EVALUATION OF NINE SPECIES OF GRAIN LEGUMES FOR GRAZING SHEEP

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SUMMARY

Young Merino wethers grazed at 40/ha for 84 days whole standing mature crops of Cyprus vetch *(Lathyrus ochrus)*, vetchling *(L.cicera)*, chick pea *(Cicer arietinum)*, lupins *(Lupinus angustifolius)*, field peas *(Pisum sativum)*, fenugreek *(Trigonella foenwn graecum)*, vetch *(Vicia sativa)*, Narbonne vetch *(V.narbonensis)*, field bean *(V.faba)* and barley *(Hordeum vulgare cv.* Clipper) during the summer months and production was compared with pasture. Sheep on the legumes grew at up to 160 g/day during the first six weeks of the experiment when no rain fell. Thereafter a heavy fall of rain was recorded, and during the six weeks which followed sheep on chick pea, vetchling, vetch and field peas lost weight whereas on field beans and lupins rapid growth continued (100-130 g/day). Ataxia and deaths occurred in sheep grazing fenugreek. The crops yielded 2.0 - 4.3t/ha grain and 1.7 - 6.0t/ha herbage.

Digestibility studies showed that grain legume residues (stem, leaf and pod) were of higher digestibility (48-60%) than a barley crop residue (44%) and mature ryegrass (48%), the legume species differing among themselves. Voluntary intakes of legume residues were greater than for mature grass.

When the grain and herbage of each legume species were fed to sheep in the proportion of 1:2 w/w the D.M. digestibility coefficients varied between 63.9 - 68.7%.

INTRODUCTION

There are many species of grain legumes which are potentially adapted to the dryland agricultural regions of southern Australia where cropping is associated with sheep and cattle production, yet apart from peas, lupins and vetches (Arnold et *al.* 1976) there'has been little detailed study of these crops.

In 1974 an agronomic programme was commenced at the Waite Institute to evaluate the yield potential of nearly 400 lines of 15 grain legume species (Anon. 1975). The object of the work reported in this paper was to assess for grazing sheep the value of those species of grain legumes which showed the greatest yield potential in the agronomic studies, namely field *beans (Vicia faba)* vetch *(V.sativa)*, Narbonne vetch *(V. narbonensis)*, Cyprus vetch *(Lathyrus ochrus)*, vetchling *(L.cicera)*, chick pea *(Cicer arietinum)*, field pea *(Pisum sativum cv.* Dun) lupin *(Lupinus angustifolius cv.* Unicrop) and fenugreek *(Trigonella foenwn graecum)*. The programme of investigation which involved both pen and field studies was carried out at the Mortlock Experiment Station, Mintaro, South Australia. The environment has been described by Pullman and Allden (1971).

MATERIALS AND METHODS

Experiment 1

This study was undertaken in pens with the object of comparing the digestibility and voluntary intake by sheep of the grain legumes under study. Selected species and cultivars were grown in small plots in 1977 for seed multiplication, and at maturity all plant material was harvested. The crop residues (i.e. total

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herbage less seed) were fed to 30 six months old Suffolk x Merino wethers in a conventional digestibility trial using 3 sheep per treatment (mean intake 500g DM /day). A sample of mature ryegrass hay was included in the comparisons. A second digestibility trial was then undertaken in which the digestibility of both grain and herbage residue of each legume were determined when fed in the proportions 1:2 w/w. In a third trial the voluntary intake of herbage was measured, there being a 10 day prefeeding period and a 6 day measurement period.

Experiment 2

In 1978 areas of 0.2 ha of grain legumes and of barley were grown in an experiment of randomized block design there being two replicates. At maturity in January 1979 the crops were grazed in *situ* by young Merino sheep for a period of 12 weeks at 40/ha. Sheep were weighed weekly and wool **growth** was estimated using dyebands. A further treatment of comparable sheep grazing sown pasture was included to provide an estimate of the benefits of crop grazing VS pasture. Barley was harvested and fed back in feeders to minimize digestive disorders, but all other crops were harvested by the grazing animals.

Crop residues were also collected for the estimation of digestibility in pens , and the in *vitro* digestibilities of samples taken from protected quadrats were also recorded.

RESULTS

Experiment 1

Table 1 presents for the different crops harvested in 1977 the coefficients of apparent D.M. digestibility of residues and of grain + residues when fed in the proportions 1:2 w/w, the daily voluntary intakes by sheep of the residues and the N contents of both grain and residues.

TABLE 1 Digestibility, intake and N values - Expt.1

Crop species	Common Name	Coefficient of D.M. digestibility %		Voluntary intake of residues g/day	N content at maturity %	
		Residues	Grain and Residues (1:2)		Grain	Residues
Cicer arietinum	Chick pea 50/66*	49.2	64.4	947	3.5	0.85
Lathyrus cicera	Vetchling 30/14	57.3	64.7	780	4.9	1.47
Lathyrus ochrus	Cyprus vetch 31/11	52.3	66.7	792	4.9	1.10
Lupinus angustifolius	Lupin (Unicrop)	58.2	68.7	914	4.9	0.80
Trigonella foenum graecum	Fenugreek 65/03	48.3	63.9	803	5.2	0.98
Vicia faba	Field bean	60.4	67.4	878	5.1	1.49
Vicia narbonensis	Narbonne vetch 14/01	55.9	65.2	893	4.5	1.22
Vicia sativa	Vetch 11.01	50.7	65.9	866	5.1	1.10
Vicia sativa	Vetch 11/19	54.7	64.3	996	5.5	1.49
Lolium rigidum	Wimmera ryegrass	47.9	NV	586	NV+	0.70
	LSD P=0.05	3.0	2.5	260		

*Selection +No value

There were significant differences in the digestibilities of the plant residues and of the residues plus grain. Field beans and lupins proved to be the crops with residues of highest digestibility (60.4% and 58.2% respectively), significantly lower values being recorded for fenugreek and chick pea (48.3% and 49.2%). Voluntary feed intakes of the different residues by sheep did not differ significantly other than the lower consumption of the ryegrass. Voluntary intake did not closely follow either digestibility (r=0.40) or the N content (r=0.48) of the feed.

Experiment 2

(i) Crop grazing. The weight gains of the different groups were influenced by a heavy rainstorm (52mm) which occurred halfway through the experiment and which resulted in leaching of the crop herbage and the germination of seed in some crops. In Table 2 the weight gains of sheep on the different species are separated into the periods preceding and following the rain (6 weeks each) and for the whole of the experiment (12 weeks). Most of the crops promoted rapid growth in sheep during the first 6 weeks period, but after the rains some failed to sustain animal growth whereas others were unaffected. Thus animals grazing the peas crop grew rapidly during the first 6 weeks but thereafter sustained considerable weight losses. Chick pea, vetchling and vetch were similarly affected. Other crops such as field beans, lupins and Cyprus vetch were less influenced by rain. Sheep grazing field beans made the greatest gains (11.3kg) for the 12 weeks period followed by sheep grazing lupin (10.1kg).

During the first (dry) period the sheep grazing pastures and -barley lost weight, the latter group taking several weeks to become adapted to the barley diet. The fenugreek crop produced toxic effects and ataxia which became apparent after 5 weeks grazing. Affected sheep did not recover when removed from the experiment. This treatment was discontinued. No other health problems were noted.

TABLE 2 Sheep production, crop yields and D.M. digestibility values - Expt.2

Crop	Weight gain kg			Initial	Yields t/ha		D.M.Digestibility of residues %	
	Before rain (6weeks)	After rain (6weeks)	Full expt. (12weeks)	Clean Wool g/day	Grain	Herb.	Harvest+	After rain ø
Chick pea	**6.6**	**-3.0**	**3.6**	**7.88**	**2.0**	**2.4**	53.9	**37.3**
Vetchling	**4.6**	-1.0	**3.6**	**7.30**	**3.5**	**4.5**	**59.3**	**32.0**
Cyprus vetch	6.1	**3.7**	9.8	**8.54**	**4.0**	**5.0**	**50.4**	29.5
Lupin	**5.6**	**4.5**	10.1	9.37	**3.5**	**6.0**	**54.7**	45.9
Field pea	**6.7**	**-2.8**	3.9	**8.15**	**3.4**	**5.8**	**56.9**	**35.8**
Fenugreek	**0.3**	**-***	**-***	**-***	**2.8**	**4.7**	**54.9**	**-***
Field bean	**6.0**	**5.3**	11.3	9.37	**4.1**	**4.2**	56.9	**38.7**
Narbonne vetch	3.8	**3.4**	**7.2**	**5.53**	**4.3**	**5.2**	**55.4**	**45.1**
Vetch	**6.4**	**-0.8**	**5.6**	**7.22**	**3.6**	**5.7**	**57.8**	**38.7**
Barley	-2.1	**4.7**	**2.6**	**6.36**	**2.4**	**1.7**	**44.4**	**44.2**
Mature pasture ‡	**-0.4**	**2.0**	**1.6**	**5.84**	**-**		**-**	
LSD(P<0.05)	1.67	**2.34**	**2.23**	1.23	1.10	1.30	5.7	**5.2**

* No values - Sheep removed from plots due to deaths. + *In vivo* ø *In vitro*

‡ Wimmera ryegrass, annual bromes, barley grass and subterranean clover.

Table 2 shows that wool production for the whole experiment ranged from 5.5 - 9.4g/day, there being a weak correlation (r=0.68) between weight change and wool growth, An exception was Narbonne vetch. Although sheep made substantial weight gains on this crop they grew significantly less wool than sheep on the other grain legumes.

(ii) Crop yields and digestibility of residues. The digestibilities of the 1978 crop residues are also presented in Table 2, together with yield data.' Grain yields were not significantly different among the grain legumes other than for chick pea and fenugreek which produced less than Narbonne vetch, field beans and Cyprus vetch.

The in *vivo* digestibilities of the residues were several units lower than in the previous year (Table 1), but all of the legume values were significantly higher than those for the barley crop. Table 2 also presents values for the in vitro digestibility of crop herbage sampled from closed quadrats after 52mm rain was recorded halfway through the experiment. The barley was little affected whereas the grain legumes recorded a decline of 9-27 digestibility units.

DISCUSSION

In the current study the main objective was to examine the production response of grazing sheep when diet was not limiting in the quantitative sense. Clearly some crops could have carried greater stock numbers than others, there being substantial yield differences in terms of both grain and herbage (Table 2). The results show that under dry summer conditions a wide range of grain legume crops will provide growth rates of up to 160g/day in young sheep at a time when production is normally low. The digestibility studies show that crop herbage residues are likely to be more digestible than cereal stubbles or mature sown pasture. However the effects of rainfall on these dry standing crops was variable, and in areas where summer storms are part of the climatic pattern the producer will need to be selective in his choice of legume. The adoption of any species or cultivar will depend on a detailed evaluation of its yield, environmental adaptation, toxicity and economic worth either as marketable grain or as an animal feed to be grazed in *situ*.

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