



Manaaki Whenua
Landcare Research



LEVELLING SAND DUNES TO IMPROVE CROP AND IRRIGATION PERFORMANCE

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These are my observations on re-contouring sand dunes to improve crop and irrigation management on the sand dune country of the Dalrymples' Waitatapia Station, Bulls.

Hew and Roger Dalrymple have recently started levelling low sand dunes for farm improvement. Paddocks in sand dune country have very variable soil patterns, with generally shallow topsoils over raw sands on the upper parts of the dunes, deeper topsoils on the lower dune slopes, and often peaty soils, sometimes with underlying iron pans and silty layering in the inter-dunal hollows. The aim of re-contouring is to even out the soil pattern and change the contours to gently rounded or more flattened slopes that follow the natural lie of the land.

Why re-contour low sand dune country?

- Re-contouring the land to flat or gently rounded slopes improves the operation of centre pivots
- A more uniform soil pattern improves irrigation efficiency (water use) and crop performance, and particularly can provide a more even pattern of when crops mature
- Plus the obvious improvements to farm management (drainage, fencing, vehicle access, cultivation, sowing, and harvesting, etc.).

The Process

The Dalrymples use imported tractor-towed scrapers (pictured) to remove and replace topsoils. The equipment has high accuracy GPS and geo-referenced mapping for controlling the stripping and re-spreading operations.



Topsoil (and peaty material in hollows) is stripped from an area of paddock and stockpiled for later re-spreading. Sand from the low dunes is removed using the same equipment, leaving them flattened or rounded. A bulldozer, which has lower ground pressure than the wheeled tractor and scrapers is also used in some areas.

The sand removed from the dunes is re-spread in the hollows to provide the flat to gently rolling contours. Topsoil is then returned to the re-contoured area, spread more evenly than before, mostly to about 100–200 mm depth. Final seedbed cultivation (using closely spaced discs and tynes) precedes sowing.

The final stage is to ensure good drainage. Open drains are dug to about 2 m depth at about 100 m spacings after the re-contouring.

Potential Problems

Topsoil damage

Topsoil in the core of stockpiles becomes temporarily anaerobic and may have patches of grey or greenish-grey colours with a pungent odour. However, research has shown that the topsoil recovers quickly when re-spread, although there may be a small flush of ammonium.

Earthworm populations can also temporarily diminish but populations are usually low in sand dune soils and should recover in time.

The main damage from topsoil stripping and re-spreading is soil structural damage from machinery compaction, burial in the stockpile, and mechanical handling. The sandy topsoils on Waitatapia Station tend to have not well aggregated, single-grained structures and thus structural degradation is not really an issue. Compaction can be a problem but seedbed cultivation relieves this.

Hew Dalrymple is planning to minimise topsoil handling and damage through operations planning. Topsoil stripped from an initial area will be stockpiled. After re-contouring, topsoil from the second area will be spread on the first. This pattern will continue, with the initial stockpile being spread on the last re-contoured area.

Nutrient availability

Some of the re-contoured area is being converted to cropping from pine plantation. Stumps are removed (they could also be ground using appropriate machinery) and the wood slash is minimal. It will soon become broken down by natural decomposition.

Because decomposition of woody carbonaceous slash uses up some of the soil nitrogen, higher than usual nitrogen fertilizer is required. Mulching the slash is an option, if the appropriate machinery is available.

Soil type implications

Sands

Normal cropping on re-contoured sand country should work well because soil structural damage is minimal and easily remedied by cultivation. However, soil structural damage on re-contouring silty or clayey soils is generally more severe, requiring a period of restorative pasture before cropping is recommended.

Silts and clays

A common problem in re-contoured land, especially on silty and clayey soils, is layering at the interface between natural and re-spread soil materials. Compaction at the interface inhibits soil drainage and root penetration. It can be remedied by scarification (cultivation) before adding re-spread soil, or by subsoiling after re-spreading.

Buried soils

Sudden textural changes and buried topsoils or silty layers also create these problems, but can be overcome by cultivating before re-spreading sand or topsoil or subsoiling. Buried topsoils should be stripped and added to the topsoil re-spreading.

Waitatapia

Most of these problems were not observed in the sand country at Waitatapia. There were, however, small patches of underlying iron pans, silty layers and buried humic topsoils.

Patchy iron pans in the underlying sands occurred in some small areas. Ripping to break up these pans will help drainage and root penetration. In effect, ripped iron pans will behave rather like a stony layer.

Ripping may not work as well for buried silty layers because they will re-consolidate. Instead, cultivation (ripping) of the silty layer may be beneficial by mixing it with sand.

It is early days for the Dalrymples' re-contouring of low sand dune country in the Manawatu. The cost-benefits of levelling the dunes will become known after two or three seasons.

