



**HAWKE'S BAY
WINEGROWERS INC.**

A guide to using sheep for leaf-plucking in the vineyard

This research was commissioned by the Hawke's Bay Focus Research Group as part of the Sustainable Farming Fund Climate Change project.

CONTENTS

Page 2
Introduction

Page 3
Why use sheep for leaf plucking?

Page 4
The basics

Page 6
Spray and chemical use

Page 9
Animal welfare and the law

Page 12
Grower experiences

Page 14
Advice from graziers

Page 15
Cost comparisons

Page 16
Permanent flocks

Page 17
Take home messages

Page 18
For further information

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INTRODUCTION

This booklet has come about through the Hawke's Bay Winegrowers Climate Change Project, which is a 3-year MAF Sustainable Farming Fund Project that began in July 2008.

It follows on from the first publication, released in May 2010, entitled "Energy efficiency in the vineyard; a series of case studies". This booklet profiled seven vineyards in Hawke's Bay to highlight the practices being used on these properties to reduce fuel and electricity usage.

One such practice that featured strongly was the use of sheep for leaf plucking. In fact this method of leaf plucking has been growing in popularity in recent years and current estimates are that sheep are used on around 1000 ha of vineyard area in Hawke's Bay as an alternative to mechanical and hand plucking.

This booklet aims to provide more information for winegrowers on the advantages and disadvantages of using sheep, share local growers' knowledge and experiences, and highlight the key issues concerned. The absence of specific withholding period data for many vineyard crop protection products in relation to use of sheep for canopy leaf plucking is one such issue that is extremely important for growers to understand when using sheep on their properties. It is pleasing to note that the wine industry and its partners are planning, and have started, to undertake further research in this area. We look forward to providing an update on this research work in the near future.

Finally, I would like to thank the people who contributed to this publication by sharing their extensive knowledge and experience, in particular Blake Herbison, Steve Wheeler, Rob Beard, Chris Howell, Brian McLay, Rex Evans, Adam Evans, Geoff Smith, Jonathan Hamlet, Emma Taylor, Lochie MacGillivray and Dr. Cheryl O'Connor, and also to our funding partners for this project.



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WHY USE SHEEP FOR LEAF-PLUCKING?

As a country, New Zealand has long been associated with sheep. Despite a drop in national flock numbers, sheep are still widely farmed for their meat and wool production. Luckily for winegrowers, sheep have a taste for vegetation other than grass. They will readily eat grapevine leaves (and fruit if ripe enough) which means we can utilise them in the vineyard.

Using sheep for leaf-plucking is becoming an increasingly common practice in Hawke's Bay. This booklet aims to share some of this local knowledge, along with some important things to consider before using sheep for leaf-plucking. This includes;

- Why use sheep for leaf plucking?
- The basics
- Spray and chemical use
- Animal welfare
- Grower experiences
- Advice from graziers
- Cost comparisons
- Permanent flocks
- Sources of further information

SO WHAT ARE THE ADVANTAGES?

Cost savings

Machine and hand leaf plucking can be expensive. In many cases, the cost of using sheep for leaf plucking only involves the transport of the animals to and from the property. So if you are using sheep on several blocks on the same property this can be a cost effective alternative to machinery and labour.

Fuel savings

Sheep can save on fuel compared to machine leaf plucking. Large leaf plucking machinery uses around 20L of diesel per hour, while the only fuel used for sheep leaf plucking is in the transport of the animals to and from the property.

Quality of the job

Many winegrowers believe that sheep do a better leaf plucking job than machines or people. Observations are that they are gentler and also seem to remove more internal leaves, which opens the canopy up to increase airflow and reduce disease pressure. While there have been no scientific trials, there is plenty of anecdotal evidence to support these observations.

WHAT ARE THE DISADVANTAGES?

Management input

Close management is essential when using sheep for leaf plucking. A few hours can be the difference between a slightly under-done job and an over plucked vineyard. Preparation is important for the animals' arrival, fencing should be established and there needs to be adequate access to fresh water while they are on the property. Sheep also happily work 7 days per week, so supervision is required at all times.

Timing is critical

Timing is critical. The window of opportunity is between 80% flowering and veraison, with early pea size being the most recommended timing. Some growers say that once sheep have had a taste of berries, they shouldn't be put back into other blocks for leaf plucking.

Issues with spray usage and animal health/residues

Certain sprays used in vineyards may present a health risk to sheep, or have the potential to leave residues in their meat. This is a significant issue and must be managed extremely carefully. Unfortunately there is still a lack of information available on this topic and most vineyard sprays do not have with-holding periods for grazing sheep. The section on spray and chemical use in this booklet explains this further.

Cannot be used in all blocks

Using sheep for leaf plucking cannot be implemented in all situations. Blocks of young vines, or older blocks with a lot of replants are not suitable for using sheep. Be aware of the restrictions of using sheep in organic vineyards, particularly for USA markets. Sheep can also spread weed seeds.

Did you know?

New Zealand's national flock has declined by more than half since its peak in 1982, currently standing at 32.4 million. Despite this decline, export meat production has fallen only 12% due to efficiencies in animal husbandry and lambing. As at 2009, the value of the export sheep/lamb meat industry was approximately 3 times that of the export NZ wine industry value.

THE BASICS

As already outlined, the use of sheep for leaf plucking has both advantages and disadvantages. Once you have considered these pros and cons and you decide to give sheep a try, then how exactly is this done?

This section explains the what, when, where and how of leaf plucking using sheep.

THE SHEEP

Sheep have a taste for grapevine leaves, which makes them ideal for leaf plucking. They will quite happily eat away until they are moved on. There are claims they often do a better job than machinery or people as they are gentle, and can reach right inside the canopy. Some growers also find that less leaf re-growth occurs compared with machine and hand leaf plucking and therefore the job lasts longer.

Observation has shown that they tend to prefer large-leaved varieties such as Merlot, but will eat any variety, including the berries if left long enough.

There are types of sheep that are better for leaf plucking than others. One consideration is height – at around 0.9 to 1.2 metres, mature ewes are a much better height to leaf pluck compared to lambs. Also, some breeds are better than others to use due to their desire to climb and rub against vines. Romney breeds tend to be quieter and are used to being moved, whereas Perendale or Perendale crosses can be highly strung and climb trunks. Mature ewes eat faster than lambs, take less training to graze on leaves, are usually quieter and inflict less collateral damage compared to lambs.

Sheep can suffer from both internal and external parasites so get sheep that are freshly shorn, drenched/dipped and lice free. This will reduce the amount of unnecessary rubbing on trunks and damage to vines and structures.

Be aware that some vineyard sprays are harmful to sheep. Consideration of the vineyard spray programme in relation to animal health and potential meat residue issues needs to be addressed before sheep enter a vineyard. These topics are covered in more detail in the section on spray and chemical use.

Remember, just like any other employees, you have responsibilities when having sheep on your property. These are explained in the animal welfare section and include providing fresh water at all times.

Sheep can carry diseases that may be transmitted to humans, and although rare, can be quite serious. These include leptospirosis, toxoplasmosis, and orf (scabby mouth in sheep). Also be aware that dogs are the primary host at the tapeworm stage for sheep measles.

THE PROCESS

Experience has shown that fencing blocks into areas of between 1 and 3 hectares works the best. These areas will hold between 100 and 300 sheep and will get plucked in 2 to 3 days depending on the canopy, the sheep, and a number of other factors.

Good boundary fencing is a must. Electric fencing is fine but will not stop sheep if frightened by dogs. Dogs can particularly be a problem if the vineyard is close to an urban area. If you are setting up a new vineyard or block, consider putting permanent wires between the ground and cordon on the outside rows. This acts as a boundary fence, and can also be used for clipping bird nets to.



Photo credit: Sally Lee, AgFirst

Experience has shown that it is best to fence different varieties separately. Sheep will prefer one variety over another, and if there are two varieties in the fenced area they may strip one and not touch the other. Some growers also recommend mowing the sward before the sheep are brought in. Having the animals in for leaf plucking will also save one herbicide spray. Sheep will not graze on thistles or nettles, and be aware they may introduce weed seeds from their previous location, and spread weeds around the property.

If the sheep have not been used for leaf plucking before they can take a while to start plucking in their first block, but they can get faster the more blocks they do. Sheep can also pull out weak shoots.

Sheep will tend to sleep in warmer parts of the block, on stone tracks or loading areas. In Hawke's Bay some growers protect the rows beside the tracks with bird netting on one side, to prevent being over plucked. Walk daily and spread the sheep out before night fall, this prevents sheep all sleeping in one area. Sheep eat more when it's cold so you don't want them all in one area in the morning.

Provide plenty of fresh water at all times. Spread the troughs throughout the block with a minimum of one at each end. The sheep will mob around the troughs and if only one trough will over pluck in that area. If there is an area of the block you want plucked more, put the water in that area.

A good relationship with your grazier is essential. Most growers pay or share the cost of transporting the animals to the property. Unlike winter grazing, no income is generally received for leaf plucking. Some graziers have their own gear such as electric fences and water troughs. However, a small capital outlay to invest in some of your own essentials may be required. It is easy to make water troughs out of old containers.

TIMING

Timing is absolutely critical.

Most growers bring sheep in any time from late November through to mid/late December. This is usually between 80% flowering and pre-bunch closure. The most common time is when berries are at the pea size stage with bunches hanging down with weight. If bunches are sticking up sheep will eat the ends.

Keep a close eye on the sheep and the level of plucking you want. If they are getting close to the ideal level, do not leave sheep in the block overnight. It is better to just under-do the job than to over-do it. One hour can be the difference between a good job and an overdone one.

Always be prepared to react and be able to move the sheep earlier rather than later.

At the first hint of veraison the sheep will start to eat the berries, so do not leave them in the block at this stage. Some growers say that once sheep have had a taste of the berries, they shouldn't be used again for leaf plucking in another block as they will bypass the leaves for the fruit.

Using sheep for leaf plucking takes up time and needs close monitoring. Remember sheep will work all weekend so keep an eye on them.

WHERE (AND WHERE NOT) TO USE SHEEP

Do not use sheep in blocks of young vines or blocks with a lot of replants. You can protect replant vines with vine guards, but ensure they cover the full height of the sheep's reach i.e. 0.9 to 1.2 metres. You may have to stack one guard above another to cover this height.

You can use sheep in a certified organic vineyard but they must be quarantined for 48 hours on arrival before being put in the blocks. Be aware that to comply with the USA organic standards there is a 90 day with-holding period on raw animal manure so this may exclude the use of sheep in early varieties.

Be careful not to let sheep into areas that contain shrubs and plants that may be poisonous to them as ewes will eat anything when hungry. This includes hedging/shelterbelts or garden plants overhanging vineyard boundaries. Rhododendron shrubs are common garden plants that are toxic to sheep. See the list of resources at the end of this publication for where to find further information about toxic plants.

Using sheep in areas that may cause them stress is not recommended – this includes residential areas with dogs, near wineries with a lot of traffic/people moving around, or areas with inadequate shade.

As also mentioned previously, you should not use sheep for leaf plucking where you have used certain sprays in the vineyard, as they can be dangerous to animal health, and/or result in potential residue problems. The next section explains more about the use of sheep in conjunction with vineyard sprays in more detail.

SPRAY AND CHEMICAL USE

Note: “In the absence of specific residue data, Agcarm members do not support sheep leaf plucking following the use of their products in vineyards.”

Agcarm represents over 30 manufacturers & distributors of crop protection products (www.agcarm.co.nz)

This is a subject that requires a significant amount of further research to fully understand the impact of sheep grazing in vineyards where sprays have been used, and the suitable withholding periods for these products. This document is not designed to outline those products that can and cannot be used – always check the product label and talk to your grazier and winery regarding your spray programme in conjunction with using sheep on the vineyard.

There are basically two major issues surrounding the use of vineyard sprays and using sheep on vineyards:

- The effect of sprays on animals' health
- The potential for residues to show up in the animals' meat

In terms of animal health, some products are known to be highly toxic to sheep. Ingesting these chemicals on the vineyard vegetation can cause serious health implications and even death. One such product is copper (see box below).

Why is copper so bad for sheep?

Sheep are unique in that they more readily accumulate copper in their livers compared to other livestock. As they eat contaminated feed over time, the copper gradually accumulates in the liver. Copper poisoning occurs when a sudden stress event (such, as the weather, environment, transportation and handling) causes the liver to release high levels of copper into the bloodstream. This leads to a widespread breakdown of red blood cells, severe illness and even death.

However, there are many products used on vineyards, **where the effect on animal health is unknown**, as the product was not designed to be consumed by sheep, so there are no label restrictions or withholding periods for stock. These products can be harmful directly to the animal itself, or to its offspring. Mature breeding ewes, which are commonly used for leaf-plucking, are usually mated in January, which is during or just after being on the vineyard.

This means their lambs can also be at risk of health implications from the sprays they ingest on the foliage and grass, as well as the ewe itself.

Also, unlike winter grazing, sheep are eating the targeted crop rather than the grass, so ingested spray residues are likely to be higher.

The second issue is that certain sprays and chemicals may show up as residues in the finished animal product sold for human consumption e.g. meat, after the animal has ingested vineyard vegetation with these sprays on them. While the chemical may not present a direct toxicity risk to the animal itself, the residues transferred in the animal end product may be higher than maximum residue limits (MRLs) permitted in the meat, or banned altogether.

Just like vineyard sprays have set withholding periods so the finished wine does not exceed MRL's, there are also restrictions in the meat industry. All animals sold must be accompanied by an 'animal status declaration'. This paperwork states all chemicals that the animal has been treated with and the applicable withholding restrictions. This means the owner can meet all withholding periods, meaning meat residue limits are not exceeded. The cost of exceeding a MRL in the sheep meat industry could be devastating to the New Zealand industry.

Unfortunately, most vineyard sprays do not have withholding periods in relation to animal grazing. The withholding periods relate only to the harvest of grapes for wine production and consumption. Therefore growers should be extremely cautious in terms of what sprays they use if sheep are being brought in for leaf plucking. The wine industry needs to do some work on categorising vineyard sprays into their levels of risk, both in terms of animal health and residue implications, and set some guidelines.

Why using mature breeding ewes doesn't always mean avoiding meat residue issues

Many growers believe that using mature breeding ewes is a solution to the residue problem. However, this is not always the case. Pregnancy scans are usually done on breeding ewes around May and those ewes that are 'dry' (not in lamb) are often sent to the meat works. If these dry ewes have been leaf-plucking in the vineyard, they may still be carrying chemical residues 90 – 120 days later, at the time of culling, meaning these residues could show up in their meat.

CURRENT GRAZING LABEL INFORMATION

Table 1 lists all registered products in the NZ Winegrowers Export Wine Grape Spray Schedule 2010/11. For each product, the trade name is stated, along with the active ingredient, and any information available (as published in the NZ Novachem Agrichemical Manual 2010) in regard to animal grazing.

For some products, the registrant has identified that there may be a risk of residues being found in meat if grazing occurs or a risk to animal health, and so have mandated a 'do not graze' statement on the product label. For other products that have a do not graze statement, the risk may be simply unknown. Some labels will specify a time period, others may not specify a time period at all, in which case we have to take this as no grazing occurring at anytime if this product has been used.

If a “-“ is shown, this means there is currently no information available about that product in relation to grazing. It does not mean that the product is safe to use in conjunction with grazing. It means the risk is unknown. Many older products do not have any label information for grazing, as the crops for which it has been registered for were not initially used for animal feed.

Some products that are registered for grapes are also registered for use on forage crops. These products will therefore have label withholding periods in regard to animal consumption for the forage crops. Because the application rates of these products will be different, and pasture and various forage crops will process the chemicals differently to grapevines, we cannot simply transfer the forage withholding period over to use in a grazing vineyard situation, but they can be used as a very rough guide. Table 2 outlines products which have withholding periods for forage crops.

Be aware that herbicides and other products can also have grazing restrictions. For example Shark® has a grazing WHP of 14 days, while glyphosate has a nil WHP but recommends grazing be delayed for up to 7 days to allow sufficient plant uptake of the chemical. Always check the product label before you use it in conjunction with sheep, and if unsure, contact the product distributor.

Table 1: Current label information for grazing

Product Trade Name	Active Ingredient	Notes
Acrobat etc	dimethomorph	-
Alto	cyproconazole	Do not graze animals on treated areas or use grass clippings for feed.
Amistar	azoxystrobin	Has WHP for forage/pasture
Applaud etc	buprofezin	-
Armour-Zen etc	chitosan	-
Attack	permethrin & pirimiphos methyl	-
Avaunt	indoxacarb	-
Botran	dicloran	-
Botry-Zen	ulocladium oudemansii	-
Bravo etc <i>(includes Balear, Barrachlor, Barrack Betterstick, Blizzard, Cavalry, Chlorotek, Cobra & Folio Gold)</i>	chlorothalonil	All products contain minute quantities of HBC, a compound that can be taken up by grazing stock to give unacceptable residues in meat and milk. Do not graze treated crops. Do not feed any part of a treated crop to stock.
Captan etc	captan	-
Comic	tebufenozide	See notes for Mimic
Confidor etc	imidacloprid	-
Copper* <i>(see end of table for products included)</i>	copper ammonium acetate, copper hydroxide, copper oxychloride, cuprous oxide	Keep stock off treated areas for at least 3 weeks after treatment.
Decis Forte etc	deltamethrin	-
Delan etc	dithianon	-
Diazinon	diazinon	Has WHP for forage/pasture
Dipel etc	bacillus thuringiensis	-
Dithane Rainshield Neotec etc	mancozeb	-
Echo	tebufenozide	Not listed but refer to Mimic
Entrust/Success Naturalyte	spinosad	-
Euparen Multi	tolyfluanid	-
Impulse	spiroxamine	Has WHP for forage/pasture
Karate Zeon etc	lambda cyhalothrin	Has WHP for forage/pasture
Keithane	dicofol	Not listed in Novachem 2010
Lannate	methomyl	Has WHP for forage/pasture
Lime sulphur	calcium polysulphide	-
Mavrik	tau-fluvalinate	Has WHP for forage/pasture
Max CL	metalaxyl & chlorothalonil	-
Microplus	streptomyces lydicus	Not listed in Novachem 2010

Table 1 continued...

Product Trade Name	Active Ingredient	Notes
Mimic etc	tebufenozide	Do not feed treated crops or pasture to stock. Do not allow spray drift onto pasture or crops that may be grazed. Do not graze in treated orchards.
Mineral oils	mineral oils	-
Omite	propargite	-
Phaltan	folpet	-
Polyram	metiram	-
Pristine	boscalid & pyraclostrobin	This product has not been assessed in terms of the potential for residues associated with grazing (or associated animal safety). It is recommended that animals do not graze within treated orchards. From website not Novachem manual
Proclaim	emamecin benzoate	-
Prodigy	methoxyfenozide	Do not feed treated crops or pasture to stock. Do not allow spray drift onto pasture or crops that may be grazed. Do not graze in treated orchards.
Prostar	mycobutanil	See notes for Systhane
Protector etc	fatty acids	-
Protek	carbendazim	-
Quintec	quinoxifen	Do not feed treated crops or pasture to stock. Take care not to let allow this product to drift onto pasture or crops which may be grazed.
Ridomil Gold etc	metalaxyl m & others	-
Rovral etc	iprodione	-
Scala etc	pyrimethanil	-
Sentinel	trichoderma	-
Serenade Max etc	bacillus subtilis	-
Shirlan etc	fluazinam	-
Sulphur etc	sulphur	-
Sumisclex	procymidone	-
Switch	fludioxonil & cyprodinil	-
Systhane etc	mycobutanil	Do not feed treated crops or pasture to stock. Take care not to allow this product to drift onto pasture or crops that may be grazed. Do not graze in orchards or vineyards which may have been treated.
Teldor	fenhexamid	-
Teracep	peracetic acid & hydrogen peroxide	-
Thiram	thiram	-

Product Trade Name	Active Ingredient	Notes
Teldor	fenhexamid	-
Teracep	peracetic acid & hydrogen peroxide	-
Thiram	thiram	-
Tokuthion	prothiofos	-
Topas etc	penconazole	-
Topsin	thiophanate-methyle	-
Twist	trifloxystobin	Has WHP for forage/pasture
Validus	mycobutanil	See notes for Systhane

*Copper products include AGPRO Copper Oxychloride, AGPRO Cupric Hydroxide, Blue Shield, Champ, Cuprofix, Headland Choice, Kocide Opti, Liquicop, Mankocide, Nordox, Oxi-Cup & Primooxycop

Table 2: Products with pasture/forage crop labels

Product	Crop	Rate	WHP for grazing
Amistar WG	Dry animal feed peas Pea/hay silage	63%	35 days 14 days
Diazinon EC	Pasture, fodder crops	higher	Nil
Impulse	Forage wheat	200%	42 days
Karate	Forage brassicas Barley/wheat forage White clover for seed	100% 100% 100%	14 days 28 days 70 days
Lannate	Pasture	Slightly higher	7 days
Mavrik	Clover for seed	Similar	56 days
Twist	Cereal silage	200%	28 days

The take-home message for winegrowers is that for many sprays we don't yet know what the risk to animal health is, or how these chemicals are metabolized and accumulated in animals. There is the risk that if any of these chemicals are detected in animal products at levels above their MRL's, there may be serious implications for both the sheep and wine industries.

One method of avoiding this risk is to refrain from using some products altogether. Another method of lowering the risk is to observe the WHP's for wine before bringing sheep in. In both cases, this may not be practical, particularly in the case of botrytis flowering sprays. This is an area where the industry needs to undertake further research. Until then, winegrowers and graziers need to act responsibly and be aware of the potential residue issues.

ANIMAL WELFARE AND THE LAW

Just like regular human employees on the vineyard, sheep are also protected under legislation in regard to their welfare.

The Animal Welfare Act 1999 came into force on 1 January 2000. This legislation establishes the fundamental obligations relating to the care of animals. These obligations are written in general terms, so a series of codes have been developed to provide greater detail including minimum standards and recommendations relating to all aspects of the care of animals.

THE ANIMAL WELFARE (SHEEP AND BEEF CATTLE) CODE OF WELFARE 2010

Under the Animal Welfare Act, the code that is most relevant to winegrowers using sheep on their vineyards is The Animal Welfare (Sheep and Beef Cattle) Code of Welfare 2010. This came into force in June 2010. The purpose of this code is to encourage all those responsible for its implementation to adopt the highest standards of husbandry. This code sets minimum standards for the care and management of sheep.

This document can be found on the MAF Biosecurity website: <http://www.biosecurity.govt.nz/files/regs/animal-welfare/req/codes/sheep-beef-cattle/sheep-beef-cattle-code-2010.pdf> and although the most relevant minimum standards are reproduced in this booklet, it is strongly recommended that all winegrowers using sheep on their vineyard read this MAF document and are familiar with the minimum standards.

The code applies to all persons responsible for the welfare of farmed sheep and beef cattle. Under the Act, the “owner” of an animal and/or the “person in charge” is responsible for meeting the legal obligations for animal welfare. In the case of farm animals, the owner of the animals may place the animals in the care of others i.e. you as the vineyard owner or manager, or vineyard staff.

Failure to meet a minimum standard in this code may be used as evidence to support a prosecution for an offence under the Animal Welfare Act 1999.

A person who is charged with such an offence can defend themselves by showing that he or she has equalled or exceeded the minimum standards in this code.

The Animal Welfare (Sheep and Beef Cattle) Code of Welfare 2010 also outlines a number of recommended best practices. A selection of these has been included below that relate to short-term use and of handling sheep in the vineyard. Unlike the minimum standards in the code, these recommendations for best practice have no legal effect and are included to encourage higher standards of animal welfare.

All vineyard staff involved in the use of sheep on the property should be encouraged to read these guidelines.

The Animal Welfare Code

The purpose of this code is to encourage all those responsible for its implementation to adopt the highest standards of husbandry. The code sets minimum standards for the care and management of sheep.



“The greatness of a nation and its moral progress can be judged by the way its animals are treated”

Mahatma Gandhi

Photo credit: Beef+Lamb NZ

ANIMAL WELFARE (SHEEP AND BEEF) CODE OF WELFARE 2010

MINIMUM STANDARDS

These are a selection of the most relevant requirements.

Stockmanship

Sheep and beef cattle must be cared for by a sufficient number of personnel, who, collectively, possess the ability, knowledge and competence necessary to maintain the health and welfare of the animals in accordance with this code.

Animal Handling

- (a) Sheep and beef cattle must be handled at all times in such a way as to minimise the risk of pain, injury or distress to the animals.
- (b) Sheep and beef cattle must not be prodded in the most sensitive areas, including the udder, eyes, nose, anus, vulva or testicles.
- (c) Only the minimum force required must be used when moving sheep or beef cattle.
- (d) Electric prodders must not be used to drive sheep or calves.

Mustering and Droving

Sheep and beef cattle being moved on foot must not be forced to proceed at a pace that will cause exhaustion, heat stress or injury.

Restraint and Facilities

- (a) All facilities, including fences, yards, sheds, and housing, must be constructed, maintained and operated in a manner that minimises the likelihood of distress or injury to animals.
- (b) Methods of restraining animals must only be used:
 - (i) when they are suitable for those animals being handled;
 - (ii) where the operators are fully conversant with their safe operation;
 - (iii) if they are in good working order so as to minimise the risk of injury or unnecessary pain or distress;
 - (iv) only for as long as necessary to perform particular husbandry practices; and
 - (v) where they allow the animal to be released immediately if required.
- (c) Animals that are physically restrained must be kept under supervision.
- (d) Electro-immobilisation devices must be used only in a manner that allows animals to breathe normally, demonstrate normal responses to pain and must not be used in place of pain relief when undertaking painful husbandry procedures.

(e) Sheep or beef cattle to be restrained by tether (e.g. pets or show animals) must have been habituated to being handled in that way.

Food and Water

- (a) All animals must receive sufficient quantities of food and nutrients to enable them to:
 - (i) maintain good health;
 - (ii) meet their physiological requirements; and
 - (iii) minimise metabolic and nutritional disorders.
- (b) All sheep and beef cattle must have access to water, sufficient for their daily needs and that is not harmful to their health.
- (c) If any beef animal shows signs of being very thin, or if the body condition score of any individual beef animal falls to 1 (on a scale of 0-5), urgent remedial action must be taken to improve condition or the animal must be destroyed humanely.
- (d) If any sheep shows signs of being very thin, or if the body condition score of any sheep falls to 1 (on a scale of 0-5), urgent remedial action must be taken to improve condition or the animal must be destroyed humanely.

Shelter

- (a) All sheep and beef cattle must have access to shelter to reduce the risk to their health and welfare caused by exposure to cold.
- (b) Sheep and beef cattle giving birth must be provided with an environment affording the newborn protection from any reasonably expected climatic conditions likely to compromise their welfare and survival.
- (c) Sheep and beef cattle must be provided with means to minimise the effects of heat stress.
- (d) Where animals develop health problems associated with exposure to adverse weather conditions, priority must be given to remedial action that will minimise the consequences of such exposure.

Injury and Disease

- (a) Signs of ill-health or injury must result in timely preventative or remedial action, as appropriate.
- (b) Medication must only be used in accordance with registration conditions and manufacturer's instructions or professional advice.

There are further minimum standards relating to other parts of sheep and beef farming such as animal husbandry, but these have not been reproduced here as are not as relevant to the use of sheep in the context of winegrowing. Please visit the MAF bio-security website for the full list.

ANIMAL WELFARE (SHEEP AND BEEF) CODE OF WELFARE 2010

RECOMMENDED BEST PRACTICE

These are the most relevant recommended best practices in relation to sheep use in winegrowing.

Handling

- When encouraging animals to move, audible or visual measures (e.g. rattles, plastic bags, stones in a container) should be preferred to devices which rely on physical contact (e.g. waddys, alkathene hoses, stock whips, stock canes, and sticks).
- The flow of animals should be monitored, and if necessary controlled, at gateways, in narrow laneways and corners, or at other pressure points so as to ensure animals, especially young animals unaccustomed to yarding, are not injured, trampled or smothered.
- Sheep and beef cattle should be allowed a period of 20-30 minutes to calm down after mustering to ensure easier and safer handling and to reduce fear.
- Time spent in the yards should be kept as short as possible. Animals in pens or yards should not be overcrowded, but allowed to be able to move away from handlers or other animals, because crowding is likely to contribute to distress and injury.
- Care should be taken not to induce sudden fear or panic in animals in confined spaces such as in pens, corners and gateways, because flight might increase the risk of injury.
- If problems of aggressive behaviour occur, the animals should be separated into compatible groups.
- Tails should not be lifted or twisted. Sheep should not be dragged or lifted by the wool or horns, or be held on their side or back for more than a few minutes at a time especially if the rumen is full or if they are heavily pregnant.
- Vehicles should not be used to push animals physically.
- When dogs are used, they should be under control at all times.
- Electric goads should not be applied to any animal for more than one second at any one time. If the desired effect is not achieved after four or five attempts, their use should be discontinued.

Food and Water

- Animals in ill health or poor condition, or in late pregnancy or early lactation, should not be deprived of food or water.
- If animals are to be given feeds to which they are not accustomed (e.g. supplementary feeds and crops), they should be gradually introduced to those feeds to enable them to adapt and to prevent digestive problems associated with the change of diet
- Animals should be closely monitored during any change in feed.

- Mould-contaminated or excessively dusty supplementary feeds should not be fed to livestock.
- Care should be taken to ensure animals, particularly in late pregnancy, do not overfeed. Overfeeding resulting in a full rumen can contribute to difficult births and, in sheep in full wool, a greater risk of becoming cast.
- The Body Condition Score (BCS) of all adult sheep should be between 3 and 4 at all times (on a scale of 0–5, see Appendix I in the code, “Condition Scoring of Sheep”).
- Automated food delivery and water reticulation systems without any storage capacity or other back up supply systems should be checked daily to ensure that they are in working order and any problems promptly rectified.
- In controlled grazing systems where feed is rationed (e.g. break feeding, rotational grazing, and techno-systems) the amount of feed available on each area should be sufficient to meet the needs of all the animals during the time that they are on that area or the break.
- There should be enough reserve feed to allow more frequent shifts if it is very wet and the fodder to be grazed becomes trampled and muddy.

General shelter

- Activities such as mustering, prolonged yarding and transportation should be avoided in hot, sunny and humid conditions likely to result in heat stress.
- Sheep and beef cattle should have access to areas free of surface water and excessive mud at all times, particularly where conditions can become very muddy such as on crops or small areas of pasture during wet weather.

Behaviour

- Sheep and beef cattle should have sufficient space to enable them to behave and interact normally without excessive aggression.
- Sheep and beef cattle should have company of their own kind and be kept in reasonably stable social groupings. Mixing groups of unfamiliar animals, or introducing new animals to a stable social group, should only occur when necessary, with plenty of space and under careful observation to minimise stress or injury.
- Sheep and beef cattle should be given the opportunity to graze.

GROWER EXPERIENCES

This section takes a look at some of our Hawke's Bay growers' experiences with using sheep for leaf plucking on their vineyards.

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CHRIS HOWELL *PROSPECT VINEYARD*

Chris is definitely an advocate for using sheep in his vineyard as an alternative to using machines for leaf plucking.

"Not only does using sheep save on fuel, but they also do a better job than people or machinery – it's really a win-win situation"

The ewes are trucked to the vineyard in mid December. Chris fences the vineyard into units, by variety, around one hectare each in size. With 200 ewes per one-hectare unit it takes between 1.5 and 2 days until they need to be moved to the next unit, depending on the amount of feed available. It takes around 3 weeks to finish the whole 12ha vineyard. Chris pays part of the trucking cost to transport the sheep to and from the property.

Chris highlights the need to be aware of spray use. In particular, he is careful not to use any copper sprays for several weeks before the sheep arrive on the property.

Sheep are also used to graze the vineyard over winter, providing excellent sward and weed control. This also means one less mowing pass and weed spraying pass for Chris.

ROB BEARD *MAIMAI CREEK*

Rob manages vineyards across Meeanee and Ngatarawa for Maimai Creek and has now had 4 years experience using sheep for leaf plucking.

"Sheep do an outstanding job of leaf plucking. We use them in our Sauvignon Blanc and Riesling blocks, and the cost savings are huge at around 0.1c per vine compared with up to 30c for hand leaf plucking. With lower value blocks it just makes sense."

Rob gets the sheep trucked in around Christmas time – the earlier the better. This is about the pea-sized berry stage. He pays the trucking cost, as well as a case of wine for the grazier for good measure. Rob mows the vineyard sward first, and fences off blocks into areas of about 2ha. With 200-300 ewes in each 2ha block, they will get through the leaf plucking in around 2 days, dependent on the canopy size.

He uses mature ewes and prefers Romney or Romney cross breeds as they are calmer, compared to the more flighty Perendale breeds. They must be recently shorn and de-loused to prevent rubbing and causing damage to vines and fixtures. He does not use the sheep at his Ngatarawa block because of the damage they could potentially cause to the frost flippers. One stray dog causing the sheep to bolt would be a disaster he says.

Rob is happy with the spray programme he uses in terms of animal health and safety, and residue issues. He doesn't use any botryticides on the blocks where sheep are used for leaf plucking, nor does he use any copper or DMI's on these blocks. Sulphur is about the only spray that is used before the sheep arrive. He also believes that the sheep assist greatly with mealybug control.

Rob has a farming background so is familiar with managing stock. He highlights the need to ensure they have plenty of fresh water, and also suggests walking through just before it gets light each morning to spread the animals out as they tend to camp together overnight in groups.

"I would recommend using sheep to people who have the time to keep an eye on them – you can't afford to be lazy or leave them in the vineyard and head out to the beach on holiday over Christmas."

REX EVANS *PUKETAPU WINEGROWER*

Rex was one of the first grape growers in Hawke's Bay to use sheep for leaf plucking. It all started about 20 years ago when feed on his farm started to run low so Rex shifted some sheep into the vineyard.

They ate the clover and weeds at first, and then happily started on the canopy. He hasn't looked back since.

As Rex says "Sheep do an A1 job at leaf plucking, and they don't complain!"

Through trial and error, Rex has settled on a system of fencing into blocks of around 4 to 5 acres (1.7 to 2.1 ha) each in size. He knows 400 ewes will get through this in around 4 days. He brings them in when berries are small pea size, but this can be extended to large pea size, so long as the berries are hard. His observations have shown that sheep prefer some varieties over others, such as Merlot, while Cabernet Franc is one of their least favourites.

He no longer has his own mob, but instead has an arrangement with a local farmer, which has now expanded to include his vineyard neighbours. Rex pays for the animals to be trucked to his property, and then once finished, the next person transports them to their property, and so on.

Rex's advice is to keep an eye on the sheep, particularly as they get close to finishing a block. They can also pull out and break whole shoots. He finds that he has to follow up with a little hand leaf plucking in the corner of the block closest to the house, as they don't tend to like congregating there.

Rex does not support the practice of using lambs for leaf plucking. Not only are they too short to reach high enough into the canopy, there is the potential for serious implications if residues are found in their meat. He only uses ewes not designated for meat production. A further piece of advice is to get ewes with long legs as he has been caught out in the past with short-legged animals.

ADAM EVANS
CONSTELLATION CORNER 50 VINEYARD

Adam has been using sheep for leaf plucking on the vineyard for the last 3 to 4 years. The animals are brought in from the farm across the road at no cost, in return for giving the farmer preferential winter grazing on the vineyard.

Adam works on a rough ratio of 100 ewes per hectare – if he can only get 250, he will put into a 2ha block, but if he can get 400, this will take care of 4ha.

His experience has shown that sheep which are new to leaf plucking can take a while to catch on to the concept of eating the canopy. But once they do, they progressively get faster. In wet summers with lush grass growth, Adams advises mowing beforehand to encourage the animals to look up.

The vineyard trellis has incorporated a permanent fence system with a high tensile wire positioned between the fruiting wire and the irrigation wire, and netting is run over the strainers to keep the animals in. Adam has heard of sheep eating green fruit, so brings them in closer to fruit set, as opposed to veraison. He also comments they can do a lot of damage to irrigation materials.

GEOFF SMITH
SILENI ESTATES

Geoff is another advocate of using sheep for leaf plucking but is quick to point out the commitment required in managing them. "Don't count on a Christmas or New Year holiday if you are going to use sheep for leaf plucking" says Geoff. However, they do a good job and fit well with Sileni's philosophy of maximum bunch exposure.

Geoff's break system consists of blocks of 1 to 1.5 ha, holding 150-200 sheep, taking 1 to 1.5 days to complete. He has a system of permanent wires, which Geoff swears by – estimating these reduce his temporary fencing time input by a huge 80-90%.

He has found varietal preferences – e.g. Merlot over Semillon. Their appetite also depends on the volume and quality of the food at their previous location. Animals from drought-affected farms will be quick to start plucking, but those from rich pastures may dawdle. Management and timing are essential – take the sheep out too soon and you can get early re-growth, too late and you get over plucked vines and canes pulled. He has found that living on site is a distinct advantage when it comes to managing the animals in the vineyard.

ADVICE FROM GRAZIERS

This section provides information from the graziers' perspective and what they want growers to be aware of when using their sheep for leaf plucking on your vineyards.

The first, and most significant, is the issue of vineyard sprays and the potential implications for animal health and meat residues.

In the past, the then 'Pesticides Board' (now equivalent to the ACVM) has attempted to ban the use of livestock for winter grazing in orchards and vineyards. However this ban was not applied following the successful argument of the following points;

- All grazing occurs more than 2 weeks past harvest, meaning all harvest withholding periods were observed by at least this amount of time
- The majority of the grass grazed by the animals grows after the last spray is applied
- And, the stock is grazing the untargeted area i.e. the grass, not the crop

Some graziers are concerned that unlike winter grazing, leaf plucking does not meet the above criteria, and in the case of a problem arising, this could cost both the wine industry and sheep industry a huge amount of money, including a ban on the use of the practice. As primary producers we rely on New Zealand's 'clean green' image, so both industries need to keep it that way.

SOME SPECIFIC ADVICE

- If you have used a product on the vines with a label that states NO GRAZING, do not bring sheep onto this property at all, or observe the correct withholding period. Even when a no grazing label seems to be unreasonable, it must be abided by. Any grazing 'off label' would be excluded from public liability insurance.
- Do not bring stock in before the minimum withholding periods (for human consumption/harvest of the crop) have been met for every single product used on the vines to date.
- Copper is toxic to sheep. Observe the grazing label restriction on all copper products.
- Some products, such as sulphur, have a nil WHP. However it is not advised to spray these products while the sheep are physically in the block. Remove animals for spraying and keep out for 6 to 8 hours after application.

- Be aware that not all breeding ewes will go onto lamb. Those that do not fall pregnant or lose lambs may be sent to the meat works, and this is where potential residue issues could arise. Also, we don't fully know the impact of spray consumption on the developing lamb fetus in pregnant ewes.

SUGGESTED BEST PRACTICE

- Do not send any animal that has used for leaf-plucking to be culled for meat within 12 months of being on the vineyard.
- Provide your grazier with a copy of your spray programme stating all products used before or while the sheep were on the property and the WHP's.
- The NZ wine industry, including representative bodies and individual producers, should be proactive in investing resources into further research into the issue of sprays and using animals for leaf-plucking, or developing guidelines, before a major disaster arises or the practice is banned altogether.

OTHER POINTERS

Providing adequate water at all times is essential. Another point to be aware of is that electric fences do not always work as well in dry soils. This is because they don't provide the same grounding between the animal and fence compared to winter months when the soil is wetter. Therefore, electric fences may not stop sheep on the move, particularly mobs that have been spooked, which can easily be triggered by dogs, vehicles or movement.

The business arrangement between the winegrower and grazier will come down to the expectations of each party. For example, some graziers can put up fencing and more intensively manage stock if the grower does not have time and is happy to pay for the graziers time to do this.

Unlike lamb grazing, as a general rule, no income is received by the grower for having the sheep on the vineyard. A common arrangement is for the grazier to supply the animals and the grower to pay for their trucking to and from the vineyard. This is dependent on a number of factors, but is usually around \$1 per head for ewes, ranging from \$0.70 to \$1.20 on average.

COST AND ENERGY COMPARISONS

One of the major advantages of using sheep for leaf-plucking is the potential cost saving.

Growers have been using sheep as a substitute to both machine and hand leaf-plucking as it is generally cheaper. An added advantage is also that less fuel is used compared to machine leaf-plucking, which is a good step in energy-aware markets.

To quantify the potential cost and fuel savings, the following case study looks at the calculated savings for Prospect Vineyard – owned by Chris and Catherine Howell.

CASE STUDY 1: MACHINE LEAF PLUCKING

Prospect Vineyard is a 12 ha vineyard near Bridge Pa, in Hastings. It was established in 1995 and grows predominately Merlot, as well as some Cabernet Franc, Syrah, Chardonnay and Semillon. Chris has been using sheep now for a couple of seasons. He uses them for leaf-plucking as an alternative to contract machinery, and he also uses them for grazing the vineyard over winter.

Chris's calculated annual savings from using sheep for leaf-plucking, instead of machinery is outlined below. The figures used are for the purposes of the example only, and will vary between vineyards and contractors.

Vineyard details

Planted area:	12.35ha
Vine spacing:	2.4m x 1.8m
Row length per planted ha:	4.167km
Row length for the vineyard:	51.46km
Row length incl. turning etc:	55.3km

Machine leaf plucking – whole vineyard	
Fuel consumption	21 l diesel/hr
Operating speed	3.5km/hr
Cost per hour	\$80/hr
Approx operating time	15.8 hrs
Total diesel consumption	332 litres
Total cost	\$1,280

On the other hand, if Chris got 200 ewes in across a 3 week period to leaf pluck the whole vineyard, he would pay approximately \$200 each way for trucking, so a total cost of \$400. This is a difference of \$880.

However, this \$880 saving excludes the cost of Chris's management time. This time input is likely to be minimal for contract machinery plucking, but significant for sheep leaf plucking.

If we valued Chris's time as a vineyard manager at \$25/hr, the time spent managing sheep would have to be less than about 12 hours per week (or 35 hours over the entire 3 week period) to make using sheep more cost effective than machine plucking.

The total consumption of fuel is also much less

CASE STUDY 2: HAND LEAF PLUCKING

If Chris decided to leaf pluck the whole vineyard by hand, these are the potential costs

Hand leaf plucking – whole vineyard	
5c/vine	\$1,430
10c/vine	\$2,859
20c/vine	\$5,718
30c/vine	\$8,576

Compared to the \$400 for trucking in sheep, hand leaf plucking is relatively expensive, especially as the rate per vine increases.

A lot of growers comment that the management time input for sheep leaf plucking is similar to that of managing a gang of labour for leaf plucking. In this case, the total cost of sheep leaf plucking is favourable. However, unlike many gangs, sheep will work 7 days a week so your management time will also be spread over 7 days a week.

Other factors to consider

Other factors to consider when comparing sheep leaf plucking with other methods includes the suitability of the block to be plucked – for example

- Does it have a lot of replants?
- Is it near areas with a lot of people and dogs where sheep could get spooked?
- Is the spray programme suitable?
- Do you have the time available to manage the animals?

PERMANENT FLOCK OPTION

Procuring stock yourself should really only be considered by people who have experience with stock.

Under this arrangement, the grower purchases their own stock and therefore takes full responsibility for their care and management. You may choose to enter the short term trading game, keeping animals only for the leaf plucking part of the season then selling them on, or have a permanent mob and take them through to after lambing.

Purchasing stock

There are a number of ways you can purchase stock. Commonly you can purchase through a stock agent (of which there are many in Hawke's Bay – see section on further information), or purchase through the sale yards at Stortford Lodge. At the sale yards, you can bid for lines of stock being auctioned – stock must be removed on the day of sale. The price of animals will vary, but a rough guide is \$60-\$70 per head for a mature breeding ewe.

Keeping stock

You may keep stock for just the leaf plucking period, or permanently. If kept as a permanent mob, here are some things to consider:

You will need grazing land for 12 months of the year. This means you need sufficient grass all year round, or will need to arrange grazing elsewhere when feed levels get low. Ewes will eat about 880 kilograms of dry matter per year. Hawke's Bay is prone to periods of summer drought, so you need to plan for this risk.

Within this grazing land you will need an area of pasture that is not in vines to keep sheep when you are spraying i.e. between bud burst and leaf plucking and then again after leaf-plucking until harvest. You will also need to invest in some extra capital such as permanent fencing, water supply, and ideally yards.

There is a lot of management required for stock care, for example shearing, crutching, health treatments, animal husbandry etc. Even if you get contractors in to do the work you still need to spend time organising these arrangements. Do you have the time to do this in between managing the vineyard? And, is it actually profitable at the end of the day?

A basic animal husbandry calendar

Jan/Feb	Rams put out with ewes
May	Ewes scanned for pregnancy, 'dry' ewes separated off
Jun/Jul	Lambing
Oct/Nov	Weaning of lambs

A New Zealand website www.lifestyleblock.co.nz is an excellent source of free information for small block farmers. The section 'lifestyle file' is particularly useful as it has a number of articles on topics relevant to keeping small flocks of sheep, and general farming advice.

Animal health is an important aspect of farming, so you will need to enlist the services of a good vet.

Selling stock

When you are ready to sell your animals, they can be sold at the sale yards – you will need to contact your stock agent and arrange for cartage to the yards. On the day they will be auctioned and sold if they meet your reserve price. You pay a commission to the stock agent and are required to disclose the withholding periods of any relevant animal health applications on the Animal Status Declaration.

Another method is to sell to a fat stock buyer with the intention of meat production. There is a risk when stock prices are volatile, but potentially good returns. Generally, you can't sell stock directly to the processor unless your property is accredited.



Photo credit: Beef+Lamb NZ

TAKE HOME MESSAGES

Using sheep for leaf plucking has its advantages and disadvantages.

Advantages

- Cost savings
- Potential fuel savings
- Can do a better job than other methods

Disadvantages

- Management required
- Timing is crucial
- There is still a lot we don't know about spray and chemical use and using sheep
- Sheep cannot be used in all situations

The basics

Use sheep for leaf plucking between 80% flowering and pre bunch closure. At around berries 'pea size' is optimal. Fence the vineyard into areas of 1-3ha, with the same variety. Mow before sheep are brought in. Keep a very close eye on their progress. It is better to slightly under-do the job than to over-do it. Some breeds are better than others, mature ewes are best as opposed to lambs.

Sprays and chemical use

Be aware that products commonly used in vineyards can have animal health and meat residue issues. There is a lot of information we still don't know in this area.

Some newer products have label grazing restrictions – always abide by these labels. Some other products have registration for forage grazing, so these withholding periods can be used as a guide so long as the difference in rates is taken into consideration. If a product has no information on its label about grazing restrictions, do not assume it is safe to use.

Talk to your grazier about the withholding periods for harvesting and the products you are using before/ while the sheep are on your property. Be aware that using mature breeding ewes does not always mean that these animals will not be slaughtered for meat in the same season. If they do not come into lamb, or lose their lambs, they may be sent for processing, resulting in potential residue issues.

Animal welfare

Under animal welfare legislation the persons in charge of animals have certain responsibilities. This booklet contains both the minimum standards that must be met and suggested best practice guidelines. In summary, you must:

- Provide access to water at all times
- Have sufficient levels of feed available
- Minimise the risk of pain, injury or distress, including exhaustion and heat stress, when handling or moving animals
- Provide access to sufficient shelter
- Provide treatment to any animals showing signs of injury or ill health in a timely manner
- Have a sufficient number of personnel with the knowledge and competence to care for the animals to meet the standards of welfare.

Grower experiences

There are a lot of slightly different methods used out there such as the size of blocks, number of sheep used etc, so it comes down to personal experience and preference. Talk to other growers about their experiences and find what works best on your vineyard.

Where to from here?

The following page lists some further sources of information. Further copies of this booklet are available at the Hawke's Bay Winegrowers office or you can download a copy from their website www.winehawkesbay.co.nz under the members login section.

FOR FURTHER INFORMATION

Below are further sources of information in relation to the use of sheep for leaf plucking in vineyards.

General

- Skeltons monthly newsletter 'Grapevine Intelligence' October 2009 issue
<http://www.skeletons.co.nz>

Animal welfare

- The Animal Welfare (Sheep and Beef Cattle) Code of Welfare 2010
<http://www.biosecurity.govt.nz/files/regs/animal-welfare/req/codes/sheep-beef-cattle/sheep-beef-cattle-code-2010.pdf>
- MAF (Biosecurity) for animal welfare queries/issues 0800 008 333

Resources for those with small sheep holdings

- <http://www.lifestyleblock.co.nz>
- <http://www.getfarming.co.nz>
- <http://www.fedfarm.org.nz>
- <http://www.gallagher.co.nz/electric-fence-brochures.aspx>
- The Sheep Farming Guide - *Clive Dalton & Marjorie Orr*
- Practical Small Farming in New Zealand - *Trisha Fisk*
- Lifestyle farming in New Zealand - managing livestock on a small holding - *Paul Martin*
- The Farmers' Veterinary Guide - *Massey University*

Information on plants toxic to sheep

- <http://www.teara.govt.nz/en/diseases-of-sheep-cattle-and-deer/3>
- <http://www.2farm.co.nz/common-diseases>
- http://www.vetservice.co.nz/home/index.php?option=com_mtree&task=viewlink&link_id=359&Itemid=99999999

Codex website

- http://www.codexalimentarius.net/web/index_en.jsp

New Zealand Winegrowers Export Wine Grape Spray Schedule 10/11

- <http://www.nzwine.com/members/>

Labels for vineyard sprays

- New Zealand Novachem Agrichemical Manual – *Agrimedia Ltd*
- <http://www.novachem.co.nz> (requires subscription)
- Your local spray representative/supplier/distributor
- Some chemical company websites

Agcarm – list of members

- <http://www.agcarm.co.nz>