Evaluating the viability of Pasture Cropping in the West Midlands Region

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Purpose: To evaluate the performance of crops (barley in 2009) when pasture cropped over different perennial species established on deep pale sands.

Location: Barberton West Road, Dandaragan (Chris Vanzetti)

Soil Type: Deep pale sand

Soil Test Results:

	Ammonium Nitrogen	Nitrate Nitrogen	Phosphorus Colwell	Potassium Colwell	Sulphur	Organic Carbon	Cond-uctivity	pH
	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	%	dS/m	($CaCl_2$)
0-10cm	5.76	17.88	13.28	45.08	7.26	1.3	0.08	5.24

Rotation: Volunteer pasture prior to sowing perennial treatments (2009)

GSR: 380mm

BACKGROUND SUMMARY

Subtropical perennial grasses (e.g. Rhodes, Panic, and Signal grass) have proved successful on sand-plain soils across the northern and southern agricultural regions of WA. As these species are summer-active, the question posed by innovative growers is: `can we crop into our subtropical grasses without limiting crop yield?'

Improved soil health, green feed over summer and a double income stream are perceived by growers to be the main benefits of pasture cropping; and the potential for crop yield reductions and opportunity costs to establish perennial pastures as the main constraints to adoption.

Over the next two years, the Future Farm Industry CRC EverCrop team will work closely with innovative growers and agronomists in the Northern Agricultural Region to evaluate the viability of pasture cropping systems in WA.

TRIAL DESIGN

In 2008, a 3 ha focus site with replicated treatments was established south-west of Moora on a deep pale sand. The site was set up to compare the profitability and NRM benefits of three general farming systems: continuous crop, permanent perennial pasture and pasture cropping. The site was considered marginal for cropping due to non-wetting, erosion risk, and loss of organic carbon (fertility) when cropped; historically it had been cropped every 4-5 years.

Annual volunteer pasture was killed with a knockdown spray (Aug 08) prior to sowing replicated plots (30 x 6 m) of Rhodes grass, Gatton panic and Siratro (4-5 kg/ha). Ten cropping treatments were implemented in 2009 and four permanent pasture treatments. A knockdown (Sprayseed 1 L/ha) was applied, and perennial pastures were slashed prior to sowing. Growers who joined the EverCrop Local Adaptation Group (Moora) suggested aiming for a 2.5 t/ha crop and supplying 50 N, 12 P, 25 K and 12S.

Buloke barley was sown (70 kg/ha) on 3 June with a disc seeder (180 cm spacing) with trailing press wheels across all cropping treatments. Agstar extra (80 kg/ha) was drilled at sowing; a blend of sulfate of ammonia (50 kg/ha), murate of potash (50 kg/ha) and urea (30 kg/ha) was topdressed across all treatments at the three leaf stage; and urea was also topdressed at two different rates (30 or 100 kg/ha) at the six leaf stage according to treatment. Broadleaf weeds and pests were controlled by spraying Barrracuda (800 mL/ha) and Dominex (100 mL/ha) on 16 July. Perennial pasture biomass was assessed by randomly cutting three representative quadrats (50 x 72 cm) per plot at a height of 5 cm. Grain was harvested using a small plot header from two 19 m strips per plot.

RESULTS

Crop performance in 2009: Crop establishment was uneven and plant density low (av. 83 pl/m^2). This was likely due to the non-wetting nature of the soil and persistent shallow furrows that had formed 9 months earlier when perennial pastures were sown.

All pasture cropping treatments yielded more than 2.4 t/ha (Table 1). Barley sown in line with district practice (without a perennial base, and 50 N) yielded 2.81 t/ha with 8.9 % protein. Using this as a reference (or `control') there appeared to be a small yield penalty (nil to 14%) for crops sown across perennial grass treatments.

Table 1 *Buloke barley performance when sown across different perennial pastures and fertilized at two rates of nitrogen**

Pasture base	50 N		80 N	
	Grain yield (t/ha)	**Protein (%)**	**Grain yield (t/ha)**	**Protein (%)**
Control – no perennial base	2.81	8.9	3.27	9.8
Siratro -36 cm row spacing	2.93	9.3	2.81	9.4
Gatton panic – 72 cm row spacing	2.85	8.8	2.58	9.3
Gatton panic – 36 cm row spacing	2.63	8.7	2.42	8.9
Rhodes grass – 36 cm row spacing (initially)	2.55	8.7	2.66	8.9

**lsd (5%) = 0.344, yield; 0.473, protein*

There was a significant yield boost (16%) in response to additional nitrogen (80 v 50 N) for the crop treatment without a perennial base (Table 1). By contrast the higher nitrogen rate tended to result in a greater yield penalty than the lower nitrogen rate for Gatton panic treatments. The reason for this is yet to be resolved.

Protein content tended to be greater for higher fertility treatments (Table 1). There were no significant differences between treatments for other quality attributes (average moisture content, 9.67 %; hectolitre weight, 68.7 kg/hL, and screenings <2.5mm, 4.9 %).

Green feed: The three perennial pasture species differed in their level of dormancy over winter. Siratro became very dormant, yellowed and did not grow. Panic and rhodes grass produced some biomass; and panic resumed growth the earliest. Rain just prior to harvest (29 mm in November) stimulated perennials to grow. The amount of green feed six weeks after harvest is presented in Table 2. Individual Siratro plants `greened up' (Nov) but their low density (<5 p/m^2) limited overall biomass production. By contrast, the green feed available in Gatton panic plots averaged 1.06 t/ha (on a dry wt basis) and the green feed in rhodes grass plots, 2.56 t/ha (dry wt). For individual species, the amount of green feed available (Jan 2010) in pasture cropped plots was comparable to that in respective permanent pasture plots (Table 2).

Table 2 *Green feed available to livestock six weeks after harvesting barley from pasture cropping treatments that differed in perennial base and Nitrogen inputs**

Pasture base	50 N Crop treatments t/ha (dry wt)	80 N Crop treatments t/ha (dry wt)	Permanent pasture treatments t/ha (dry wt)
Control – no perennial base	0	0	-
Siratro – rows 36 cm spacing	0.25	0.12	0.13
Gatton panic – rows 72 cm	0.82	1.33	0.72
Gatton panic – rows 36 cm spacing	1.26	1.37	0.89
Rhodes grass– 36 cm row spacing (initially)	2.61	2.56	2.52

** Permanent pasture plots received 50 units of N in winter and had been mown to a height of 5 cm on 21 Sept 2009; lsd (5%) = 0.765*

Logistical issues : There are some logistical issues to consider when seeding a crop into `live' perennial pastures. Prior to seeding the crop, rhodes grass had spread by runners and produced considerable bulk (>1.5 t/ha). Nevertheless, the disc seeder passed through the sward without clumping. By harvest (24 Nov 09) the perennial species had grown as tall as the crop in some places. As a consequence, substantial green leaf material (esp. panic and rhodes grass) was cut and passed through the header, but this did not result in contaminated grain samples.

DISCUSSION

There is still a lot of work to be done but it appears crops can be sown successfully into perennial pastures in some situations. Agronomic results from the Moora focus site appear to support the view that marginal or problem soils are a potential fit for pasture cropping systems. However, it is important to note that the extra green feed produced over summer-autumn needs to be converted into wool or meat in order to offset any grain yield losses. Further research is required across different sites and seasons as the yield penalty on better soil classes may well be greater than on deep pale sands which have limited capacity to store moisture from summer rainfall for crop production. The viability of pasture cropping systems based on other subtropical grass species, native grasses, Lucerne and bluebush are also worth evaluating.

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