

Progress report on project:

Restructuring Vineyard Soils with Dung Beetles

Running cattle in the vineyard

The original funding submission proposed grazing cattle in a vineyard and inoculating dung pads with dung beetles.



Quantification of the results is incomplete but it soon became apparent that grass within the vineyard was the limiting factor. Even with hay introduced into the vineyard, insufficient dung was produced on site to make a measurable increase in the vineyard soil carbon budget within the one year trial .

In this trial there was no damage to vines or trellis from running cows and calves in the vineyard.

Cows and calves in grazed vineyard

Small plot trial

In addition to the grazing trial, Dr Bernard Doube installed small plots using short cylinders cut from large diameter PVC pipe. Each plot received one of three treatments:

0 = Nil, the control treatment.

1 = dung only

2 = dung plus inoculation with *Bubas bison* dung beetles



The 30 small plots



Left: dung in cylinder over buried bag. Centre: after dung beetles have buried some dung and brought casts of subsoil to the surface. Right: cylinder lifted to show beetle tunnels

The plots were within the vine row and so in the wetted strip from drip irrigation. In half the plots, holes were first dug to 50cm. Double onion bags were used to line the holes before

they were back filled with the excavated soil. Only then were the PVC cylinders superimposed and the three treatments applied. The bags then became underground cages for the dung beetles. They dug tunnels to the base of the bag where they dragged dung down to 50 cm and laid eggs in the dung.

In early May the bags were lifted with the help of a backhoe used to excavate a trough into the stony soil alongside the buried bags. These were taken back to the Dung Beetle Australia lab where measurements of soil volumes and moisture content were made of:

- At the surface –any remaining dung and the subsoil brought to the surface by dung beetles during tunnel excavation
- In the bag – the bulk of the soil profile including any soil moved by beetles in making tunnels to the base of the bag.
- In the bag – the carbon rich beetle larvae excreta and brood chambers at the base of the bag.



The backhoe trenching alongside plots

Samples of these soil fractions have been sent away for chemical analyses including for carbon. With the results quantitative estimates can be made of soil carbon and other nutrient increases due to dung beetles.

Some preliminary findings are:

- *Bubas bison* is well adapted to conditions at Phil Lehman's vineyard. Beetles have moved quantities of dung into the subsoil.
- A new generation of beetles both as fully formed adults and as larvae that will take a further year to develop, were plentiful at the 50 cm level.
- During the year that the caged plots were in place, vine roots penetrated and were plentiful in the dung with beetle cage bags but there was virtually no root colonisation of the control or dung only bags.
- At the time of exhuming the bagged soil it was noticeable that all the soil in the dung with beetles treatment, was moister than the other two treatments. The likely reason is that beetle tunnels have improved rainfall penetration.



50 cm bags of soil laid horizontally on lab bench with the original soil surface to the left. Left: control plot showing no root colonisation. Right: the deeper end of a dung plus beetle plot showing the concentration of beetle larvae excreta colonised by vine roots

These results indicate that on a commercial scale there would be benefits to the physical and nutrient value of vineyard soils, if dung could be imported from dairies or feedlots, banded along the vine rows and inoculated with the appropriate type of dung beetles. A funding submission to investigate a larger scale experiment has been submitted for funding.

Reporting findings

Once the soil carbon and nutrient results are received, we will produce a written report and present it to the EVWGGG at a field day held at Phil Lehmann's vineyard where we can also dig a trench where we applied a thick ribbon of dung alongside vines and inoculated with *Bubas bison* and another dung beetle genus (*Spinager*).



Laying dung strips to simulate a possible commercial application system using imported dung inoculated with beetles.

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