

# Improving efficiency and carbon storage to reduce vineyard costs and GHG emissions



## Owner & vineyard locations

Clover Hill Wines  
Tea Tree (Coal River Valley) and  
Lebrina (Pipers Brook), Tas

## Property sizes

16 ha Tea Tree  
22.1 ha Lebrina

## Enterprises

Grapes (sparkling wine production).  
Varieties: pinot noir, chardonnay, pinot  
meunier and sauvignon blanc.

## Average annual rainfall

500mm Tea Tree & 1200mm Lebrina

## Soil types

Tea Tree: heavy black cracking clays to red  
clay soils. A mix of Dermosols, Sodosols and  
Chromosol over a dolomite & sand stone base.

Lebrina: deep red volcanic 'krasnozem' soil  
(averaging 1-5m deep) with basalt stone.

## Clover Hill Wines

By Sophie Folder

In Tasmania, Clover Hill Wines operate two vineyards, Tea Tree vineyard in the Coal River Valley and Lebrina vineyard at Pipers River. Pinot noir, chardonnay, pinot meunier and sauvignon blanc varieties are grown for sparkling wine production across the two Tasmanian vineyards. Wines are made at the company's winery located at Lebrina.

Clover Hill Wines are part of the Goellet Wine Estates along with Victorian based Taltarni Wines. The company has been progressive in taking actions to reduce the carbon footprint of their wines through strategies that reduce greenhouse gas (GHG) emissions in their growing and wine production practices. Reducing GHG emissions is good for the environment and also has the added benefit of saving costs through increased efficiency. An example of the company's saving measures has included a switch to LED lighting.

*"Taltarni wines have made huge changes in lighting and have changed to LED lights. They are expecting a \$37,000 drop in power bills alone over 5 years."* Alex Van Driel, Clover Hill, Vineyard Manager

Clover Hill Wines have recently participated in the Tas Farming Futures project to calculate their GHG emissions and investigate ways of reducing them. From discussions with Vineyard Manager Alex Van Driel it was revealed that Clover Hill Wines are already well on the way to implementing practices that will reduce their GHG emissions.

Through a process of reviewing their efficiencies Clover Hill Wines are hoping to reduce their carbon footprint. This includes reducing diesel usage by changing inter-row grass species to reduce requirements for mowing, efficient use of nitrogen by applying soluble forms of nitrogen fertilisers which can be applied directly to the root zone of the vines through irrigation and implementing practices to build on stored soil carbon. These practices will benefit the bottom line through labour, diesel or cost savings and also help to combat GHG emissions from the vineyard operations.

*"In the vineyard we [estimate to] have reduced our carbon footprint by applying nitrogen [fertilizer] as calcium nitrate or potassium nitrate through the dripper system [rather than foliar or broadcast application]. It is more efficient and can transform into the soil with irrigation and put nutrient into the root system of the vines [leading to better plant uptake, reducing potential nitrogen losses and nitrous oxide emissions]."* Alex Van Driel, Clover Hill Vineyard Manager

# Greenhouse gas (GHG) emissions in vineyards

## Clover Hill Wines vineyard GHG emissions

Clover Hill Wines have been participating in the Tas Farming Futures (TFF) project. Tasmanian Vineyard Manager Alex Van Driel has worked with a project extension officer to calculate the GHG emissions derived from the vineyard operations for the two Clover Hill properties.

Alex commented;

*“By calculating the vineyard’s GHG emissions it fits with the company’s focus on emissions reduction and helps us to demonstrate that we are operating our vineyards in an efficient manner.”*

*“Emissions from the vineyard account for about 1-2% of the emissions per bottle; 98-99% of emissions are from the winery.”*

Figures 1 and 2 (below) show emissions sources at the vineyards.

Total vineyard GHG emissions over the two vineyards is:

- 59 t CO<sub>2</sub>e/year
- 1.5 t CO<sub>2</sub>e/year/ha
- 0.012 t CO<sub>2</sub>e/ t of fruit produced.

These were calculated using the Australian Wine Carbon Calculator, available at [www.wfa.org.au/entwineaustralia/resources/carbon-calculator/](http://www.wfa.org.au/entwineaustralia/resources/carbon-calculator/)

Emissions at the vineyards are identified according to their scope.

- Scope 1 refers to emissions from direct activities at the vineyard and includes mobile fuels (diesel and petrol use) and nitrogen fertiliser use.
- Scope 2 emissions are from the production of electricity for direct use by the vineyard.
- Scope 3 emissions are from associated activities which are either not at the vineyard or are emissions from other activities at the vineyard. These include contractor use and energy transmission and distribution losses.

In carbon accounting situations (if a vineyard was to participating in a carbon neutral or offset program / scheme) businesses only need to report (to their participating program / scheme) on their Scope 1 and 2 emissions. Scope 3 emissions have been included in the above calculations for comparison.



### What is CO<sub>2</sub>e?

CO<sub>2</sub>e (Carbon dioxide equivalent) is a measure of global warming potential of greenhouse gases such as nitrous oxide compared to carbon dioxide (CO<sub>2</sub>). E.g., nitrous oxide has a global warming potential of 298, which means that 1t of nitrous oxide in the air has the same heat trapping effect as 298t of carbon dioxide over a 100-year time frame.

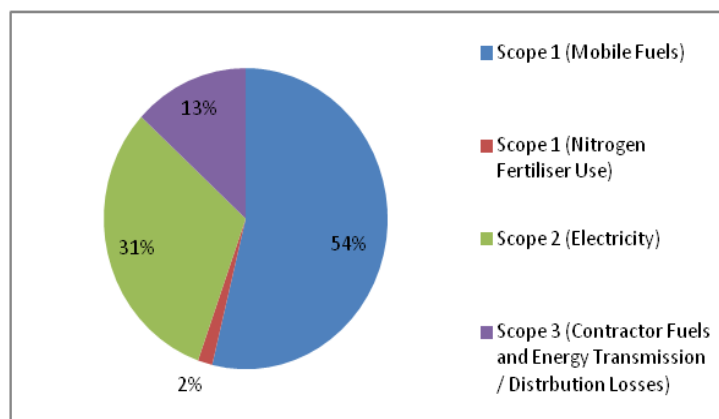


Figure 1: Estimated GHG emissions from the vineyard operations at Tea Tree are 33 t CO<sub>2</sub>e/year, of which 54% is CO<sub>2</sub> from fuel use

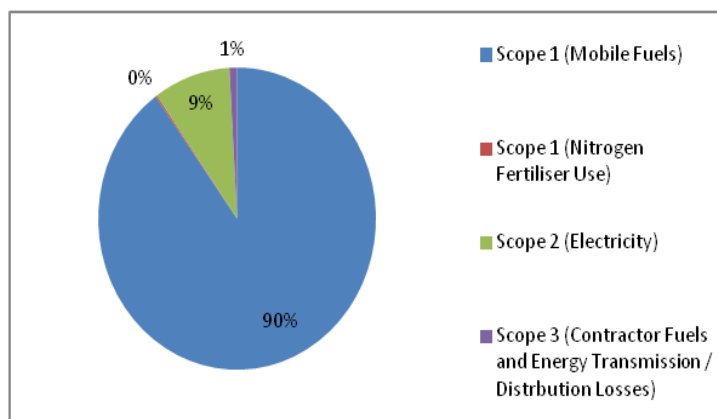


Figure 2: Estimated GHG emissions from the vineyard operations at Lebrina are 26 t CO<sub>2</sub>e/year, of which 90% is CO<sub>2</sub> from fuel use

## Fuel Use

Diesel and petrol use is a source of carbon dioxide (CO<sub>2</sub>) emissions from vineyards. Reducing fuel use is a matter of reviewing the efficiency and size of your tractors / vehicles for the operations that are undertaken, ensuring that equipment is best suited to the tasks and reducing where possible the number of passes needed to undertake vineyard activities. Fuel consumption at the Clover Hill vineyards accounts for 54% of the GHG emissions at Tea Tree and 90% at Lebrina. This is attributed to the difference in rainfall and resulting growth of inter-row grasses and subsequent need for mowing. The high rainfall at Lebrina results in high growth rates and inter-rows are slashed every two weeks during the growing season, leading to higher diesel usage.

Contractors are not used at the Lebrina vineyard and all tractor based vineyard operations are conducted by owned equipment which adds to the Lebrina diesel figures. In comparison, contractors are used for barrel pruning and mechanical harvest at Tea Tree which is reflected in the scope 3 emissions figures. Clover Hill vineyards are working to reduce their fuel usage through making changes to their vineyard practices, including changing the type of grass species used in inter rows to reduce the need for mowing. See the tips overleaf for more detail on these changes that Clover Hill are implementing in their vineyards.



Photo 1: Inter row grasses in vineyard, fescue (left row) and ryegrass mix (right row)



Photo 2: Kangaroo grass (*Themeda spp.*) growing on banks adjacent to the vineyard

## Tips for reducing GHG emissions in vineyards

### Tip 1 – Use low growth grasses

In order to save time and diesel, Clover Hill are moving from a cover cropping inter-row system to one of slow growing perennial grasses.

*“We have moved away from growing cover crops. We were growing Ryecorn every second row and then knocking it down with a crimp roller to provide a ground cover. We still mow in some blocks although we will move away from this to put in more perennial grasses that are slower growing so we don’t have to slash as often e.g. fescue.”*

Currently the Tea Tree vineyard is mowed four to six times over the growing season. By planting slower growing grass species in the inter rows, Alex hopes that the frequency of mowing will be significantly reduced.

*“We will sow a mix of Quantum and Resolute (Fescue varieties) and should only have to slash it twice a season.”*

*“In our northern vineyard (Lebrina) we are using Kentucky Bluegrass, which is a short growing grass even in high rainfall situations. Currently we have to slash every two weeks. We are wasting time and diesel.”*

Native grasses including Kangaroo Grass (*Themeda spp.*) are growing on some banks, headlands and fencelines at Tea Tree. This is encouraged and maintained and does not require regular slashing (Photo 2).

*“The plan will be to put sheep in to graze the inter-rows over the winter. This saves us diesel and costs. It costs \$20 - \$60 per hectare to put a tractor in and [sheep grazing] will save us two cuts (over winter), which is about \$500 saved per year.”*

It should be noted from an emissions perspective, the use of sheep grazing in the vineyard will add an additional source of emissions (methane from belching and nitrous oxide from urine and manure) which should be included in future GHG modeling.

### Tip 2 – Evaluate efficiency of vehicles and equipment

Alex has taken the time to evaluate the equipment used in the vineyards and to ensure that operations are undertaken efficiently.

*“We want to use new generation tractors with 3 point linkage on the front and front end drivers so we can do two jobs at one time. Such as applying a weedicide and slashing or foliar trim and slash at the same time. So far we have 1 of the 5 tractors fitted with a Front End Loader. Over the next 5 years it is hoped to have all tractors with some form of 3PL linkage system.”*

They have recently purchased a new Quantum Mister sprayer for use at the Tea Tree vineyard which has enabled a massive reduction in time spent spraying.

*“It used to take us 28 hours to spray the vineyard, this has been reduced to 10 hours.”*

At certain times of the season foliar fertilisers can also be added to fungicide spray mixes, and/or can be injected into the irrigation system through the drippers (at Tea Tree) saving in additional passes with the tractor.

*“If we spray we can apply calcium nitrate and potassium nitrate through our fungicide spray program.”*

## Electricity Use

Electricity is another source of CO<sub>2</sub> emissions in vineyards.

Electricity use at Clover Hill vineyards is related to irrigation, lighting, pumps and a manager’s residence. Tea Tree is an irrigated vineyard and electricity accounts for 31% of GHG emissions where as Lebrina is dryland so only 9% of GHG emissions are attributed to electricity use. A winery is located at the Lebrina vineyard but winery electricity usage from this was excluded from this calculation for the vineyard.

Emissions produced by energy consumption can be reduced by increasing the energy efficiency of appliances and equipment used or through offsetting energy use with on farm renewable energy systems (e.g. solar panels, solar hot water, wind turbines or mini hydro schemes).

### Tip 3 - Undertake a pump efficiency review

One of the first steps is to undertake a pump efficiency review. A pump efficiency calculator is a simple tool that can be used to assess the performance of irrigation pumps and indicate if upgrades are required to save energy.

A simple pump efficacy calculator and further information can be found at; [www.farmpoint.tas.gov.au/farmpoint.nsf/UsefulResources/6BF64301272D6475CA25775100226DDD?OpenDocument](http://www.farmpoint.tas.gov.au/farmpoint.nsf/UsefulResources/6BF64301272D6475CA25775100226DDD?OpenDocument)

### Tip 4 – Ensure vineyard irrigation is efficient

Effective irrigation design is crucial to ensure that vineyard irrigation systems deliver the quantities of water required in the most efficient manner.

*“We have an electric pump that is 37 KW / 50hp and is fully automated. The electric delivery system delivers water via drippers at a rate of 2L per hour. It enables the delivery of water exactly where we want it.”*

*“We irrigate more frequently two times per week for four hours to maintain available moisture for the vines and prevent deep cracking of soil in the vine row, that would normally result in roots being sheared off. ”*

# Tips for reducing GHG emissions in vineyards

## Tip 5 – Save costs through using off peak power tariffs

The use of off-peak power can significantly reduce costs associated with irrigation. It will not directly reduce emissions in the vineyard, although some savings may be made through reducing evaporation by irrigating at night (when temperatures are at their lowest) and therefore lower the amount of water applied.

Alex has made changes to the irrigation systems at Clover Hill which has enabled them to make use of off-peak power tariffs, which offers a cost saving to the vineyard.

*“We have moved to off-peak power. We now have 7 hours of pumping at a lesser cost than peak power. This change will cut about 11% off the cost of the power bill. Previously we couldn’t do that as the grommets (lines) would pop out. They were put in wrongly and pop out of the ground when running at high pressure in the main lines, it was a big issue.”*

## Tip 6 – Reduce irrigation needs through using mulches to help retain soil moisture

Under vine soil management practices will influence water retention and soil organic carbon stores.

The use of compost or other organic amendments / mulches under vines will reduce water evaporation and can increase soil organic carbon thus leading to increased water holding capacity, increased nutrient availability and increased microbial activity.

The use of side throwing mowers to throw grass clippings from grassed inter-rows under the vines is a useful way of providing a ground cover / mulch.

*“We mulch prunings into the ground and blow grass mulch under the vines.”*

In the past, cover crops such as Ryecorn have been grown and then knocked down with a crimp roller to provide a mulch under the vines at Clover hill vineyards.

Soil amendments are being looked at to help reduce water needs.

*“Fish and kelp emulsions will be used to add more enzymes in the soil to make our soil more active.”* Alex thinks it will give the vines more drought resistance which will be important for the dryland Lebrina vineyard.

## Nitrogen Fertiliser Use

Nitrous oxide (N<sub>2</sub>O) is a GHG that can be emitted when Nitrogen (N) fertiliser is added to the soil. N<sub>2</sub>O is a particularly powerful GHG, and its emission (via denitrification) is one path of nitrogen loss in vineyards (along with volatilisation, leaching and run-off). Adopting vineyard management practices that reduce losses of N (see tip 7) is important for the environment as well as saving dollars in nitrogen applied and lost out of the rootzone.

## Tip 7 – Apply Nitrogen fertilisers through irrigation (fertigate)

Applying fertiliser through irrigation systems (fertigation) not only saves on diesel (through reduced tractor use) but is also good practice for increasing uptake of applied nutrients by the crop and therefore reduces the potential for nitrogen to be lost through denitrification, leaching or volatilization.

*“We [estimate to] have reduced our carbon footprint by applying nitrogen as calcium nitrate or potassium nitrate through the dripper system. It is more efficient and can move into the soil with irrigation and put nutrient into the root system.”*

This delivery system is more efficient than broadcast application of fertiliser in achieving plant uptake of nitrogen and should result in reducing nitrous oxide emissions from vineyard fertiliser use.

*“In delivering the fertiliser through the irrigation systems it is more convenient and means less passes (with the tractor).”*

*“It takes 6 hours to inject what we want (fertiliser) where as it would take 10 hours to apply it as a foliar spray and wouldn’t deliver as much. Therefore we would have to do it in 2 passes and risk burning the foliage.”*

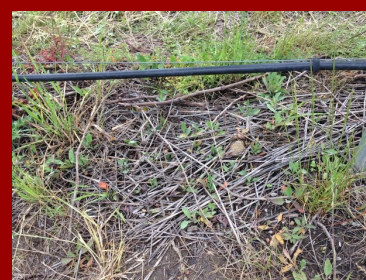
## Renewable Energy

## Tip 8 – Investigate options for renewable energy use

The use of on farm renewable energy sources such as wind, solar or mini hydro systems can be an option for some properties to fully or partially offset their energy use drawn from the national grid. Such systems are site specific and it is not a case of one system fits all – do your research before investing in a particular system.



*“In delivering the fertiliser through the irrigation systems it is more convenient and means less passes (with the tractor).”*



*“We mulch prunings into the ground and blow grass mulch under the vines.”*



*“Our soil carbon levels are increasing slightly. We expect to get a better result when we go to a perennial grass system [in the inter rows] as we will grow more roots that go deeper and we’ll have the addition of the mulch to blow under the vines. The mulch will add carbon back into the ground.”*

## Carbon sequestration in vineyards

### Storing Carbon

#### Tip 9 - Use practices that ‘store’ carbon

Vineyards can play an important role in sequestering carbon from the atmosphere. This can be in various forms including on farm ‘environmental’ plantings (e.g. shelter belts) and in the soil through building soil organic matter.

Clover Hill have recently planted a large windbreak at the Tea Tree Vineyard which as it grows will store carbon in the wood. The changes they are making in moving from a cover crops inter-row to a perennial grassed inter-row should also have benefits on soil carbon stores.

One of the most significant factors influencing soil carbon levels is the time that it is left fallow (Cotching, 2009). Perennial pastures are known to have a positive impact on soil organic carbon levels (due to their fibrous root system) as well as the addition of crop residues and mulches, (Cotching, 2009). Therefore a perennial grass system being implemented at Clover Hill should be positive for soil carbon.

*“Our soil carbon levels are increasing slightly. We expect to get a better result when we go to a perennial grass system as we will grow more roots that go deeper and we’ll have the addition of the mulch to blow under the vines. The mulch will add carbon back into the ground.”*



## Emissions Reduction Fund

#### Tip 10 - Investigate options to participate in the Emissions Reduction Fund

The Emissions Reduction Fund (ERF) will help to reduce Australia’s emissions by providing an incentive for businesses, land owners, state and local governments, community organisations and individuals to adopt new practices and technologies which reduce emissions.

A number of activities are eligible under the scheme and individuals and organisations taking part can earn Australian carbon credit units (ACCUs). One ACCU is earned for each tonne of carbon dioxide equivalent (tCO<sub>2</sub>-e) stored or avoided by a project. ACCUs can be sold to generate income, either to the Government through a carbon abatement contract, or on the secondary market e.g. the voluntary market or those needing additional ACCUs to meet the obligations of their ERF abatement contract with the government.

To participate in the ERF, an ERF project using an approved method has to be registered with the Clean Energy Regulator. For sequestration projects, carbon must be stored for set period of time e.g. 100 years or 25 years (at a reduced rate of ACCUs), depending on the type of project and method. The selected carbon storage or emission reduction activity must be additional and not ‘business as usual’. The only current methods that are applicable for vineyards are those involving carbon sequestration in other types of trees e.g. new environmental plantings or re-growth, on land not used for vineyard plantings.

Whilst carbon sequestration in soils is not yet approved as a method for participation in the ERF for vineyards, increasing soil organic matter and thus carbon is something that growers should focus on with their vineyard management practices, as it is linked to soil health and productivity. (As of June 2015 the soil carbon methods available under the ERF relate to soils used for grazing, so is not applicable for vineyards). New methods are being approved under the ERF, so it is worth watching this space as opportunities for participation may change.

Further details on the ERF is available at: <http://www.cleanenergyregulator.gov.au/Emissions-Reduction-Fund/About-the-Emissions-Reduction-Fund/Pages/Default.aspx>



## Summary

Clover Hill Vineyard's experience shows that there are many ways in which vineyards can reduce GHG emissions and store carbon on farm for the benefit of the environment and the business bottom line.

Simple changes in vineyard practices including improved inter row management, efficient use of nitrogen fertilizers and improved pump and irrigation efficiency will help Clover Hill Wines to reduce fuel and electricity use, increase labour efficiency, get the most out of their fertiliser inputs and build on soil organic carbon stores.

Whilst currently participation in the ERF for vineyards is limited, it is hoped that in the future this may change to provide additional options for vineyards to gain benefit from emissions reduction and carbon sequestration projects.

## Like to know more?

Contact our extension team:

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*We can visit you on-farm and support you with improving farm efficiency & reducing GHG emissions*



**Tas Farming Futures**

*Supported by funding from the Australian Government*

## Points to remember

Tip 1 – Use low growth grasses in inter rows

Tip 2 – Evaluate the efficiency of vehicles and equipment

Tip 3 – Undertake a pump efficiency review

Tip 4 – Ensure that vineyard irrigation delivery is designed to run efficiently

Tip 5 – Save costs through using off peak power tariffs

Tip 6 – Reduce irrigation needs through using mulches to help retain soil moisture

Tip 7 – Apply Nitrogen fertilisers through irrigation (fertigate)

Tip 8 – Investigate options for renewable energy use

Tip 9 – Use practices that will 'store' carbon on farm

Tip 10 – Investigate options to participate in the Emissions Reduction Fund (ERF)

**Working with industry and NRM statewide**

Resources available online  
[www.rmccg.com.au](http://www.rmccg.com.au)



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## References

Cotching, B, 2009, Soil Health for Farming in Tasmania, Bill Cotching.