Case study

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Mid row crops for vineyards – A demonstration trial

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Key messages

- Crop residues of legume shoots and roots still provide nitrogen during breakdown.
- The use of inoculated legume seed at sowing along with the recommended strain of rhizobia will maximise nitrogen(N) fixation.
- Large volumes of biomass can be generated by sowing field peas and faba beans without irrigation if winter rains dominate.
- Sowing time, sowing rate, seed quality, germination rate and sowing depth are crucial factors which will all affect the desired outcome.
- Discuss appropriate and suitable crop species and varietal selection with your local agronomist, consultant and seed supply company.
- Vineyard operators should practice crop rotation to limit pest and disease pressure.

Introduction

Various winter crops such as brassicas, legumes and pulses are usual suspects in vegetable and broadacre cropping but they are rarely seen in vineyard production systems. Demonstration trials were undertaken at vineyard sites in the Hunter Valley and Orange to investigate the effectiveness of winter crops to establish without applied irrigation. Their ability to capture free nitrogen and generate biomass to drive healthy biologically active soils was assessed.

Figure 1: Cultivation of mid rows in the Hunter Valley, NSW.

In the Hunter Valley there is a tendency to cultivate alternate mid row areas while the adjacent undisturbed row allows tractor access (Figure 1). This is a long-held practice aimed at eliminating competition from weeds and breaking up heavier soils to allow water to infiltrate more readily in wetter years. However, drawbacks include a loss of carbon to the atmosphere, disturbance and loss of soil flora and fauna, which may result in collapsed soil structure and possible sodicity issues. In Orange, permanent mid-row swards (Figure

Figure 2: Permanent mid-rows in Chardonnay at Orange, NSW.

Variety	Sowing rate (kg/Ha)	Cost of seed ($/Ha)
Faba beans – Warda	180	$210.00
Field peas – Morgan	100	$233.00
Fescue – Hummer	10–20	$360.00
Lupins – Luxor	80–100	$205.00
Crimson clover – Soweasy	8–10	$69.00
Forage brassica – Winfred rape	3–5	$123.00

Table 1: Seed varieties, sowing rates and cost per hectare.

Month	Avg. air temp (˚C)		Avg. soil temp (˚C) 10cm		Rainfall mm	
	Hunter	Orange	Hunter	Orange	Hunter	Orange
May	15.1	11	17.1	12.8	20.6	122.8
June	12.1	7.6	13.5	9.5	55.2	266.8
July	11.8	7.2	12.3	8.7	41.2	172.6
August	11.5	7.8	13.1	9.3	36.2	90
September	15	9.7	15.9	11.4	66.2	185.6
October	16.9	11.9	16.7	13	59.6	71.2

Table 2: Onsite weather station data showing average air temperature, average soil temperature and rainfall totals for trial period May 2016 to October 2016.

Variety	Fresh Wt (T/Ha)		Dry matter yield (T/Ha)		N_2 fixed (kg/Ha)	
	Hunter	Orange	Hunter	Orange	Hunter	Orange
Faba Beans	53	65	6.36	10.4	100	170
Field Peas	42	86	7.56	13.7	120	200
Crimson Clover		51		8.1		120
Forage Brassica	36		5.04			

Table 3: Fresh weight, dry matter yield and fixed nitrogen data of the three best performing crops at each site.
Note: N fixation assumptions provided via www.soilquality.org.au/factsheets/legumes-and-nitrogen-fixation-south-australia

2) are typical with either selected grass species and/or naturally mixed grasses and weed species. This allows grasses to uptake excess rainfall and include tractor access at all times. Benefits of this practice include retention of soil carbon, biology and maintenance of soil structure.

Methods

Six winter crop species (Table 1), were dry sown in late May of 2016. The starter fertiliser CROPLIFT ®15 was applied as a band at recommended rate into the top 5cm of fully cultivated soil at the Hunter Valley site and direct drilled into existing soil at the Orange site. Average soil temperature at both sites remained above that of air temperature for the entire trial period and significant rainfall followed planting across both regions over the winter. Record rainfall occurred in the Orange region during the trial period (Table 2).

Biomass cuts were undertaken by cutting complete plant structures at the soil surface using garden shears, with the area cut measured using a one by one metre quad. Data was collected from the three best-performing crops at each site with the averaged fresh weight, dry matter yield and nitrogen fixation figures provided in Table 3. Crops measured at both sites covered the entire mid-row areas to the undervine area, with tall crop heights achieved at both sites. Faba beans (Figure 3) reached over 110cm at the Hunter Valley site and field peas exceeded the height of the cordon wire at the Orange site (Figure 4).

Figure 3: Faba beans in the Hunter Valley.

Figure 4: Field peas reaching great heights in Orange.

Discussion

This demonstration trial was successful in producing biomass and N fixation to promote biologically active soils across two separate wine growing regions in New South Wales. Crop establishment was assisted by record rainfalls across several months especially at the Orange site.

However, not all crops were successful. The lupin crops failed to establish across both regions due to being sown later than the recommendation of early April. This highlights the importance of sowing time. The fescue crop also resulted in sporadic and sparse establishment at both sites, possibly due to sowing depths being shallower than the recommended depth of 10-15cm.

Field peas were the most productive crop in this demonstration, generating the highest tonnage of dry matter yield and fixed nitrogen across both trial sites.

The biomass can be rolled over and left to lay on the soil surface to decay slowly over time, becoming an excellent source of readily digestible labile carbon, which soil biology can feed upon and return into the soil. Alternatively, it can be cut and thrown under the vine row to be used as a temporary mulch.

The use of inoculated legume seeds showed the importance that rhizobia play in capturing free atmospheric nitrogen in plant roots (Figures 5 and 6). Faba beans also produced significant biomass and fixed N with bees highly attracted to its flowers (Figure 7). Crimson clover started slowly but was knee deep by the time harvest data was collected in Orange (Figures 8 and 9). Fresh weight moisture of harvested crops ranged between 80–90 percent highlighting the amount of water captured within plant parts.

Figure 5: Nodules of fixed N on roots of faba beans.

Figure 6: Nodules of fixed N on roots of field peas.

Figure 7: Bees foraging and pollinating faba bean flowers.

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Figure 8: Crimson clover in early September 2016.

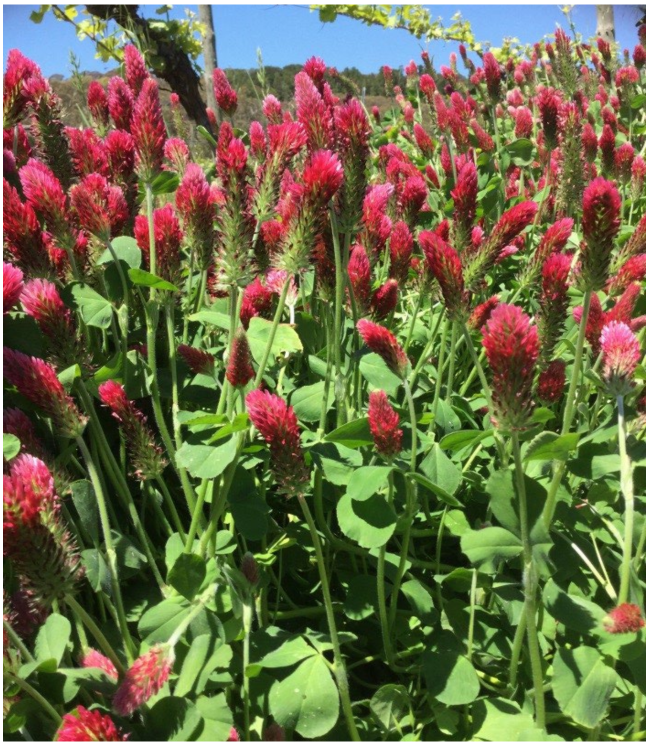

Figure 9: Crimson clover in full flower in October 2016.

More information

For more information on the relationship between cover crops and vine nutrition and water use see the factsheets available on the Wine Australia website www.wineaustralia.com/au/growing-making/vineyard-management/cover-crops.

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