Carrot yield on a steep slope versus low slope from the north-west coast of Tasmania: A preliminary study.

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Abstract

This preliminary study was undertaken to compare carrot (*Daucus carrota* L) yields on low and steep sloping land. Two sites were selected in a field (where?), one of low slope (2%) the other of steep slope (14%), and carrot yield and quality determined from fifteen 1 m^2 plots.Soil strength was measured before and after commercial harvest of the crop. There was no statistically significant difference in either yield (108.5 vs. 107.2 t/ha) or quality parameters (split or broken carrots, diseased or insect damage) between the low and steep slopes, however, there was a greater number of damaged carrots from the steep slope compared with the low slope. This represents a loss of income to both the grower and processor. The damaged carrots were dominated by having disease infection or insect pest damage. There was no significant difference in soil strength to a depth of 300 mm before harvest between sites, but the steep slope was significantly stronger than the low slope below this depth After harvest there were significant differences in soil strength between the two slopes, with the steep slope being significantly stronger than the low slope except for the top 50 mm. Soil strength after harvest increased dramatically for both slope positions, and there are significant differences between the two areas with the steep slope having greater strength than the low slope. This will have implications for land preparation and growth of the following crop.

Key Words

Carrots, Slope, Soil Strength

Introduction

It has been speculated that soil loss and deposition should affect soil properties and crop yield of vegetable crops grown on steep slopes on the north-west coast of Tasmania (R. Laurence, Personal communication, 2003) Erosion loss can also have off-site impacts from sedimentation of dams, damage to road infrastructure and a reduction of water quality in streams. From a grower perspective the investment in producing a crop is the same on low slopes as on steep slopes, so if yield is compromised by soil loss on steep slopes a monetary cost is incurred. Carrots are largely grown on the north-west coast of Tasmania on low to steep sloping land. The industry average carrot yield is 70 t/ha and is valued at $6.4m to the state (DPIWE, 2004). This preliminary study was undertaken to compare carrot yields on low and steep sloping land.

Methods

A carrot crop was selected near Devonport, Tasmania on a relatively uniform northeast slope. The soil type was a red ferrosol (Isbell, 1996). The site has a known history of poor management and erosion loss (P. Aird, pers. comm. 2004). Two sites were selected in the same field, one of low slope (2%) the other of steep slope (14%). The steep slope site was directly upslope from the low slope site. Fifteen 1m^2 plots were sampled along a transect on each slope to assess crop yield. Carrots were also graded for quality parameters, which included split or broken carrots and diseased or insect damage. Soil strength was measured at 15 mm depth intervals at each site using a Rimik Cone Penetrometer. These measurements were repeated after commercial harvest of the crop. Results were analysed using standard ANOVA in Release 6 of GENSTAT.

Results

There was no significant yield difference in carrots between the low and steep slopes (108.5 vs. 107.2 t/ha). Also, there were no differences in quality parameters between the two slopes, although there were a slightly greater number of unblemished carrots from the steep slope compared with the low slope. However, there were a greater number of poor quality carrots from the steep slope compared with the low slope, with those carrots dominated by having disease infection or insect pest damage.

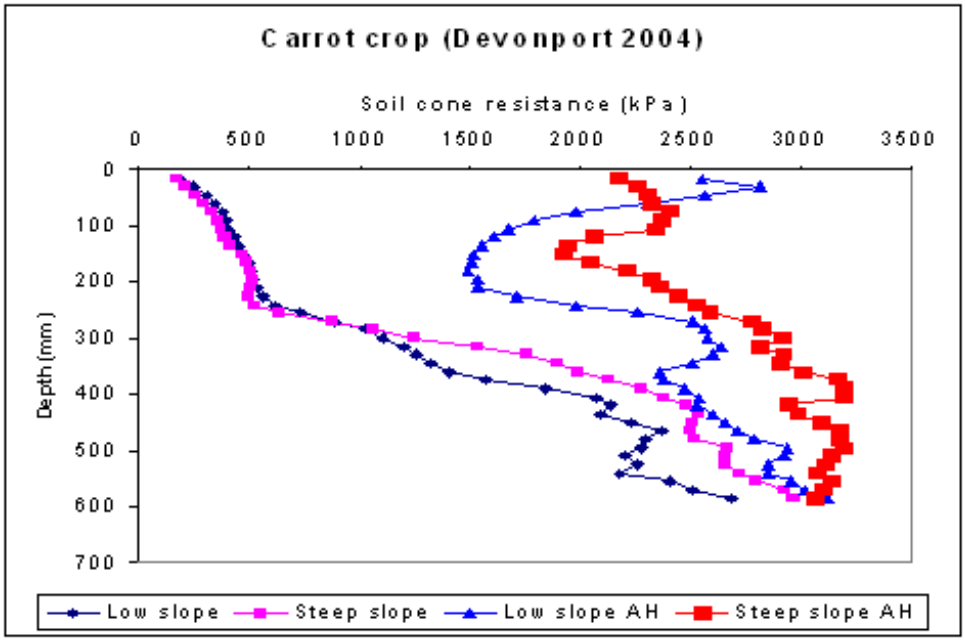

Figure 1 Soil strength before and after harvest of a carrot crop

There was no significant difference in soil strength before harvest of a carrot crop between the steep slope and low slope to a depth of 300 mm, but the steep slope was significantly stronger ($P<0.05$) than the low slope below this depth (Figure 1). It can be seen that the harvesting traffic has resulted in a large increase in soil strength. This will affect the following crop since high soil strength was measured to 600 mm making it very difficult, if not impossible, to remove. Soil strengths greater than 2000 kPa have been shown to restrict root growth (Russell, 1977). Soil strengths of 3000 kPa have been measured at 600 mm in this instance. Another effect of such high soil strength is the production of soil clods when the soil is first cultivated, thus making it difficult to generate a seedbed for the next crop. A change in soil texture was observed at the 300 mm and 500 mm depths on the steep and low slope, respectively, which may account for the increase in strength below these depths.

Conclusions

There was no statistical difference in carrot yield between steep and low slope areas within the same paddock (107.2 vs. 108.5 t/ha), however, there was an increase in carrots not suitable for processing. This represents a loss of income to both the grower and processor.

Soil strength measurements before harvest indicate no difference between the two slopes to a depth of 250 mm; however, there was a significant difference between the two slopes below this depth. It was noted that there was a change in soil texture at 500 mm for the low slope, whereas this change occurred at 300 mm for the steep slope. This corresponds to marked increases in soil strength as seen in Figure 1. It is speculated that soil has been lost from the steep slope and has been deposited on the low slope area. Soil strength after harvest has increased dramatically for both slope positions, and there are

significant differences between the two areas with the steep slope having greater strength than the low slope. This will have implications for land preparation and growth of the following crop. The high strength developed at depth will be very difficult to alleviate and will restrict root growth especially on the steep slope.

Reference

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