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VETCH

SECTION 1

INTRODUCTION

KEY POINTS | WHAT IS VETCH? | WHY GROW VETCH? | SUITABLE ENVIRONMENTS | MARKETS

Introduction

Key points

- Vetch is a versatile, high-production, low-input crop
- It can be used for grazing, forage, green or brown manure, grain for livestock or for seed
- It is more tolerant of acidic soils than most grain legumes, except lupin
- It brings many benefits to cropping and mixed-farming rotation, including nitrogen fixation and control options for resistant weeds

FEEDBACK

IN FOCUS

Versatile vetch

Unlike other grain crops grown in Australia, vetch is not grown for human consumption. Grain from some species is used for animal feed. The other reasons for growing vetch are to produce seed that can be sown for green manure crops, which fix nitrogen and provide a control option for weeds, or for the production of grazed and conserved forage.

Determining why vetch is being grown is an important starting point in the selection and management of vetch crops.

1.1 What is vetch?

Vetch (*Vicia* species (sp.)) is a winter-growing, multi-purpose, annual legume. It produces a scrambling vine, climbing by means of branched tendrils, which can grow as a dense pure stand to about 80 cm, or will trellis on cereals or canola with which it can be grazed, ensiled or conserved as hay.

Vicia sp. is a genus of about 140 species of flowering plants commonly known as vetches. Bitter vetch (*Vicia ervilia*) was one of the first crops grown in the Middle East, about 9,500 years ago. *Vicia* sp. is in the biological family Fabaceae, the same as true pea and lentil, and is a close relative of the pulses faba bean (*Vicia faba*) and narbon bean (*Vicia narbonensis*)[1].

Vetch is classified as large-seeded pasture legume that can be used for forage, fodder and a nitrogen-fixing green manure. All Australian Common vetch varieties are suitable for grain to be used as high-protein feed for all ruminants and a limited amount in pig rations (see Table 1). Grain from most species of vetch cultivated in Australia is unsuitable for human consumption (see Section 1.4 Markets).

The species of vetches bred and grown in Australia are:

- Common or grain vetch – *Vicia sativa*
- Purple vetch – *Vicia benghalensis*
- Woolly pod vetch – *Vicia villosa* subspecies *dasycarpa* and *eriocarpa*

Common vetch is the most versatile of the vetch species as it can be grown for early grazing, green or brown manure, conservation as silage, hay, dry grazing and as grain.

Key characteristics[2]

- Mature plants are erect to 80 cm, with square stems branching from the base resulting in a tangled mass. Stems have longitudinal ridges.
- Cotyledons do not emerge.
- Leaf pairing, shape and hairiness vary with variety.
- Flower from August to November.
- Flower colour and size varies with variety (see Photo 1).
- Pods are flattened, to 50 mm long and 12 mm wide.
- Seed colour is light to dark brown, orange to beige when split. Hilum (seed scar) is the same colour as seed coat.

1 Vicia. Wikipedia, https://en.wikipedia.org/wiki/Vicia

2 GRDC. Weed ID: The Ute Guide App, https://grdc.com.au/resources-and-publications/app

FEEDBACK

Photo 1: *(From left) two examples of Common vetch and one of Woolly pod vetch. Common vetch is the most versatile of the vetch species as it can be grown for early grazing, green or brown manure, conservation as silage, hay, dry grazing and as grain. Woolly pod vetch cannot be grown for grain but produces large volumes of dry matter.*

Photo: Emma Leonard, AgriKnowHow

1.1.1 Hard seed

Namoi vetch (*Vicia villosa* ssp. *dasycarpa*) was developed in NSW in the late 1960s for grazing. Its ability to grow on a wide range of soil types increased the grazing capacity of poorer sandy soils. It is a hard-seeded variety, which means not all seed germinates the year after seed shed. Hard seed can lead to unwanted germinations of vetch in other parts of the rotation and gave vetch a reputation as a weed species in crops.[3] This reputation still exists, although it can be managed with newer varieties and by minimising seed set.

New varieties of vetch have a much higher proportion of soft seed, which will germinate on late summer rainfall and with less carryover of hard seed into future years.

Self-sown vetches from hard-seeded varieties can cause admixture problems in pulse crops. Even soft-seeded varieties can cause problems in subsequent pulse crops if germination and control has not occurred before sowing the following crop. Vetch contamination in lentil creates a major marketing problem because it is difficult to clean vetch seed out of lentil grain and vetch is unacceptable in international food markets.

Common vetch is also known as ‘tare’ and it may be referred to by this name when considered a weed rather than a crop.

Vetch can be controlled with herbicides in cereal and canola crops but control in pulses is much less reliable. If there is concern over unwanted in-crop germinations of vetch in other parts of rotations, varieties with a zero or low proportion of hard seed should be sown.

3 B. Bull, A Mayfield (1992) Growing Vetch – out of print

FEEDBACK

1.2 Why grow vetch?

Vetch can be grown for forage, green or brown manure or grain. No other legume offers the same degree of versatility as vetch. Cereal yields are generally higher following vetch, irrespective of whether it was for forage, green manure or grain.

For example, in trials in NSW, soil nitrogen increased, weeds decreased and direct drilling was easier following a vetch hay crop. In these trials, wheat yield and protein after vetch hay increased by 25% and 1.8% respectively, compared to cereal-on-cereal.

Generally vetch is a low-input crop, often requiring no additional fertiliser inputs after seeding, but it can require applications of herbicide, insecticide and fungicide (see Section 5 Growth stages, Section 6 In-crop management – pests and Section 7 In-crop management – disease).

1.2.1 Forage

Vetch is highly palatable to sheep and cattle at all growth stages but care should be taken not to overgraze during early growth stages otherwise the crop will not produce bulky regrowth (see Section 5 Growth stages).

Capable of producing a large amount of biomass (5–10 t/ha dry matter), but this is dependent on rainfall and sowing date. For example, in trials in Upper Eyre Peninsula that recieved 237 mm of growing season rainfall the average yield across 3 common and 1 woolly pod vetch crop of different maturities was 3.19 t/ha of biomass at flowering for crops sown 5 May and 2.35 t/ha for those sown 28 May. Yields increased to 4.45 t/ha and 3.17 t/ha for the respective sowing dates by maturity. Vetch can provide excellent grazing or be conserved as high-protein silage or hay.

Vetch can be successfully grown for forage in combination with cereals, particularly oats, and with canola.

Vetch hay is higher in protein than cereal hay and provides similar nutrition to medic and lucerne hay (Table 1). Dairy farmers report vetch hay or silage can increase milk production per cow by more than 12% compared to grass or cereal hay.[4]

Photo 2: *Vetch can produce a large amount of biomass that is highly palatable to sheep and cattle. If overgrazing is avoided, especially at early growth stages, several grazings can be achieved.*

Photo: Emma Leonard, AgriKnowHow

4 R Matic (2007) Improved vetch varieties for fodder production. AgriFutures Publication No 07/123, https://agrifutures.infoservices.com.au/downloads/07-123

FEEDBACK

Table 1: Feed quality of vetch forage compared to forage from other grain crops.

	Metabolisable energy (MJ/kg DM)	Crude protein (%)	Dry matter digestibility (%)
Vetch hay	8.0–11.0	12.0–20.0	60–70
Field pea hay	5.1–12.5	4.5–23.1	38–82
Medic hay[1]	7.8–9.7	14.0–24.0	58.0–71.4
Lucerne hay[2]	9.0	More than 19.0	More than 65.0
Cereal hay	7.5–9.0	6.0–12.0	55–75
Field pea straw	6.0–7.0	Less than 5.0	35–50
Cereal straw	5.0–6.5	Less than 4.0	35–50

Source: Vetch the Ute Guide, (2010) Primary Industries and Resources South Australia, via B Ashton (2013) Feed analysis results Eyre Peninsula, Sheep Consultancy Services. http://www.sheepconsultancy.com.au/Technical/FEED%20analysis%20EP%20Current.pdf and M Lattimore (2008) Producing Quality Lucerne Hay. RIRDC Publication No. 08/101. https://rirdc.infoservices.com.au/downloads/08-101

1.2.2 Grain

Grain can be harvested with a conventional grain harvester. Harvesting should be relatively early as seed shatter can be an issue with some varieties (Section 2, Table 1 and Table 2).

In trials in south-eastern Australia, vetch grain yield has averaged 2–2.75 t/ha grain (Section 2, Table 1). Production varies by season and rainfall region and yields are generally similar to field pea in the same environment but with lower establishment costs.

The grain of Common vetch is a valuable protein source in livestock diets. It contains 280–300 g/kg crude protein, 16–19 g/kg lysine and 14–15 megajoules/kg of energy. It can be used without limit in the diet of ruminants and up to 20–25% (depending on variety; Section 2, Table 1) of the diet of pigs[5].

Table 2: Comparison of break crops in low-rainfall regions – grain yield (kg/ha) for each trial site and as an overall average across all sites.

Legume	Loxton flat	Loxton sand	Waikerie flat	Waikerie sand	Average
Albus lupin	0.28	0.14	0.02	0.30	0.18
Narrow-leaved lupin	0.71	0.60	0.20	0.49	0.50
Kabuli chickpea	0.43	0.22	0.05	0.45	0.29
Desi chickpea	0.55	0.30	0.09	0.77	0.43
Faba bean	0.83	0.55	0.29	0.46	0.53
Field pea	0.58	0.71	0.16	1.21	0.66
Lentil	0.96	0.64	0.48	0.82	0.72
Canola	0.52	0.69	0.20	0.66	0.52
Vetch	0.77	0.86	0.19	0.69	0.63
P value	<0.001	<0.001	<0.001	<0.001	<0.001
lsd (5%)	0.12	0.19	0.09	0.09	0.23

Source: Comparing break crop performance on sandhills and flats in the SA Mallee (2016), Mallee Sustainable Farming. http://www.msfp.org.au/comparing-break-crop-performance-in-the-sa-mallee

5 Proceedings of Nutrition Society of Australia (2002) 26 Victorian Institute of Animal Science, Werribee

FEEDBACK

MORE INFORMATION

Web resource: Green manure calculator – http://www.soilquality.org.au/calculators/green_manure

1.2.3 Manure crop

A green vetch crop can be worked into the soil with cultivation equipment to boost organic matter content. More commonly the vetch crop is brown manured by desiccating using a knockdown herbicide to kill both the vetch and weeds and allowed to decompose over the fallow period before being worked into the soil at sowing.

Its production of large volumes of biomass makes vetch a good green or brown manure crop. This is because vetch returns large amounts of organic matter to the soil, which in turns boosts biological activity. Add to this its ability to fix nitrogen (see Table 3) – it provides the ideal manure crop. There are three key reasons for manuring legumes:

- management of weeds, particularly if they are herbicide-resistant;
- to boost soil nitrogen; and
- to conserve soil moisture for subsequent crops.

The main disadvantage of a manure crop compared to a non-cropped fallow is the cost of establishment (seed plus sowing) and herbicides. Despite the manure phase being cashflow-negative in the first season, a crop production system involving a manure crop can be more economic than continuous cropping.

To gauge the true value of legumes in a crop sequence, the input costs and crop returns need to be considered over the whole crop sequence in terms of net income per hectare per year.[6]

Photo 3: *Vetch being grown with safflower as a manure crop. The vetch provides bulk to out-compete weeds, returns organic matter to fix nitrogen. The safflower can punch root holes through a hard pan and is killed by any winter frost before any flower heads are set.*

Photo: Emma Leonard, AgriKnowHow

6 Manuring of Pulses (2013) GRDC Fact Sheet. https://grdc.com.au/Resources/Factsheets/2013/09/Manuring-of-Pulse-Crops
Returning nutrients to the soil (2000) *GroundCover*™. https://grdc.com.au/Media-Centre/Ground-Cover/Ground-Cover-Issue-31-SA/Returning-nutrients-to-the-soil-canola-vetch-stubble-extra-tasty-to-microbes

FEEDBACK

MORE INFORMATION

Fodder crops and soil improvement in low rainfall areas: http://www.malleecma.vic.gov.au/resources/technical-bulletin/foddercrops2011_final_lowres.pdf

GRDC Manuring of pulse crops Fact Sheet: https://grdc.com.au/Resources/Factsheets/2013/09/Manuring-of-Pulse-Crops

1.2.4 Benefits of vetch in the rotation

In a cropping sequence vetch can offer agronomic benefits primarily through the fixation of nitrogen for the following crop (see Section 3 Paddock preparation).

Vetch is well adapted to no-till, standing stubble systems and can be grown and harvested using the same equipment as for cereals and other pulse crops.

Vetch makes a good disease break for cereals and oilseeds. Grass-free vetch crops are a good break in the life cycles of the cereal diseases crown rot and take-all. However, vetch can cause carryover of some diseases such as Botrytis grey mould and Sclerotinia to faba bean and lentil.

1.2.5 Weed control and herbicide resistance management

Grass-selective herbicides or manuring vetch can be used to control grass weeds such as ryegrass, barley grass and brome grass. Herbicide options for broadleaf weed control in vetch are limited to pre-emergent herbicides.

Vetch is a poor competitor for weeds in early growth stages. Knockdown herbicides should be used to provide a clean seedbed and pre-emergent herbicides for some residual control of broadleaf weeds. Vetch is a very good competitor from seven nodes (10–15 cm high) onwards.

Grazing, silage and early hay cuts, brown manuring and crop-topping or spray-topping of vetch provide non-selective weed control options that can be part of an integrated weed management strategy.

1.2.6 Nitrogen fixation

Results from the Australian National Vetch Breeding Program (ANVBP) across five sites over three years have shown increases in soil nitrogen after vetch was grown for grain (56 kg/ha), hay (94 kg/ha) and green manure (154 kg/ha) (see Table 3).

1.2.7 Soil cover

The leafy structure and rambling growth pattern of vetch can provide good soil protection during the growing season but stubbles lack bulk and can leave lighter soils vulnerable during summer.

1.2.8 Biology booster

Research in the Mallee found total microbial activity in soil after vetch was 16% greater than after wheat.[7]

7. Inoculating Legumes: a practical guide (2012), GRDC https://grdc.com.au/GRDC-Booklet-InoculatingLegumes

FEEDBACK

1.3 Suitable environments

Vetch is adapted to a wide range of soil types, from light sands to heavier clay soils, and prefers slightly acidic to alkaline conditions (pH 5.2 to 8.2). However, vetch is more tolerant of acidic soils than most grain legumes, except for lupin which will tolerate pH levels as low as 4.0.

Vetch performs best on moderate-to-high-fertility soils. In hard-setting soils and soils with subsoil compaction, root growth and consequently drought tolerance may be poor, resulting in reduced production. Stony and uneven soils can create difficulties for hay-making and harvesting grain.

Vetch is negatively affected by high salinity and boron levels encountered in subsoils in many areas in the southern cropping zone in Australia. It is more tolerant of salinity than lentil and chickpea, but considered similar to faba bean, field pea and lupin.

Vetch is very sensitive to aluminium and manganese toxicity, which often occur on acidic soils, generally making these unsuitable for vetch.

The species and varieties differ in their tolerance to low rainfall but vetch can be grown in districts with as little as 250 mm annual rainfall. Rainfall also influences selection of varieties and whether they are grown for grain or forage (Section 2, Table 1).

While including vetch is a good option for dryland situations, it is not ideal when a crop is likely to be flood irrigated at any stage, due to potential foliar disease problems. Irrigation with saline water should also be avoided.

Common vetch varieties do not tolerate prolonged waterlogging but Woolly pod and Purple vetch have been found to survive waterlogging where other crops, such as oats, die out.

Vetch can be affected by frost at flowering and early podding as well as by temperature spikes of more than 35°C, which can cause flowers to abort.

1.3.1 Productivity

Overall productivity is determined by rainfall region, species and variety (See Section 2, Table 1).

Common (grain) vetches produce good yields of forage and grain while Woolly pod vetch and Purple vetch are generally grown for dry matter.

1.3.2 Nitrogen returns

Vetch can fix substantial amounts of nitrogen but this depends on biomass production and rainfall (see Table 3). No difference in nitrogen fixation has been recorded between vetch varieties at the same weight of biomass production. Nitrogen fixation is directly correlated to biomass production.

This increase in soil nitrogen can have a positive impact on the yield and quality of the following crop.

FEEDBACK

Table 3: Increases in soil nitrogen after vetch grown for grain, hay and green manure in kg N/ha.

Sites in South Australia	Rainfall	Soil texture	pH	Planted for	2001		2002		2003		Average (kg N/ha)		Increased (kg N/ha)
					B	A	B	A	B	A	B	A	
Blyth	350 mm	Sandy loam	8.4	Grain		36		34		31		33.7	60.5
				Hay	19		21	40	18	43	19.3	41.5	93.2
				Green manure				61		58		60	169
Lameroo	383 mm	Non wetting sand	8.3	Grain	16	27	18	31	17	29	17	29	50
				Hay				36		33		35	74
				Green manure				48		42		45	118
Kingsford	467 mm	Heavy loamy clay	7.4	Grain		38	27	42		39		40	63
				Hay	25			49	22	51	25	50	106
				Green manure				68		71		70	188
Peake	384 mm	Loamy Clay	8.2	Grain		25	21	27		36		29	49
				Hay	17			34	15	48	18	41	98
				Green manure				42		56		49	132
Charlick	350 mm	Loamy clay	7.8	Grain		32	20	29		38		33	59
				Hay	20			40	17	46	19	43	101
				Green manure				62		56		59	168

Before (B) = soil is taken before seeding vetch. After (A) = soil is taken a year after seeding vetch, just before seeding following crop.
Source: R Matic, SARDI, 2016.

Nitrogen was calculated using a formula from SARDI Soil and Plant Analysis to achieve a total of nitrogen for 60 cm/ha: [(nitrate nitrogen + ammonium nitrogen) x 1.4] x 3.

For example, at Blyth three years before, a vetch crop had soil nitrogen of 19 kg/ha (nitrate + ammonium nitrogen).

1. *(19 x 1.4) x 3 = 81 kg/ha (see comments above about decimal places) total nitrogen (this is not all available for plant).*
2. *On the same paddocks after vetch (example for grain production) average was 34 kg N/ha. (34 x 1.4) x 3 = 142 kg N/ha.*
3. *Difference in total nitrogen before and after vetch crop is: 142–81 = 61 kg N/ha.*

FEEDBACK

1.4 Markets

Vetch grain is mainly used as seed to sow, for feed as grain, forage or hay or as a manure crop. Only grain from Common vetch is also used as livestock feed.

Purple vetch must not be fed to pigs and only used as birdfeed in a mix with other recommended grains.

Woolly pod vetches cannot be fed to any livestock and are only grown for manure crops or forage production.

None of these species of vetch are used for human consumption.

1.4.1 Stockfeed (ruminants)

Grain from Common vetch varieties including Rasina$^{\Phi}$, Morava$^{\Phi}$, Volga$^{\Phi}$, Timok$^{\Phi}$, Blanchefleur, Languedoc and Cummins are used to feed ruminants and can safely comprise up to 100% of the diet of sheep and beef cattle.

1.4.2 Stockfeed (monogastrics)

While there is a limited domestic and export market for grain vetch for the birdseed market, use of vetch in poultry rations is not recommended. This is because vetch contains the toxin gamma-glutamyl beta-cyanoalanine (GBC). This toxin reduces growth rates and feed intake of poultry, adversely affecting the metabolism of laying hens and may reduce growth rates and feed intake of pigs if included as more than 20–25% of the diet in pigs, depending on variety. GBC can give rise to favism, a sometimes-fatal haemolytic disease in humans (Section 2, Table 1).

Grain vetch is also exported to limited birdseed markets.

1.4.3 Seed

Seed is in demand as seed for manure crops. Many varieties are subject to Plant Breeder's Rights and seed purchase arrangements (Section 2.1.1 Common or grain vetch – Vicia sativa ssp. sativa). Vetch grain for sowing often receives a higher price than other pulse grains.

1.4.4 Hay

Vetch hay is very popular with dairy farmers as a high-protein forage for milk production, but it is also good for beef and sheep production. Vetch hay and silage price are similar to clover or field pea hay.

MORE INFORMATION

For information on PBRs, please see *South Australian Sowing Guide 2016*: https://grdc.com.au/Resources/Bookshop/2016/02/SA-Sowing-Guide-2016