MURRAY DAIRY - AUTUMN START-UP WORKSHOPS.

Technical Note: DEPTH, TEXTURE & STRUCTURE OF A HORIZON TOPSOIL.

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Description of the issue and importance: The depth of A horizon (or depth of topsoil) is the primary soil profile attribute to be assessed for pasture or cropping systems under irrigation. As the depth of topsoil increases, improvements in production can be expected from the following:

- Increasing availability of macro-nutrients and trace elements
- Increasing rates of mineralisation of organic matter
- Improved profile drainage
- Higher yield potential for pastures or crops
- Better exploitation of soil water
- Enhanced patterns of root development

The A horizon hosts the plants root system for the first 4-8 weeks after planting. Plant development during this period is critical for establishing yield potential which places emphasis on their structural condition and nutrient levels.

The A horizons of duplex soils on the Riverine Plains and North-East Victoria generally evince lighter textured topsoils in comparison to subsoil, a characteristic of the duplex soils in this region. The topsoil is usually the most favourable zone for root growth for accessing water and nutrients. The subsoil primarily supports the plant for supply of water.

Hard, dense, compacted, consolidated or poorly structured topsoil horizons limit access to water, air and nutrients. These aspects are fundamental for improving water use efficiency from rainfall or irrigation water. Cycles of wetting and drying are necessary for optimal soil functioning.

Problem Identification: Dig with a pick, shovel or backhoe and identify where the transition between the A and B horizons occurs in duplex profiles. Ideally, all A horizon topsoils throughout irrigation areas of the Riverine Plains will function efficiently if they:

1. Are well-structured with defined soil aggregates that show evidence of plant roots and organic material. Figure 11 shows variable types of soil structure (McMullen, 2000).

2. Do not contain soil with a 'platy' or plate-like structure (McMullen, 2000).

3. Evince bulk density levels of less than 1.3 t/m^3, but preferably between 1.1-1.2 t/m^3 (Brady and Weil, 2008; Charman and Murphy, 1991; McKenzie *et al*, 2004). Bulk

density testing can be performed using a simple weight to volume process with hand tools, drying and scales (Australian Standards, 1980).

4. Are free of bleached and impervious subsurface layers that restrict or impede root elongation.

5. Contain a surface layer which is free from dispersion and crusting, which may impact on the germination of planted seed.

Maintenance of soil structure and amelioration of problems that exist can be difficult to overcome in the short term and may take some time. Previous land-forming practice and the degree of cut and fill land forming may also play a role.

Sites with less than 12cm of A horizon topsoil overlying clay dominant subsoil commonly suffer from poor drainage and become problematic during periods when rainfall exceeds evapotranspiration, particularly where soils are at or near field capacity. Examples of various types of soil structure are shown below.

Figure A3–3. Some different aggregate shapes

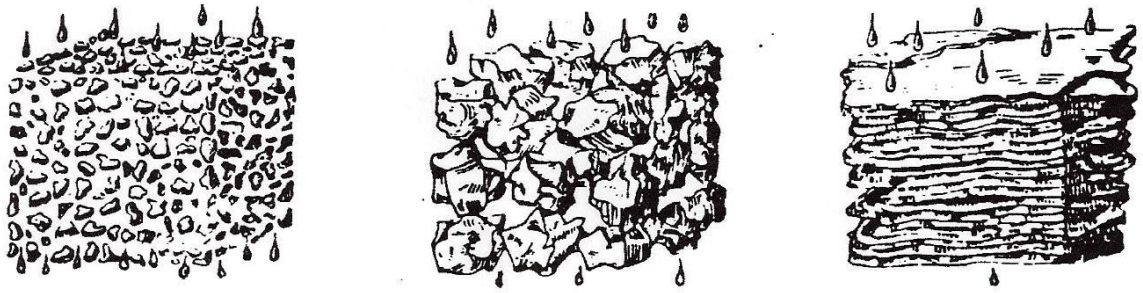
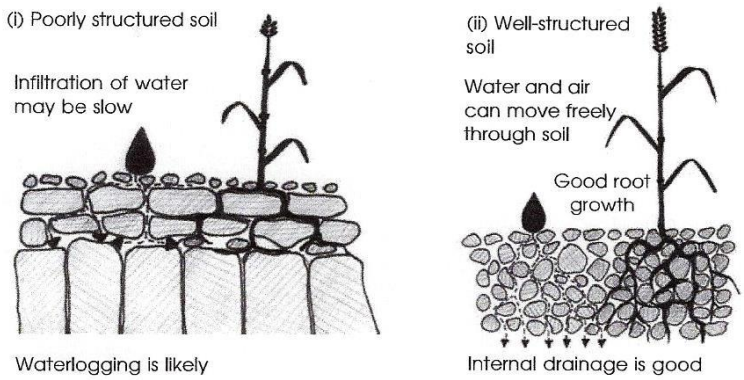


Figure A3–4. Well structured and poorly structured soils



Various aggregate shapes and structures (McMillen, 2000. Vegetable Soilpak, NSW DPI).

<u>Management options:</u> Management of topsoil depth is difficult particularly where the natural depth is already shallow. Based on literature and experience in this region, the average depth of topsoil depth can range from 8-20cm. Areas of shallow topsoil require topsoiling to ensure topsoil is replaced at a uniform depth upon completion. Topsoiling involves full removal of the topsoil, land forming clay subsoil and replacement of topsoil at a uniform thickness.

Re-land forming existing border check irrigation areas is an expensive option but should be considered where growth is impeded by minimal topsoil. In cases where there is nil topsoil from complete removal, ameliorants and gypsum may also have minimal impact on improving soil condition.

It is difficult to try and turn subsoil into a material that functions like topsoil. This is achievable from a nutrient and structure perspective with appropriate amelioration and nutrition, however infiltration, drainage and wetting characteristics change and areas with minimal topsoil or exposed subsoil suffer surface waterlogging under irrigation.

Maintenance of soil structure where topsoil is prevalent is assisted by the application of organic matter and soil ameliorants including gypsum and lime. Where sub-optimal structure is a problem, mechanical effort may be required to shatter aggregates along with ameliorant application to stabilise soil aggregates. Stabilising aggregates from dispersion or slaking allows plants to extend their roots throughout aggregated soil. Clay dominant subsoil should not be mixed with topsoil. Ideally, the bleached layer requires shattering without raising material or mixing with the surface layer.

Detailed assessment of the soil profile and amelioration of topsoil layers should occur prior to physical amelioration. Identification of problems is essential for success and generally involves shallow digging with a pick or shovel. Auger ole testing is commonly undertaken by some agronomists and landholders. This type of sampling is suitable for revealing soil texture, but provides a lack of detail into structure once augured material is shattered and mixed.

The approach of doing nothing is unlikely to yield a long-term outcome which is productive, sustainable or profitable.