

Soil Structure Close Up

- *Excessive cultivation over the years in many areas of NSW has resulted in a damaged "soil structure".*
- *This has lead to:*
 - *reduction in the amount of water entering the soil,*
 - *reduction in the amount of water held in the root zone*
 - *restricted root growth and reduced seedling emergence; and,*
 - *reduction in availability of oxygen*
- *Establishing crops using direct drilling or minimum tillage techniques can improve soil structure: This is shown by the following photographs.*

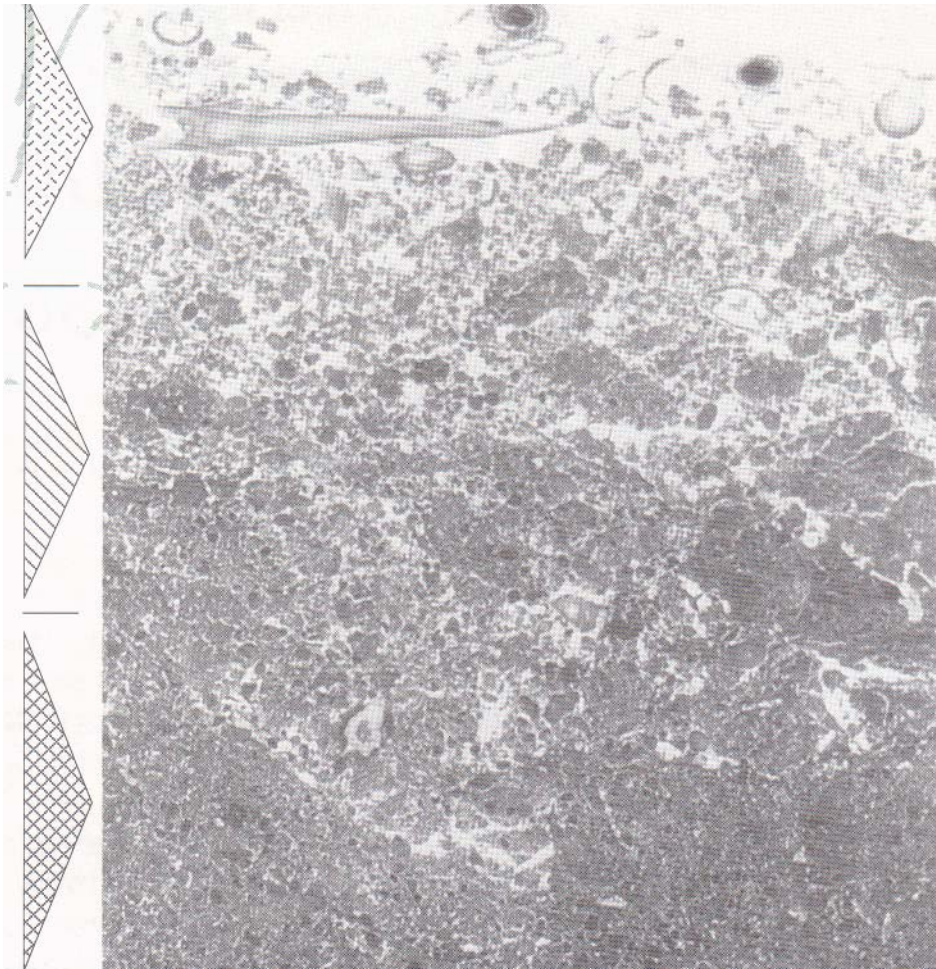


Soil structure affects both erosion and plant growth. Take a close look at your soil.



Good Soil Structure

Photographs are of thin sections of Red Brown Earth from Cowra, NSW, Australia. The soil structural conditions were at the flowering stage of the wheat crop (i.e. the soil was settled) in September 1986.



ABOVE: (8 YEARS OF DIRECT DRILL WHEAT)

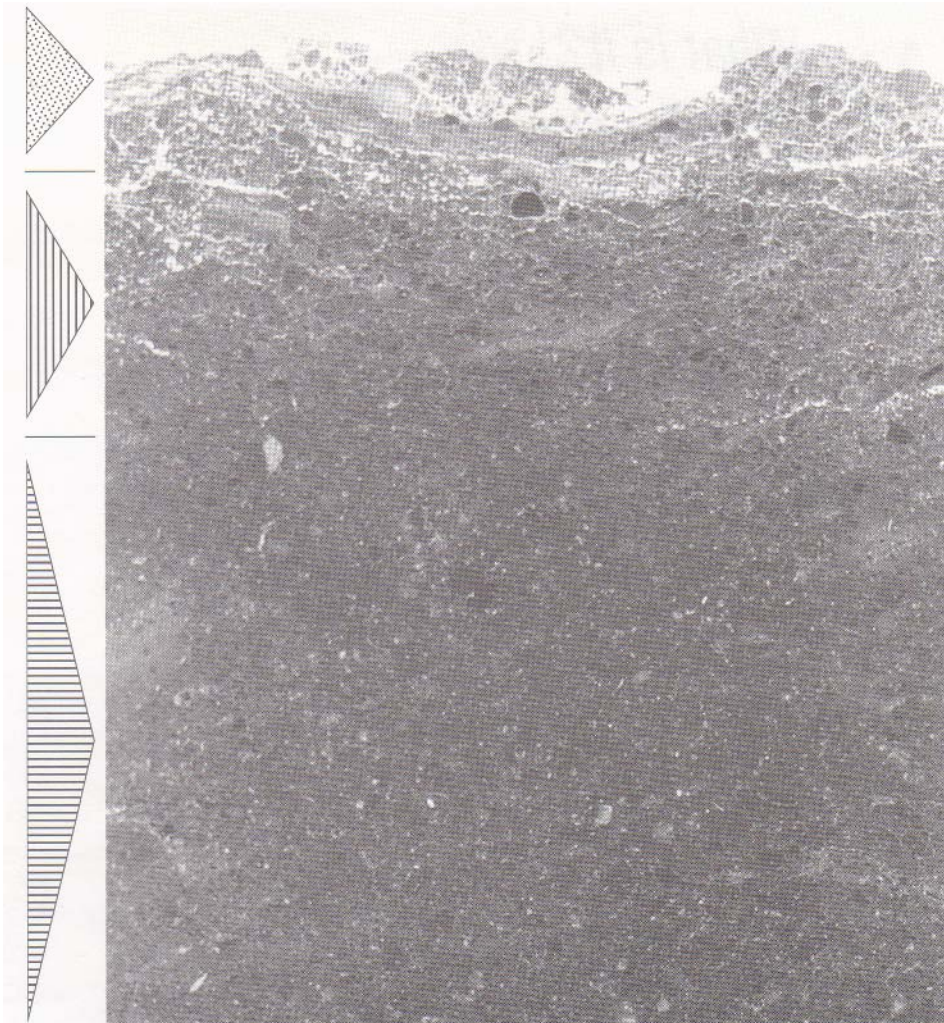
10mm

TOPSOIL	No crust formed at the surface, good pore continuity.
SUBSURFACE	Soil pores (holes) plentiful
SUBSOIL	Open soil structure

NOTES

- Surface crust not formed because of high soil particle stability, due to better retention of organic matter.
- Good pore continuity to the surface results in good water infiltration and aeration.
- Approximate water infiltration 53mm/hour resulting in,
 - high rainfall infiltration
 - most rain converted to useable water for the crop.
- No crust to limit seedling emergence.

Poor Soil Structure



Photos produced by
Department of Soil
Science, Sydney
University and
Division of Soils,
CSIRO. (Moran et al
1988)

ABOVE - 8 YEARS OF TRADITIONALLY TILLED WHEAT



TOPSOIL	<i>Dense surface crust formed, reduced pore continuity</i>
SUBSURFACE	<i>Soil pores (holes) limited</i>
SUBSOIL	<i>Dense soil structure</i>

NOTE:

- *Surface crust formed because of low soil stability due to loss of organic matter.*
- *Low pore continuity to the surface reduces infiltration of water and aeration.*
- *Approximate water infiltration 10mm/hour, resulting in:-*
 - *low rainfall infiltration and high erosion hazard*
 - *rain lost as runoff, and,*
- *Crust may form a barrier to seedling emergence.*

Soil Structure

-What is it?

Soil structure is defined as the arrangement of particles and pores in soils. A well structured soil has adequate pore space for the storage of water, for the movement of water

The decline of soil structure is best considered as a reduction in soil physical fertility. There are a number of aspects to soil physical fertility that can affect productivity. These

1. **INFILTRATION** The ability of the soil to infiltrate rainfall is important for moisture availability to crops and pastures.
2. **WATER RETENTION** The ability of soil to retain moisture can have a major influence on productivity especially in drier years.
3. **AERATION** Plants need air to grow. If soils become waterlogged plants
4. **FRIABILITY** The ability of soil to form an ideal seedbed with minimal ground disturbance ensures good seed/soil contact and no limitation to germination, emergence and initial root growth.
5. **SOIL STRENGTH** A dense layer at the surface (crust) or at cultivation depth (hard or plough pan) can restrict plant emergence and root growth.

Organic Matter

Organic matter plays an important role in the physical properties of soils. It not only contains nutrients required by plants it also helps bind soil particles together to form large aggregates that give soil its structure. Generally speaking the higher the organic matter in the soil the better the soil-structure. It is therefore critical that organic matter levels are maintained or increased in the soil by retaining crop residues and minimising cultivation.

Organic matter levels are increased most effectively in the cropping phase by retaining cereal crop residues. The cereal residues need to be decomposed to allow sowing with conventional combines. This can be achieved by mechanically splitting the straw with mulching harrows, slashers or straw mulchers or by shallow incorporation into the soil, preferably with a tined implement.

A late burn may be necessary depending on the trash handling ability of seeding equipment used.

Organic matter levels produced during the pasture phase are best maintained by minimising cultivation in the subsequent cropping phase.

Moran, CJ, Koppi A.J., Murphy B.W., and McBratney, A.B., (1988) Comparison of macropore structure of a sandy loam surface horizon subjected to two tillage treatments. Soil Use & Management 4, 96 -102. Published 1994

