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VETCH

SECTION 1

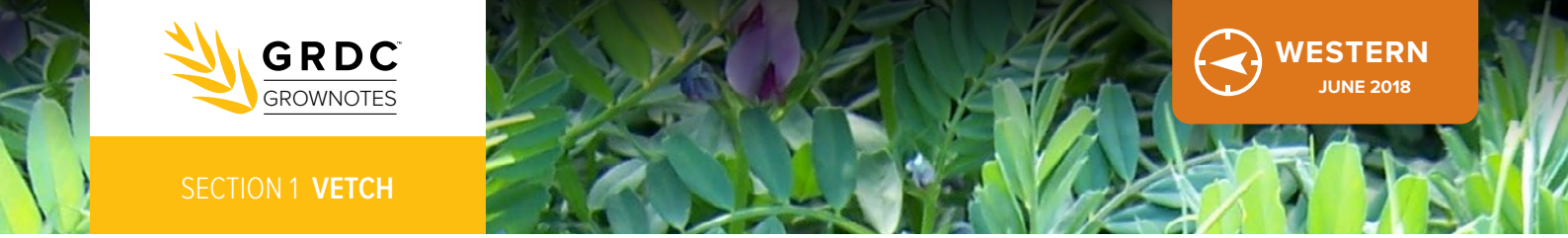
INTRODUCTION

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 and for seed.
- Vetch is suited to a wide range of rainfall regions and soil types; vetch is more tolerant of acid soils than most grain legumes, except for lupin.
- Vetch brings many benefits to the cropping and mixed-farming rotation including nitrogen fixation and control options for resistant weeds.
- Vetch is not grown for human consumption but grain from some species is used for animal feed.
- Vetch can be grown 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.
- The reason for growing vetch is an important starting point in the selection and management of vetch crops.



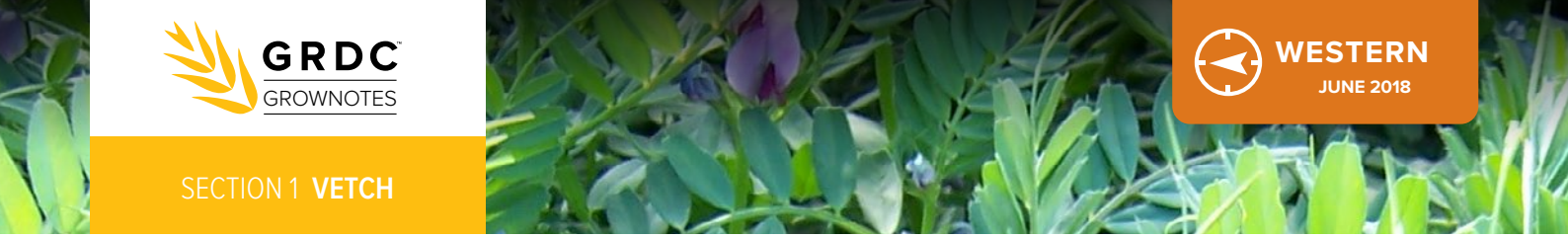
FEEDBACK

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.

A grower's reason for growing vetch is an important starting point in the selection and management of vetch crops.



FEEDBACK

1.1 What is vetch?

Vetch (*Vicia* spp.) is a winter-growing, multipurpose, 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 spp. is a genus of about 140 species of flowering plants commonly known as vetches. Bitter vetch (*V. ervilia*) was one of the first domesticated crops grown in the Middle East, about 9,500 years ago. *Vicia* spp. is in the biological family Fabaceae, the same as true peas and lentils 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 Section 2, Table 1.)

Grain from most species of vetch cultivated in Australia is unsuitable for human consumption. (See Section 13 Marketing)

The species of vetches bred and grown in Australia are:

- Common or grain vetch – *Vicia sativa*
- Purple vetch – *Vicia benghalensis*
- Wooly 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.

In trials in the low to medium rainfall areas of the Western Australian cereal belt, vetch showed considerable potential as grain and forage legume crops. Cultivars of Common vetch showed the most potential in terms of dry matter and seed yield, and, on average, across sites and seasons.[2]

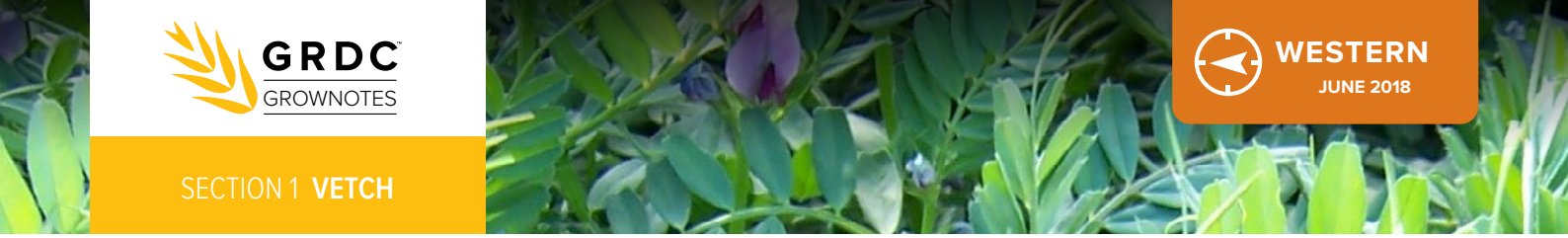
Key characteristics:

- mature plants erect, to 80 cm with square stems branching from the base resulting in a tangled mass; stems with longitudinal ridges;
- cotyledons do not emerge;
- leaf pairing, shape and hairiness vary with variety (see Section 2);
- flowers August to November;
- flower colour and size varies with variety (see Section 2);
- pods flattened, to 50 mm long and 12 mm wide; and
- seed colour light to dark brown, orange to beige when split; hilum (seed scar) is the same colour as seed coat.[3]

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

2 KHM Siddique & SP Loss (1996) Growth and seed yield of vetches. Aust. Journal of Experimental Agriculture 36(5): 587–593 www.publish.csiro.au/?act=view_file&file_id=EA9960587.pdf

3 GRDC, Weeds 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.*

1.1.1 Hard seed

Namoi vetch (*Vicia villosa* subsp. *dasycarpa*) was developed in New South Wales 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 led to unwanted germinations of vetch in other parts of the rotation and gave vetch a reputation as a weed species in crops.[4]

This reputation still exists, although it can be managed with newer varieties and by minimising seedset.

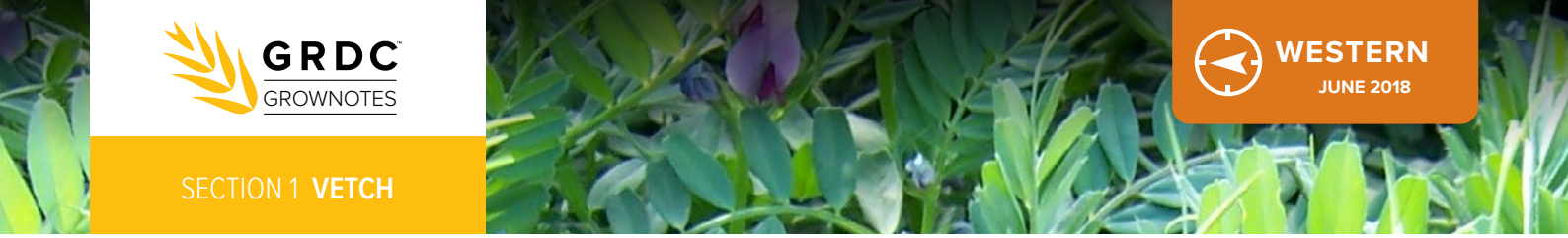
New varieties of vetch have a much higher proportion of soft seed, which will germinate on late summer rainfall and with less carry-over of hard seed into future years. (See Section 2, Table 1.)

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 the international food markets.

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

Vetch can be controlled with herbicides in cereal and canola crops (Section 2.3.2 Weeds) but control in pulses is much less reliable. If there is concern over unwanted in-crop germinations of vetch in other parts of the rotations, varieties with a zero or low proportion of hard seed should be sown.

4 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 New South Wales, soil nitrogen increased, weeds decreased and direct drilling was easier following a vetch hay crop. In these trials, wheat after vetch hay increased grain yield and protein by 25% and 1.8% respectively, compared with cereal on cereal.[5]

Generally, vetch is a low-input crop often requiring no additional fertiliser inputs after seeding but it can still require applications of herbicide, insecticide and fungicide (see Section 6, Section 7 and Section 8).

1.2.1 Forage

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

Capable of producing a large amount of biomass (5–10 t/ha dry matter), vetch can provide excellent grazing or be conserved as high-protein silage or hay (see Section 2, Table 1).

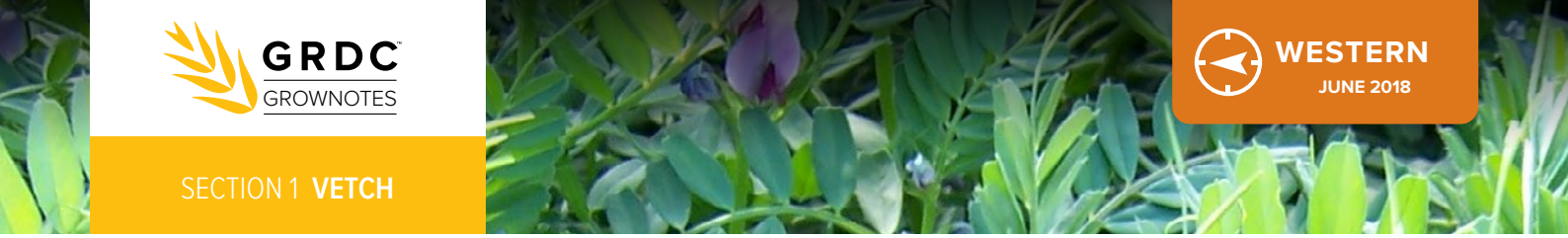
Vetch can be successfully grown for forage in combination with cereals, particularly oats, and with canola.

Vetch hay is higher in protein than cereal hay and provides similar nutrition to medic and lucerne hay (see Table 1). Dairy farmers report vetch hay or silage can increase milk production per cow by more than 12% compared with grass or cereal hay.[6]

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

5 R Matic (2007) Improved vetch varieties for fodder production. RIRDC Publication No 07/123 https://rirdc.infoservices.com.au/downloads/07-123

6 R Matic (2007) Improved vetch varieties for fodder production. RIRDC Publication No 07/123 https://rirdc.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	7.8–9.7	14.0–24.0	58.0–71.4
Lucerne hay	9.0	>19.0	>65.0
Cereal hay	7.5–9.0	6.0–12.0	55–75
Field pea straw	6.0–7.0	<5.0	35–50
Cereal straw	5.0–6.5	<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 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. (See Section 2, Table 1 and Table 2.)

In trials in the low to medium-rainfall areas of the Western Australian cereal belt varieties of Common vetch showed the most potential, producing over 2.5 t/ha of dry matter at flowering.[7]

Production varies by season and rainfall region, and yields are generally similar to narrow-leaf lupin in the same environment but with lower establishment costs (see Table 2).

Grain of Common vetch is a valuable protein source for livestock diets (see Table 3). It can be used without limit in the diet of ruminants and up to 20–25% (depending on variety, see Section 2, Table 1) of the diet of pigs.[8]

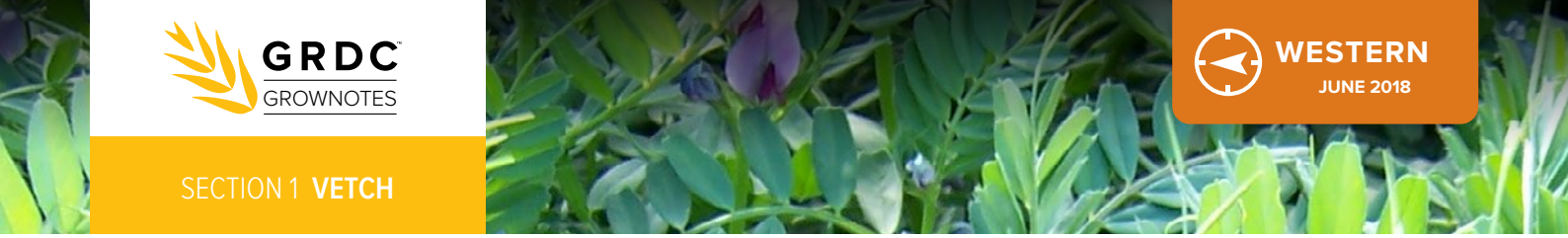
Table 2: Comparison of break crops in low-rainfall regions: grain yield (kg/ha) for each trial site and as an overall average across all sites.

Legume	Loxton Flat	Loxton Sand	Waikerie Flat	Waikerie Sand	Average
Albus lupin	0.28	0.14	0.02	0.30	0.18
Narrow-leaf 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: M Moodie *et al.* (2016), Comparing break crop performance in the SA Mallee. Mallee Sustainable Farming www.msfp.org.au/comparing-break-crop-performance-in-the-sa-mallee

7 KHM Siddique, SP Loss (1996) Growth and seed yield of vetches. Aust. Journal of Experimental Agriculture 36(5): 587–593 www.publish.csiro.au/?act=view_file&file_id=EA9960587.pdf

8 Proceedings of Nutrition Society of Australia (2002) 26. Victorian institute of Animal Science, Werribee



FEEDBACK

Table 3: Dry matter, energy, protein and fibre content (dry matter basis) of cereals and pulses commonly fed to sheep. The average across the range of values tested in WA is shown in brackets.

Cereals and pulses	Dry matter (%)	Metabolisable energy (MJ/kg)	Crude protein (%)	Acid detergent fibre (%)
Wheat	91	12.4–13.3 (12.9)	7.5–15.0 (11.5)	2.5–4.5 (3.0)
Barley	91	11.6–12.2 (11.9)	7.0–13.0 (11.0)	7.0–9.5 (8.0)
Oat	92	10.4–11.3 (10.7)	5.5–13.5 (9.0)	16.0–21.5 (18.5)
Narrow-leaf lupin	92	13.1–14.1 (13.7)	27.0–42.0 (34.0)	17.5–23.0 (20.0)
Albus lupin	92	13.4–15.0 (14.0)	34.0–44.0 (38.0)	17.0–21.0 (19.0)
Field pea	91	12.5–13.5 (13.0)	21.5–30.0 (25.5)	6.0–10.5 (9.0)
Vetch	91	12.4–13.2 (12.8)	26.0–34.5 (29.0)	7.5–9.5 (8.5)
Chickpea	91	12.0–13.0 (12.4)	18.0–24.0 (21.0)	12.0–16.0 (14.0)
Faba bean	90	12.4–13.2 (12.9)	22.0–30.0 (26.0)	7.5–9.5 (8.5)
Canola (>35% oil)	95	15.0–17.0 (16.0)	20.0–25.0 (22.0)	22.5–26.5 (24.0)

Source: DAFWA (2016) Sheep feed value guide. https://www.agric.wa.gov.au/feeding-nutrition/sheep-feed-value-guide

MORE INFORMATION

Green Manure Manure Calculator, http://www.soilquality.org.au/calculators/green_manure

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

1.2.3 Manure crop

A green crop of vetch 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.

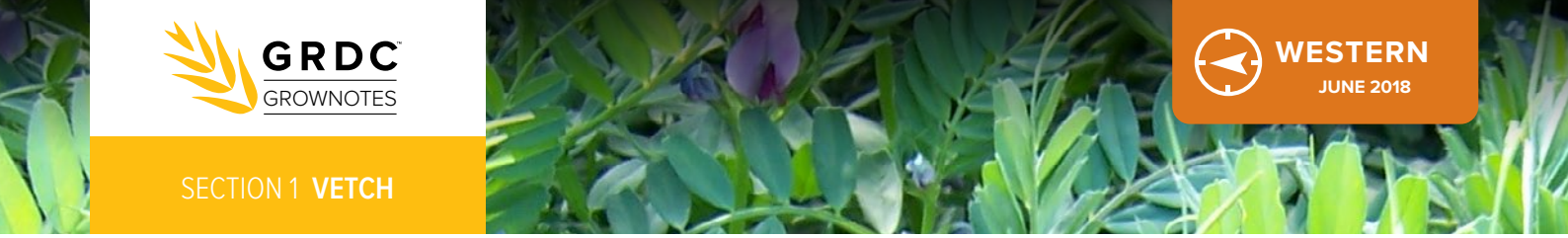
Producing large volumes of biomass makes vetch a good green or brown manure crop. This is because vetch returns large amounts of organic matter to the soil, which, in turn, boosts biological activity. Add to this its ability to fix nitrogen (see Table 3) and it provides the ideal manure crop. There are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

- management of weeds, particularly if they are herbicide-resistant;
- boost soil nitrogen; and
- 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 cash-flow 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.[9]

9 GRDC (2013) Manuring of Pulses. GRDC Fact Sheet https://grdc.com.au/Resources/Factsheets/2013/09/Manuring-of-Pulse-Crops
GRDC (2000) Returning nutrients to the soil: canola, vetch stubble extra tasty to microbes. GroundCover, GRDC 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

Trials run in the south of WA at Green Patch in 2015-2017 by SEPWA investigated the costs and benefits of growing vetch for brown manure.

Please see:
http://www.sepwa.org.au/stories/2016/2015_16GrassPatchBreak_CopProfitabilityTrial_\2016Results.pdf

http://www.sepwa.org.au/stories/2016/2016_17GrassPatchBreakCropProfitabiltyTrial_2016Results.pdf

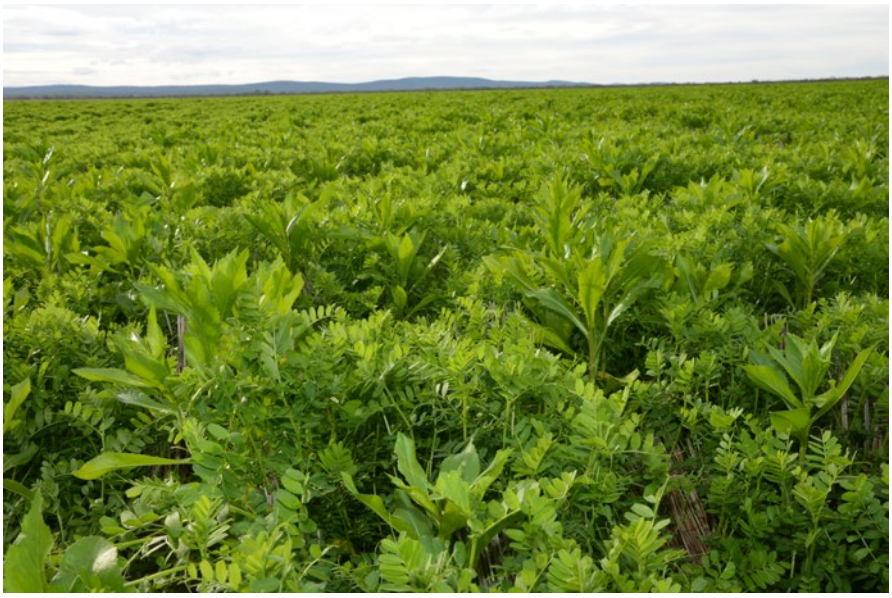


Photo 3: *Vetch being grown with safflower as a manure crop. The vetch provides bulk to outcompete weeds, return organic matter and to fix nitrogen. The safflower can punch root holes through a hardpan and is killed by winter frost before any flower heads are set.*

Source: Emma Leonard, AgriKnowHow

MORE INFORMATION

Do fodder crops improve the and sustainable management of Mallee soils?, http://www.malleecma.vic.gov.au/resources/technical-bulletin/foddercrops2011_final_lowres.pdf

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 4)

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.

Disease break

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

Weed control and herbicide resistance management

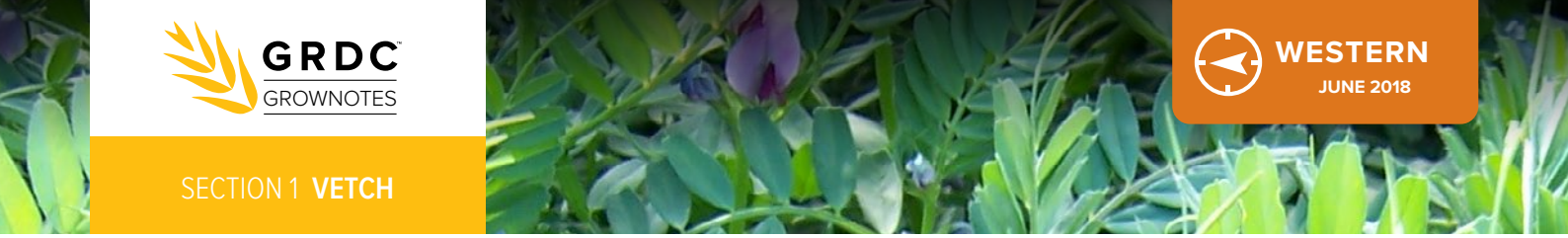
Grass-selective herbicides or manuring vetch can be used to control grass weeds such as ryegrass, barley grass and brome grass. Herbicide options for broadleaf weed control in vetch are limited to pre-emergent herbicides.

Vetch is poor competitor against weeds in its 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 against weeds from seven nodes (10–15 cm high) onwards. (See Section 5)

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.

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).



FEEDBACK

Soil cover

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

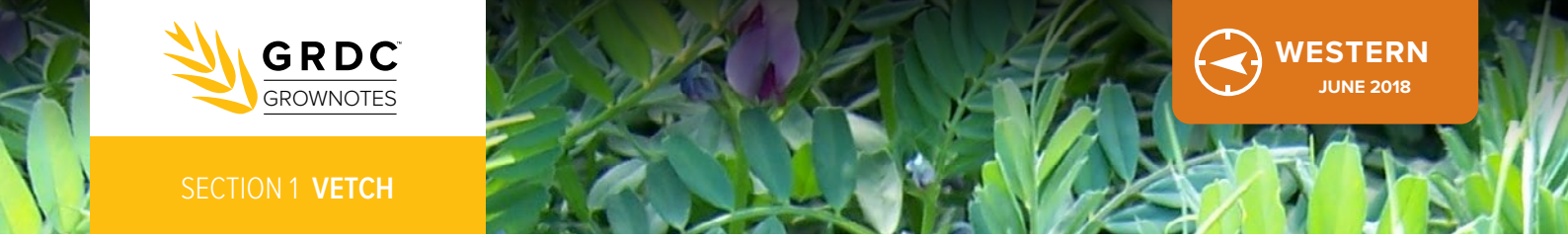
Biology booster

Research in the Mallee found total microbial activity in soil after vetch was 16% greater than after wheat.[10]

1.2.5 Nitrogen fixation

Trials in the south of WA at Green Patch found the nitrogen boost was mainly in the 0–10cm of the soil profile.

10 GRDC (2012) Inoculating legumes: a practical guide. 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 alkaline soils pH ($CaCl_2$) of 5.2 to 8.2. However, vetch is more tolerant of acid soils than most grain legumes, except for lupin, which will tolerate soil pH as low as pH 4.5 ($CaCl_2$).

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 haymaking and grain harvesting.

Vetch species may have a role in farming systems in Western Australia on fine-textured neutral to alkaline and shallow duplex soils where narrow-leaf lupin is poorly adapted.[11]

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

Vetch is also 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 (see Section 2, Table 1).

While including vetch is a good option for dryland situations, vetch 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, died out.

Vetch can be affected by frost at flowering and early podding, as well as by temperature spikes of over 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 (or grain) vetch produces good yields of forage and grain while Woolly pod vetch and Purple vetch are generally grown for dry matter (see Table 1).

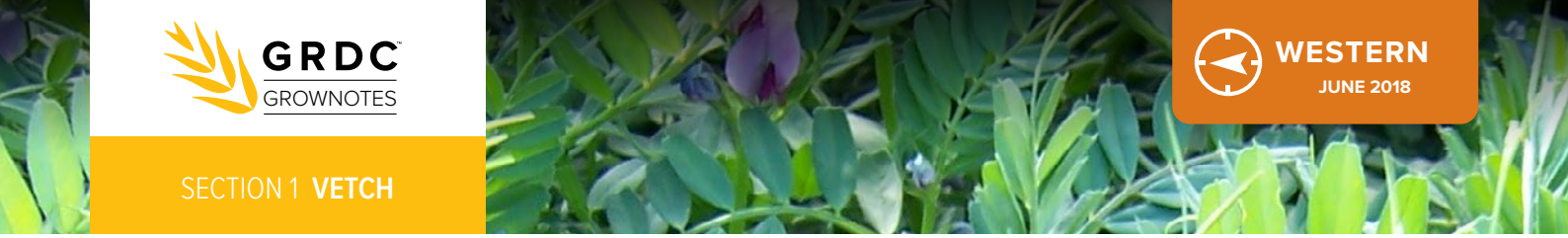
1.3.2 Nitrogen returns

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 with biomass production.[12]

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

11 KHM Siddique, SP Loss (1996) Growth and seed yield of vetches. Aust. Journal of Experimental Agriculture 36(5), 587–593 http://www.publish.csiro.au/?act=view_file&file_id=EA9960587.pdf

12 Proceedings of Nutrition Society of Australia (2002) 26. Victorian institute of Animal Science, Werribee



FEEDBACK

Table 4: Increases in soil nitrogen (kg N/ha) after vetch grown for grain, hay and green manure.

Site in South Australia	Rainfall	Soil texture	pH (H_2O)	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	19	36	21	34	18	31	19.3	33.7	60.5
				Hay				40		43		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	25	38	27	42	22	39		40	63
				Hay				49		51		50	106
				Green manure				68		71		70	188
Peake	384 mm	Loamy clay	8.2	Grain	17	25	21	27	15	36		29	49
				Hay				34		48		41	98
				Green manure				42		56		49	132
Charlick	350 mm	Loamy clay	7.8	Grain	20	32	20	29	17	38	19	33	59
				Hay				40		46		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.

Nitrogen was calculated using formula from SARDI, Soil and Plant analysis to get total nitrogen for 60 cm/ha: [(nitrate nitrogen + ammonium nitrogen) × 1.4] × 3.

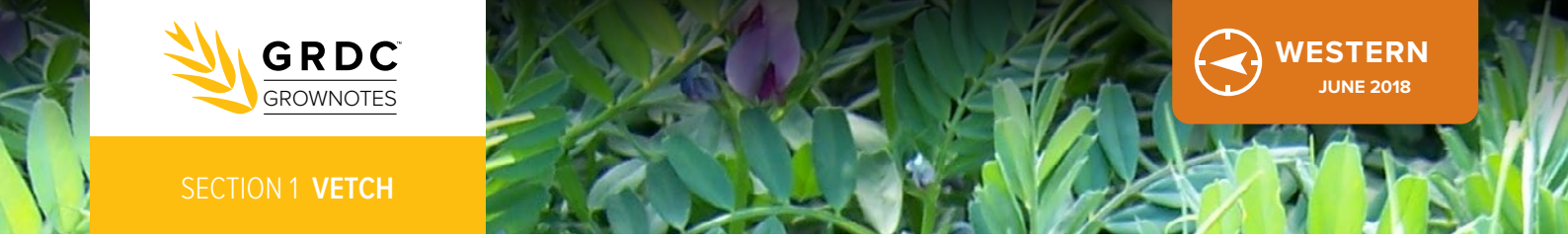
For example, at Blyth three years before a vetch crop soil nitrogen was 19 kg/ha (nitrate + ammonium nitrogen):

(19 x 1.4) × 3 = 81 kg/ha (see comments above about decimal places) total nitrogen (this is not all available for plants)

On the same paddocks after vetch (example for grain production) average was 34 kgN/ha (34 × 1.4) × 3 = 142 kg N/ha

Difference in total nitrogen before and after vetch crop is: 142 – 81 = 61 kg N/ha

Source: R Matic (2016) SARDI



FEEDBACK

1.4 Markets

Vetch grain is mainly used as seed to sow, as feed 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 is 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 Stock feed – ruminants

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

1.4.2 Stock feed – 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 betacyanoalanine (GBC). This toxin reduces growth rates and feed intake of poultry, adversely affecting the metabolism of laying hens. It may also reduce growth rates and feed intake of pigs if included as more than 20–25% of their diet, depending on variety. GBC can give rise to favism, a sometimes fatal haemolytic disease in humans (see Section 2, Table 1).

Grain vetch is also exported into 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 (see Section 2). 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

PBR information South Australian Sowing Guide 2017, https://grdc.com.au/resources-and-publications/all-publications/publications/2016/12/sa-sowingguide2017