Soil Properties under Raised Bed Farming Systems in Tasmania

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ABSTRACT

Raised bed farming results in improved soil physical conditions on duplex soils in Tasmania in the short term. The better physical properties on raised beds are likely to result in better drained and aerated soil for plant growth compared with conventionally managed sites.

KEY WORDS

Raised beds, sodosols, soil properties.

INTRODUCTION

Sodosols (soils with strong texture-contrast between A horizons and sodic B horizons) in Tasmania have traditionally been used for pasture production but they are being used increasingly for cereal, pea, poppy and potato cropping. Sodosols are very difficult to crop as they usually become wet and unworkable in winter and occasionally flood. Cultivation for crop sowing and harvesting is often carried out when soil moisture content is greater than ideal, which results in soil structure problems such as compaction and hard setting. Farmers in Tasmania's Northern Midlands, particularly poppy growers, have adopted raised bed farming systems over the past 2 years to try and avoid these soil management problems. Under this farming system machinery tracks are restricted to the furrows ie. controlled trafficking, compaction is limited to the furrows and optimal physical conditions are provided in the seedbed. Improvements in seed bed conditions should also occur through the effects of reduced waterlogging and direct drilling.

This study aimed to determine the differences in soil structure, chemistry and biology between soil in raised beds and soil in conventionally managed areas.

METHODS

Six paired sites were selected in Tasmania's Northern Midlands on soils mapped as Brumby series. Soil samples were collected from raised bed and conventionally managed (control) areas at each site during spring in 1999.

Raised bed areas had been formed in the current growing season or in 1998. Analyses included physical, chemical and biological tests by methods given in Cotching *et al.* (in press).

RESULTS AND DISCUSSION

Results showed that raised beds on sodosols have significantly (F probability < 0.05) better physical properties than conventionally managed sites (Table 1. and Figure 1.) as shown by greater infiltration, lower bulk density, lower shear strength and lower penetration resistance. Smaller dry soil aggregates (MWD) accompanied these changes indicating that the benefits are probably derived from greater tillage intensity associated with forming the beds. These results are in general agreement with tests conducted by Southern Farming Systems where it was found that bulk density and penetrometer resistance were lower in second year raised beds compared with a control area (1). The amount of tillage used in forming the raised beds has not been to the detriment of soil properties such as aggregate stability, which has been found to be associated with potato production on sodosols (2). Soil chemical properties tested were not significantly different between raised beds and conventionally managed sites apart from pH at 75-150mm depth. This difference may be attributable to mixing to greater depth of limed soil by the bed

forming process. Biological properties showed no significant differences between raised beds or conventionally managed sites.

CONCLUSIONS

This study found improved soil conditions under raised bed soil management systems but the sites investigated had only had one or two seasons under this form of management. The better physical properties on raised beds are likely to result in better drained and aerated soil for plant growth than conventionally managed sites. A longitudinal study is required to determine if this soil management practice is sustainable in the longer term on these Tasmanian sodosols.

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REFERENCES

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Table 1. Soil properties of duplex soils (sodosols) under raised bed farming.

Soil physical properties		Control	Beds	Anova Fprob
Infiltration (mm/hr)		**1773**	**2545**	**0.003**
Bulk density Mg/m³	0-75mm	0.99	0.90	<0.001
	75-150mm	1.12	1.06	<0.001
Shear strength (kN)	**0-100 mm**	**22.2**	**14.3**	**0.138**
	100-200 mm	49.9	32.3	0.029
Dry aggregates MWD	0-75mm	8.6	7.1	0.035
	75-150mm	9.3	7.5	0.067
Water stable aggregates %	0-75mm	66.7	66.3	0.911
	75-150mm	68.7	69.5	0.820
Water stable aggregates MWD	0-75mm	9.2	7.8	0.049
	75-150mm	10.1	9.1	0.155
Plastic limit (%w/w)	0-75 mm	34.7	34.7	0.982
	75-150mm	32.3	34.3	0.228
Field capacity (%w/w)	0-75 mm	24.1	26.4	0.598
Tension (kPa)		16.7	15.0	0.215
Soil chemical properties				
Organic C (%)	**0-75 mm**	**2.4**	**2.7**	**0.318**
	75-150 mm	2.1	2.2	0.562
pH(water)	0-75 mm	5.9	6.0	0.737
	75-150 mm	5.5	5.8	0.002
P Colwell (ppm)	0-75 mm	65	56	0.133
	75-150 mm	41	50	0.209
K Colwell (ppm)	0-75 mm	140	156	0.619
	75-150 mm	111	132	0.072
Conductivity (dS/m)	0-75 mm	0.16	0.10	0.818
	75-150 mm	0.14	0.08	0.491
Soil biological properties				
Worms (total/m²)		4	5	0.574
Microbial biomass carbon (mg/kg)		**204**	**212**	**0.665**

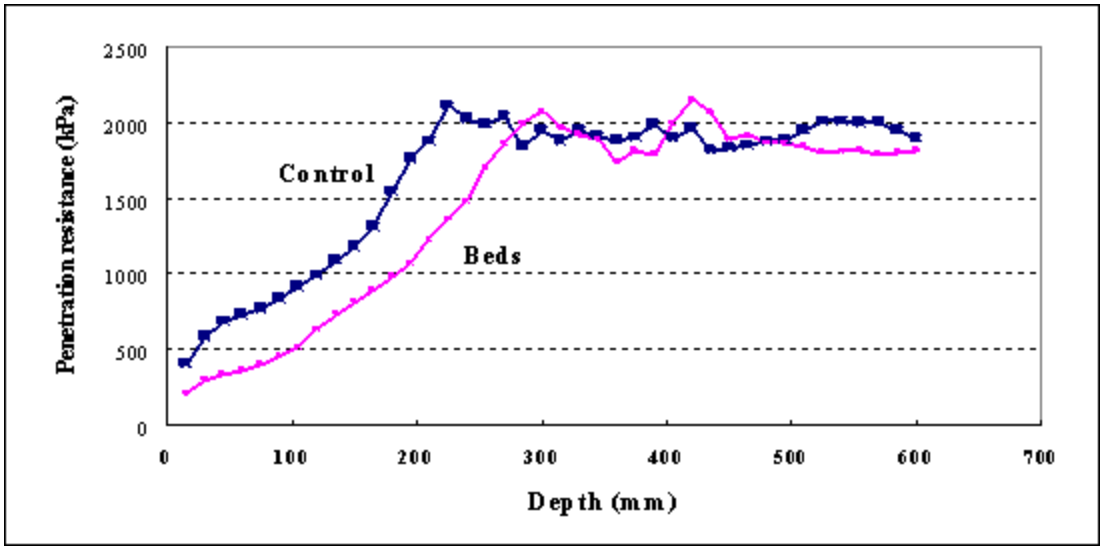

Figure 1. Penetration resistance of raised bed and control sites.