Southern Incentives Southern Soils

land

EVERGREEN FARMING
QUANTIFYING THE IMPACT ON SOIL FERTILITY OF PERENNIAL PASTURE CROPPING

FARMER PROFILE

NAME: John Wallace
LOCATION: Neridup, WA
AVERAGE ANNUAL RAINFALL: 450 mm
ENTERPRISE: Mixed phase farming
PROPERTY SIZE: 6000 hectares
SOIL TYPE: Deep non-wetting sand over gravel

NUTS & BOLTS

- The yield of canola grown in the acidic, deep, non-wetting sandy soil present at this site was increased when sown in to well-established chicory and kikuyu pastures.
- All plots showed evidence of leaching nitrate, sulphur, and phosphorous indicating the perennials were not slowing down leaching of these nutrients, but neither were they "robbing the crop."

Perennial pastures can be used to overcome some of the soil productivity problems associated with sandy soils; vulnerability to wind erosion, non-wetting soils, and low water and nutrient holding capacity.

Perennial pastures, with their deep root systems and year round growth, can influence soil water levels and potentially reduce the risk of nutrient leaching and acidification as leached nutrients are recycled by the plants from deep in the soil profile back to the soil surface. Improvement in soil nutrition could benefit the performance of annual production species, either crop or pasture, growing amongst the perennial pastures.

THE TRIAL PADDOCK & BASELINE DATA

The trial site was a 15 ha paddock with existing and well established plots of kikuyu, chicory and panic grass. There were also two control strips of annual pasture. The paddock's soil type was deep non-wetting sand over gravel. The trial plot widths were determined by the width of the air-seeder.

Soil cores were taken from 3 sampling locations within each of the treatment plots and 20 soil parameters were chosen and analysed. Samples were taken at the beginning of the trial and again after harvest. In season crop tissue tests were taken from the same sampling locations in each treatment plot and analysed.

Soil chemistry data was tabulated and graphs were prepared for pH, potassium, phosphorus, nitrate nitrogen, sulphur (the latter 4 being the main easily leachable nutrients analysed for), organic carbon and soil moisture from each of the sampling times.

Neridup 2016 pasture cropping trial site design. Soil and tissue test sites within each pasture species and control plot are indicated.

RESULTS & DISCUSSION

While we might intuitively believe that cropping in to perennial pastures would reduce crop yield, the results of this trial indicated that the converse was the case. The yield of canola grown in the acidic, deep, non-wetting sandy soil present at this site was increased when sown in to well established chicory and kikuyu pastures as can been seen in Table 1.

The perennial pastures may have influenced crop performance in a variety of ways. The three soil parameters measured that indicate differences between the perennial and control plots were -

- soil moisture;
- soil pH; and
- soil potassium.

From Figure 1, it can be seen that at the time of planting, the surface soil moisture levels (0-20cm) were highest in the kikuyu. By harvest, the surface soil moisture was the lowest in the same plot.

It is thought that the groundcover provided by the kikuyu thatch reduced the amount of moisture lost from the soil over the summer months. This enabled the soil to retain more surface moisture that was available to be taken up by the newly sown canola.

Panic and chicory have more patchy growth habits that don't allow the same kind of groundcover as the kikuyu. Similarly, the annual grasses in the control plots were at lower groundcover levels. In both cases, this left the soil more vulnerable to moisture loss over summer.

TABLE 1: Canola harvest results from Neridup pasture cropping trial.

Species Plot	Chicory	Panic	Kikuyu	Control 2	Control 3
Harvest Date	9/12/16	9/12/16	9/12/16	9/12/16	9/12/16
Yield (tonne/ha)	1.45	0.81	1.34	1.09	0.52
Protein (%)	20.3	19.7	19.8	19.9	19.9
Oil (%)	45.6	43.8	46.1	45.5	44.4
Grain Classification	CAG1	CAG1	CAG1	CAG1	CAG1

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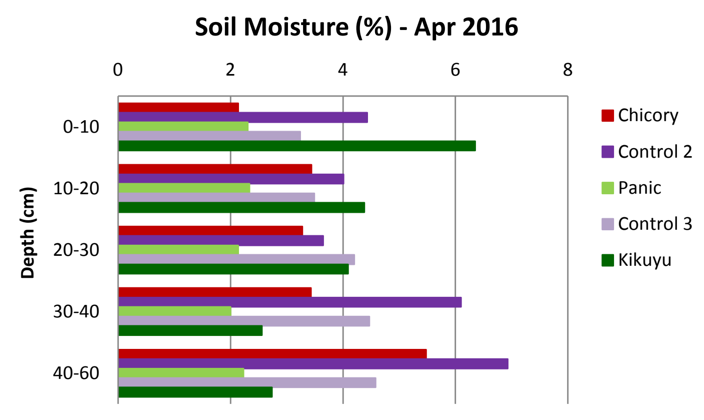

FIGURE 1: Soil moisture results from cores collected from each of the 3 pasture species strips and 2 control strips at seeding. The data presented are averages of 3 cores collected per treatment strip.

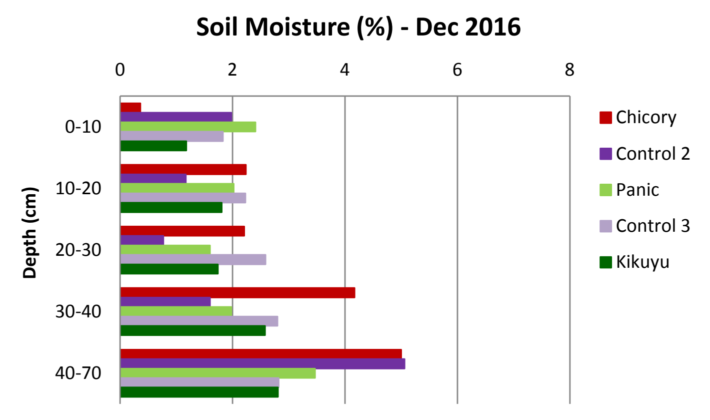

FIGURE 2: Soil moisture results from cores collected from each of the 3 pasture species strips and 2 control strips at harvest. The data presented are averages of 3 cores collected per treatment strip.

A second soil parameter that may have influenced crop yield was soil pH. Canola is known to prefer soil pH levels of 5.0 (CaCl) and above, with impairment of root growth occurring at pH levels between 4.5 and 5.0 (CaCl) which can affect crop vigour. Soil pH levels recorded prior to seeding were closest to or at 5.0 (CaCl) in the kikuyu plot from 0 to 40cm depth and pH levels in the chicory plot were the same or similar to those in the kikuyu plot at 0-10cm depth and 20-40cm depth.

This trial was too short to determine if the different plant species was directly responsible for the differences in soil pH or if it was other factors.

Soil potassium was found to vary between the treatment plots. Higher soil potassium levels were recorded in the kikuyu plot to 40cm depth at seeding (Figure 3), when compared to those recorded in the other plots. These levels were followed by comparatively high levels of potassium recorded in canola plant tissue from the kikuyu plot in early August when the crop was at late cabbage development.

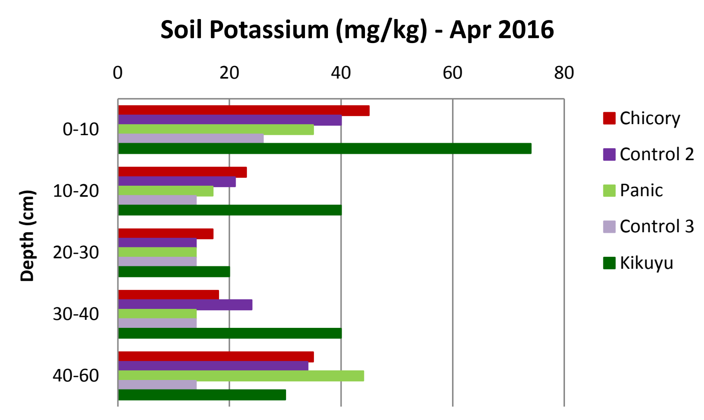

FIGURE 3: Potassium levels recorded in soil cores collected from 3 pasture species plots and 2 control plots on 7/4/16. The data presented are averages of 3 cores collected per treatment strip.

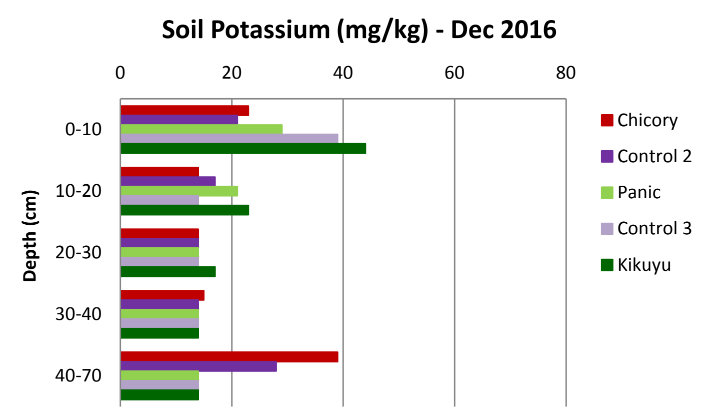

FIGURE 4: Potassium levels recorded in soil cores collected from 3 pasture species plots and 2 control plots on 21/12/16. The data presented are averages of 3 cores collected per treatment strip.

Nitrate, sulphur, and phosphorus were also tested as they are easily leached from soils. All plots showed evidence of leaching indicating the perennials were not slowing down leaching of these nutrients, but neither were they "robbing the crop."

The soil moisture levels recorded at seeding (Figure 1) and harvest (Figure 2), coupled with harvest yield results, indicate that there was sufficient soil moisture left following the canola crop to support perennial pasture biomass production. This shows that perennial pasture species provide a way for this farming system to capitalise on the soil water available over summer without jeopardising the soil water required to support a crop during the growing season.

"Perennial pastures can be used to overcome some of the soil productivity problems associated with sandy soils"

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The Southern Incentives - Southern Soils program facilitates field trials in targeted locations across the south coast region to demonstrate sustainable practices in the key soil health areas of soil biology, soil acidity, soil erosion, water repellence and managing nutrient additions.

ACKNOWLEGEMENTS
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