



March 2010

## NRM Plan

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# Delving Sandy Soils

## Sustainable Agriculture in the Northern and Yorke NRM Region

Delving or digging and dragging clay to the surface of sandy soils is being increasingly used by landholders within the Northern and Yorke NRM region to reduce the risk of wind erosion and overcome water repellent sands.

Sandy soils that have moderate to extreme susceptibility to wind erosion occur mostly west of the Hummocks–Barunga Ranges, on the Yorke Peninsula and in scattered areas in the Lower to Upper North. These soils generally have a low soil fertility and poor water holding capacity. Delving on these soils will also help to increase soil moisture, retain nutrients, break up any hardpans and reduce groundwater recharge that can cause and increase saline areas.

### Issues to consider before delving

Before delving the characteristics of the target sand should be considered such as depth, pH and presence of carbonate (free lime) as this will determine if there will be any potential problems with the addition of clay. If the sand is too deep then delving will not be possible and clay spreading may be an option.

The next step is to identify if clay is available on site and if it is, then the depth and suitability needs to be assessed. Delving machines will only raise sufficient amounts of clay to the surface if the clay is less than 60 cm from the soil surface. The depth and suitability of the clay may vary across the paddock so several backhoe pits should be dug to assess the variation. Clay material should be assessed for percentage of clay, carbonate level and dispersion.



The clay source can vary significantly in the percentage of the amount of clay it contains. Some clayey material may contain low amounts of actual clay while heavier clays may contain more than 50% of actual clay. If clay percentages are higher then lower rates of clay can be applied.

It is best to avoid clay with a high pH particularly when the target sand has a high or very high soil pH as this can increase the soil pH and cause nutritional problems in crops and pastures.

Clay with a high level of carbonate should also be avoided as this can affect nutrient availability and plant root growth. Carbonate can reduce the availability of essential plant nutrients including phosphorus, manganese, zinc and iron. The amount of carbonate can be tested using hydrochloric acid diluted with water (1:10 dilution). If the clay fizzes with the acid then carbonate is present and the greater the fizz the greater the carbonate level. Monitor the carbonate levels during delving and if material brought to the surface has a high carbonate level then stop delving within that area.





The most effective clays are those that break down to fine particles during the action of rain. Clays that slake or disperse are ideal as they breakdown and spread quickly on the soil surface. Generally clays that are yellow, orange or brown and mottled are more likely to be dispersive than red or black clays. The red clays are often better structured and require more effort to incorporate.

### How much clay to apply?

The amount of clay required will vary depending on the average annual rainfall, actual percentage of clay, carbonate levels and depth of incorporation. The amounts of clay material raised is difficult to assess and will vary with the delver design, depth of clay and the number of passes.

Rates can vary from 100 tonnes per hectare when using a high percentage of actual clay or up to 200 tonnes per hectare when using a low percentage of actual clay.

The rates used in the Northern and Yorke NRM region have ranged from 80 to 150 tonnes per hectare using material with greater than 30% actual clay.

In the lower rainfall areas (<350 mm rainfall) significantly less clay should be used as it will tend to hold water in the top-soil rather than allowing water to move deeper into the soil profile. In these areas about 80-100 tonnes of clay should be applied per hectare.

It is best to start with a low to mid rate of clay per hectare and then if more clay is needed then this can be delved at a later date. Over claying will be expensive and high rates of clay could create a seal on the soil surface causing problems with crop emergence and water infiltration as well as problems with incorporation.

Clay with a high carbonate level (Figure 1) should be only be brought to the surface at rates of 50 – 80 tonnes per hectare.

Figure 1: Carbonate percentage determined by a fizz test.



Slight reaction (low carbonate)

High reaction (high carbonate)



## Delving and incorporation

Clay is normally delved by a contractor using specialised machinery that raises the clay to the surface. The best time to delve is preferably summer through to autumn as this allows the clay a longer time to break down on the soil surface well before seeding. The delving tracks also need to stabilise and pack down sufficiently to reduce trafficability problems at seeding time.

After delving, lumps of clay are generally left in rows. It is important to break these up and to get an even distribution of clay across the soil surface before incorporation. This can be done using a smudging bar/ railway iron or equivalent.

Good incorporation is necessary to thoroughly mix the clay with the sand. This prevents the clay on the surface sealing and allows for more even water infiltration. The clay can be incorporated on the surface with normal tillage machinery. Some farmers use wide points and others use off-set disc machines. Specialised machinery such as a spader has the ability to mix the clay within the sand with fewer passes. The clay should be incorporated to a depth of 10-15 cm.

With clay delving mechanical incorporation is necessary to mix the clay with the sand but once the clay has been incorporated then farmers can return to using a one-pass sowing system with narrow points or disc seeders.

## Nutrition following delving

Clay delving can alter both the nutrient status of the soil and the ability of the plants to take up nutrients. Delvers provide sub-soil mixing of layers where bleached layers occur and can lead to large improvements in root growth. Nitrogen demand may increase with higher crop or pasture growth. Phosphorus levels may decrease slightly as the phosphorus levels in the clays are much lower than the topsoil. Where clays have a high pH or are calcareous, manganese and possibly zinc could be an issue on sensitive crops. Soil and/or tissue testing is recommended to determine plant nutrient levels.

Figure 2: Delving in the Northern and Yorke region





### **Cost : Benefit**

The cost of clay delving is not as expensive as clay spreading but greater effort is needed to ensure an even distribution and incorporation of the clay. Experience from the south-east of the State has shown that once an area has been clayed the benefits have lasted for more than thirty years.

### **Further information**

### **Help and assistance**

