Mouldboard Plough and Cereal Rye Incorporation Demonstration

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Key Messages

- Cereal rye has done an excellent job of providing ground cover on poor windblown sand.
- Approximately 4 t/ha of biomass was produced by the cereal rye.
- Using a mouldboard plough to incorporate cereal rye has increased soil organic carbon in the subsoil but decreased topsoil levels.

Aim

To evaluate the effects of mouldboard ploughing and its ability to increase carbon on a poor yellow sand.

Background

Cereal rye can be used to stabilise eroded land as it can tolerate infertile sandy soils, withstanding sand blasting much better than other cereals. The straw is tough both when growing and when mature, providing good protection for poor soil throughout the summer.

Mouldboard ploughing is a complete inversion of the soil, in this case to approximately 30cm. It can help with weed control, water repellent soils, placing lime at depth as well as having a deep ripping effect. Many farmers are considering using mouldboard ploughing as a once off paddock renovation to overcome one or more of these issues. Cost of operation is approximately $100-120/ha (Davies et al, 2012).

The trial is on a problem area of land that has been identified by the farmer as relatively unproductive with poor organic carbon levels and low pH at depth. In 2011 the area was planted to cereal rye in an effort to create some cover, preventing erosion. In 2012 the mouldboard plough was used to invert the top 30cm of soil, burying the rye stubble. 1 t/ha lime was later applied to the top soil.

Trial Details

Property	Bwlch Hendreff (G&H Pearse Pty Ltd), west Wubin
Plot size & replication	80m x 15.3m x 2 replications
Soil type	Yellow sand
Soil pH ($CaCl_2$)	0-10cm: 5.1 10-20cm: 4.5 20-30cm: 4.5 30-40cm: 4.5
EC (dS/m)	0.028
Sowing date	05/06/2014
Seeding rate	80 kg/ha top dressed + self sown cereal rye
Paddock rotation	2010: canola, 2011: cereal rye, 2012:cereal rye, 2013: cereal rye
Soil amelioration	21/06/2012: 1 t/ha lime
Fertiliser	50 kg/ha Macro Pro Extra
Herbicides	None
Growing Season Rainfall	210mm

Results

This season as well as being self sown the farmer also top dressed with another 80 kg/ha of seed. The farmer estimated that there is approximately 4 t/ha of biomass. The cereal rye has done the job that it was intended for, in that it has stabilised the poor windblown soil by providing exceptional ground cover. Grain yield and quality results are displayed in Table 1. There was almost no difference in yield between the mouldboard and the control plots.

Table 1: Yield, quality and grade of cereal rye sown at west Wubin.

Treatment	Hectolitre weight (%)	Protein (%)	Yield (t/ha)
Control	348.59	11.8	0.320
Mouldboard	351.50	12.1	0.315

Soil nutrient levels are low in both treatments as can be seen in Table 2, this is as a result of only having a small amount of fertiliser applied over the duration of the trial. The pH has dropped in the control plots from 5.5 to 5.1 whilst in the mouldboard treatments the pH has increased from 5.1 to 5.4.

Table 2: Comparison of soil nutrients from 0-10cm from the 2013 and 2014 seasons.

Treatment	Ammonia Nitrogen (mg/kg)	Nitrate nitrogen (mg/kg)	Phosphorus (Cowell mg/kg)	Potassium (Cowell mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	EC (dSm)	pH ($CaCl_2$)
Control 2013	0.9	1	9	18	2.7	0.46	0.021	5.5
Control 2014	2.5	4	16.5	39.5	3.95	0.53	0.031	5.15
Mouldboard 2013	0.9	0.9	9	22	2.4	0.21	0.017	5.1
Mouldboard 2014	1.5	3	17.5	48.5	3.25	0.25	0.035	5.4

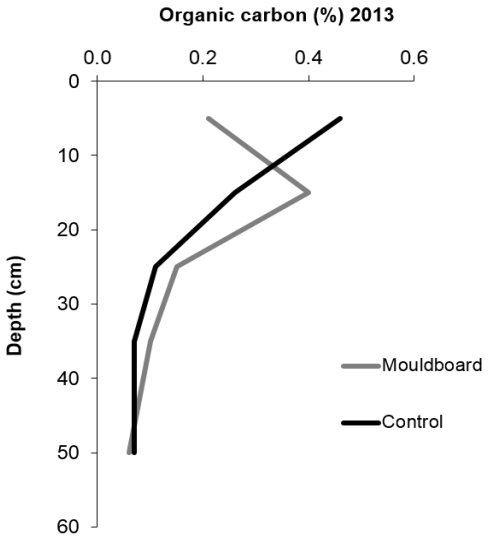

Figure 1: Soil organic carbon as a percentage of soil after cereal rye has been incorporated by ploughing (grey line) compared to no ploughing (black line), west Wubin, October 2013. Ploughing occurred in 2012.

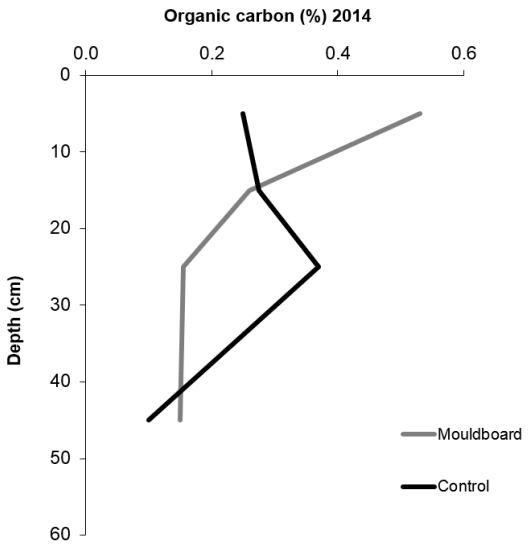

Figure 2: Soil organic carbon as a percentage of soil after cereal rye has been incorporated by ploughing (grey line) compared to no ploughing (black line), west Wubin, December 2014. Ploughing occurred in 2012.

Comments

This is not a fully replicated trial but a farmer demonstration that has nearest neighbour controls. In 2013 mouldboard ploughing increased subsoil organic carbon but decreased the topsoil levels, see Figure 1. In Figure 2 you can see that the mouldboard treatments topsoil organic carbon has improved slightly from 0.21% to 0.25%, this is as a result of the topsoil beginning to recover with the aid of the cereal rye. The control has seen a similar increase from 0.46% to 0.53%.

Results show that the soil organic carbon % has increased over both treatments since 2013. The total soil organic carbon has increased from 0.18% to 0.27% in the control treatment and 0.19% to 0.25% in the mouldboard treatment (measurements taken as an average of soil organic carbon % from 0-60cm). This indicates that the increase in soil organic % has come as a result of the cereal rye treatment and not from the mouldboard treatment. This tells us that as a short term investment mouldboard ploughing is not the answer in increasing soil organic carbon %. It is hypothesised that over a longer period of time the mouldboard plough treatment will

continue to build organic carbon in the topsoil at a quicker rate than the control due to the current low levels. The trial will be continued to be monitored to see if it has an impact over a longer period.

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References
Davies, S., Blackwell, P. and Newman, P. 2012. 'The role of mouldboard ploughing in cropping systems', *Spring Field Day Booklet 2012,* Liebe Group.

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