Field selection & preparation

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Cotton soils

The soils on which cotton is grown in Australia are inherently fertile. They are dominated by cracking clays (Vertosols) which are naturally fertile, alkaline, with high clay content and high organic matter in soils that initially supported brigalow/belah associations. These soils were formed from fertile alluvium and windblown dust under conditions of relatively low rainfall. (Hence, nutrients are not leached as in soils formed in more tropical areas). Other soil types on which cotton is grown include red-brown earths (in the Macquarie, Namoi and Gwydir valleys) and in many of the Queensland districts Solodic and Solodised-Solonetz form a part of the soil. These soils supported natural vegetation of woodland and grassland, prior to cotton cropping, the previous land use was grazing and dryland wheat production.

Cotton has poor tolerance of water logging. To allow adequate water entry, and to encourage root exploration by quickly re-establishing aeration after irrigation and rainfall, cotton soil needs to have good porosity for infiltration and internal drainage.

The alluvial soil types, black earths and the better structured grey and brown clays, with their extensive cracking – provide favourable conditions, for vigorous root growth. Soil types with dense, sodic subsoil's have poor profile permeability and drainage, and hence limit root development.

Structural damage, due to excessive traffic or tillage at high moisture contents, may create large platey clods in any cotton soil. Such damage restricts permeability. While the root zone should be permeable, the deep subsoil should be almost impermeable; excessive deep drainage may cause water tables to rise. Irrigation management and crop rotation should aim to minimise the amount of water draining to the deep subsoil.

Crops are more likely to produce high yields when their roots are able to grow freely.

Root growth is retarded by the same factors that restrict water entry and seedling growth. Subsoil sodicity tends, however, to cause water logging by the process of excessive swelling rather than dispersion of clay particles.

For more information on Cotton Soils refer to SOILpak.

BE AWARE OF

- Crop growth will be easier to manage in a field with a uniform soil type.
- Fix problems associated with land forming before planting cotton
- Favour fields that have most recently grown a crop other than cotton, where stubble has been retained and there is low risk of herbicide residues
- Consider alternative irrigation systems i.e. would lateral moves or pivots be more appropriate on lighter soils than flood irrigation.
- Consider suitable run lengths not just for cotton but possible rotation crops.

Starting soil moisture

Large values of Plant Available Water Capacity (PAWC), which are found in some clay-rich alluvial soil types and deep black earths, allow a longer interval between furrow irrigations. Under dryland conditions, if the profile starts out full, large values of PAWC delay the onset of moisture stress in crops.

Compaction may also reduce the ability of a soil to allow water entry. An appropriate slope and field length, in combination with furrows and hills/beds, will ensure good surface drainage and reduce water logging. Land forming using lazer grading usually is needed to provide the required slope across all parts of a field, particularly under irrigation.

Surface drainage and tail drains must be designed to minimise flooding during heavy rain, the consequences of which may be disastrous during the seedling stage. Furrow-edge compaction and water application rates need to be matched so that the root zone does not become waterlogged due to excessive water intake. Slopes that are too steep create erosion hazards.

Further information on PAWC can be found in the Water Management module in *my*BMP and in WATERpak.

Soil variability

To allow efficient management of each crop area as a single unit, it is highly desirable that the soil of the area be fairly uniform. A complex distribution of soil types with differing tillage and irrigation requirements, for example, cannot be managed optimally.

In some cotton growing locations cracking clays are intimately associated with hard-setting soil types. The latter, with poor intake of water, require more frequent irrigation than the former, and often there are different fertiliser and herbicide requirements. Gilgai micro-relief, once levelled, can also provide a complex mosaic with former mound and depression sites giving differing crop performance which may persist for many years.

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Soil surveys

Money spent on a soil survey before development usually is repaid several times over because of the potential management problems that it highlights. Soil survey information provides a benchmark that can be used to check progress with soil quality management as the cotton farming project proceeds.

When planning a new cotton development, each management unit should have soil condition and slope as uniform as possible. To achieve this aim, the soil should be mapped before any irrigation design work is carried out. In fields already already developed for irrigation, variability problems may be so severe that the field must be redeveloped. Again, soil surveys should be made before redesigning.

When soil properties within a field are variable, it usually is impossible to deliver the required inputs to all sub-sections simultaneously when flood irrigation is used. Some parts of variable fields, therefore, will have lint yields that are lower than the field's potential, and product quality for the whole field will not be uniform.

In practice, it is unlikely to ever be economically feasible to completely remove across-field soil variability. However, if good quality soil survey information is available, the variation within each management unit can be minimised in a cost-effective fashion.

Further information on mapping slopes and soil types across the farm can be found in the Natural Assets module in *my*BMP

Land forming

Land forming of cotton fields often creates soil problems that should be dealt with before cotton is grown. Issues include exposure and spreading of unstable subsoil, compaction, creation of abrupt texture-contrast boundaries and excessive dust production. These problems should be overcome before planting the next cotton crop.

Other soil problems (such as sodicity) that may have been identified during the pre-development soil survey can also be dealt with.

Subsoil exposure usually is unavoidable because of the need to provide an even slope in irrigated fields. Even drip irrigated fields have to be land formed because of the need to quickly dispose of runoff water after heavy rain. At best, the exposed subsoil will have inadequate organic matter.

At worst, it will be sodic, depleted of mycorrhiza, have a high pH and perhaps be saline.

Where sodic subsoil is exposed, the scraped material also has poor physical properties. It may be spread thinly over low lying areas which previously had a favourable soil structure. Therefore it is desirable to stockpile the original topsoil, landform the subsoil, and then replace the topsoil.

If stockpiling and replacement of the topsoil is not possible, the exposed sodic soil will have to be reclaimed by the use of gypsum, and perhaps by the growth of a well-fertilised cereal crop (e.g. Barley). Zinc fertiliser may need to be added.

Due to the tight schedules of land forming contractors, it is difficult to reshape fields at exactly the correct soil water content, particularly when there is a mix of grey and red soil. Nevertheless, a well fertilised crop such as wheat should be grown just before land forming to maximise the chances of the soil being drier than the plastic limit (PL).

If, however, there is heavy rain before land forming and the contractors cannot be delayed, deep compaction may occur. In this situation, the soil needs to be carefully re-assessed. Create beds and/or hills using a listing rig, preferably with a guidance system that ensures very straight furrows. Dig inspection pits close to at least three of the pre-development assessment sites, and use the soil inspection and interpretation procedures.

For more information on soil constraints refer to the Cotton Nutrition and Soil Health chapter and SOILpak.

Further information:

SOILpak – http://www.dpi.nsw.gov.au/agriculture/resources/soils/guides/SOILpak/cotton

***my*BMP – www.mybmp.com.au**

WATERpak – http://www.cottoncrc.org.au/content/Industry/Publications/Water/WATERpak.aspx