

IMPACT OF COMPACTION AND SOIL STRUCTURE ON POTATO PRODUCTION

With soil structure becoming an issue for cross compliance, the opportunity was taken to demonstrate the effect of over-working the soil on compaction and potato production at the PIP 2005 site. Following ploughing and production of deep ridges, ground preparation on pairs of beds was carried in the following ways

1. Destoning only
2. Bed tilling followed by destoning
3. Bed tilling twice followed by destoning
4. Bed tilling twice followed by destoning twice
5. As 4 but additional tractor traffic using wide wheels up the plots after planting during wet conditions

Although treatments 4 and 5, and even 3 were not realistic options, it was hoped to demonstrate a steady increase in compaction and poor soil structure with increasing working of the soil. The trial was planted on 17 May 2005 with healthy seed of the variety Sante and grown normally thereafter. However, across the treatments further applications were made soon after planting. In one strip, irrigation was applied just after planting to simulate the effect of heavy rainfall on soil structure. In a second strip, extra nitrogen (40 kg/ha) was applied to see if this would influence rooting and crop performance. A third strip was untreated.

There were, in all, fifteen plots. The plots were monitored regularly for crop development and lifted to see the impact on yield, tuber number and quality. On the day before PIP 2005 in August, pits were dug to demonstrate depth of rooting and to show where compaction existed.

Just after PIP2005, measurements were made using a penetrometer of soil resistance which also provides a measure of soil structure.

The soil at the site is a sandy loam of 40-50cm depth. It is very free draining and overlies rocky subsoil which is also free draining. As with most fields in the area, the depth of topsoil varies from point to point. Being light, the soil is very easily worked and rarely needs much more than destoning to achieve a good bed for planting into. However, despite its light nature, there is still the potential to affect soil structure if inappropriate soil cultivations or trafficking by machinery are carried out.

The most obvious early effect was that extra unnecessary cultivation and trafficking (treatments 3, 4 and 5) resulted in slower emergence. The emergence of treatments 3 and 4 rapidly reached the same level as those of treatments 1 & 2 but the last treatment (5) with extra trafficking continued to affect emergence and the amount of ground cover (Figure 1). However, at PIP2005 in August, it was difficult to see any differences in haulm growth between treatments.

The effect of the cultivation treatments on total tuber number was limited; although where extra nitrogen was applied the tuber numbers were increased by around 4%. Yield was affected by the cultivation practice. In general, where bed tilling was carried out yield was increased by 5 to 7 t/ha (Figure 2). However, the extra trafficking in treatment 5 reduced yield to that of destoning only.

To counterbalance this result where increased working of the soil improved yield, when the tubers were assessed for defects after harvest, the percentage of mis-shapes were least where only destoning was carried out and the percent marketability was greatest with this treatment.

Below ground the impact of cultivation was very apparent in some plots. Each pit dug was photographed and two photos are shown overleaf. The most obvious visual effect on soil structure came where the extra trafficking occurred (Photo 1). Here the zone below the wheeling had almost no root growth in it. Compare this to where no wheel trafficking took place (Photo 2).

Figure 1. Effect of soil cultivation treatments on emergence and ground cover

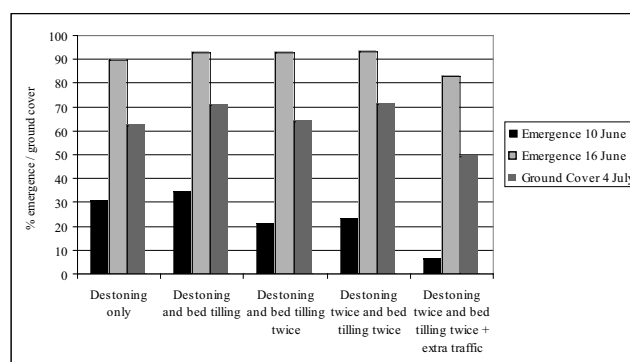


Figure 2. Effect of cultivation treatments on yield

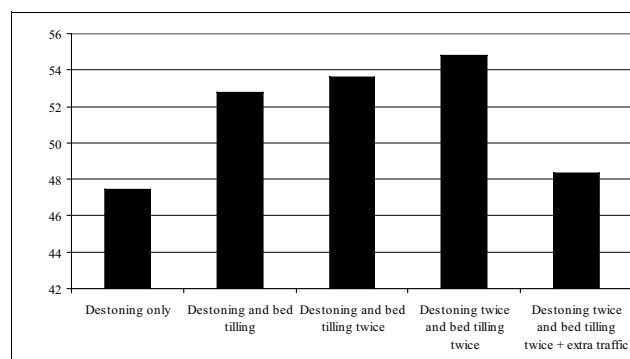
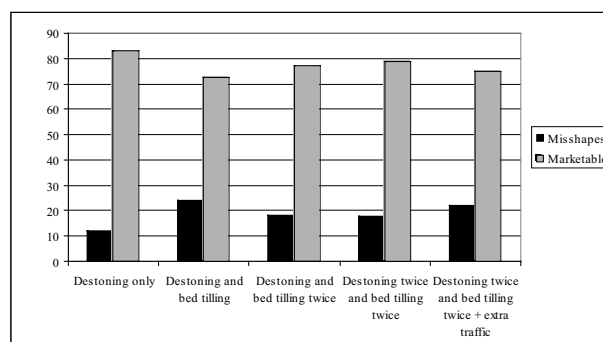


Figure 3. Effect of cultivation treatments on mis-shapes and marketability



Evaluation of soil structure using a penetrometer, confirmed the variability of the site but the depth of the ridge to where the resistance to penetration was 2.0 MPa was least in treatment 5 where the trafficking had occurred (27.7cm compared to 32.3cm for the destoned only).

What conclusions can be drawn from this trial? Probably, it is fair to say that this soil type (provided soil conditions are not too wet at the time) will not be affected too badly by extra cultivation of the soil. However, trafficking by wide wheels did have an effect on root development and in consequence on emergence and crop development. The almost continuous dry weather conditions during the summer at PIP2005 meant that soil structure remained much as it was at planting. Without heavy rain to compact it, the differences between treatments were relatively small.



Plot showing limited root growth below cultivation level

It is clear from the results that working the soil more than that achieved by destoning improved yield, presumably by permitting more uniform root development. However, there was a perceived small negative effect on marketability as a result.

Despite being a year when differences in treatments were small, the demonstration that wrong cultivations or unnecessary trafficking can influence crop growth, yield and quality was achieved. There will be a greater emphasis on getting soil cultivations correct when soil roadshows organised by the BPC start in 2006.

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Plot with wheeling (treatment 5) showing absence of rooting beneath wheeling