



Soil compaction Stool damage



- With 70 – 140 tc/ha to remove from the land heavy agricultural equipment is part of sugarcane farming.
- Soil compaction is therefore unavoidable and must be managed.

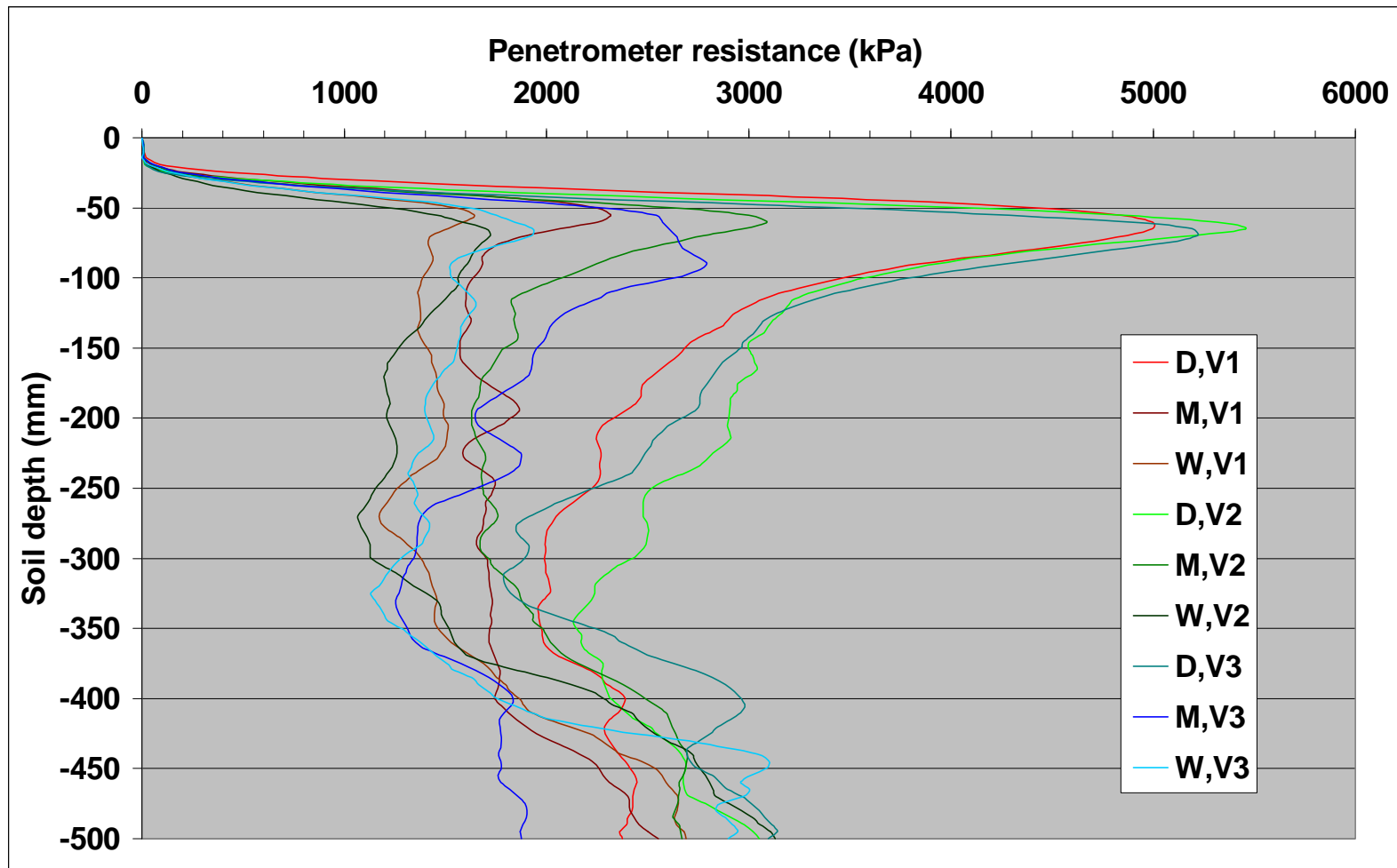


Equipment in all shapes and sizes

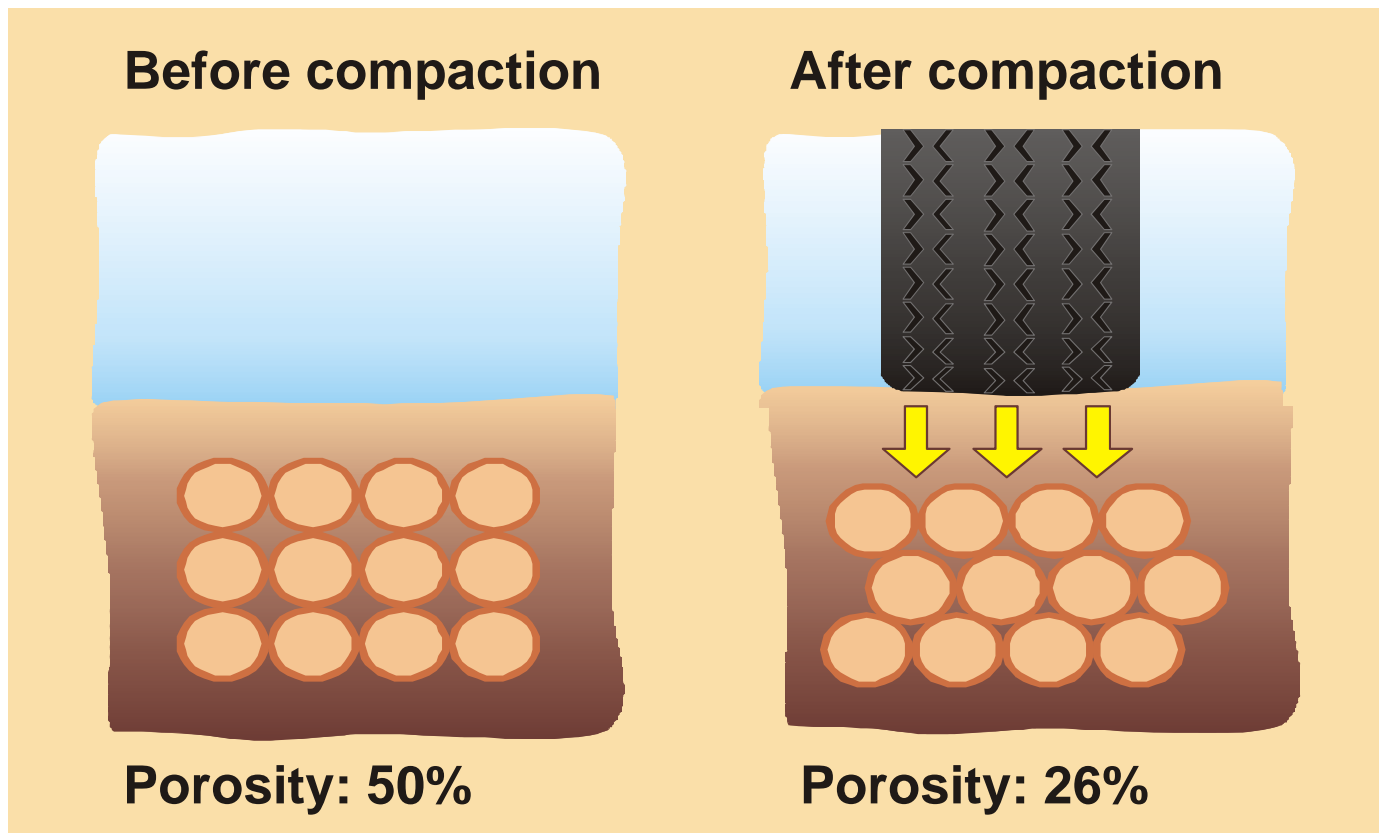
At what depth is the soil compacted?



Soil compaction by vehicles



Effect of compaction on pore volume



What will we see under magnification?



Effect of compacted soil on roots



Effect of surface cover on soil density.



Signs of a soil compaction problem

Zero till

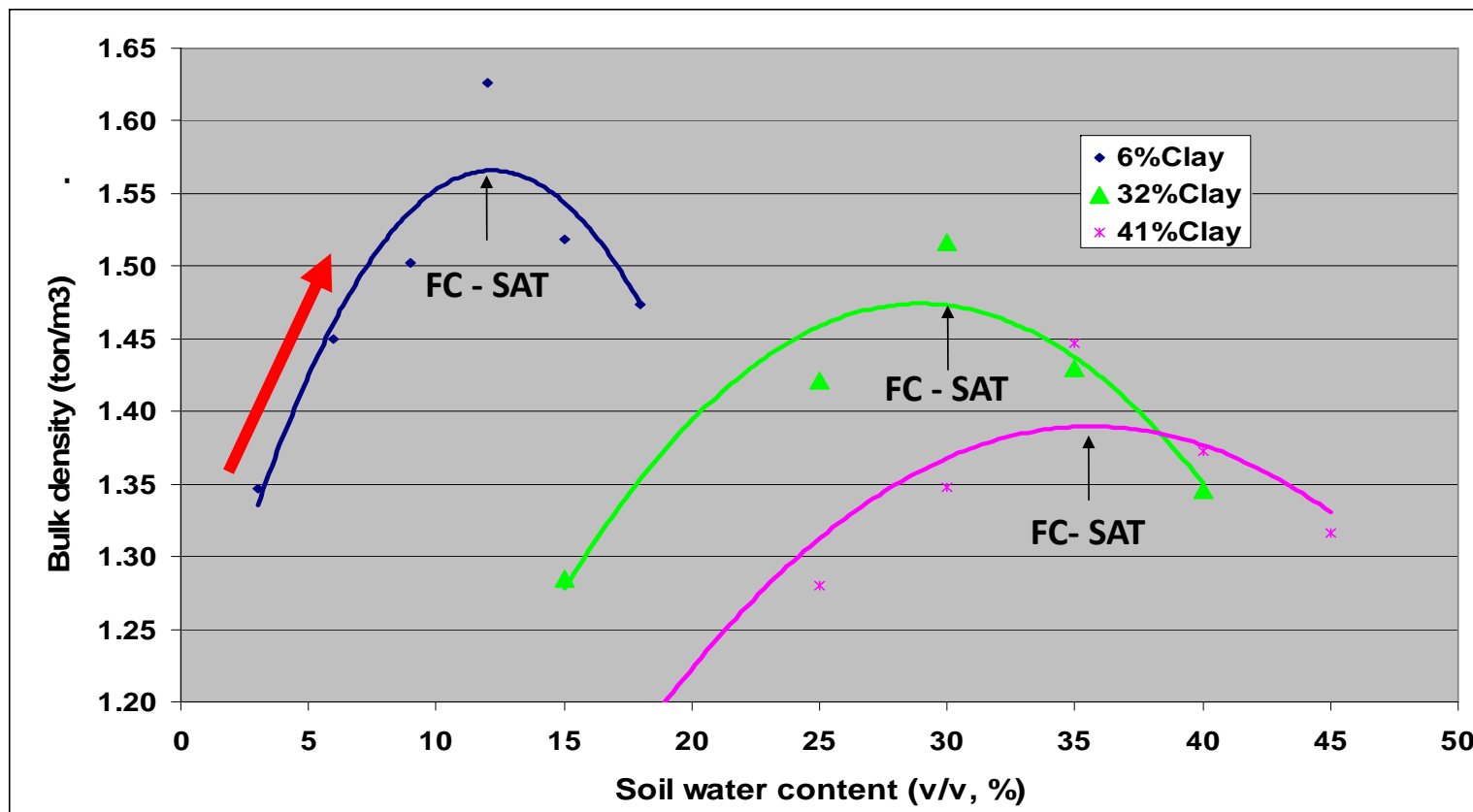


Conventional



Photo: Des McGarry

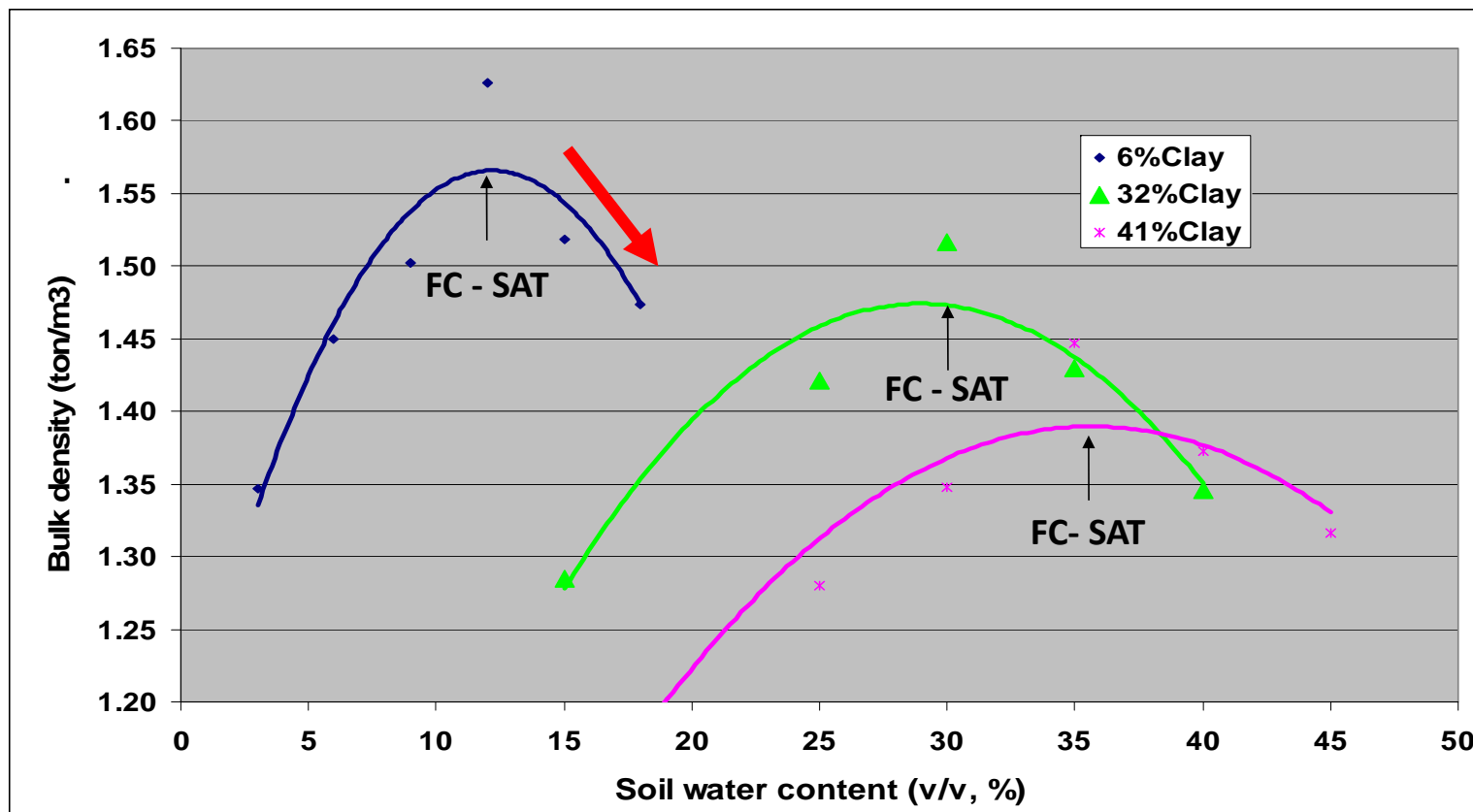
Effect of soil water content on compactability of soils



Effect of soil water content on soil compactability



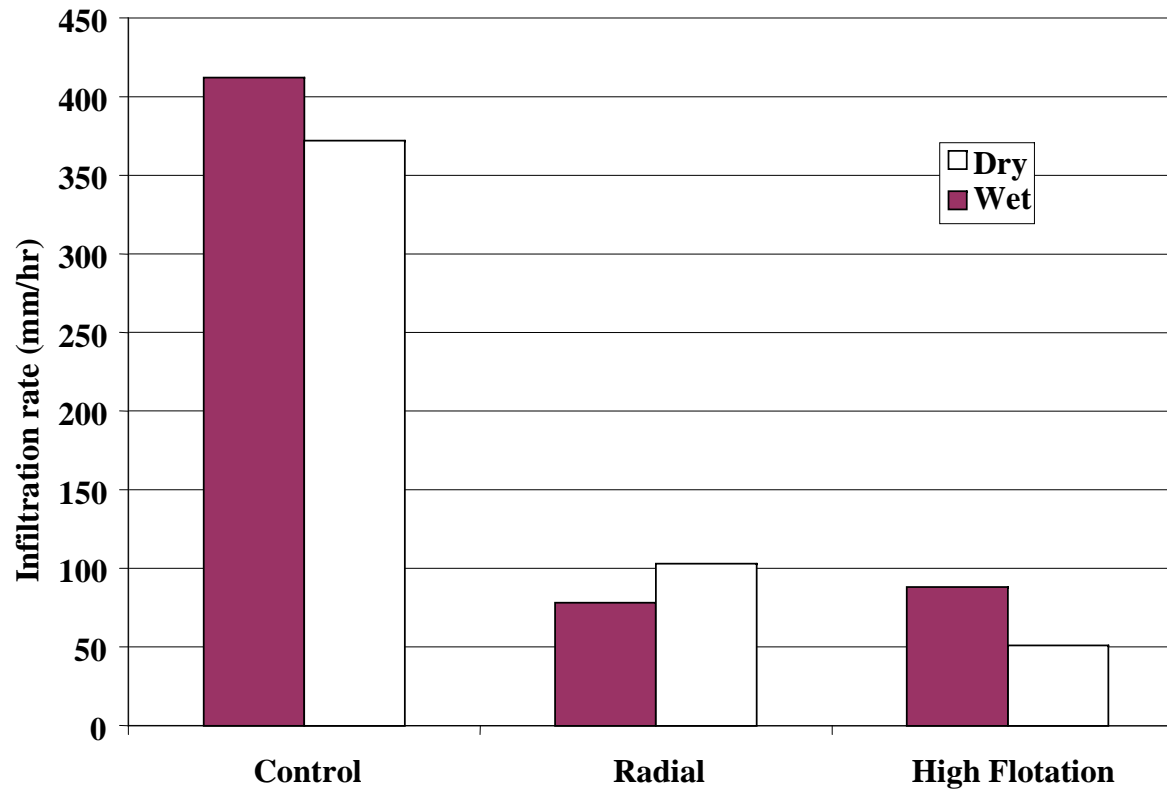
Effect of soil water content on compactability of soils



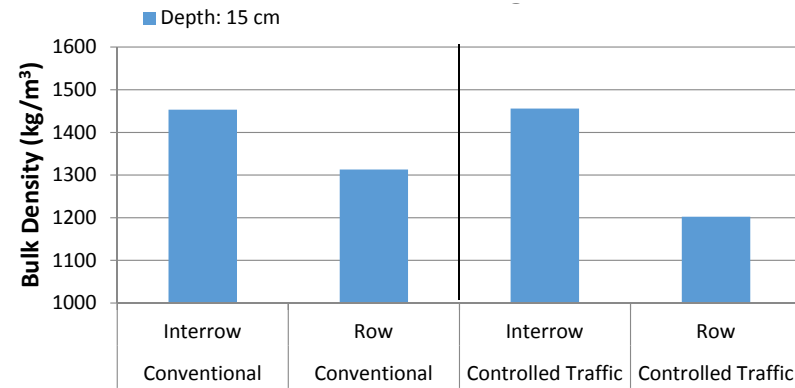
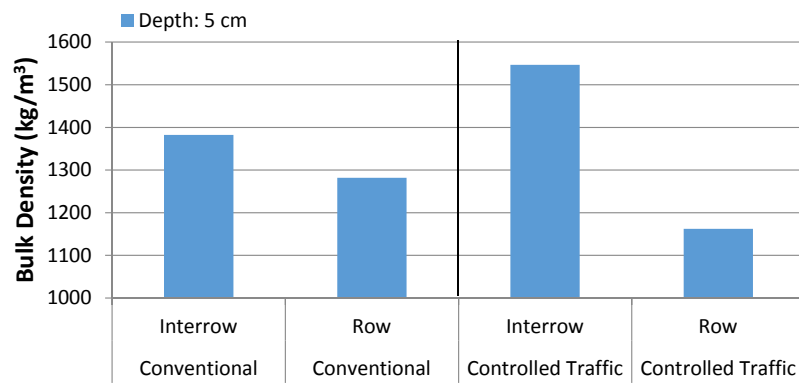
Destruction of soil structure



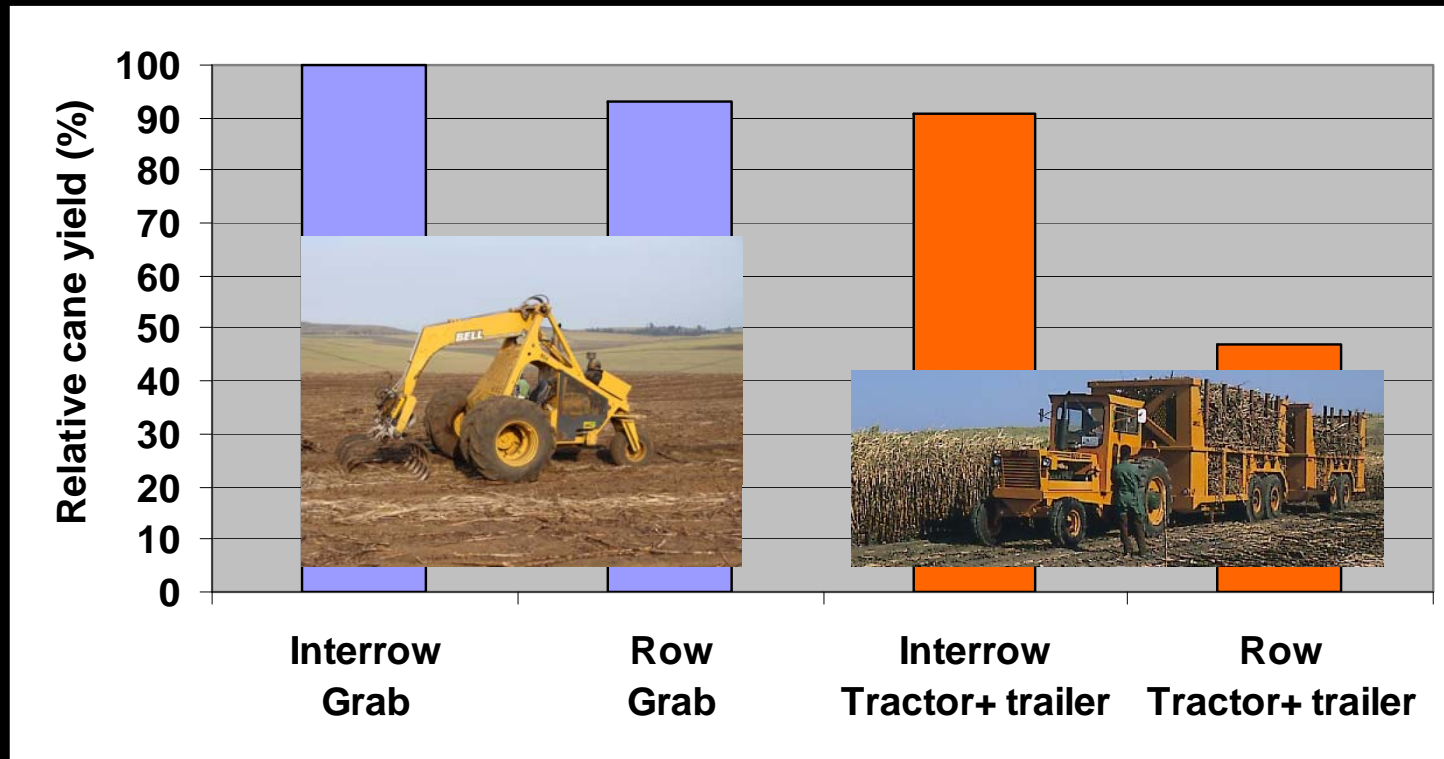
Water infiltration rates as affected by tyre treatment



Comparing soil bulk densities for conventional and controlled traffic



Soil Compaction vs Stool Damage ... their effects on crop yield



We can live with soil compaction
but not with stool damage!

Effect of tillage on yield

<u>Author</u>	<u>Soil</u>	<u>Tillage</u>	<u>Effect</u>
• Moberly '69	Gs, Mw, Ar	Rip	Reduction
• Moberly '69	Kd, Lo, Cf	Rip	Reduction
• Johnston & Wood '71	Hu, (sc)	Rip	No
• Moberly '72	Kd, Lo, Mw	Deep	No
• Moberly '72	Fw	Deep	Increase
• Leibbrandt '85	Sd, Tk, Ar, Es, Ss	Rip	No
• Donaldson '86	Sd	Rip	No

This does not mean we should not alleviate compaction.

Negative effects of compaction

- Reduced pore space.
- Lower water infiltration.
- Increased erosion.
- Restricted gas exchange.
- Root distribution restricted.
- Poor germination.
- Nutrient deficiency.



Positive effects of compaction

- Improved traction.
- Reduction in frost damage.
- Resistant to wind erosion.
- Stable foundation for buildings.
- Essential for earth dam construction.
- Increased soil strength.
- Increased load-bearing capacity.



To summarise ...

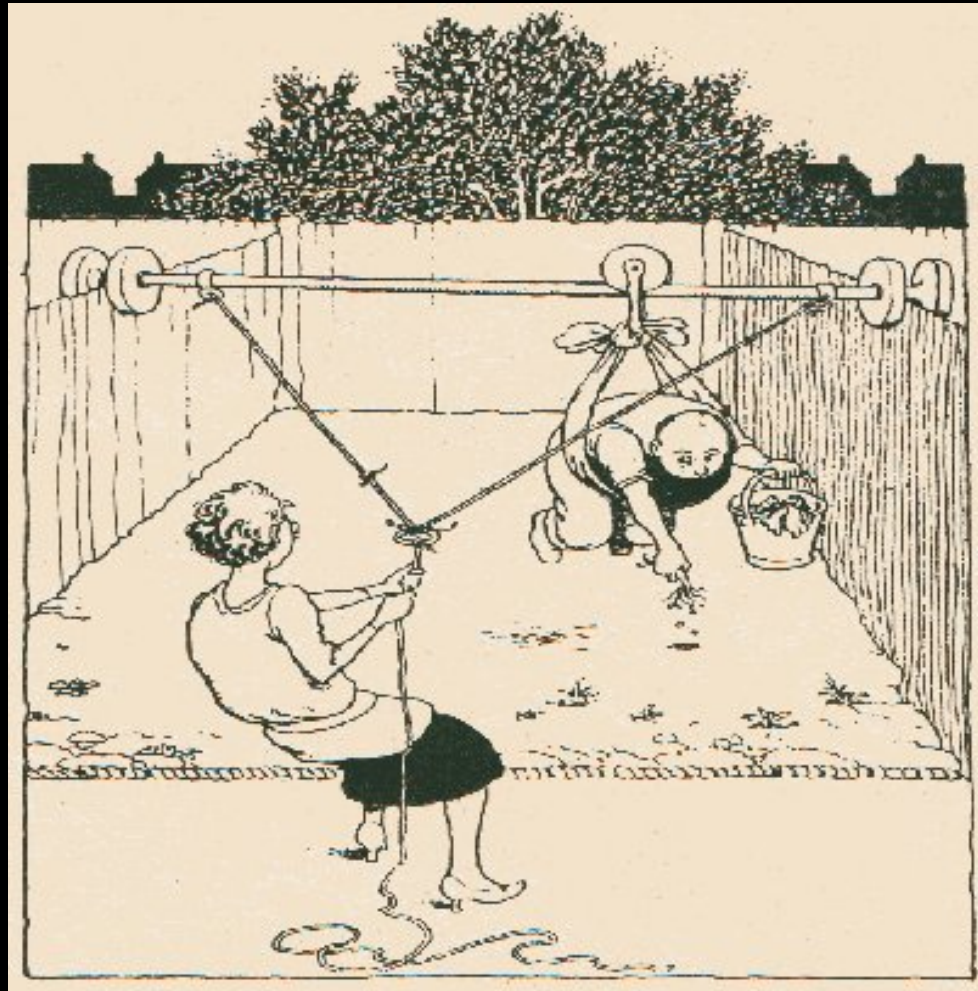
- Soil compaction is a reversible form of land degradation.
- Alleviation of compaction will not necessarily lead to increased yields,
- but will improve water infiltration, water use, fertiliser usage and aeration of the soil (improve Soil Health).

- How do we reverse soil compaction?

• Moberly '69	Gs, Mw, Ar	Rip	Reduction
• Moberly '69	Kd, Lo, Cf	Rip	Increase
• J & Wood '71	Hu, (sc)	Rip	No
• Moberly '72	Ar, Sd, Lo, Mw	Deep	No
• Moberly '72	Fw	Deep	Increase
• Leibbrandt '85	Sd, Tk, Ar, Es, Ss	Rip	No
• Donaldson '86	Sd	Rip	No



This is an option ...

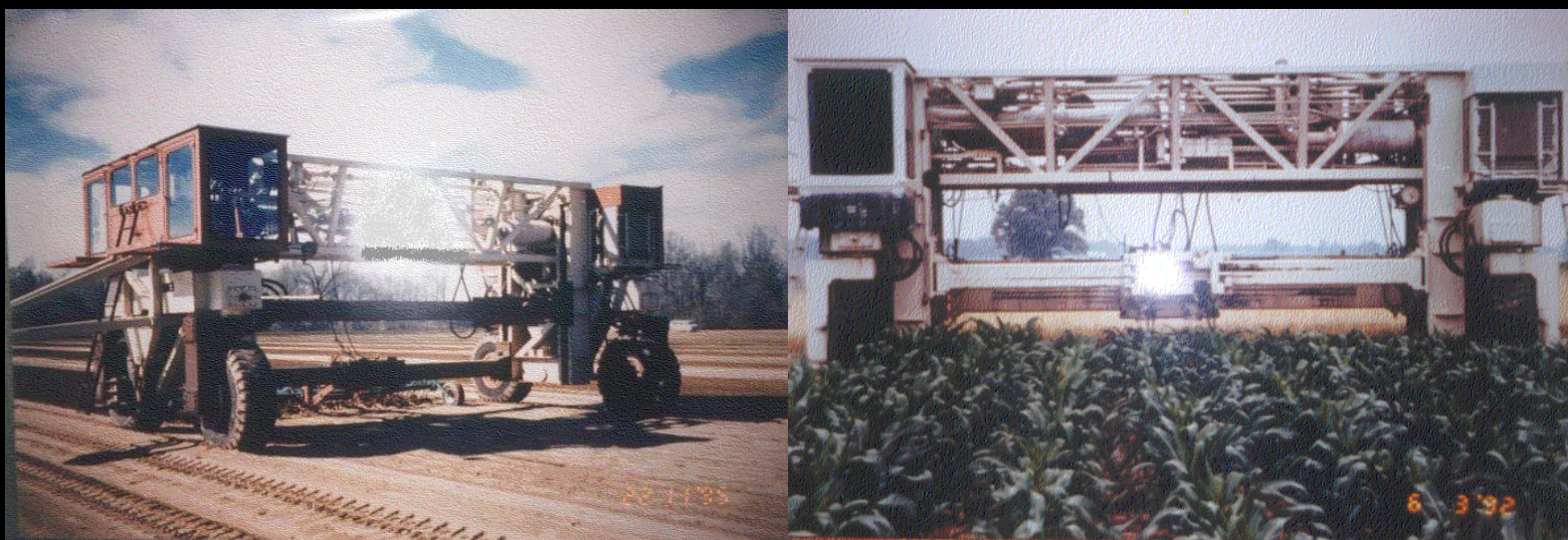


... and this is an option!



Sugarcane is a heavy crop and large mechanical equipment is required to remove the harvest from the field.

This is an option to reduced the foot print/ha but,
I'm not aware of any units operating in Africa!



... and then there is this option ... but slow!



Ademir Calegari

Sugarcane is a high tonnage crop and large mechanical equipment is required to remove the harvest from the field.
Thus - soil compaction is a given.



How should we manage soil compaction?

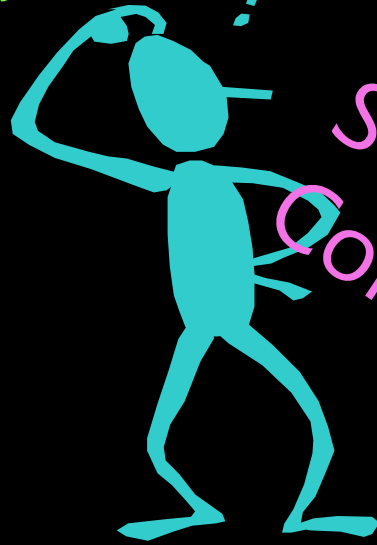
Tillage
type

Frequency

Equipment

Between ratoons

Soil Water
Content



Grouped compacted soils
into two:

- soils that crack



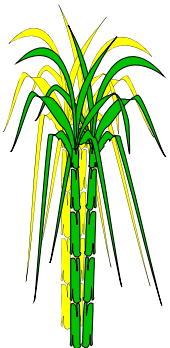
and

- soils that don't



Myth

surface residue will prevent soil compaction



Alleviating soil compaction

A) Between ratoons:

- Establish the depth of the compacted layer (open a pit, steel rod).
- Rip the interrow within days of harvest to minimise damage to the roots.
 - Large clods on the surface – Ok – keep the surface rough to maximise water infiltration, minimise fertiliser loss.
 - Moving stools – soil is too dry and will result in yield loss – abandon operation.



1

2

3

Alleviating soil compaction

B) End of the cropping cycle:

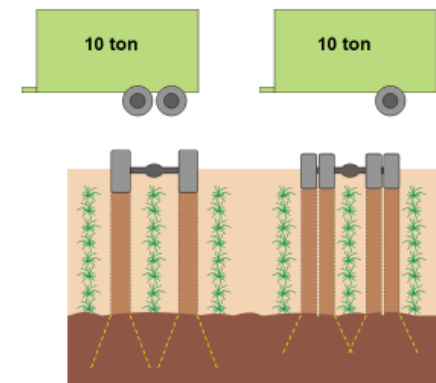
- Kill the crop.
- Establish the depth of the compacted layer (open a pit, steel rod).
- Rip to the required depth.
- Reduce size of large clods.
- Plant green manure crop.

Winter vs Summer, Combinations

- Maximise OM return.
- Adopt controlled traffic system.
- Replant to sugarcane.
- Keep the surface covered.



**Double axle single tyres
vs single axle double tyres**







Two options to break the clods



Other ideas to deal with compaction and surface crusts.



Minimum tillage





Surface crusts.



5 Components in the System to Management Soil Compaction

1. Reduced **T**illage.
2. Maintain or increase **O**rganic matter (Cane residue, cover crops).
3. Keep the surface **C**overed (crust prevention, reduced runoff, microbes)
4. Use high flotation tyres and smaller, lighter **E**quipment.
5. Practice **C**ontrolled Traffic.



TO CEC



Thank you 😊