Lupin yield when pasture cropped over subtropical grasses

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Purpose:	To evaluate the performance of crops (Lupin in 2012) when pasture cropped over different perennial species established on deep pale sands.
Location:	Chris Vanzetti's, Barberton West Road, (~20 km south-west of Moora)
Soil Type:	Deep pale sand
Soil Test Results:	(0-10cm): pH($CaCl_2$) - 5.3, OC - 1.1%, P - 12 mg/kg, K - 29 mg/kg, S - 7.8 mg/kg, N - 16 mg/kg, conductivity - 0.06 dS/m.
Rotation:	Lupin **(**2012), Barley (2011), Lupin (2010), Barley (2009)
Growing Season Rainfall (April- October 2012): 258 mm	

BACKGROUND SUMMARY

Deep sandy soils are a major part of the landscape in the West Midlands. However, the productivity of these soils is generally low and they are prone to wind erosion. Clearly there is a need to evaluate alternative options to lift productivity on these soils and reduce susceptibility to erosion. Subtropical perennial grasses (e.g. Rhodes, Panic, and Signal grass) have proved to be a successful option 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 pasture crop over our subtropical grasses without limiting crop yield?'

Over the past four seasons personnel with the Future Farm Industries CRC's EverCrop project have been evaluating the viability of pasture cropping over different subtropical perennial species at a focus site south-west of Moora. Results to date have been very promising with little or no yield penalty (0-15%) in Barley (Ward *et al,* 2012). Last year (2012) the performance of a Lupin crop sown over different subtropical species was evaluated.

TRIAL DESIGN

A focus site was established in 2008 on a deep sandy soil about 20 km south west of Moora. Perennial pastures, Gatton panic (*Megathyrsus maximus*), Katambora Rhodes grass (*Chloris gayana*) and Aztec Siratro (*Macroptilium atropurpureum*), were sown in appropriate plots in September 2008. Row spacing was 36 cm for Siratro and Rhodes grass, and 36 or 72 cm for Gatton panic. There were 14 treatments in total and three replicates. Crops of Buloke barley were sown in 2009 and 2011 in the 'crop only' and 'pasture cropped' plots, and lupins were sown in 2010 but failed due to drought. This paper reports on the management inputs and results for the 2012 Lupin crop.

Plot size: 6 x 30 m (42 plots)

Machinery use: DAFWA cone seeder (1.5 m wide), 180 mm row spacing, discs with trailing press wheels

Repetitions: Three replicates (14 treatments)

Crop type and varieties used: Lupins (Wonga)

Seeding rates and dates: 120 kg/ha, 15 May (sown dry)

Fertilizer rates and dates:
150 kg/ha big phos mn + 50 murate of potash (22 May);

60 kg/ha urea (7 August) 100 kg/ha Urea (30 Aug) was topdressed across High-N treatments only to evaluate crop and perennial grass performance when Nitrogen was not limiting.

Herbicide rates and dates:
1 L/ha Sprayseed + 1.5L/ha Simazine (15 May) - Knockdown

0.5 L/ha Simazine + 150 mL/ha Brodal (29 Jun) – Broadleaf selective

100 mL/ha Verdict 520 + 0.5 L/ha Uptake (9 Jul) – Grass selective

800 mL/ha Gramoxone (23 Oct) – Crop-topped

TRIAL LAYOUT

Treatment Code	*Treatment description*		*Plot*	
		Rep1	*Rep2*	*Rep3*
CNH	Crop only, with 80 kg N/ha	8	15	41
CNL	Crop only	5	22	32
G36	Gatton panic only, 36 cm row spacing	13	19	42
G36NH	Gatton panic 36 cm, pasture cropped with 80 kg N/ha	10	20	29
G36NL	Gatton panic 36 cm, pasture cropped	11	21	36
G72	Gatton panic only, 72 cm row spacing	3	17	34
G72NH	Gatton panic 72 cm, pasture cropped with 80 kg N/ha	4	25	30
G72NL	Gatton panic 72 cm, pasture cropped	14	18	39
R36	Rhodes grass only, 36 cm row spacing	12	26	31
R36NH	Rhodes grass 36 cm, pasture cropped with 80 kg N/ha	1	28	37
R36NL	Rhodes grass 36 cm, pasture cropped	6	23	35
S36	Siratro only, 36 cm row spacing	9	24	40
S36NH	Siratro 36 cm, pasture cropped with 80 kg N/ha	2	27	33
S36NL	Siratro 36 cm, pasture cropped	7	16	38

RESULTS/STATISTICS

Crop performance in 2012

Lupin establishment was good (44 pl/m^2 overall) but growing season rainfall (258 mm) was well below average. The wettest month was June (108 mm), July was dry (only 29 mm) and useful rain fell during grain fill in September (53 mm). The grain yield from pasture cropping treatments varied (1.1-2.0 t/ha, see Table 1). Lupin grown in line with district practice (without a perennial base, or nitrogen) yielded 1.4 t/ha. Using this as a reference (or `control') there did not appeared to be any significant yield penalty for crops sown across perennial grass treatments in line with district practice. By contrast, the application of additional nitrogen (80 N) reduce grain yield relative to the control for Gatton panic treatments (13-28%).

The 'high N' treatments were included to evaluate crop and pasture performance in situations where nutrition is not limited for either component. Interestingly, there appeared to be greater growth of grass weeds and Gatton panic in the 'high N' treatments which might account for the yield penalty.

Table 1. Wonga lupin performance when sown across different perennial pastures and fertilized at two rates of nitrogen[a].

Pasture base and row spacing	Grain yield (t/ha)			
	Low N	%	High N	%
Control - No perennial	1.43	100	1.63	100
Gatton panic - 36 cm	1.61	113	1.17	72
Gatton panic - 72 cm	1.33	93	1.42	87
Rhodes grass - 36 cm[b]	2.04	143	1.51	93
Siratro - 36 cm[c]	1.55	108	1.52	93
LSD (5%)	0.3			

[a] 80 units of N topdressed on 'High N' treatments (Aug); no extra N was applied to 'Low N' treatments

[b] Verdict 520 (grass selective herbicide) had a severe impact on Rhodes grass

[c] The density of siratro was <1 plant/m^2

Pasture growth

The three perennial species did not grow much over the winter growing season. This was due to plant dormancy, herbicide suppression and/or low plant numbers. Siratro plants (<1 pl/m^2) yellowed and became completely dormant by early June. In July, the perennial grasses were severely impacted by the grass selective herbicide (100 mL/ha Verdict 520): leaves 'browned off' and a lot of Rhodes grass plants were killed. Recovery was best in Gatton panic; however, green feed under the crop was still low at harvest (8 Nov): <500 kg/ha for Gatton panic and <200 kg/ha for Rhodes grass. In summer (2012/13), the perennial grasses 'fired up' after some significant rainfall events (126 mm, Nov-Jan). Results for green-feed-on-offer, two months after harvest are presented in Table 2. It is worth noting that pasture production in Siratro and Rhodes grass was limited by low plant density.

Table 2. Green feed available to livestock (t/ha) two months after harvesting lupin from pasture cropping treatments that differed in perennial base and Nitrogen inputs[a]

	Pasture crop treatments		
Treatment	N Low	N High	Permanent pasture
Control - No perennial	0	0	-
Gatton panic - 36 cm	0.87	1.33	1.41
Gatton panic - 72 cm	1.01	1.47	1.64
Rhodes grass - 36 cm[b]	0.75	0.96	0.91
Siratro - 36 cm[c]	0.38	0.63	0.21
LSD (5%)	0.3		

[a] 80 units of N topdressed on 'High N' treatments (Aug); no extra N was applied to 'Low N' treatments

[b] Verdict 520 (grass selective herbicide) had a severe impact on Rhodes grass density

[c] The density of siratro was <1 plant/m^2

Crop performance over three seasons

Results over three seasons have shown that pasture cropping can be viable in the West Midlands. In 2009, barley yield was slightly depressed in 'High N' treatments, possibly due to increased competition from the pasture base (Figure 1).

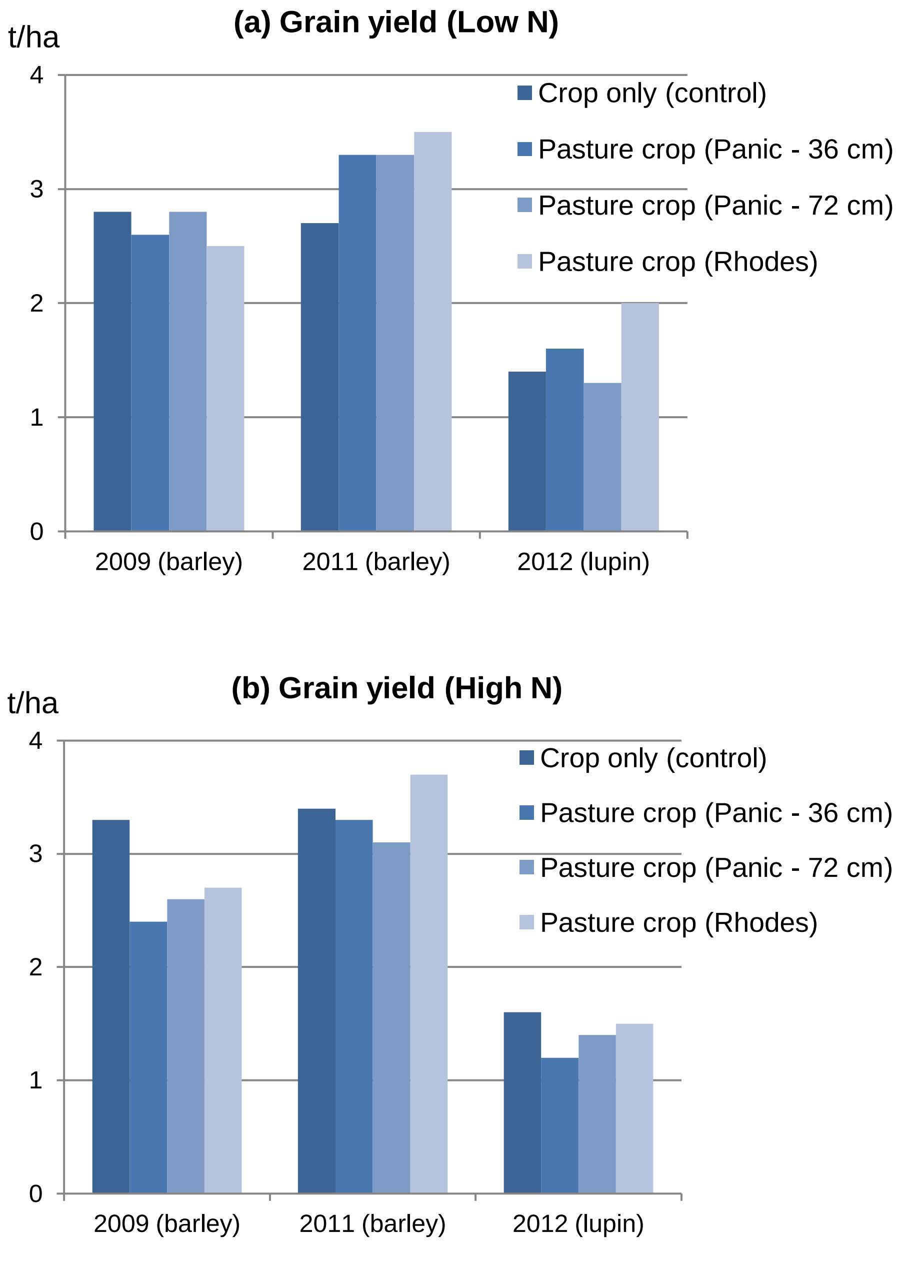

Figure 1. Grain yield for 'crop only' and pasture cropping treatments over three seasons. (a) 50 units of nitrogen (Low N) was applied to Buloke barley crops in 2009 and 2011. (b) 80 units of nitrogen (High N) was applied to barley crops in 2009 & 2011 and the lupin crop in 2012. LSD (5%): 0.3 in 2009 & 2012, 0.6 in 2011

In 2011, barley yields were similar in all plots, despite average seasonal conditions during spring. In 2012, Lupin yield for pasture cropping treatments were similar to controls. The good yields in pasture cropping treatments over time are possibly due to better nitrogen and water cycling in the ‘pasture cropped’ plots offsetting the impact of competition for water.

CONCLUSIONS

Pasture cropping across subtropical grasses is viable in the West Midlands but success is dependent on effective weed control, adequate fertility and moisture, and winter dormancy (or suppression) of the perennial pasture.

Pasture cropping can also provide out of season fodder, improve the feed value of stubbles, and reduce the likelihood of wind erosion and groundwater recharge on deep sandy soils.

PEER REVIEW

Perry Dolling

REFERENCE

Ward P, Ferris D, Lawes R, Palmer N, Micin Sand Barrett-Lennard P (2012). Crop yield, pasture yield, and environmental impact of pasture cropping with sub-tropical perennials. *In* proceedings of the 16th Australian Agronomy conference, Armidale, NSW. http://www.regional.org.au/au/asa/2012/pastures/8093_wardpr.htm

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