ORGANIC
WINEGROWERS NEW ZEALAND

Undervine Weed Management

A practical guide

to effective weed control in organic vineyards

A publication produced by Organic Winegrowers New Zealand
www.organicwinenz.com

NEW ZEALAND WINE
PURE DISCOVERY

ACKNOWLEDGMENTS

Produced by
Organic Winegrowers New Zealand,
with funding support from
New Zealand Winegrowers.

NEW ZEALAND WINE
PURE DISCOVERY

Scientific consultant
Charles Merfield

Writer
Anna Lambourne

Grower advisory panel
Bart Arnst, Jonathan Hamlet and the Organic Winegrowers New Zealand executive committee

Graphic design
Megan Boreham

Project coordinator
Rebecca Reider

Photos courtesy of
Black Estate, Clos Henri, Kiwi Seeds, Max Marriott, Mission Estate, Peregrine Wines, Supernatural Wine Co., Te Whare Ra, TOSQ, Villa Maria Estate, Wither Hills

ORGANIC
WINEGROWERS NEW ZEALAND

Organic Winegrowers New Zealand is a grower-led organisation providing education, networking, and advocacy for organic producers and other interested members of the New Zealand wine industry.

To become a member, visit our website:
www.organicwinenz.com

INTRODUCTION

Organic weed management is an increasingly important topic for New Zealand grape growers. Weeding is often the most intricate technical challenge for new organic growers to master.

It is not only organic growers who are using these techniques. With herbicide-resistant weeds on the rise, many conventional growers now face the need for alternative weed management methods. This booklet aims to make organic weeding practices accessible to all growers.

Organic vineyard managers need to achieve effective weed control without using synthetic herbicides, and ideally with minimal disruption to the soil. Weed management is a critical operation due to its impact on vine vigour and yield.

Organic Winegrowers New Zealand has produced this booklet drawing on current science and the practical know-how of New Zealand's most experienced organic viticulturists. It is grounded in an ecological understanding of vines and soil. The aim is to help growers:

- understand the options for organic undervine weed management
- decide which options may be right for your vineyard
- understand the practical 'how-to' of weed management
- understand potential issues that may arise, and how to address them.

Contents

What Undervine Weed Management Options Are There?

Most organic growers choose one of two options: mowing or cultivation. Each of these options has a place in weed management for different vineyard situations. It is also common for organic growers to include other weeding methods such as hand weeding, grazing or mulching at specific times of the growing season or in particular situations.

CULTIVATION

The most commonly used weed management option. Cultivation works by disturbing or cutting the root system so that the plant dies from drying out before it can re-establish its roots. Cultivation can also kill small weeds by burying them in a soil mulch. It easily controls small weeds and is most effective in hot, dry weather with dry soils.

MOWING

Mowing is used to control weeds by cutting or shredding the foliage. It is most effective on annual weeds before they flower and set seed; specific timing and frequency of mowing varies with species and vineyard location. It is a relatively quick operation and causes minimal soil disturbance.

GRAZING

Grazing is a supplementary weed management practice for many organic vineyards. Sheep are the most practical grazing animal due to their size and relative ease of management. It is common practice to use grazing for weed control from leaf-fall through spring.

HAND WEEDING

Hand weeding is often used in conjunction with other weed control methods to remove remaining weeds which machinery has left behind around vine trunks and posts. It may also be done to remove weeds around young vines. It is a labour-intensive and costly option.

MULCHING

Mulching limits weed growth by blocking sunlight and moisture from reaching new weed seeds. Organic materials such as grape marc and straw may be used as mulches. Mulches also help with moisture conservation and can add nutrients to the soil. However, due to cost, this is not a commonly used option on large vineyard areas.

SCARIFIERS

Scarifiers offer a middle ground between mowing and cultivation. A scarifier aims to destroy all of the weed shoots and stems, which can either kill weeds or at least set them back much more than mowing, with less soil disturbance than cultivation. This method has had limited use in vineyards and needs more trials to determine effectiveness.

Grower Tip

"To successfully establish young vines, reducing weed competition is critical. Mowing does not reduce competition enough on its own."

Sheep can help with winter weed management in the vineyard.

Early spring undervine cultivation.

Choose a Weeding Method That Suits You

When you are considering what undervine weeding methods and equipment to use, you need to make the decision based on your own situation and vineyard characteristics. Start by considering the soil type and slope of the vineyard. These will dictate generally which type of undervine weeding will suit. Once you have a starting point, you can consider other parameters that may affect your final decision. There are pros and cons for all methods and types of equipment.

MATCHING EQUIPMENT TO YOUR VINEYARD

STEP 1 : CONSIDER SOIL TYPE AND SLOPE SUITABILITY

	LARGE OR EXCESSIVE STONES	STONE / GRAVEL	SAND	SILT / LOAM	CLAY
MOWING	Not practical	Stones must be flush with soil or removed		May require additional mowing in wet seasons	
CULTIVATION - DRAFT TOOLS	Very difficult		Difficult to mound up due to lack of soil structure		Difficult if wet or very dry
CULTIVATION - POWER TOOLS	Very difficult	Stones move to interrow and often require levelling after	Difficult to mound up due to lack of soil structure		Difficult if wet or very dry
GRAZING				Compaction issues for wetter areas	
HAND WEEDING	Potentially more difficult			More difficult when very dry	
MULCHING*	Potentially difficult to place mulch undervine via side-throw mowing				

Easy Potentially Difficult Most Difficult

** Windy sites may also present challenges regarding the staying power of lightweight mulches.*

Grower Tip

"Choose your weeding strategy and equipment based on an ecological understanding of your vineyard. This includes a consideration of soil type and vineyard history. If vine roots are concentrated close to the surface, consider how you will help them go deeper over time, to adapt to mechanical weed management."

SLOPE CONSIDERATIONS

If you are intending on operating on very steep terrain, it is important to have machinery that will cope. Consider 4WD tractors and ensure that your tractor is not under-powered.

If you are intending to operate on terrain with cross-slope or terraces, use a single-sided weeder rather than double-sided. You need to ensure that your equipment and implements can accommodate different heights for each side of the machine.

Figure 2-1: Double-sided weeding is impractical on rows that run across a hill slope. The two sides of the implement will hit the ground at different heights.

STEP 2 : CONSIDER ADVANTAGES AND DISADVANTAGES OF EACH METHOD

The next step is to understand the advantages and limitations for each of the options identified as suitable.

Overall Performance Rating System ☆ POOR ☆☆ AVERAGE ☆☆☆ GOOD

	MOWING	CULTIVATION DRAFT TOOLS	CULTIVATION POWER TOOLS	GRAZING	HAND WEEDING	MULCHING
Weed competition with vines	☆	☆☆☆	☆☆☆	☆	☆	☆
Soil disturbance ☆ = significant disturbance ☆☆☆= little disturbance	☆☆☆	☆☆	☆	☆☆	☆	☆☆☆
Young vines	☆	☆	☆	☆	☆☆☆	☆☆☆
Operation speed	☆☆☆	☆☆	☆☆	☆	☆	☆
Operation cost	☆☆	☆☆	☆	☆☆	☆	☆
Labour efficency	☆☆☆	☆☆☆	☆☆☆	☆	☆	☆

STEP 3:
CHOOSING A CULTIVATION TOOL, IF NECESSARY

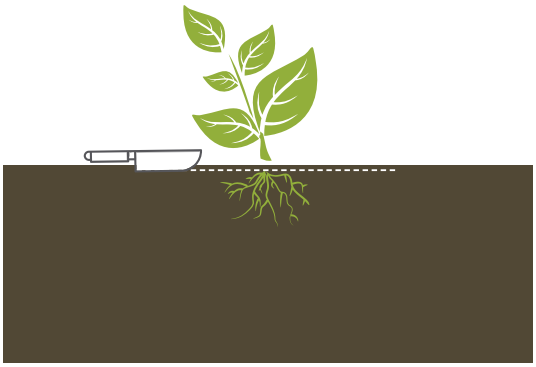
If you are considering cultivation, there are two types of equipment to choose from: draft tools and power tools.

DRAFT TOOLS – CONSIDERATIONS

- Simpler and cheaper than power tools
- Disturb less soil
- Generally quicker operation than power tools
- May not kill large weeds as effectively as power tools

HORIZONTAL

Knife blades cut weeds off. They aim to separate the shoot from the stems at the hypocotyl.
If set correctly, blade can cut just a few cm deep; this causes little soil disturbance and has less impact on vine roots.



VERTICAL

Tines, disks, chisels. These tools can rip whole weeds out or chop, mix and bury weeds in soil 2-10 cm deep to kill them. Mixes and moves more soil than a blade tool.

POWER TOOLS – CONSIDERATIONS

- Cause more soil disruption and soil structure damage than draft tools
- Can kill larger weeds
- May require more tractor power to operate
- Higher cost for maintenance and parts replacement
- The more aggressive a tool, the more weeds it kills, but it also will require more power and cause more soil damage.

EXAMPLES OF POWER TOOLS

Figure 2-2: Rotary hoe

Figure 2-3: Vertical spring rods

Figure 2-4: Vertical power harrow

Grower Tip

"We operate on a hilly site and had struggled with topsoil erosion due to water running off our compact soils. We were initially concerned that the erosion would increase once we disturbed the soils with undervine cultivation. We were happily surprised to find that the opposite was the case. When we started operating an organic system, undervine cultivation and increased ground cover led to increased water infiltration under the vines, resulting in less runoff and much less erosion."

STEP 4: Consider compatibility of weeding method with your existing equipment

When you are deciding what equipment to use for weeding, consider the following:

- Does your current tractor have adequate oil flow to run the equipment?
- Does your tractor have adequate hydraulic outlets for the equipment?
- Can your tractor and the equipment cope with the slope?
- What position can you mount the equipment?

Front-mounting	Good placement Visual monitoring easy Allows for rear-mounted machinery to be used at the same time Can make steering more difficult
Mid-mounting	Most accurate placement Visual monitoring easy Allows for rear-mounted machinery to be used at the same time
Rear-mounting	Simplest and most common position Least accurate placement Poor visual monitoring

- Do you want to operate the equipment on one side of the row or two at the same time?

One-sided equipment	Lower capital cost Higher operating cost. Can double operation time, depending on equipment; however, some one-sided tools have faster ground speed
Two-sided equipment	Higher capital cost Lower operating cost (faster to operate) Requires more power from the tractor

Grower Tip

"Invest in an automatic weeding sensor bar to guide tools around vines and posts. Don't rely on a manually operated system. The damage to vines is not worth it. Maintain the ability to override the sensor bar for exceedingly crooked trunks and other unforeseen obstacles."

Grower Tip

"Use a contractor to start with for weed control, and look at the various options before you invest in a weeder of your own."

How to Carry Out Effective Undervine Weeding

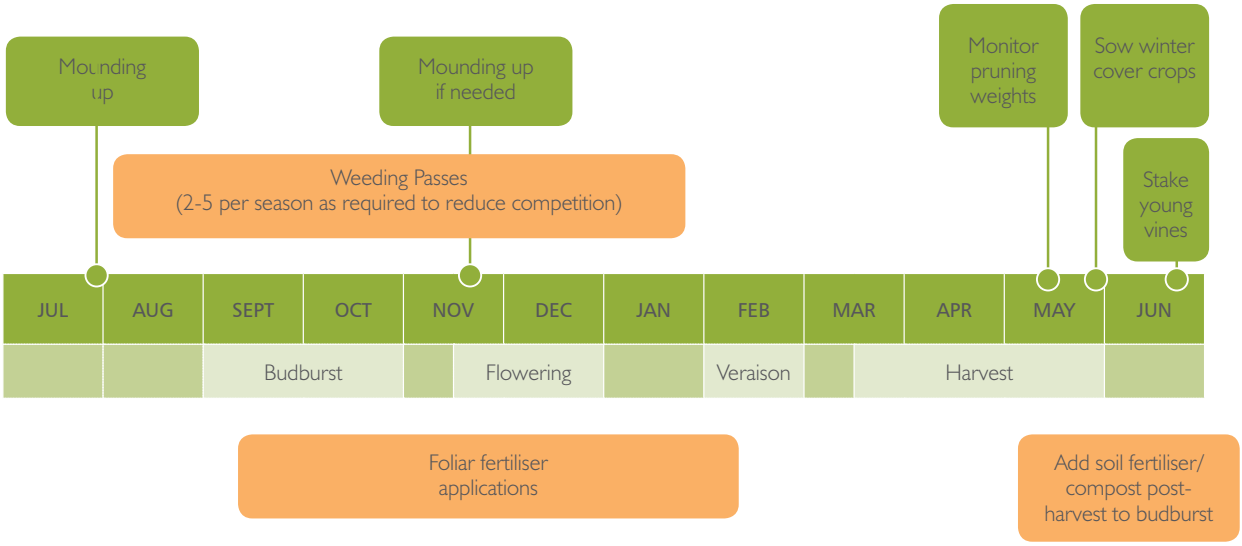
WEEDING STRATEGY
SET UP YOUR VINEYARD
WHEN TO WEED / CRITICAL TIMES
CULTIVATION TIPS
MOWING TIPS
INCORPORATING HAND WEEDING OR GRAZING
HOW TO MANAGE YOUNG VINES
MULCHING
POTENTIAL ISSUES AND HOW TO ADDRESS THEM:

- REDUCED VINE VIGOUR
- COMPACTION

WEEDING STRATEGY

Effective undervine weed management is the result of multiple actions coming together. It is not only about what equipment to use, but also when and how to use it effectively. This includes considering what impact your weed control method may have on your soil and vine health, and taking steps to support vine health throughout the process.

The following diagram provides an overview of a seasonal weed strategy, highlighting important activities and timings to consider.



Grower Tip

"The biggest test around weeding is the strength of character in you, as the manager or owner, to allow your vineyard to look 'rustic,' and to change your belief of what a vineyard should appear to look like from the outside."

SET UP YOUR VINEYARD

If you have decided to use **ANY** kind of mechanical undervine weeding method, be it mowing or cultivation, there a few crucial things you must do before you start, in terms of setting up your vineyard.

STEP 1	**SUPPORT YOUNG VINES**
	Young vines need to be protected. Staking young vines is essential.
	There needs to be something strong and rigid alongside the vine to activate the weeder's sensor arm so that the implement can retract and move around the vine.
	Your stake choice should give support for three seasons.
	Options include either two bamboo stakes around each vine, or a single 10mm steel rod.
STEP 2	**LIFT IRRIGATION WIRES**
	To avoid damage from weeding operations, lift irrigation wires and lateral pipe to 500mm so they are above the weeder sensor bars.
STEP 3	**PROTECT IRRIGATION FLUSH VALVES / SOLENOIDS**
	Any infrastructure that may get damaged needs to be either moved or protected to avoid ongoing damage issues.
STEP 4	**DEAL WITH STONES** On stony soils, undervine weeding may cause some issues for machinery and staff.
	Stones should be flush with soil if you are planning to mow.
	Stones can be tossed out into the row by weeding machinery. To get stones back undervine, consider using a levelling bar, which pushes stones out to the edge of the row.
	Manually remove any large rocks unearthed after first weeding pass.
	Be aware that interrow cultivation can also bring up more stones, resulting in a rougher tractor ride unless stones are dealt with.
	As with all machinery operations, undervine machinery works best when the midrow is flat and smooth.
STEP 5	**MOVE DRIPPERS**
	Often machinery misses weeds growing directly beside vine trunks. If drippers are located beside trunks, they will be directly irrigating these weeds. Move any drippers located immediately beside vine trunks to a third of the way along the inter-vine area.

WHEN TO WEED/CRITICAL TIMES

Timing your weeding is a balancing act involving time of the season, weed size, weather and vine age. However, there are no hard and fast rules; weed when necessary to reduce competition with vines.

Weed Size

- Weeds are easiest to kill when they are small. It's ideal to kill them before they have four leaves or surpass 5cm in height.
- Weeds get harder to kill as they grow bigger. Weeds higher than 15cm can survive even the most aggressive weeders.
- Larger weeds can block machinery and require lower operating speeds, both of which increase work hours.
- Weeds must be killed before they set seed. If you see flowers on the weeds, it is nearly too late; it is your last chance to weed, as seed set will follow in days, not weeks.

Time of Season

- Early season weed management is important. Whether undervine cultivating or mowing, aim for a clean understory pre-budburst. This will give the vines the best chance to maximise vigour.
- The most critical period for weed competition is from budburst through veraison. Keeping the vines competition-free for the first two months after budburst gives the vines the best opportunity to attain the required growth and vigour.
- Weeds just a few centimetres high can reduce vine vigour.
- During winter months, presence of weeds is not as much of an issue. But remember, do not let weeds get bigger than 5-10cm or go to seed.
- Plan bud rubbing rounds with weeding rounds in mind, so that you remove as many buds as possible without covering them up with the weeder.

Vine Growth Stage

- Weed competition is most critical during the early stages of vine growth, usually the first three years after planting.
- Weed competition can decrease survival, severely retard vine growth, and prolong the time before a vineyard comes into production.

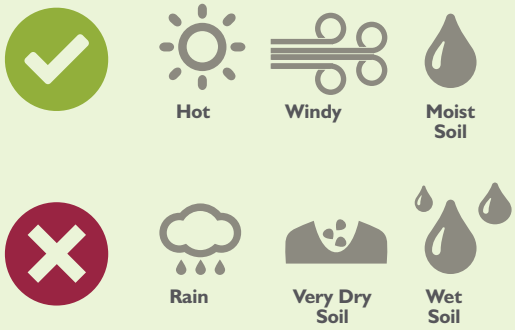
Grower Tip

"The best task to master in an organic vineyard is undervine weeding. Operators need to be well trained, as incorrect use can destroy vines and vine roots. The manager needs to have a clear direction for the block and be prepared to try different strategies to achieve it. Being observant and proactive throughout the season is critical."

Figure 3-1: Stake young vines to protect them from cultivation.

CULTIVATION TIPS

Weather and soil moisture are important for timing your cultivation.



- If you are cultivating, finding the balance when both weather and soil moisture are appropriate can be tricky.
- Ideally, pick times to weed when the weather will be hot and windy but soil conditions are still moist, to get the best results.
- Hot dry weather and hot dry soils are ideal for weed death. Weeds that have been disturbed but not killed will dry out before they can regrow.
- However, dry soil can be hard to cultivate, which results in lower weed kills. On fine silt soils, dust can also be a significant issue, especially when using powered cultivators such as rotary hoes.
- Weeding in rain and wet soils can result in a very low weed kill, and can be a waste of time.

- **The first cultivation pass (the 'mounding up' pass) is the most important**, as you set the area up for cultivation under the vine. Be aware of the width of the implements, making sure your wheel width is significantly within the space between the cultivated strips, to avoid wheels 'tracking' into the undervine area.
- For the **first pass after herbicide control, you may need to cultivate the undervine twice** if soils have been heavily compacted. If the cultivated soil sticks together in hard slabs, a second cultivation pass will make it more friable.
- If you are on stony soils, be aware that **during the first cultivation pass a lot of rocks may be unearthed.** Any large rocks need to be either removed from the interrow manually, or pushed back undervine using a trailed A-frame unit.
- After the initial 'mounding up' stage of cultivation, **do not cultivate too deeply.** If cultivation is too deep, the weed roots will sit in the same place and then with irrigation or rain can easily and quickly re-root and establish. Instead, a shallower cut takes these weeds out, pulls them from their location and moves them slightly down the row, disrupting the weed roots.
- **Speeds of 4-6km/ hr are ideal.** If you go too fast, you may get an unweeded shadow effect around the base of each vine.
- **Undervine cultivation can result in a rut beside the vine.** This can impact on other operations in the vineyard such as trimming, leaf plucking and spraying. Avoid ruts by offsetting the implement further so that tractor wheels do not fall into the undervine area. This is especially important in vineyards with narrow rows.

MOUNDING UP

Mounding up is the quickest undervine weed control method. This refers to the process of cultivating the soil and heaping it up under the vines. Mounding up is often undertaken post-vintage or in the winter. This creates a soil mulch which then breaks down over time and provides an easier area to cultivate in the following spring.

A second early-season mounding up is often carried out, creating a mound to cut away at for the rest of the season.

Mounding up is sometimes used to raise soil levels back up to normal, as some weeding methods can create a 'dishing' or hollow effect under the vine.

MOWING TIPS

Mowing controls undervine and interrow weeds by cutting or shredding the foliage. Be aware that using mowing as the main weeding strategy can leave behind a fair amount of weed competition, leading to reduced vine vigour. Therefore mowing is most suitable on vigorous sites.

When

- Mowing before or while weeds flower will reduce seed set. The timing of this will vary based on weed species present. Mowing passes may number 3-5 in a season, or more in wetter climates.
- Ensure you have a clean understory pre-budburst.
- During times of frost risk, mow the interrow and undervine areas more frequently than the rest of the season, especially if no other frost protection is available.

If mowing interrow cover crops, consider side-throw mowing/mulching. This is a way to produce mulch material which can suppress weeds in the undervine areas. Slasher mowers are preferable to mulchers (e.g. flail mowers). The coarser material produced by slashers will break down more slowly and have a longer effective life as a mulch.

Figure 3-2: Mowing in progress

Figure 3-3: Mowing results

Grower Tip

"We mounted an old spray unit on the back of the tractor that we use for weeding, which meant we were able to spray a fertiliser mixture every time we did a weeding pass."

Cover crops enhance soil life, giving vines a nutritional boost that helps them adapt to undervine weeding.

Top: *Sowing a cover crop of ryecorn, oats, lupins, kale and red clover in alternate rows, Central Otago. Undervine cultivation and seed sowing are done together here, in the same tractor pass.*

Left: *Crimson clover grows in a Marlborough vineyard.*

HAND WEEDING

Hand weeding is best incorporated into an overall weeding strategy as an annual or biannual maintenance programme. The aim should not be to achieve an absolutely clean undervine area, but to remove the most aggressive weeds. This compliments other weed management techniques.

Why

There will always be a percentage of weeds that cannot be controlled by machines. If these weeds are tall or are competing with surface vine roots, they need to be hand-weeded.

Where

- Mostly very close to vine trunks or next to posts/ strainers.

How

- Grubbing is most effective.

When

- It is best to grub immediately after a cultivation pass, as the weed's root system may already be damaged, meaning less effort is required to remove weeds. Make sure weeds are removed before they set seed.

Consider

- Balance time and cost when considering your approach.
- It is cheaper to do hand weeding regularly when weeds are smaller.
- Good instruction to staff or contractors is essential.
- Integrating hand weeding with other operations is more cost-effective.
- Hand weeding improves the efficiency and performance of mechanical weeding and mowing.

Figure 3-4: Grubbing is the most effective hand-weeding method

Grower Tip

"Twice a season we combine hand weeding around the posts and vine trunks with bud rubbing. By combining the two tasks together it makes hand weeding much more cost-effective."

GRAZING

Grazing sheep can be useful during winter to clean up the undervine area, prior to budburst. Avoid grazing sheep in the vineyard while pruning or while there are pruned canes on the ground, as sheep will spread around the pruned canes, making mulching harder. Sheep can also be used for leaf plucking, which will clean up the vineyard floor at the same time; this may save you a weeding round. However, problems can arise if sheep prefer to eat vines and not the understory, so monitor weed levels. A winter-grazed vineyard results in a very clean understory for the first weeding pass of the season, making weeding more effective.

Cattle are also an option. They will often clean up more mature grasses high in lignin and cellulose that sheep avoid. An undervine application of molasses or seaweed can help encourage cattle to graze in this area. However, the infrastructure setup required to manage cattle is greater than for sheep.

Check with your organic certifier for any stock quarantine requirements before bringing grazing animals onto a certified organic vineyard.

HOW TO MANAGE YOUNG VINES

If you are establishing young vines and want to use either cultivation or mowing, there are a number of additional things to consider.

- Stake young vines. Young vines must be staked for two reasons:
  1. There needs to be something strong and rigid to activate the weeder's sensor arm so that the implements can retract and move around the vine.
  2. Provide added support for the vine.
  Your stake should last for three seasons. The added support that you give your young vines will also result in straighter trunks, reducing problems in the future.
- Set your machinery's sensor to a more sensitive setting.
- To further reduce competition for the vines, consider cultivating the interrow for the first season, either every row or every second row.
- Remember that young vines may need extra nutritional inputs to ensure good establishment.

Replants

Replants will require extra hand weeding, nutrition and water. When you replant a vine in an established block, punch in an extra dripper in the irrigation line directly above the new vine, so that the replant gets extra irrigation. After two to three years, once the vine is established, this dripper should be plugged, as such dripper placement can cause weeds to build up around the base of the vine.

Add compost and/or mulch to provide nutrition and suppress weeds.

Grower Tip

"Three times a season we fill up the water tank and add fish fertiliser and seaweed. Then we drive the vineyard and find every replant and give it a bit of help."

MULCHING

How it works	Mulching works by blocking sun from reaching the soil surface so that weeds cannot germinate and grow. Mulching is particularly useful on stony soils where undervine cultivation is not possible. Mulching is more common on small vineyards or on smaller blocks within the vineyard, as mulching whole blocks is not cost-effective or realistic. Mulching is more commonly used to support vines that are struggling with low vigour. It is helpful to mulch individual replants within an existing block.
What can be used	Almost any organic material can be used as mulch. Straw, grape marc and composted green waste are common choices. Other options include shredded paper and wet paper pulp. Check your organic certifier's rules before introducing mulch materials to your property. Mulching materials can also be grown as interrow cover crops, which are mown and spread under the vines. This reduces the cost and the risk of bringing in new weeds from offsite. The mowing/mulching operation can be performed in a single pass, using a side-throw mower that delivers the mown material directly to the undervine area.
How thick	The depth of mulch is important. Weeds will not be suppressed effectively if the mulch is too thin. If mulch is too thick, it can inhibit water getting to vines or can result in vine roots growing in the mulch zone, which is undesirable. For straw mulch, a 20cm layer is recommended, while only 7.5-10cm of composted green waste mulch is needed.
How often	Apply mulch annually. (This may vary depending on the durability of specific mulching materials.)

Figure 3-5: Young vines after mulching with a side-throw mower.

Potential Issues and How to Address Them

LOSS OF VINE VIGOUR

When a vineyard is transitioned from herbicide use to cultivation or mowing, a reduction in vine vigour may sometimes occur.

Mowing

Loss of vine vigour can occur due to increased weed competition for vines. For this reason, mowing is not recommended on lower-vigour sites.

Cultivation

Loss of vine vigour can result from the cultivator damaging the vine's surface feeder roots. Over time (two to three seasons), the vines adjust by 'moving' their feeder roots further down into the soil profile, below the cultivation zone. However, in the short term, this effect can significantly impact vine vigour and yields.

HOW TO PREVENT VIGOUR ISSUES?

Reduce weed competition	Early season weed management is important. Whether cultivating or mowing, aim for a clean understory pre-budburst. This will give the vines the best chance to maximise their vigour.
Soil test	Make sure that soil nutrient levels are in the optimum range before cultivation starts. Keep soil nutrients at optimum levels, particularly in the first three years of organic weed management.
Address compaction	Compaction from wheels in the interrow may prevent vine roots from accessing the full soil profile. Consider deep ripping the interrow if compaction is an issue.
Provide adequate soil moisture	Vines can access water throughout the soil profile. However, where irrigation is available, keeping soil moisture deficits as low as practical may help improve vigour. This helps the surviving surface feeder roots to take up nutrients.
Cover crops	Growing cover crops in the interrow can improve soil biology, improve soil structure, and add nutrition, giving a boost to vine health. This can help vines cope with undervine disturbance.

HOW TO MONITOR FOR VIGOUR ISSUES?

Take pruning weights.

Monitor changes in pruning weights in order to pick up any changes in vigour early on. This will alert you to any impacts your weed management strategy may be having on the vines, before such changes become visually apparent.

Watch growing tip and leaf colour.

Careful observation of vines is important. If vines show early season colour changes – for example, lighter green/yellowish tinges – this may be a warning bell about vigour and nutritional issues. However, be aware that if you are not artificially feeding vines with high amounts of nitrogen, you can expect a lighter-coloured canopy; this is natural.

WHAT TO DO IF YOU DO DEVELOP VIGOUR ISSUES?

Soil and foliar test	Take soil and foliar tests to determine if there are any limiting nutrients.
Check prevention techniques	Refer to the prevention techniques on page 24; are these being fully addressed?
Add soil-based fertiliser	Adding appropriate fertilisers and/or compost under the vines will boost mineralisation and nutrient levels to improve vine growth.
Use foliar fertilisers	Using soil-based fertiliser may not be enough on its own. Consider adding a foliar fertiliser to your programme to boost plant nutrient levels. Timing foliar nutrition at the right physiological stage is important. Key times to supply nutrition include pre- and post-flowering, for better fruit formation and canopy development. The post-harvest period before leaf drop is also an important time to give extra nutrition, as the vines store up carbohydrate reserves for the following spring. Apply small amounts frequently (e.g. eight times during the growing season). Combine these with your applications of pest and disease sprays.
Fertigation	Water-compatible nutrients and biological fertilisers can also be applied through irrigation.
Increase soil organic matter	Increasing organic matter in the soil will provide a healthier environment for vines. Organic matter increases nutrient availability for the vines and improves water availability / retention in the soil profile.
Winter cover crops	Sow winter cover crops such as lupin, oats and barley in every second row, in order to build soil fertility and increase nitrogen and organic matter. Once crops reach sufficient height, mulch and disk them into the soil to provide nutrition for spring growth. In nitrogen-fixing crops such as lupins, nitrogen fixation peaks when the plant is flowering. Therefore, turn the crop into the ground at flowering time if nitrogen is your main requirement.
Interrow cultivation	Interrow cultivation in spring can aerate the soil, reduce compaction, reduce competition for nutrients and water, and provide a free root run for vines.

COMPACTION

When a vine's surface roots are disturbed by undervine weeding, it becomes especially important to address soil compaction issues, so that vines can access water and nutrients from other areas of the soil profile.
If soil compaction is contributing to poor canopy growth or lack of root growth, it is worth the effort to break up the compaction. This allows vine roots to access more water and nutrients, and helps fertiliser work down through the soil instead of remaining in the surface layers.

1. To reduce compaction, deep rip down the middle of the interrow. Wheel tracks are often more compact than the midrow, so pay particular attention to this area.
2. Consider ripping alternate rows only, as doing every row could disturb root systems too much on vines that are underperforming.
3. Rip at a depth of 500mm. The compact layer caused by machinery is often around the 300mm zone.
4. Before ripping, be aware of irrigation and electrical systems.

Seeding a spring cover crop in alternate rows. Cover crops can improve soil fertility, helping vines cope with the transition to undervine cultivation.

ORGANIC
WINEGROWERS NEW ZEALAND

www.organicwinenz.com