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VETCH (*Vicia spp*) EXPANSION AND USE IN AUSTRALIA[1]

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Abstract: Vetches are one of the best adoptable crops for Australian alkaline loamy- sandy soils with <320mm of annual rainfall. Also, vetches are very versatile in end-use. Feeding values of common vetch grain and plant material is very high in crude protein, metabolise energy and digestibility. In a dietary ration for lambs of vetch/oats grain, when the ratio of vetch grain in the mix was below 50% the growth rate of the lambs was reduced. Common vetch (Vicia sativa L.) grain can be used without limit to feed all ruminants, but anti-nutritional components in the grain are a limiting factor to use for monogastric and poultry.

Key words: vetch, lamb, grain, end-use, crude protein.

Introduction

Over the last 15 years Australian shareholders have invested in research into new crops for inclusion in cereal cropping rotations to provide feed for on farm livestock and export of hay, silage, grain and chaff.

Over 80% of Australian broad-acre field crops are grown in low (<350mm) and mid rainfall areas (<420mm). In 1992-1995 vetches covered 12-15.000ha, and were mostly used as a pasture and green manure crop. From 1995-2004 vetches significantly expanded and for the last four years covered over 250.000ha/annually, and were used as hay/silage, grain, pasture and green manure *(Matic, Nagel, 2004).* Sheep, cattle and goats are the main livestock commodities in mixed farming systems in the low/mid rainfall areas of Australia. Also, in crop rotations vetch is one of the best crop to increase soil fertility and increased yield in the following cereal crops and protein in wheat crops.

Vetch is one of the best crops that can tolerate a sharp finish of the season, and giving to farmer's flexibility of end-use as a grain, hay, silage, pasture or green manure crop. Grain from common vetch (*Vicia sativa L.*) contains a high level of crude protein *(Mihailovic et al 2004*), and can be used as a valuable feed for all ruminants without limit, and between 10-25% in a ration with cereal grains for pig production *(Collins et al 2002; Mqtic et al 2004, van Barneveld et al 1992).*

In Australia a few programs started in the early 1990s to determinate the best species for producers and end-users. Two vetch species, common vetch *(Vicia sativa L.),* and hairy vetch *(V.villosa Roth.)* showed the best potential to be include in crop rotations and used as a feed for livestock. Common vetch can be used both as a plant for grazing/ hay/ silage and as grain for fodder, but hairy vetch can be used only as pasture and hay/silage for livestock *(Matic et al 2000-2004 annual reports, recom. to farmers)*. Vetch as grain or as a pasture, hay/silage increase livestock weight gain significantly better than voluntary pastures with supplementary cereal grains *(Anderson, 1975).*

Further details of this paper will focus on the few feeding trails of lambs with grain from common vetch *(Vicia sativa).*

Material and Methods

The vetch grain, pure and mixed with oats, was evaluated for lamb growth at Westminster School, Agriculture Science *(WSAS),* in collaboration with the National Vetch Breeding Program, located at South Australian Research and Development Institute *(SARDI),* Adelaide, South Australia. From 2000-2004 five trials were conducted as collaboration between WSAS and SARDI. These trials used, pure vetch grain from *Vicia sativa spp*. *variety Morava* alone, and mixed with oat grain from different varieties. Lambs were introduced to grain commencing at 100g/day/head, and adding an additional 100g each day until reached the level of 15g/kg live weight, where using pure vetch grain and vetch/oats mixtures, and 20g/kg live weight were used pure oat grain. Grain residue was collected and weighed each day. If no residue remained, an

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additional 100g/day was fed, if there was residue more than 300g/day the amount fed was reducing by 100g. Meadow pasture was introduced equally to all groups during research.

- Trial 1. Involved 21 lambs were divided into 3 groups of 7. Each group was fed one of 3 different treatments (A, B, or C). Weights of the lambs were taken over 30 days at intervals, 0,10, 20 and 30 days.
- Trial 2. Involved 29 lambs were divided into 2 groups of 10 and I group of 9. Each group was fed one of 3 different treatments (A, B, or C). Weights of the lambs were taken over 40 days at intervals, 0,10, 20, 30 and 40 days.
- Trial 3. Involved 34 lambs were divided into 2 groups of 11 and 1 group of 12. Each group was fed one of 3 different treatments (A, B, or C). Weights of the lambs were taken over 30 days at intervals, 0,10, 20 and 30 days.
- Trial 4. Involved 29 lambs were divided into 2 groups of 10 and I group of 9. Each group was fed one of 3 different treatments (A, B, or C). Weights of the lambs were taken over 32 days at intervals, 0,10, 20, and 32 days.
- Trial 5. Involved 50 lambs were divided into 5 groups of 10. Each group was fed one of 5 different treatments (Purple, Orange, Yellow, Green or Black). Weights of the lambs were taken over 46 days at intervals, 0,10, 20, 40 and 46 days.

All lambs are from one large group of lambs with no differences between them. Also the lambs are from one large random population.

The treatments in trials 1-4 are the same and therefore the data from these 4 trials is combined into one analysis, trial 5 is kept as a separate analysis.

Results and discussion

For trial 1-4 the model is: Weight = Constant+day+Group: day+trial: day+Random (lamb)+error

where day is a continuous variable representing the number of days since initial weights were taken, Group is a factor with 3 levels representing the 3 treatments, trial is a factor with 4 levels representing the 4 different trials.

For trial 5 the model is: Weight = Constant+day+Group: day+Random (lamb)+error

where day is a continuous variable representing the number of days since initial weights were taken and Group is a factor with 5 levels representing the 5 treatments.

The results from the fitting of the model for trial 1 – 4 is given below. The values in the first column (solution) are the coefficients for each term. The Z ratio enables us to compare the coefficients with the first level. For a 5% test the critical Z value is 1.96. In the first table we can see that all the Z ratio values are higher than 1.96 and therefore the slopes for trials 2,3 and 4 are all significantly higher than the slopes in trial 1, also the slopes for group B is significantly higher than the slope for Group A and the slope for Group C is significantly lower than the slope for Group A.

Table 1. Results for trials 1-4 and 3 groups of lambs

Trial	Solution	Std error	Z ratio
Trial 1 : day	*0*	*NA*	*NA*
Trial 2 : day	0.076	0.014	5.296
Trial 3 : day	0.046	0.016	2.941
Trial 4 : day	0.042	0.016	2.656
Group A : day	*0*	*NA*	*NA*
Group B : day	0.040	0.011	3.522
Group C : day	- 0.146	0.011	- 12.696
Day	0.211	0.014	14.932
Intercept	23.585	0.268	88.057

Group A=pure Morava vetch grain; Group B=50/50 Morava/oats; Group C=pure oats (mix varieties)

The second table enables the test for significant differences in slopes between trails 2, 3 and 4. In these three trials Z values are inside the range –1.96:1.96 and therefore the slopes for trials are not significantly different from each other.

Table 2. Comparison Z value between trials 2,3 and 4.

Trial(s)	Trial 2	Trial 3	Trial 4
Trial 2	0.000	1.422	1.609
Trial 3	- 1.422	0.000	0.184
Trial 4	- 1.609	- 0.184	0.000

The random effects in the model are given in the table below. Results showed there is very high variability between the lambs. Each coefficient can be converted to an equation by adding up the relevant numbers from the coefficient.

Table 3. R variance between lambs

Random Components			
	Component	Std error	Z ratio
Lamb	6.9260	0.9905	6.9922
R variance	1.7690	0.1317	13.4349

The common intercept, i.e. the average weight of any lamb at the initial time is given by 23.585kg. The slopes for each trial and each group are given in the table below.

Table 4. Slopes for each Trial x Group

	Lamb growth rate (kg/day)		
	Group A	Group B	Group C
Trail 1	0.211	0.251	0.065
Trial 2	0.287	0.327	0.141
Trial 3	0.257	0.297	0.111
Trial 4	0.253	0.293	0.107
Mean	0.252	0.292	0.106

Conclusions

1. The growth weights for lambs in trial 1 are significantly lower than the growth rate for lambs in other 3 trials. Trial one is done in winter2002 with very poor voluntary pasture and initial weights of lambs varied from 19kg-32kg. We can conclude these factors reduced the total growth in all three groups.
2. The growth rate for lamb's in-group C is significantly lower than the growth rate for lambs in other two groups. That means the oats grain is not satisfactory feed for growth lambs by self.

Trial 5 introduced 5 feeding rations were Yellow group (50/50 Morava/oats) used as a standard.

Table 5. Fixed regression components for trial 5

Group : day	Solution	Std error	Z ratio
Yellow* : day	0.000	NA	NA
Black* : day	- 0.100	0.014	- 7.328
Green* : day	- 0.197	0.014	- 14.365
Orange* : day	0.021	0.014	1.499
Purple* : day	- 0.048	0.014	- 3.489
Day	0.300	0.010	30.701
(Intercept)	22.341	0.354	63.168

Yellow=50/50 Morava/oats grain; Black=20/80 Morava/oats grain; Green= pure oats grain; Orange=80/20 Morava/oats grain; Purple=pure Morav vetch grain

Also, in trail 5 occurred large variation for lambs as in trials 1-4. See variance for trial 5 in table below.

Table 6. R variance between lambs

	Component	Std error	Z ratio
Lamb	5.3863	1.1638	4.4282
R variance	1.5724	0.1594	9.8667

The Z table below can be used to compare all other treatment. There are no values inside the –1.96:1.96 range and therefore all treatments are different from each other.

Table 7. Z value for trial 5

Group(s)	Black	Green	Orange	Purple
Black	0.000	4.950	- 6.208	- 2.700
Green	- 4.950	0.000	- 11.159	- 7.650
Orange	6.208	11.159	0.000	3.509
Purple	2.700	7.650	- 3.509	0.000

In trial 5, comparisons between groups coefficient below showed Orange group is not significantly different from yellow, all other groups are.

Table 8. Average lamb growth per day for 46 days

Group	Initial weight Mean (kg/head)	Growth Mean (kg/day/head)	Final weight after 46 days Mean (kg/head)
Yellow	22.341	0.300	36.141
Black	22.341	0.200	31.541
Green	22.341	0.103	27.079
Orange	22.341	0.321	37.107
Purple	22.341	0.252	33.933

For lamb growth, balance between highly protein grain from Morava vetch and fibre component from oats grain is very crucial. See main feed components for grain of Morava vetch and oats (mix varieties) in Appendices 1.

Grain	No. of samples	Crude protein (%)	Metabol. Energ. (MJ/kg)	Dry Matter Digestibility (% digest. DM)
Morava	35	30.2 (28.2-33.8)	11.8 (10.8-13.2)	85.7 (79-88)
Oats	35	8.2 (6.8-10.8)	10.3 (7.8-11.4)	72 (64-86)

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EKSPANZIJA I KORIŠĆENJE GRAHORICE (*Vicia spp*) U AUSTRALIJI

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Rezime

Grahorica je jedan od najprilagodljivijih useva u slovima zemljišta koje postoji u Australiji – alkalno peščano zemljište sa <320mm padavina godišnje. Takođe, upotreba grahorice je višestruka. U vezi sa nutritivnim vrednostima zrna obične grahorice i biljnog materijala, ona ima visok sadržaj sirovog proteina, metaboličke energije i svarljivosti. U obroku za jagnjad koji se sastoji of zrna grahorice/ovsa, kada je učešće grahorice u obroku bilo ispod 50% brzina porasta jagnjadi je smanjena. Obična grahorica (*Vicia sativa L.*) u

zrnu se bez ograničenja može koristiti za ishranu preživara, ali anti-nutritivne komponente u zrnu predstavljaju limitirajući factor za upotrebu ove biljke u ishrani živine i nepreživara.

Ključne reči: grahorica, jagnje, zrno, krajnja upotreba, sirovi protein

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