Cropping kikuyu pastures – a case study from Wellstead

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Key messages

Kikuyu pastures have been grown along the south coast of Western Australia for over 70 years to stabilize sandy surface soils and lift the productivity of cattle and sheep enterprises. In more recent times, some of these perennial pastures have been cropped. Profitable crop yields can be obtained on paddocks that have been rarely cropped in the past especially if the kikuyu is removed early. Ploughing the stand may increase yields but at extra cost. Cropping also rejuvenates the kikuyu stand by reducing the kikuyu thatch and removing silver grass. For mixed farming enterprises a kikuyu system does offer advantages as it can be successfully cropped, it can respond to rain during summer and autumn, it protects the soil from wind erosion, it can reduce waterlogging and it prevents leaching of nutrients

Aims

To examine via the EverCrop project a range of sowing techniques/systems for cropping into kikuyu pasture.

Method

A long-term kikuyu pasture located near Wellstead on Blackboy Hill Farms owned by the Davy family was initially sprayed with 2L/ha glyphosate 450 on the 20 March 2015. The paddock was cultivated with an offset disc plough on the 2 April with a 50m by 100m area left uncultivated. A second knockdown was applied on the 18 April, the ploughed area was sprayed with 1L/ha paraquat (as there were minimal weeds) and the unploughed area with 1.5L/ha glyphosate 450. Both areas were also sprayed with 1.1L/ha atrazine on the 18 April. The demonstration was then sowed with 3.3 kg/ha of Thumper TT canola on the 20 April. The fertiliser inputs were 100kg/ha CSBP Agstar (14.3% N, 9.6% S, 14% P) at seeding, 90kg/ha urea (46% N) plus 40kg/ha muriated potash (49.5% K) on the 10 June and 100kg/ha CSBP NS 41 (35% N, 8.9% S, 0.6% P) on the 18 July. The paddock was sprayed with 500ml/ha Select® 100ml/ha Verdict® and 1.1L/ha atrazine on the 13 June. The paddock was swathed and harvested in early to late November.

The demonstration strips (un-replicated) were as follows:

- Pre-sowing cultivation and sown with a tyne seeder (29m by 100m)
- No pre-sowing cultivation and sown with a tyne seeder (29m by 100m)
- No pre-sowing cultivation and sown with a disc seeder (20m by 100m)

Soil samples were taken from the site pre-seeding on the 15 April 2015 for nutrient analysis. For each treatment estimates were made of the plant density (20 measurements of 2 rows by 31cm) and above-ground biomass (10 measurements of 2 rows by 31cm) on the 10 August and on the 8 October. As the biomass samples on the 8 October and formed grain the material was threshed and cleaned to estimate the grain yield. Nutrient analyses were conducted on the biomass sampled on the 10 August.

Results

The demonstration site was located on a sandy gravel soil. The soil pH ($CaCl_2$) was 4.5 to 4.7 in the surface 20cm but was 5.2 in the 20-30cm layer. The organic carbon content was 3.5% in the surface 10cm, 1.8% in the 10-20cm layer and 1.2% in the 20-30cm layer. Colwell phosphorus and potassium were 20 and 150mg/kg in the surface 10cm. There was also significant P (7-14mg/kg) and K (79-130mg/kg) in the 10-20cm and 20-30cm layers.

Table 1. Canola plant density (plants per square meter) and biomass on the 10 August 2015 following a kikuyu pasture

Parameter	Un-ploughed Disc seeder	Un-ploughed Tyne seeder	Ploughed Tyne seeder
Plant density (PSM)	31	28	31
Biomass (t/ha)	3.89	4.20	6.30

Mid-season biomass

There was no difference in the plant densities between the three sowing techniques and systems (Table 1). Mid-season above-ground biomass was 33% higher in the cultivated or ploughed area compared to the un-ploughed area both seeded with a tyne machine (Table 1). On the un-ploughed area the area sown with the tyne seeder had 8% higher biomass than the area sown with a disc machine.

Plant analysis

Total nitrogen was 4.3% in the ploughed area compared to 4.0% in the un-ploughed area using the tyne seeder (Fig. 1). The higher nitrogen concentration and the higher biomass in the ploughed area resulted in an extra 96kg of N/ha in the above-ground biomass compared to the un-ploughed area (Fig. 2).

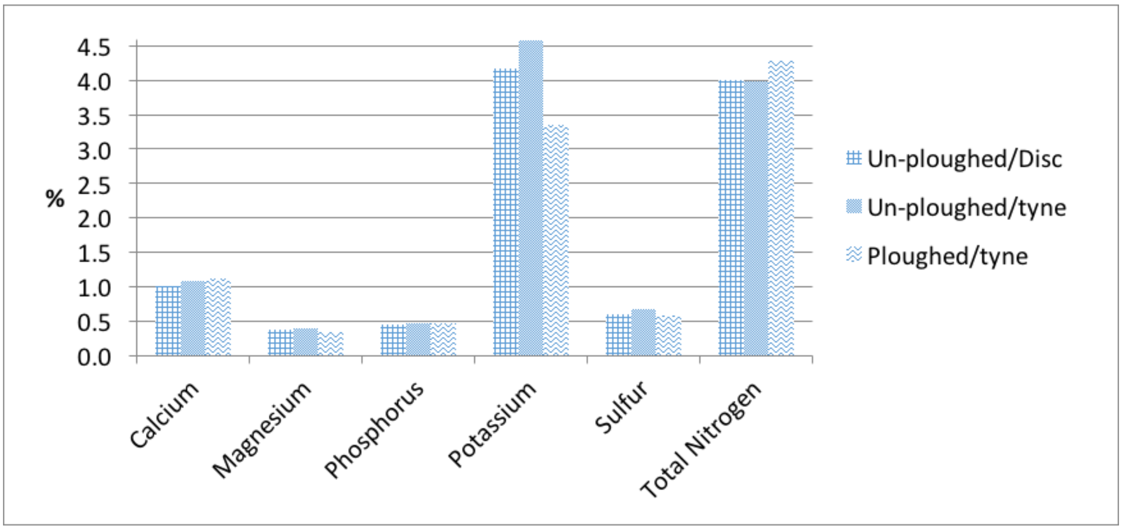

Fig. 1. Macro nutrient concentration in canola on the 10 August 2015

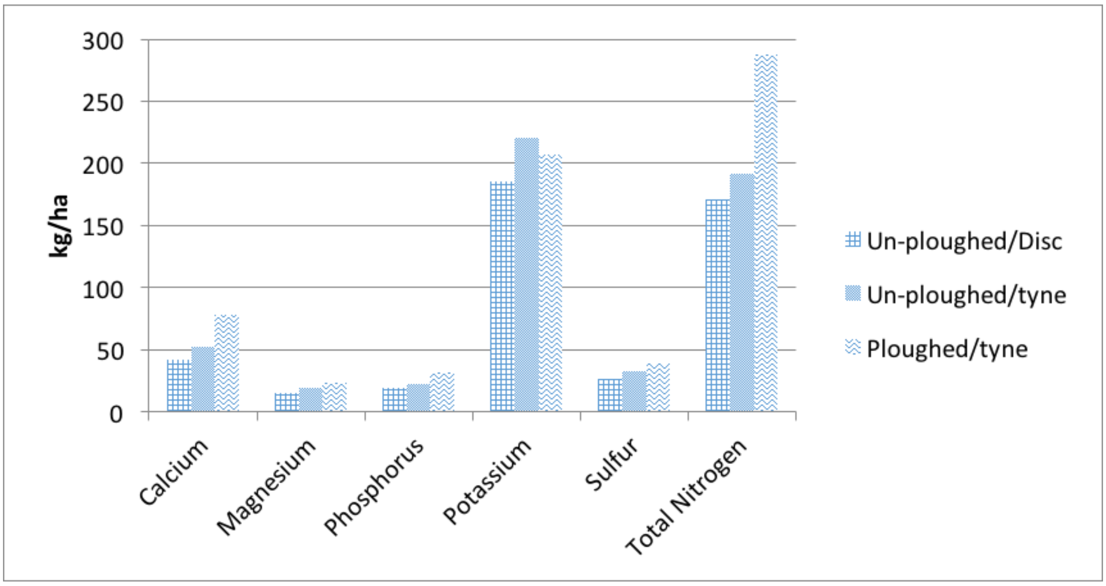

Fig. 2. Nutrient content (kg/ha) in canola on the 10 August 2015

The potassium concentration was 3.3% in the ploughed area compared to 4.5% in the unploughed area (Fig. 1). This is possibly caused by rapid growth due to the extra nitrogen released from ploughing diluting the concentration of potassium. Even though there was dilution the concentration of potassium was not deficient in the ploughed area. In addition, the potassium content (kg K/ha) was similar between treatments (Fig. 2). For the other macro nutrients differences between treatments were relatively minor (Fig. 1, Fig. 2). The exception being calcium where there was an extra 26kg Ca/ha in the ploughed area compared to the unploughed area (Fig. 2).

In terms of the micro nutrients, some nutrients were higher in the ploughed area such as manganese but other nutrients were lower such as molybdenum compared to the unploughed area (Fig. 3). However, none were deficient although copper levels were low.

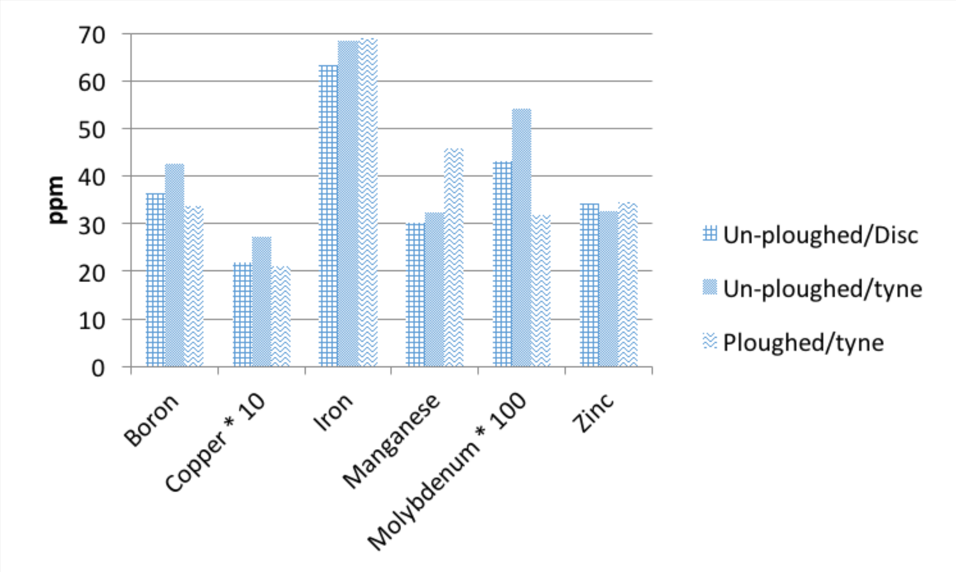

Fig. 3. Micro nutrient concentrations in canola on the 10 August 2015

Late season biomass

There was no difference in the above-ground biomass between the ploughed and un-ploughed areas on the 8 October seeded with the tyne machine (Table 2). However, on the un-ploughed area the area seeded with the tyne seeder had 10% higher biomass than the area seeded with the disc seeder (Table 2). There was no green kikuyu in any of the treatments on the 8 October.

Ploughing increased the grain yield (Table 2) although the crop was not fully mature on the 8 October and the ploughed area appeared to more advance in its maturity than the un-ploughed area. The machine grain yield of the ploughed area was 2.5t/ha and 2.2t/ha for the unploughed area a 14% increase with ploughing.

Table 2. Canola above-ground biomass and grain yield on the 8 October 2015

Parameter	Un-ploughed Disc seeder	Un-ploughed Tyne seeder	Ploughed Tyne seeder
Biomass (t/ha)	8.03	8.81	8.76
Grain yield (t/ha)	1.32	1.12	1.60

Rotations

Blackboy Hill Farms farm 4700 arable ha at Wellstead with 50% of the area in crop and 50% in pasture. They have 500ha of kikuyu pasture and have been successfully cropping into kikuyu pasture for the last 4 years. The rotation after ploughing the kikuyu consists of canola, wheat and one year of kikuyu pasture. At this stage the ploughing is a once off to breakdown the thatch which has developed over many years.

Conclusion

Long-term kikuyu paddocks can be successfully cropped especially if the kikuyu is removed early. Ploughing can release more nitrogen than direct drilling. However, we do not know how long this effect will last and these resources are not unlimited. The cost of ploughing and the un-even paddock needs to be weighed up with using more nitrogen and not ploughing. Over summer we will examine the return of kikuyu to see if ploughing has had an impact on the kikuyu density. For mixed enterprises kikuyu does offer advantages as it can respond to rain during summer and autumn, it protects the soil from wind erosion, it can reduce waterlogging & it prevents leaching of nutrients.

Key words

Kikuyu, pasture cropping, nutrient re-cycling, EverCrop

Acknowledgments

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