5.5 Spring sown cereal, legume and mixtures fodder trial - Cressy, Tas

Location:
Cressy Research Station, Cressy, Tasmania.

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Researchers:
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Background/Aim:
There is increasing demand for high quality fodder. This trial compared several field pea, vetch, canola, triticale, oat, barley and wheat varieties for dry matter production and feed value. A further trial was included to determine the optimal densities of field pea/oat mixtures. In mixtures the oats help to prevent the peas from lodging and may increase the dry matter production. Peas can be susceptible to excess competition from the oats, so it is important to find the optimum proportions of peas to oats. The fodder trials are normally autumn sown but this year's autumn trial was lost to waterlogging so a spring trial was sown.

Paddock History
2007: Pasture
2008: Forage rape

Soil Characteristics
Soil Type: Fine sandy loam
Soil test: pH 5.3 (water)

Take home messages:
- Oats can be included as a minor component (up to 25% on a density basis) in peas with around a 10% increase in yield compared to growing the crops separately.
- Higher proportions of oats are too competitive with the peas and the pea yield is greatly reduced.
- Spring sown fodder crops yield substantially less than autumn sown crops but they may be a viable option where waterlogging affects autumn sowings.

Rainfall:

Avg. Annual:	627mm Cressy 1939 to 2010
Avg. G.S.R.	254mm Cressy September to January 1939 to 2010
2009 Total:	671mm Cressy January 2009 to December 2009
2009 G.S.R.	210mm Cressy September 2009 to December 2009[1]

[1] Yield Potential or Water Use Efficiency as per French-Schultz
1/3 of Jul (74mm), Aug (163mm) & Sept (75mm) + ½ Oct (41mm) rainfall when total above 20mm + ((November (66mm) to December (27mm) rainfall) – 110mm) x 55kg/mm/ha. (for vegetative growth)
Therefore, for Cressy, the Cereal Fodder Trial water limited DM yield should be 5.9t/ha.

Sowing rate:
Target densities of peas was 65 plants/m^2, vetch 100 plants/m^2, canola 100 plants/m^2 and cereals 200 plants/m^2.

Sowing date: 28 October 2009

Fertiliser: 250kg/ha of 7:14:13:7

Herbicides:
- 25/9/09, Cereals Kamba @ 280 ml/ha, Bromicide @ 1.4 L/ha and wetter 1 ml/L
- 25/9/09, Peas Spinnaker @ 250 ml/ha and BS1000 2 ml/L

Plot size:
Dimensions, eg. 4m x 1.5m x 4 reps.

Harvest:
Legumes, Barley and Pea/Oat mixtures harvested on 7th of January 2010 and all other plots were harvested on the 14th of January 2010.

Measurements:
Dry matter yield t/ha, feed quality (not tested yet)
Pea oat mixture were analysed by comparing the yield obtained from the mixtures with the yield from the same proportions of pure stands of peas and oats at the standard densities of 65 plants/m2 for peas and 200 plants/m2 for oats.

Estimated mixture yield = mixture component density x pure stand yield/ density

Efficiency = Actual mixture yield/ Estimated mixture yield

Water Use:
Yield Limiting Factors: late sowing and early finish.

Results and discussion

With the late spring sowing of this year's trial, all yields were low in comparison to autumn sown trials. The establishment was good with moderate rains mid season and a dry finish. Vetch was very slow to establish with low densities. The peas were very competitive. The brassica rape Leafmore remained vegetative until harvest while the canola Hyola433 was in early pod fill at the time of harvest.

The triticale and barley lines gave the highest cereal yields, there were no significant differences between varieties (Table 1). The yields of triticales and barley were equivalent to the French-Schultz water limited yield for fodder. The oats had the next highest yield at a little over 5 t/ha which was significantly lower than the Hawkeye triticale. There were no significant differences between the oat varieties. The wheats were the lowest yielding cereal with Kellalac yielding significantly less than Preston. Target densities were 200 plants/m^2 for the cereals, the wheats were below the target density and given the short growing season they would not be able to make up for the lower densities by increased tillering. At the time of harvest the crops were beginning to show signs of severe water stress.

Morgan peas and the canola Hyola 433 gave the highest yields from the non cereal fodders. The pea Mukta yielded significantly less than Morgan. Leafmore is a forage rape that is suitable for repeated grazing it was vegetative at the time of harvest and would have given successive harvests given the right conditions (irrigation). The yields of the vetches were both significantly lower than any of the peas.

Table 1: Title – Yields (t/ha) of legume, cereals and total dry matter of the fodder trial.

	Legume yield t/ha		Cereal yield t/ha		Total yield t/ha	
Pea and Oat mixtures						
25% Morgan 75% Quamby	0.22	bc	4.87	a	5.09	bc
50% Morgan 50% Quamby	0.64	bc	4.33	a	4.97	bc
75% Morgan 25% Quamby	3.19	a	1.62	c	4.81	bc
50% Morgan 50% Quamby Low sowing rate (0.67)	0.71	bc	2.67	b	3.38	e
50% Morgan 50% Quamby High sowing rate (1.33)	0.72	b	4.64	a	5.36	abc
Pea						
AP2					3.52	de
Morgan					4.06	cd
Mukta					2.86	ef
Vetch						
Rasina					2.03	g
Morava					1.57	g
Canola						
Leafmore					2.7	f
Hyola 433					4	d
Oat						
Quamby					5.24	bc
Saia					5.32	bc
Graza50					5.19	bc
Wheat						
Kellalac					3.91	de
Preston					4.68	c
Triticale						
Hawkeye					5.92	a
Tahara					5.87	ab
Barley						
Gairdner					5.9	ab
F prob	**<.001**		**<.001**		**<.001**	
l.s.d.	**0.5045**		**0.704**		**0.585**	
c.v.	**31.57**		**25.5**		**12.83**	

The yield of the pea and oat mixtures was strongly dependent on density. The low sowing rate gave the lowest yield, while the high sowing rate gave the highest yield (Table 1). Mixtures at the standard sowing rate all yielded intermediate with a tendency for higher yield with more oats in the mixture. High densities of oats in the mixtures tended to suppress the peas, this effect is still present when the oat densities were as low as 66 plants/m2. The efficiency of the mixtures, based on the yield from the corresponding areas of pure stands, increased as the proportion of peas increased, this was mainly due to overcoming the suppression effect of high oat densities (Table 2). High pea densities do not adversely affect the yield of oats. The high values of efficiency of the oat, particularly the 50/50 mix were probably due to lower competition, but there may also be a benefit from legume fixed nitrogen (fujita *et al* 1992).

Table 2: Title – Estimated yield and efficiency of pea (Morgan) and oat (Quamby) mixtures.

	Target density		Estimated yield		Actual yield		Efficiency		
	Pea	Oat	Pea t/ha	Oat t/ha	Pea t/ha	Oat t/ha	Total	Pea	Oat
25% Pea 75% Oat	16.25	150	1.02	3.93	0.22	4.87	1.03	0.22	1.24
50% Pea 50% Oat	32.5	100	2.03	2.62	0.64	4.33	1.07	0.32	1.65
75% Pea 25% Oat	48.75	50	3.05	1.31	3.19	1.62	1.10	1.05	1.24
100% Pea (Morgan)	65				4.06				
100% Oat (Quamby)		200				5.24			

Summary:
Oats can be included as a minor component, up to 25% on a density basis, in peas with around a 10% increase in yield. When the oat component is increased to 50% or more the oats are too competitive and the pea yield is greatly reduced. Pea oat mixtures should have more peas than oats. Further research should look at pea and oat mixtures with more than 75% peas.
Spring sown fodder crops yield substantially less than autumn sown crops but they may be a viable option where waterlogging prevents or wipes out autumn sowings.

Fujita, K., Ofosu-Budu, K. G. and Ogata, S. (1992). Biological nitrogen fixation in mixed legume-cereal cropping systems. Plant and Soil 141 (1-2) 155-175