

Vetch breeding and versatility of vetch in field crop rotations

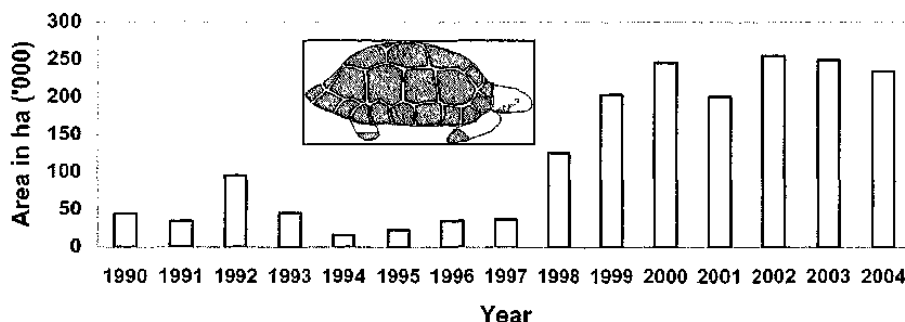
Rade Matic

Australian farmers have adopted vetch as a pulse rotation crop where drought is the major environmental stress. Farmers perceive vetch as a reliable, versatile legume, which can be used to manage cereal diseases and grass weeds, improve soil fertility and contribute to increased yield and protein content in subsequent crops. Also, vetch can be used as hay, silage, pasture and green manure in farm crop rotations; it is this usage that is one of the best methods to reduce herbicide resistance in weeds and to avoid chemical contamination of paddocks.

Vetch germplasm has been selected for targeted traits and used as a parental material in the breeding program since 1992 in Australia. The breeding strategy is based on conventional breeding methods of gene recombinations from different parents where at least one of the parents possesses drought tolerance. These parents are recombined with other parents that possess high yield potential, rust and ascochyta resistance and lower anti-nutritional components. An Australian cultivar Morava is the progeny of the parents that have these traits.

Vetch production in Australia collapsed in early 1990, due to the lack of disease-resistant cultivars, greater awareness of vetch grain toxicity and the substitution of split lentils with red cotyledon vetch varieties for human consumption in the Middle East. Grazing, hay, silage, green manuring and grain usage of vetch is widely known throughout the world and Australia. In the last 6 years, vetch crops have occupied over 200,000ha/yr in Australia.

Vetch area in Australia 1990-2004



Vetches are one of the best-adapted crops for Australian alkaline loamy- sandy soils with <320mm of annual rainfall. Vetches were tested for soil type from low pH 5.2 to pH 8.7; they are very tolerant to different soil types. Vetch fixes up to 80% of its total nitrogen requirements from the atmosphere. Our data showed in three years across six sites, the annual nitrogen balance (output minus input) was 57kg, 92kg and 136kg/ha after use for grain, hay/silage and green manure, respectively. Cereal crop yields following a crop of vetch are usually over 30% higher than those derived from continuous cropping with cereals. Protein in durum wheat was increased 1.7 to 2.3% after vetch compared with the durum after other cereals, according to farmer reports and our results from SA in the mid-north (Blyth) and south-eastern mallee (Lameroo). If farmers use vetch as a green manuring crop the best time to put back in the soil or spraytop is in the early flowering stage, at this stage the nitrogen percentage is the highest.

Three common vetch varieties, Morava, Blanchefleur and Languedoc are very palatable for grazing from early stages to mature plants. Our grazing experiments with common vetch, bitter vetch, wooly pod vetch and narbon bean showed clear differences in the payability for sheep and cattles. Both groups of animals preferred the pure common vetch or mixtures of common vetch with cereals (oats/triticale) compared with the other three species. Inclusion of vetches in the pasture or hay production in SA mid-north (Blyth) significantly increased number of livestock, sheep and cows per ha.. Vetches can be grazed from 8 nodes (20cm) onwoods. Regrowth is dependant upon followup rains. In the low rainfall areas vetches are recommended to graze or cut for hay at flowering, early podding stage.

At this stage the nutritive and feeding values are very satisfactory for ruminants, the levels of dry matter (DM), dry matter digestibility (DMD), crude protein (CP), acid detergent fibre (ADF) neutral detergent fibre (NDF) and water-soluble carbohydrate are at the best achievable combinations. Forage crops may be harvested at different stages depending on the quality of the forage requirements. As plant mature, DMD, leafiness and CP decreased and NDF and ADF increased. Grain from common vetches can be used to feed all ruminants without limit and up to 20% for pigs in the diet. Grain from *Vicia villosa* varieties {*Popany*, *Namoi*, *Haymaker*, *Capelo*} SHOULD NOT BE USED TO FEED ANY LIVE STOCK. This species has high toxin levels, which can kill ruminants and monogastric. Use this species for hay/silage or green manure only.

The Vetch breeding program conducted several lamb feeding trials with Westminster School in Adelaide, with vetch from Morava species and barley. See lamb growth in the following table 1.

Table 1. Average lamb growth over 46 days of feeding different ratios of vetch grain and barley.

Treatment	Mean initial weights (kg/head)	Growth (kg/day/head)	Mean final weights (kg/head)	Ration vetch:barley
Purple	22.1	0.267	34.3	100:0
Orange	22.6	0.331	37.8	80:20
Yellow	23.7	0.311	38.0	50:50
Black	21.8	0.205	31.2	20:80
Green	21.1	0.112	25.9	0:100

In a dietary ration for lambs of vetch/barley grain, when the ratio of vetch grain in the mix was below 50% the growth rate of the lambs was reduced.

The second main target of the vetch-breeding program is to breed varieties for grazing, hay/silage and green manuring. These varieties have to have good early vigour, high winter yields, low alkaloid content in the foliage and grain, long flowering duration, later maturity (>120 days from seeding to flowering), adaptability to grazing, high herbage yield, soft seeds and not shattering if using for seed production. Over the last few years the program organized herbage (dry matter) trials in different soil types and annual rainfall.

One of the trials was in 2005 at Ranking Springs, but not with the lines for grazing/forage production, most lines were from the grain production group. The latest maturity variety in this trial was Morava. Crude protein and dry matter yield showed the cutting time was very late and all lines/varieties, except Morava, were in full grain filling stage. The two earliest lines, 33748 & 33811, gave the highest yield, because they were in full pod stage and yield is an expression of plant plus grain performance in that stage. Results from Morava clearly showed the yield is lower than in early maturity lines but CP is higher. See following Table 2.

Table 2: 2005 Ranking Springs - Dry matter yield and feeding value of 11 introductions.

Variety/Line	Dry matter (t/ha)	Crude protein (%)	Neutral Deter. Fiber (%)	Dry Matt. Digest. (%)	Metabolic. Energy (MJ/kg)
Morava	5.29	17.7	35.3	75.3	11.3
Blanchefleur	6.32	14.2	33.3	76.6	11.6
Languedock	5.50	15.2	33.1	76.2	11.6
34894	5.80	15.1	33.6	76.2	11.6
34811	6.84	13.8	32.4	77.0	11.6
34748	7.28	16.2	33.0	77.2	11.6
34746	6.03	15.6	33.4	76.4	11.5
34739	5.99	15.4	34.9	75.6	11.4
34730	6.13	15.8	31.7	78.5	11.9
34719	6.50	16.5	31.5	78.2	11.8
34576	5.75	16.5	34.4	75.8	11.3

Vetch breeding trials in 2004 for hay were conducted at Blyth and Lameroo in medium to low rainfall sites with alkaline loamy soils. Twelve lines were repeated in 2005 in Blyth and Charlick medium neutral soil and in high rainfall (>450mm/yr) acid soil at Kingsford.

Table 3: Dry matter production in 2004 and 2005 in SA

Variety/	2004			2005				Mean (t/ha)	% of BF
Line	Blyth	Lameroo	Overall	Blyth	Charlick	Kingsford	Overall	2004&2005	2004&2005
34467	4.3	3.2	3.8	4.4	6.0	7.8	6.1	4.9	97.0
34479				4.8	6.0	8.1	6.3		
34494	3.9	2.1	3.0	4.8	6.3	8.2	6.4	4.7	92.5
34514	5.5	3.1	4.3	5.2	6.5	8.4	6.7	5.5	107.8
34522				5.7	7.0	8.7	7.1		
34526				4.7	6.2	8.0	6.3		
34533	5.9	3.6	4.8	5.8	7.1	8.7	7.2	6.0	117.8
34546				4.8	6.1	8.1	6.4		
34739				4.7	6.0	8.1	6.3		
34821				5.3	6.3	8.4	6.6		
34831	5.7	3.3	4.5	5.5	6.5	8.5	6.9	5.7	111.4
34856				4.6	6.1	7.9	6.2		
34869	6.1	3.9	5.0	6.1	7.1	8.8	7.4	6.2	121.3
34871				4.6	6.0	7.9	6.2		
34872				4.7	5.8	8.1	6.2		
34875				4.4	6.1	7.8	6.1		
34877				4.1	5.8	7.6	5.8		
34883				4.6	6.1	8.0	6.2		
34901				4.4	5.9	7.9	6.0		
34906	5.8	3.9	4.9	5.2	6.5	8.4	6.7	5.8	113.5
34926				4.8	5.8	8.0	6.2		
BF	5.2	2.9	4.1	4.5	6.0	7.9	6.2	5.1	100.6
Capelo	4.9	2.5	3.7	4.6	6.0	8.1	6.2	5.0	97.5
Evinos				5.6	6.7	8.6	7.0		
Haymaker	5.4	2.8	4.1	5.2	7.1	8.3	6.9	5.5	107.4
Morava	5.3	2.8	4.1	4.2	6.1	7.6	5.9	5.0	98.5
Popany	4.3	2.2	3.3	2.5	4.2	6.7	4.5	3.9	76.1

In two years over 5 sites 6 lines out-yielded check variety Blanch fleur (BF).

Our recommended seeding rates for the grazing, hay/silage and green manuring are 50-60 plants/m² in areas with annual rainfall <350mm/yr, and 60-80 plants/m² in areas >350mm/yr.

For all your Spatial Mapping Inquiries

Contact Ian Maling
Phone: 08 9361 0955
Fax 08 9361 0977
Email: info@silverfox.net.au

