

Raised beds and controlled traffic cropping

Bruce Wightman

Agronomist, Department of Primary Industries, Geelong

Abstract

Waterlogging is the major constraint in achieving potential crop yields in the cool, high winter–spring rainfall areas of south-eastern Australia and Western Australia. Over many years various soil drainage techniques have been tried, but none have been widely adopted . on a commercial scale for extensive dryland cropping.

In 1996 the former Department of Natural Resources and Environment, in partnership with the farmer lead group Southern Farming Systems, began a drainage and soil structure project at Gnarwarre, 20 km west of Geelong. A demonstration site compared three methods of soil drainage: wide raised beds; fully underground drainage; and narrow raised beds / controlled traffic. The site received enough rainfall to cause waterlogging. All three treatments produced a 60% higher yield than a control treatment, but the narrow raised bed had other advantages, including cost. During the very dry years of 1997–2000 there was enough evidence that narrow raised beds could lead to substantial yield increases in wet conditions and equal or better yields in dry conditions.

The concept of combining high-yielding cropping with improved soil health, biodiversity and intensive cropping (vegetables) has been highly successful to date and has appealed to many people. Raised-bed cropping has expanded rapidly and today there is estimated to be 50 000 ha throughout Australia, including about 30 000 ha in Victoria. Raised-bed cropping has also been combined with alley tree farming, grassed waterways, water harvesting (nutrient sinks) and water reuse.

Keywords

agriculture, cropping, raised beds, soil drainage, waterlogging

Waterlogging is the major constraint to achieving potential crop yields in the cool, high winter–spring rainfall areas of south-eastern Australia and Western Australia.

Throughout Australia there are large areas of duplex soils, which are often sodic and have a low subsoil permeability. During periods of high rainfall and low evaporation a perched water table often results in a waterlogged topsoil. Saturated soils damage plants, destroy soil biota and soil structure, and often produce environmentally damaging runoff.

Over many years various soil drainage techniques have been tried. On a commercial scale for extensive dryland cropping, none have been widely adopted.

In 1996 the Department of Natural Resources and Environment (NRE), in partnership with the farmer lead group Southern Farming Systems, began a drainage and soil structure project at Gnarwarre, 20 km west of Geelong. A demonstration site compared three methods of soil drainage:

- wide raised beds (20 m wide, 30 cm high) shaped like a roadway
- full underground (slotted plastic pipes / gravel / earth moles
- narrow raised beds / controlled traffic (1.5 m wide, 20 cm high).

The site received enough rainfall to cause waterlogging. All three treatments produced a 60% higher yield than the control. After only one year the research and development group decided to commercially develop narrow raised beds, for the following reasons:

- Underground drainage costs between \$1000 and \$2000 per hectare to install. Sodic soils usually require constant remoling, and rocks throughout the volcanic soils make installation difficult.

- Wide raised beds have a large catchment and there is an increased risk of erosion. An uneven depth of topsoil creates uneven crop growth and maturity.
- Narrow raised beds appeared to have superior drainage characteristics.
- Narrow raised beds produced superior vegetative and root growth.
- Research by NR Tatura in the 1980s clearly showed that there are beneficial soil structure improvements from narrow raised beds under furrow irrigation.
- Narrow raised beds introduce the concept of controlled traffic (that is, machinery wheels travel in the furrows between the beds whenever possible). Australian research has proven that eliminating soil compaction caused by vehicles and animals greatly improves soil structure.
- Narrow raised beds cost between \$100 and \$200 per hectare to install.

In 1997, commercial research and development of raised beds included installing 300 ha of beds on eight farmers' properties. GPS contour surveys were carried out for each paddock, and appropriate plans were drawn. Factors considered included soil type, slope, alignment of beds, surface water movement, drain design, waterways and runoff catchment.

A machinery development project was run in parallel with the paddock development project. With engineering expertise from farmers, agronomists, and Geelong and Queensland engineering companies, raised-bed cropping equipment suitable for extensive cropping in rocky soils was successfully produced.

During the very dry years of 1997, 1998, 1999 and 2000 enough evidence was produced to show that narrow raised beds could lead to substantial yield increases under wet conditions, and equal or better yields under dry conditions.

In 1998 the raised bed project joined with Farm Forestry and Soil Conservation groups with the commercial development of two 'concept farms'. On each of the 200 ha catchments, raised beds have been combined with alley tree farming, grassed waterways, water harvesting (nutrient sinks) and water reuse.

The concept of combining high-yielding cropping with improved soil health, biodiversity and intensive cropping (vegetables) has been highly successful to date and has appealed to many people. Our concept farms have attracted over 3000 visitors in the past 36 months.

The development of raised beds is ongoing, but a small outlay of sometimes less than \$10 000 has resulted in some farmers turning wet, waterlogged country into well-drained, highly productive and profitable land. Farmers are consistently achieving cereal yields of between 4 t/ha and 7 t/ha, and canola yields of between 2.5 t/ha and 3.5 t/ha.

Raised-bed cropping has expanded rapidly, and today there is an estimated 50 000 ha throughout Australia. In Victoria (30 000 ha) cereals, canola and pulses are grown on raised beds, principally for the benefits of drainage and soil structure. In Tasmania (5000 ha) opium poppy is the main crop grown. Western Australia (15 000 ha) has had its own raised bed program since 1996, and drainage combined with recharge control has been the main driving force for adoption. Southern New South Wales and south-eastern South Australia have smaller raised bed programs.

The combination of alley farming and raised beds has been slow, but with recent high crop yields and good prices farmers are beginning to have surplus income, and the idea is gaining momentum.