



Non-chemical weed control – Vasse Felix



Background

Vasse Felix has 341 hectares of vineyard spread across the Margaret River region in Western Australia. The soils range from gravel to gravel or sandy loam over clay. The climate is Mediterranean with strong maritime influences. Of the 1,122 mm of average annual rainfall, 76% falls outside of the growing season. Of the 341 hectares of vineyard, 311 hectares are undervine drip irrigated and 30 hectares are dry grown.

In 2015, Vasse Felix started transitioning its vineyards to organics, giving Vineyard Manager, Bart Molony, the challenge of managing weeds without herbicides.

Key non-chemical weed control practices:

- Inter-row cropping to compete with weeds in the mid-row .
- Rolling or mulching of annual mid-row cover crops in spring.
- Mechanical undervine sweeping to keep weed growth out of the canopy.
- Sheep grazing in winter to reduce weed pressure.
- Mow and throw of the mid-row sward to establish desirable crops undervine to aid weed control.

Key results:

- 150% increase in soil organic carbon levels in the mid-row of blocks with permanent swards and annual cover crops, compared to herbicides.
- An elimination of herbicides by using undervine cover crops and sweepers.
- Reduced need for weed control establishing desirable crops undervine.
- Elimination of at least one weed control pass by grazing sheep in winter.



Weed control overview

When Vasse Felix first transitioned to organics, its approach changed from trying to get rid of weeds with herbicides to managing weed growth using mechanical methods. Through trial and error, the company now uses a combination of tools rather than trying to find the perfect single tool that does everything. This is particularly important when dealing with difficult to control perennial grasses such as couch and kikuyu.

With the elimination of herbicides, Bart has noticed a major change in the types of weeds found in the vineyards. Overtime, a more balanced and diverse species mix has established in the mid-row and undervine, which requires much less active control. In addition, Vasse Felix has also changed the way it views weeds in the vineyard. It now recognises the value some weeds bring to the vineyard (Table 1).

Table 1. Weeds recognised as adding value to Vasse Felix vineyards

Tolerated weeds	Reason for tolerance
Rye grass	Increases soil carbon
Flat weed	Improves soil structure
Cape weed (in winter)	Host for beneficial insects
Clovers and medics	Fix nitrogen



Figure 1. Flat weed (photo courtesy of HerbiGuide)



Figure 2. Capeweed (photo courtesy of HerbiGuide)



Figure 3. Kikuyu (photo courtesy of HerbiGuide)



Table 2. Weeds that have a negative impact on Vasse Felix vineyards

Weeds NOT tolerated	Reason for lack of tolerance
Couch	Highly competitive for water and nutrients
Kikuyu (found everywhere except sandy soils)	
Plantain	



Figure 3. Plantain (photo courtesy of HerbiGuide)

Vasse Felix has developed a much more considered approach to weed management where consideration is first given to what the weeds are doing before jumping in to control them. If the weeds are not having a negative impact on the vineyard, or if the control option is more damaging than the weeds, the weeds are tolerated.

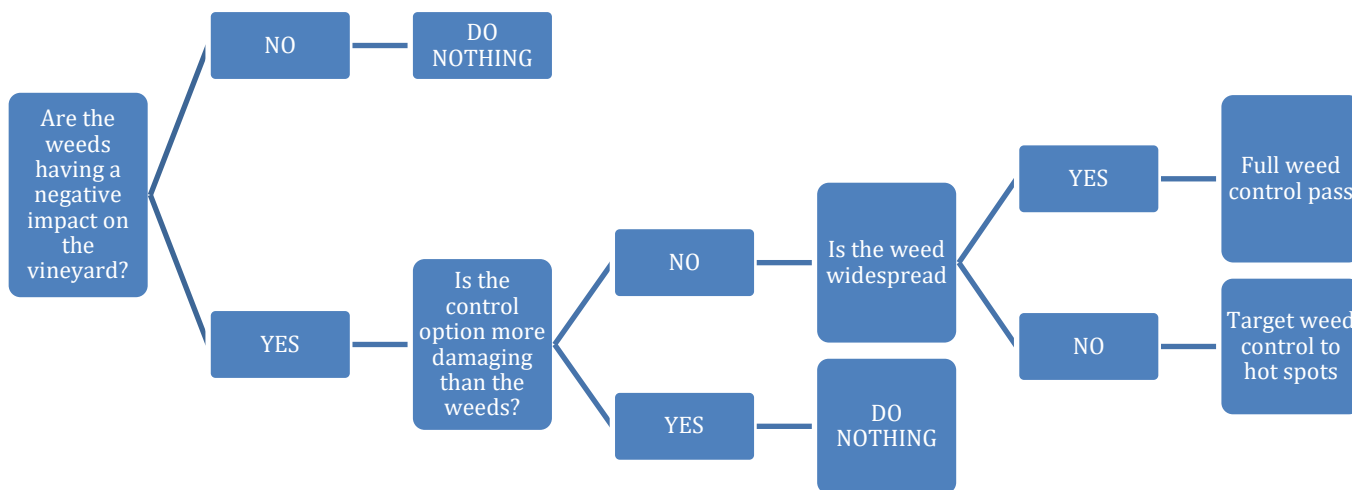


Figure 4. Weed control decision tree (modified version of Bart Molony's weed control decision tree used at Vasse Felix)



Detailed description of weed control practices

Mid-row weed management

Vasse Felix uses an annual cover cropping program to rejuvenate the vineyard soils before permanent swards are established. A 12-species mix of legumes (peas, serradella), cereals (oats, rye, corn) and brassicas (radish) is used, with the goal of building soil organic carbon levels and improving soil structure. The annual cover crops are mostly seeded with a direct drill in autumn when adequate rainfall for crop establishment is likely. The crops are either rolled or mulched in late spring to reduce competition with the vines. The cover crop debris creates a thick mulch that helps to protect the soil from erosion and high summer temperatures. Managing the annual cover cropping program with minimal tillage techniques protects the soil organic carbon and soil structure from degradation, a practice that complements the soil rejuvenation program.



Cultivation increases the degradation of organic matter and breaks up soil aggregates, diminishing soil structure. Techniques such as direct drilling of seeds and rolling green manure crops help Vasse Felix retain soil carbon and conserve soil structure.

After the rejuvenation period, a diverse permanent sward mix including two types of clover, annual rye grass, low-growing oats, medics and perennial rye grasses is direct drilled into the mid-row. The perennial grasses are rolled or mulched after seed set to encourage regeneration the following year. The permanent swards are rejuvenated every few years or as required with a green manure crop and then resown with a permanent pasture. The way mid-row growth is managed depends on the site, season and whether the block is sown with an annual cover crop or a permanent sward.

In its southern vineyards, where conditions are favourable for growing pastures, Vasse Felix grazes sheep in the permanent sward blocks over winter. During the growing season, mowing is used to manage growth in the mid-row. Introducing sheep into the vineyard helps keep the vegetation out of the canopy and is useful for controlling woody weeds and perennial grasses; however, Bart stresses that it is important not to over-graze a vineyard, particularly an organic vineyard. Sheep export nutrients off the property and can cause soil compaction if managed poorly. Fencing is used to ensure the stock rates and grazing time are matched to the weed growth and grazing area.



Introducing sheep into the vineyard has provided a source of revenue from sheep agistment and has eliminated one undervine weed management pass and one mid-row weed management pass.

Sheep are also good at controlling woody weeds and provide a source of manure.

In Vasse Felix's northern vineyards, the ironstone rock soils moderate plant growth. In most blocks, the mid-row sward growth is not adequate to support sheep over winter and in dry years, does not require management during the season. In wet years, the summer grasses in the mid-row permanent swards are rolled to keep them out of the vine



canopy and to create a surface mulch that protects the soil from extreme heat and erosion. Clovers start to push through the mulch, providing a source of nitrogen for the sward.

Annual cover crops:

- Seeded with a direct drill in autumn.
- Rolled or mulched in late spring to reduce competition with the vines.



The thick thatch from the cover crop protects soil from erosion and high summer temperatures.



Permanent swards:

- Seeded with a direct drill in autumn.
- Low vigour site:
 - Rolled in wet years
 - Left in dry years.
- Higher vigour site:
 - Graze sheep
 - Mow.



Delaying mowing and rolling until after seed has set encourages regeneration.

Figure 5. Mid-row weed control practices; (left) mid-row sward pre-rolling; (right) mid-row sward post rolling (photos courtesy of Bart Molony, Vasse Felix)

Undervine weed management

Undervine weed growth is generally only managed if it starts to grow up into the canopy. In dry years, the low vigour blocks in Vasse Felix's northern vineyard require very little undervine weed management because the weeds tend to hay off before they start to grow into the canopy. In wetter seasons, and in higher vigour blocks, Vasse Felix uses modified industrial sweepers to keep weed growth out of the canopy. The sweepers generally do not kill the weeds; instead, they flatten the weeds, keeping them out of the canopy. Some weeds, such as wild radish, can be pulled out of the ground by the sweeper. The best results are obtained when grasses are swept after they have hayed off. In wet seasons, such as the 2020-21 season, multiple passes may be required. Vasse Felix sets its double-sided sweepers 10 mm above the ground and the sweepers can travel at 3.2km/hr.



Moving away from herbicides and maintaining plant cover across the whole vineyard has increased soil organic carbon levels by 150% with no major effect on yield or vine growth.

Instead of using an undervine seeder to establish crops undervine, Vasse Felix mows and throws the mid-row swards to spread seed undervine. This method has been found to be a cheap and effective way to establish desirable plants undervine, but the timing is important. Slashing needs to be delayed until after the mid-row has hayed off to ensure that mature seeds are spread undervine. Vasse Felix is also trialling a broad acre super spreader to spread a mix of seed and compost in the mid-row and undervine areas of its vineyards. Compost is added to the seed mix at



a rate of 3-5m³/ha to aid the spreading of the seed and to provide the germinating seeds with a source of nutrients.

Compost is banded undervine in weak sections of the vineyard at a rate of 50m³/ha every three years. The compost is applied after the annual grasses have hayed off but prior to the sub-soil drying out, which results in less weed growth in the undervine area after composting. Compost applied at this rate does not provide any weed control but gives the vines a good boost. The compost is made on-site from wood chips (200 m³), grape marc (400 m³), 20 straw bales and cow manure (60 m³). Enough compost is made to cover 5-10 ha/year.

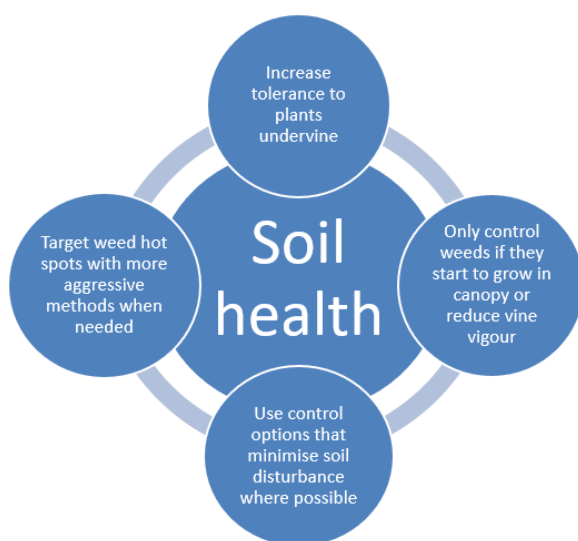


Figure 6. Undervine weed control practices at Vasse Felix



Figure 7. Undervine sweeper

Managing challenging weeds

Vasse Felix controls patches of couch and kikuyu in the mid-row and undervine areas of its vineyard using cultivation and competitive cover crops. The weed-infested areas are cultivated with a disc cultivator to break up the soil, followed by a power harrow to pull up the weeds. In the mid-row, the cultivated areas are sown with a green manure or a pasture crop in autumn that competes with couch and kikuyu. Options are being considered for establishing crops in the undervine areas to help keep the couch under control.

The best results are achieved when cultivation is timed to occur just before a stretch of really hot days. High temperatures help to kill the exposed couch. In cool conditions, Slasher, an organic herbicide, is applied to give the couch and kikuyu a knock before cultivation. This technique mimics the effect of hot weather and reduces the risk of the couch and kikuyu re-establishing.



Where to next?

Vasse Felix's long-term goal is to establish permanent swards in the mid-row and undervine area of all of its vineyards that do not grow into the canopy and require less maintenance. Ideally, the company wants to establish diverse crops that include nitrogen-fixing plants such as clover, legumes and medics, as well as annual rye grass, flowering plants, and low-growing oats for bulk. Bart sees the use of crops to suppress weed growth as a way of "building a system up rather than pulling it down".



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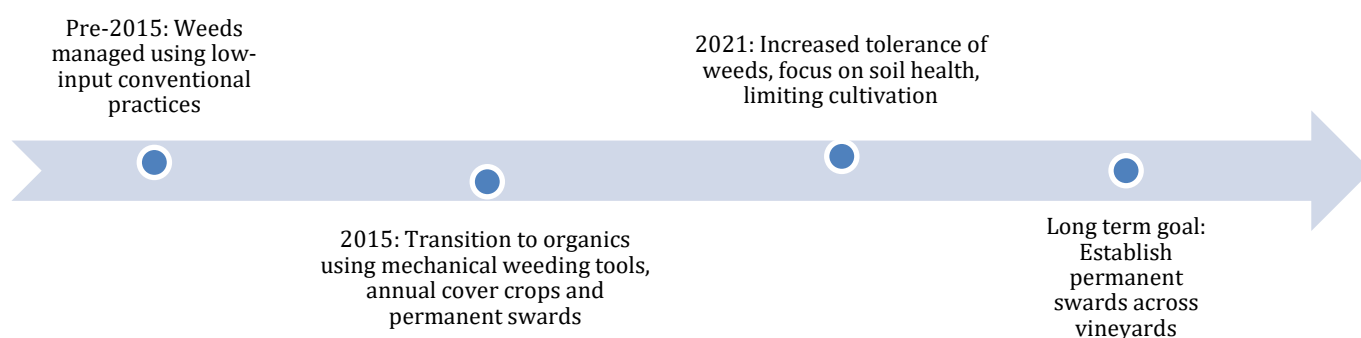


Figure 8. Progression of weed control practices at Vasse Felix

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References and further reading

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[Cover crops and weed suppression](#) (Wine Australia fact sheet)

[Cover crops and vineyard floor temperature](#) (Wine Australia fact sheet)

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Organic Winegrowers New Zealand. 2017. [Undervine weed management – A practical guide to effective weed control in organic vineyards](#)



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Contact

For further information, please contact:

AWRI helpdesk

Phone 08 8313 6600 **Fax** 08 8313 6601 **Email** helpdesk@awri.com.au

Website https://www.awri.com.au/industry_support/viticulture/pests-and-diseases/weeds/

Address Wine Innovation Central Building, Corner of Hartley Grove & Paratoo Rd, Urrbrae (Adelaide), SA 5064