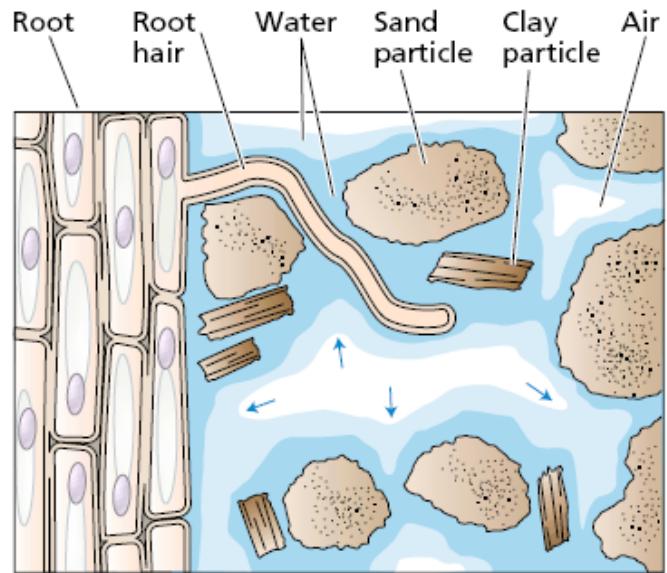


Visual evaluation of soil structure

Rachel Muylaert Locks Guimarães,
Bruce Ball, Lars Munkhom and Tom
Batey

Importance of soil Quality

- Optimum productivity
 - Water
 - Air
 - Adequate Soil resistance



Visual Evaluation of Soil Structure

- Evaluation directly in the field
- Little equipment required
- Replication can be obtained easily
- Compacted layers can be identified
 - Tillage procedures
 - Research – layer of interest

Visual evaluation can detect layers of contrasting structure

- Guide further diagnostic soil measurements
- Suitability for minimum tillage
- Need for subsoiling
- Need for drainage improvement



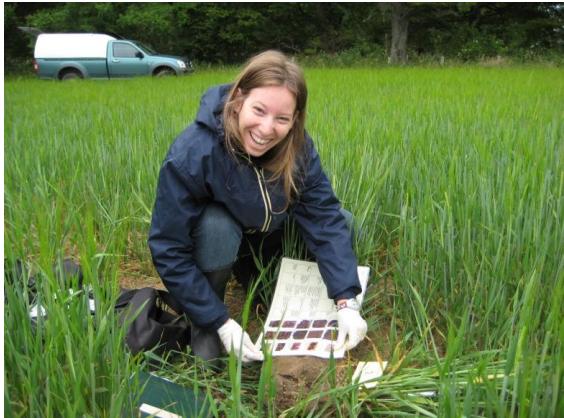
VSSQA - Methodology



Block extraction



Block break up



Block break-up



- Along natural failure planes by pulling apart
- Break up by applying progressively more force – between the fingers, in one hand and with both hands
- Structural quality estimated from aggregate size, shape and strength, porosity, roots, colour and smell



VESS – layering



Improved chart

Structure quality	Size and appearance of aggregates	Visible porosity and Roots	Appearance after break-up: various soils	Appearance after break-up: same soil different tillage	Distinguishing feature	Appearance and description of natural or reduced fragment of ~ 1.5 cm diameter
Sq1 Friable Aggregates readily crumble with fingers	Mostly < 6 mm after crumbing	Highly porous Roots throughout the soil			Fine aggregates	 The action of breaking the block is enough to reveal them. Large aggregates are composed of smaller ones, held by roots.
Sq2 Inert Aggregates easy to break with one hand	A mixture of porous, rounded aggregates from 2mm - 7 cm. No clods present	Most aggregates are porous Roots throughout the soil			High aggregate porosity	 Aggregates which obtained are rounded, very fragile, crumble very easily and are highly porous.
Sq3 Firm Most aggregates break with one hand	A mixture of porous aggregates from 2mm -10 cm; less than 30% are <1 cm. Some angular, non-porous aggregates (clods) may be present	Macropores and cracks present Porosity and roots both within aggregates.			Low aggregate porosity	 Aggregate fragments are fairly easy to obtain. They have few usable pores and are rounded. Roots usually grow through the aggregates.
Sq4 Compact Requires considerable effort to break aggregates with one hand	Mostly large > 10 cm and sub-angular non-porous; horizontal platy also possible; less than 30% are >7 cm	Few macropores and cracks All roots are clustered in macropores and around aggregates			Distinct macropores	 Aggregate fragments are easy to obtain when soil is wet, in cube shapes which are very sharp-edged and show cracks internally.
Sq5 Very compact Difficult to break up	Mostly large > 10 cm, very few < 7 cm, angular and non-porous	Very low porosity. Macropores may be present. May contain anaerobic zones. Few roots, if any, and restricted to cracks			Grey-bite colour	 Aggregate fragments are easy to obtain when soil is wet, although considerable force may be needed. No pores or cracks are usable internally.

Aggregates Sq2, Sq3 and Sq4



Sq1



Sq2



SAC



Sq3



SAC



Sq4



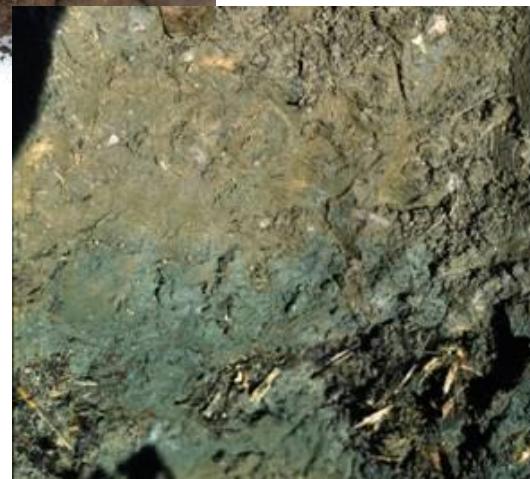
SAC



Sq5



SAC



'Core' aggregate to improve quality identification



Sq 1 – made of smaller aggregates



Sq 2 – rounded, crumble easily, porous



Sq 3 – rounded, contain pores and roots



Sq 4 – cubic, sharp-edged, contain cracks



Sq 5 – hard to create, no pores or cracks

- Block depth = 25 cm
- 1st layer depth = 15 cm
- Sq 1st layer = 4
- 2nd layer depth = 10 cm
- Sq 2nd layer = 2



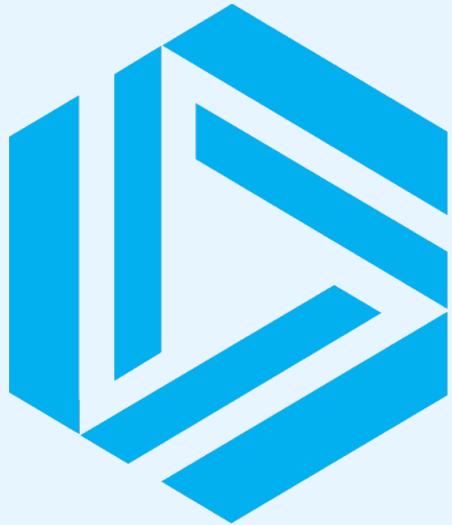
$$\text{Block Sq} = (15^*4)/25 + (10^*2)/25 = 3.2$$

Threshold Sq values for sustained agricultural productivity

Sq score	Soil structural quality	Management needs
1-3	Good	No changes needed
3-4	Fair	Long-term improvements
4-5	Poor	Short-term improvements

Honour the soil





SAC

S✓ccess through **Knowledge**