WHEAT AFTER PASTURE (BENEFIT TRIAL)

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Aim To establish and manipulate 3 varieties of pasture and determine their effect on the following wheat crop.

BACKGROUND

Cereal cropping in Dalwallinu has a huge economic benefit with gross margins well in front of legume rotations such as lupin, field peas, clover and serradella. The long-term effects of these cereal rotations are now creeping in such as increasingly difficult grass and radish control, effects of nematodes and declining organic matter. These factors combined with the current low prices are motivating many growers to improve pastures with annual legumes and ryegrasses and improve pasture productivity as a result. When considering this as part of a rotation it is important to note that there are also benefits to the following year's wheat crop, which should be taken into account and offset against the establishment cost. This trial was set-up in 2004 to measure the benefits of improved pasture on the following years wheat crop.

TRIAL DETAILS

Property	EG Carlshausen & Co, Wubin
Plot size & replication	2004: 2 reps, 25m x 100m, across workings, Losa subclover, Erica serradella, Drummer ryegrass, 6 plots* 2005: 2 reps sown with workings (perpendicular to the 2004 plots) over previous pasture plots (Arrino, Bonnie Rock, Wyalkatchem wheats), 6 plots to total 36 individual plots *For more details of 2004 pasture demonstration, see Liebe Group R&D Book Feb. 2005 pp. 73-74.
Soil type	Loamy sand
Sowing date	23rd May 2005
Seeding rate	All wheat sown at 70 kg/ha
Fertiliser (kg/ha)	Agstar Extra 90 kg/ha, Flexi N 50 L/ha at sowing, top up 40 L/ha.
Paddock rotation	2003 = Pasture, 2004 = Manipulated Pasture
Growing Season Rainfall	Apr – Oct = 228mm

RESULTS

Table 1: CSBP soil analysis conducted before the trial was sown to pasture in 2004 (1st table) and before the trial was sown to wheat in 2005 (2nd table). Species indicate the 2004 treatment.

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Elders - Dalwallinu - 28 May 2004 - Soil - 2004

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	ryegrass	serradella	subclover	serradella	subclover	ryegrass
Organic carbon (Walkley Black) (%)	1.1 Ideal	0.9 Low	0.9 Low	0.8 Low	0.9 Low	0.9 Low
NITROGEN	Marginal	Marginal	Marginal	Marginal	Marginal	Marginal
Nitrate nitrogen (KCl) (mg/kg)	3.0	1.0	1.0	2.0	5.0	3.0
Ammonium nitrogen (KCl) (mg/kg)	7.0	5.0	7.0	8.0	8.0	8.0

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Elders Merchandise

Organic carbon (Walkley Black) (%)	0.91 Low	0.88 Low	1.13 Ideal	0.97 Low	1.01 Ideal	1.05 Ideal
NITROGEN	Marginal	Sufficient	Sufficient	Sufficient	Marginal	Sufficient
Nitrate nitrogen (KCl) (mg/kg)	7	18	13	17	15	11
Ammonium nitrogen (KCl) (mg/kg)	2	6	3	5	6	4

Averaged across all 6 samplings, organic carbon increased from 0.92% to 0.99% between 2004 and 2005. Total N also increased, from 11.8 mg/kg to 21.5 mg/kg (raw figures shown in Table 1). Most of the increase in N in 2005, following the improved pasture phase, was due to higher nitrate N levels rather than ammonium N. The ryegrass plots returned lower nitrate and ammonium levels compared to the legumes.
Table 2 gives the yields for each variety cross-plotted against what pasture it was sown to in 2004. Statistics were conducted on the yields with ANOVA however the data needs to be interpreted carefully as not all assumptions for ANOVA were met. Three general trends were evident; Wyalkatchem showed the highest yield potential, Wyalkatchem also responded well to a legume in the rotation, and, in a low nitrogen background ie. Ryegrass plots, the farmer may achieve higher yields with a low protein requirement wheat (for the APN grade) such as Arrino.

	2004 sown						
2005 sown	**Ryegrass**	**Erica**	**Losa**	**Erica**	**Losa**	**Ryegrass**	**AVG**
Wyalkatchem	1.59	1.86	1.76	1.61	1.67	1.53	**1.67**
Bonnie Rock	1.52	1.66	1.67	1.50	1.46	1.59	**1.57**
Arrino	1.60	1.62	1.64	1.44	1.60	1.71	**1.60**
Wyalkatchem	1.47	1.64	1.55	1.46	1.52	1.51	**1.53**
Bonnie Rock	1.53	1.61	1.52	1.40	1.62	1.49	**1.53**
Arrino	1.62	1.63	1.51	1.44	1.65	1.52	**1.56**
AVG	**1.56**	**1.67**	**1.61**	**1.48**	**1.59**	**1.56**	

Table 2: Diagram showing the layout of the trial and wheat yields (t/ha) in 2005.

Protein was also measured for one of the replicates in 2005 (Table 3). Grain protein was similar between the 3 wheat varieties, albeit with a tendency for Arrino to have a lower average protein than Wyalkatchem and Bonnie Rock. Including a legume in the rotation increased grain protein by 3% from 11.3 to 14.3%.

Table 3: Protein % (NIR) for one replicate.

	2004 sown						
2005 sown	**Ryegrass**	**Erica**	**Losa**	**Erica**	**Losa**	**Ryegrass**	**AVG**
Wyalkatchem	11.3	14.2	14	15.6	13.5	12.7	**13.55**
Bonnie Rock	11.1	14.1	14.7	14.7	14.3	11.5	**13.40**
Arrino	9.8	14.8	15	14.7	12.4	11.2	**12.98**

AVG	**10.73**	**14.37**	**14.57**	**15.00**	**13.40**	**11.80**	

Table 4 shows the 1000 grain weight and highlights the heavier grain of Arrino compared to the APW and AHP varieties. Grain weight was low at this site but there was no other consistent trend among treatments.

Table 4: 1000 grain weight (g) for one replicate.

	2004 sown						
2005 sown	**Ryegrass**	**Erica**	**Losa**	**Erica**	**Losa**	**Ryegrass**	**AVG**
Wyalkatchem	30.3	29.55	29.15	29.35	29.35	26.85	**29.09**
Bonnie Rock	28.75	31.3	27.4	28.1	29.95	31.1	**29.43**
Arrino	31.65	30.3	29.7	30.55	33.8	30.45	**31.08**
AVG	**30.23**	**30.38**	**28.75**	**29.33**	**31.03**	**29.47**	

ECONOMIC ANALYSIS

Table 5: Wheat revenue ($/ha) generated from the treatments. Calculated using appropriate AWB Golden Rewards matrices and a flat screenings level of 2%. Prices are farm gate. Yields used were the average of two replicates.

	2004 sown						
2005 sown	**Ryegrass**	**Erica**	**Losa**	**Erica**	**Losa**	**Ryegrass**	**AVG**
Wyalkatchem	259	312	295	274	285	268	**282**
Bonnie Rock	265	324	318	282	290	268	**291**
Arrino	279	245	237	216	244	277	**278**
AVG	**268**	**294**	**283**	**257**	**273**	**271**	

AWB Golden Rewards Matrices for AHP, APW, APN, ASW were used to calculate the values in Table 5. Bonnie Rock generated the greatest returns averaged across all treatments with an average of $291/ha wheat revenue generated. For Arrino the previous ryegrass plots generated the greatest returns, due to meeting the protein window for APN. In contrast, Bonnie Rock & Wyalkatchem provided substantially greater returns from the previous legume plots over the ryegrass plots.

COMMENTS

Economic benefits are a result of a complex interaction between grain yield and quality (incl. protein) weed control and disease. Manipulated pasture provides benefits to the following wheat crop in all these factors. However, in different seasons different factors will dominate in their contributory effects on wheat gross margin.

Based on previous similar work we expected a yield increase of around 20% with about a 0.5% increase in protein. This did not happen. Yields were not improved, however protein was increased significantly. This would have allowed delivery to the AHP grade for Bonnie Rock and an average increased return of $9/ha over Wyalkatchem and $12/ha over Arrino (Table 5).

Yield differences were unable to be interpreted fully due to the design of the trial, however Bonnie Rock was consistently the highest returning variety in this trial. The protein & therefore classification differences account for the substantially greater returns for Bonnie Rock. Bonnie Rock is an AWB premium choice variety and had high protein, which attracts bonuses under the Golden Rewards scheme.

The value of the legumes in 2004 in providing additional N to boost protein is clear in Table 3 and Table 5. This was partly attributable to higher nitrate levels than ammonium levels at the start of 2005, indicating a readily available source of N for the germinating wheat plants. However this benefit was variety dependent. The AH variety Bonnie Rock and the APW variety Wyalkatchem performed better after legumes than after ryegrass, due to the high protein and associated bonuses whereas the lower protein criteria of Arrino for APN gave it a high return following the ryegrass. This highlights the need to match sound agronomy with wheat variety and segregation when deciding on rotations. For example, this trial suggests Arrino performs better

following a non-legume rotation. An interesting comparison would be a mix of ryegrass and legumes and its effect on wheat in the following year.

This site did not meet its potential considering three previous years of pasture and high fertiliser inputs. Many of the crops in this area did suffer from a severe dry spell in July, which certainly may have masked some differences, in yield at least. Visual observation showed the previous legume plots greener throughout the season. A hardpan and/or nematodes may also have been a factor, as patchy early growth was observed, however this was not tested. The higher 1000 grain weight for Arrino is likely to be the result of less fertile florets per square metre. This means that Arrino had less grain to fill than Wyalkatchem & Bonnie Rock and therefore more assimilate is available to each individual grain.

Screenings were not tested due to cracked grain from the harvester and the Eastern end of the trial was higher yielding which again may have affected the results.

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