Non-residual Pesticides

henry manufacturing limited

HML32 POWDERY MILDEW ERADICATION TRIAL

HAWKE'S BAY, JANUARY 2014

Trial undertaken by Chris Henry, Henry Manufacturing Ltd
Independently assessed by Peter Wood, Plant and Food Research
Report prepared by Chris Henry, Henry Manufacturing Ltd

Eradication of Powdery Mildew infection – Montepulciano January 2014

Background

This trial was undertaken on a small privately owned vineyard on Shanley Road, Hastings. The variety was Montepulciano and the vines are approximately 6 years old. Montepulciano is an Italian red variety with large bunches, large berries and loose bunch architecture.

These vines had a history of powdery mildew, blind budding and poor cropping. They were in the first season of conversion from 2 cane VSP to a Guglielmo system (4 x half cane VSP).

The vines were inspected on the 10 January 2014. The canopy was minimally tucked and sprawled. No leaf plucking had been undertaken and bunch exposure was less than 10%. The vines were heavily cropped.

There was no evident canopy powdery mildew but bunches were significantly infected – high incidence of bunch infection up to 40% severity. The berries were clean of any sulphur (or other) spray residue and the powdery mildew infection enveloped parts of the rachis and part areas of individual berries. All bunches were green with no indication of veraison.

Individual bays were taken at one end of 6 rows where the infection was most advanced (single treatment plots – not replicated). All vines were tucked and the bunchline leaf plucked for total light exposure.

Treatments

There were six treatments as follows:

- HML^{32} (1.25l/100l water)
- HML^{32} (1.25l/100l water) + 300gms/100l potassium bicarbonate
- HML^{32} (1.25l/100l water) + 600gms/100l potassium bicarbonate
- HML^{32} (1.25l/100l water) + 900gms/100l potassium bicarbonate
- HML^{32} (1.25l/100l water) + Kocide 90gms/100l
- HML^{32} (1.25l/100l water) + Kocide 90gms/100l + 300gms/100l potassium bicarbonate

Application and Dates

Treatments were hand-sprayed using a hand gun powdered from a quad bike on Saturday, the **11th January 2014**, early/mid-afternoon in mild warm conditions. A second application was made to one half of each treatment bay on the Saturday the **18th January 2014** of the same treatments – again in good spraying conditions.

Bunches were tagged in each treatment and a photographic record was taken prior to each application (11 and 18 January 2014), then 12 January 2014, 26 January 2014 and on 8 March 2014.

Assessment

The treatments were **inspected early morning on the 12th January 2014**. All treatments appeared to have depressed the mycelium and the best treatment appeared to be the one which contained both the boost of copper and potassium bicarbonate. In this treatment, all the mycelium was depressed and had turned grey. The mycelium also appeared to have provided a filter effect or an attraction of spray residue. This is discussed in 'Discussion and Summary'.

Ten of the most infected bunches were harvested from all treatments on the 30th January 2014 and **assessed on the 1st February 2014**, except for HML[32] + 300gm potassium bicarbonate (x2) ,which was harvested and assessed on the 4th February 2014.

These bunches were assessed by Peter Wood of Plant and Food Research, initially for the degree of primary infection, then secondly for re-infection of powdery mildew.
His findings are graphed in Figures 1 and 2.

Interestingly, it was from infection in this trial that Peter Wood for the first time in New Zealand identified **'chasmothecia'** (the sexual phase of powdery mildew) as being present. Since then it has been found to be wide spread in Gisborne and Hawkes Bay and in Marlborough.

Summary of Results (for eradication of infection)

The treatment of HML[32] by itself required two applications to produce any lasting efficacy in eradicating powdery mildew.

The ability of HML[32] to eradicate was improved by further additions of potassium bicarbonate and additional effectiveness increased as the rate of potassium bicarbonate was increased.

HML[32]'s ability to eradicate was massively enhanced by the addition of copper. The treatment of HML[32] with copper and potassium bicarbonate was found to be the most effective, confirming the initial observations made a day after the first application.

All of the treatments improved their efficacy if sprayed twice.

Chronological Photographic Record

Figures 3 and 4 show the photographic record for the two tagged bunches in the HML32, copper and potassium bicarbonate treatment, before the initial treatment through to harvest.

Electron Microscope Images

Figures 5 through to 10 show images obtained using an electron microscope at Massey University on the **29th January 2014.** These show surface effects of various treatments, images of untreated powdery mildew mycelium and spores to compare with images of various treatments on mycelium and spores.

Figure 1: Assessment Results – Percentage of Infection

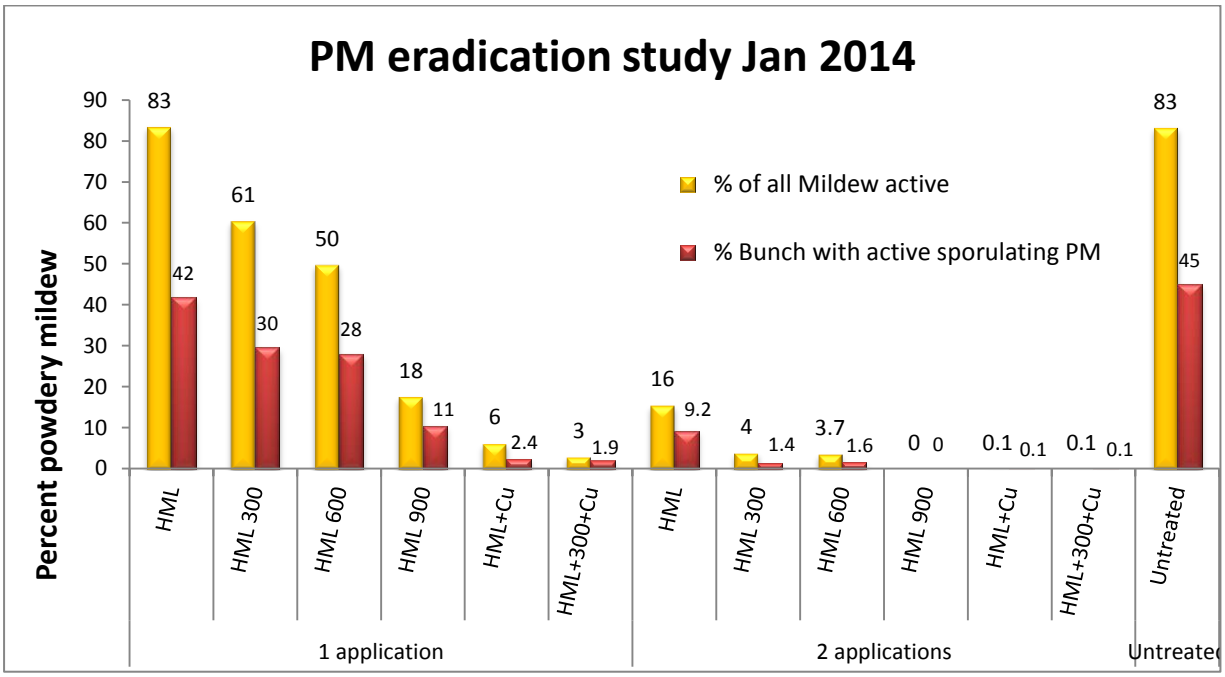
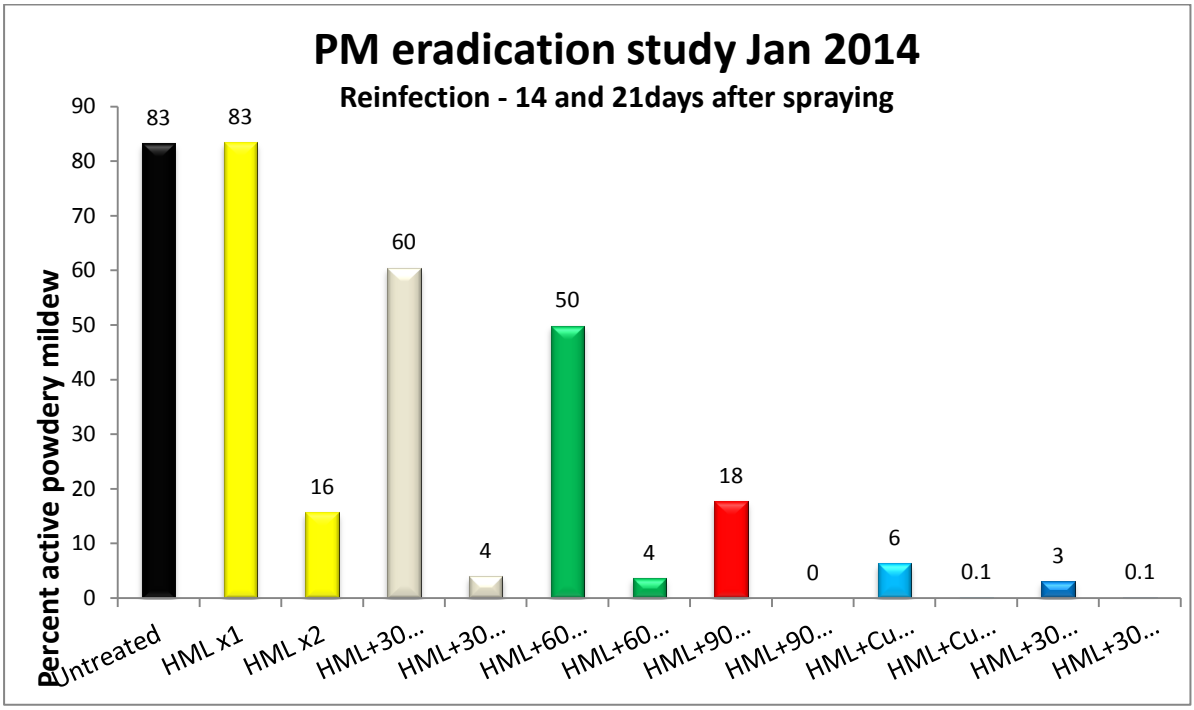


Figure 2: Assessment Results – Percentage of Reinfection



Comments on Graphs: The data and results as represented in this study are sound. There are two aspects that however do not allow it to meet higher thresholds of scientific standards.
One aspect is that the trial was not replicated, the other is that the comparisons between one and two applications are not 'an even playing field', in that the assessment was made on the same date, while the application dates of the first and the second application were a week apart.

Figure 3: Photographic Record for Bunch 1 in Treatment **HML32+Cu+300g KHCO3**

Treatment - HML32+Cu+300g KHCO3	
Site 1	Site 2
	
1. 11 January 2014	2. 12 January 2011
	
3. 26 January 2014	4. 8 March 2014

Figure 4: Photographic Record for Bunch 2 in Treatment **HML32+Cu+300g KHCO3**

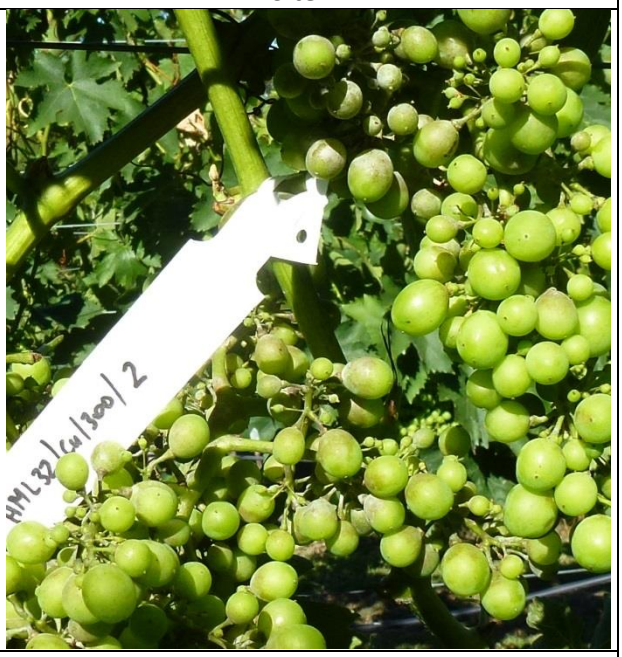
Treatment - HML32+Cu+300g KHCO3	
Site 1	**Site 2**
	
1. 11 January 2014	**2. 12 January 2014**
	
3. 26 January 2014	**4. 8 March 2014**

Figure 5: Electron Microscope images - A typical image showing desiccation of a spore and 'calcification' of mycelium. The treatment was HML32 + Cu + 300gms potassium bicarbonate

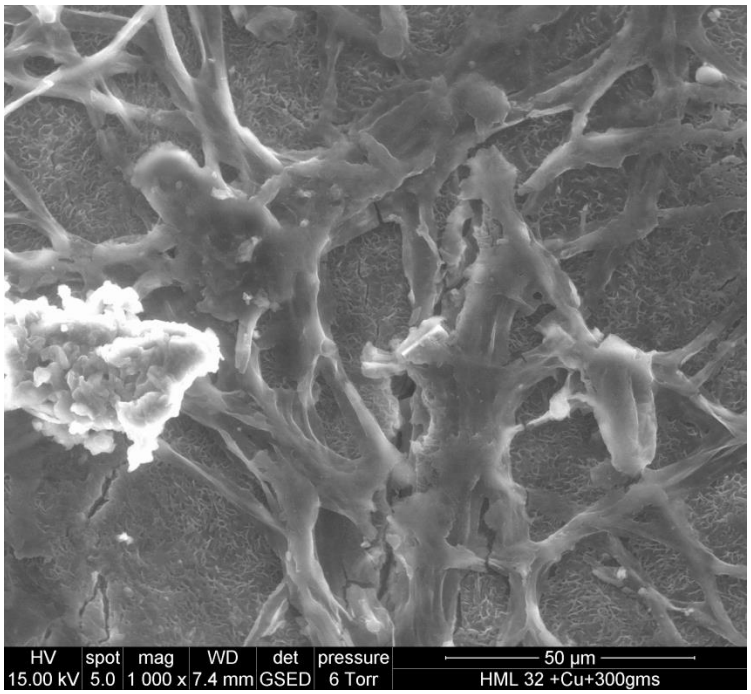


Figure 6 - Electron Microscope images - A typical image showing 'calcification' of mycelium. The treatment was HML32 + Cu + 300gms potassium bicarbonate

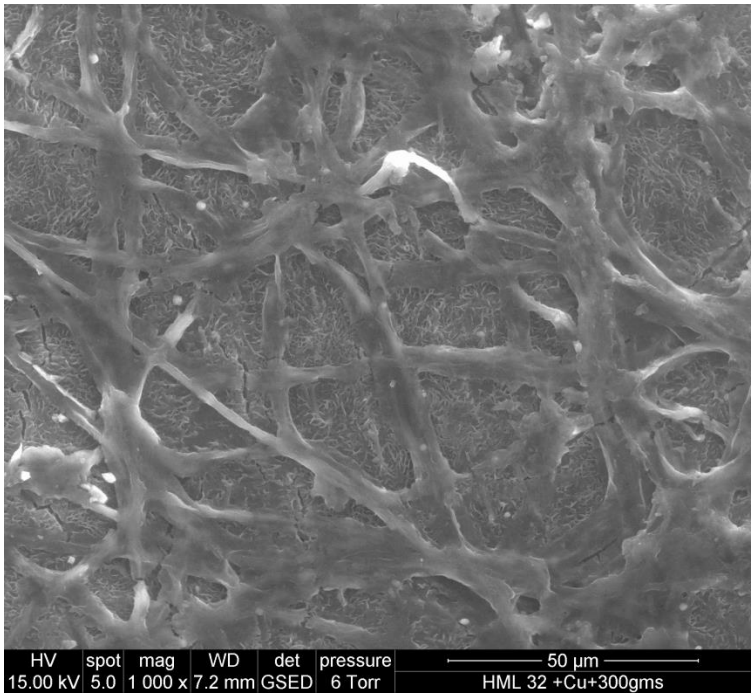


Figure 7: Electron Microscope images - This is a non-typical image showing live powdery mildew spores and mycelium. In this case the spores have been dislocated from the mycelium probably by transit vibration.

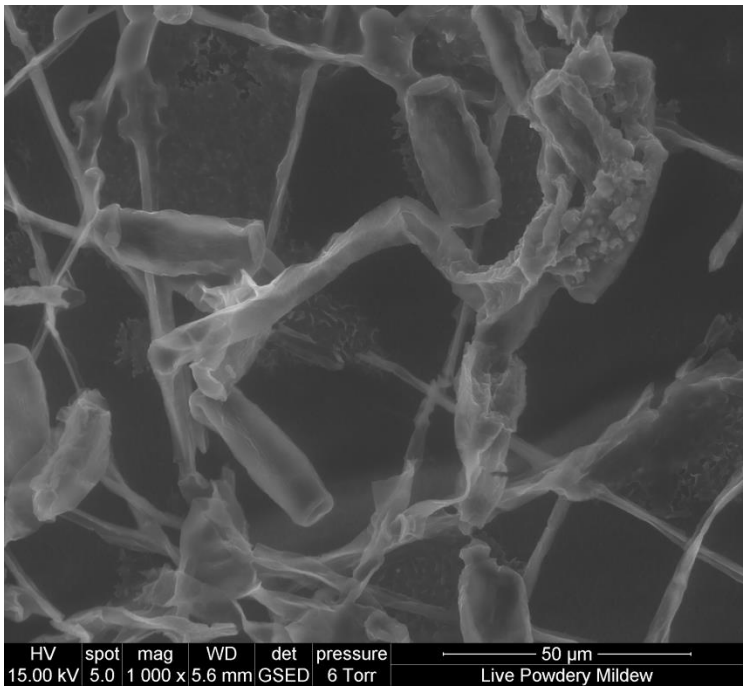


Figure 8: Electron Microscope images - An image of HML32 + 900gms of potassium bicarbonate. Of note beside the 'calcification' of mycelium is the appearance of 'flower' type structures thought to be crystalline potassium bicarbonate.

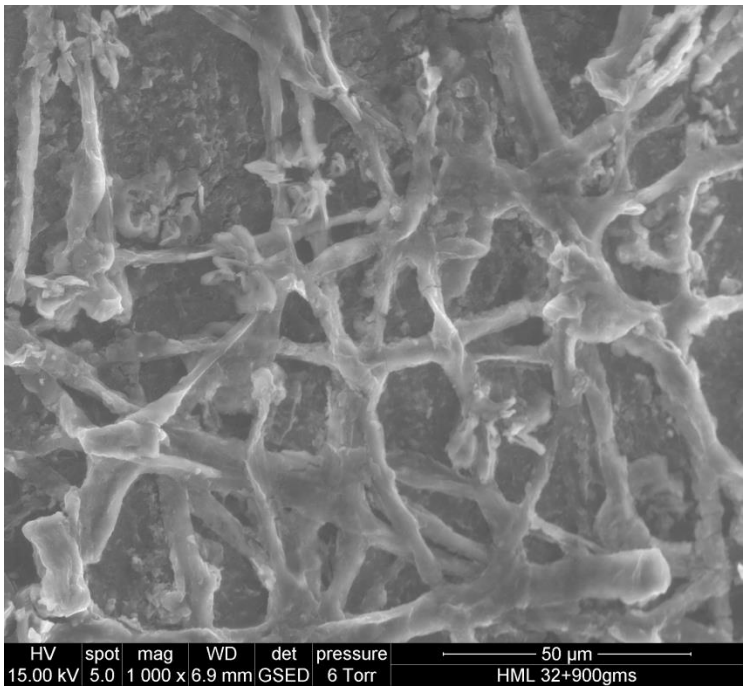
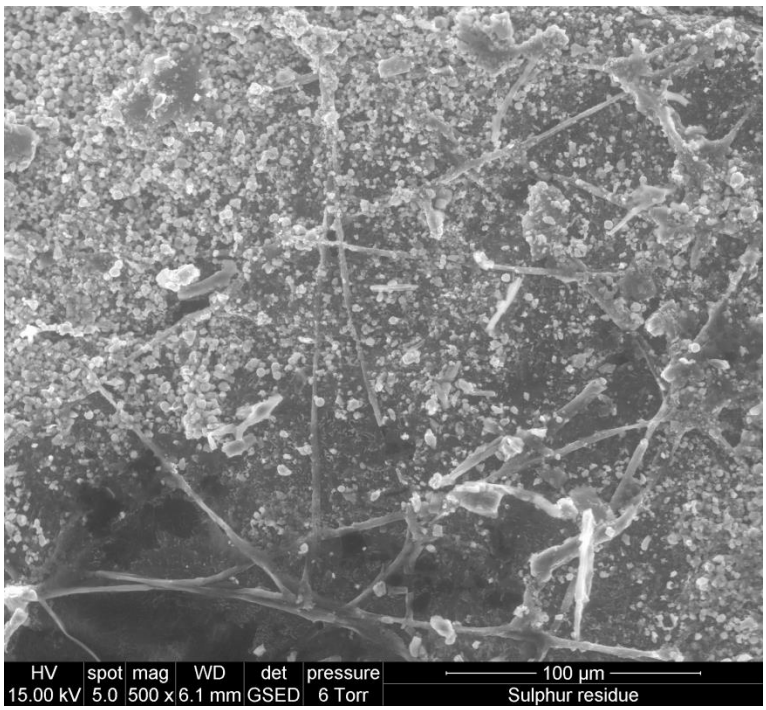


Figure 9: Electron Microscope images - An image of 'scar' tissue formed in the area of treated (eradicated) powdery mildew infection. The skin is thickened and more lightly coloured than areas of non-infection. Photograph Number 4 in both Figures 3 and 4 are typical.

Figure 10 - Electron Microscope images - An image of heavy sulphur residue - not from the trial area. The sample came from a Gisborne vineyard that had failed to contain powdery mildew infection with heavy sulphur applications.



The Grower's response to powdery mildew infection and their harvest outcome

The most infected area of the vineyard was used for the hand sprayed trial. Throughout the remainder of the vineyard, bunch powdery mildew incidence was high, but the severity somewhat less than the trial area.

In the first instance, the grower tucked and top trimmed the vineyard, followed by a hand leaf pluck which fully exposed the fruit zone.

Shortly after the 12th January 2014, the crop was then bunch line sprayed one way, then the opposite way with HML32 + copper + potassium bicarbonate (as treatment 6). A follow up application was made approximately 10 days later – as a precaution against re infection – however the power mildew infection seemed to be already dealt with before the second application. The trial area was left unsprayed.

The crop went normally through veraison and developed thick skins. For the most part, the diseased berries did not split (as expected) nor did they raison significantly. In general, they did not grow to the same size as uninfected berries. Their sugars and flavours came earlier but no musty off flavours associated with powdery mildew occurred. It should be noted that the grower applied a Switch® at veraison and there were 2 subsequent applications of HML32. They remained sound from botrytis until the very end of the season when +150mm of rain occurred over a few days. At that point the row ends that had been severely infected with powdery mildew (including the trial area) became infected with botrytis and subject to wasp attack– the rest of the crop however survived and was harvested without botrytis or other issue on 19th April 2014

Figure 7: Near Harvest - 15 April 2014

Discussion and Summary

The simple conclusion is of this study is that "HML32 with additional copper and potassium bicarbonate has the ability to control an outbreak of powdery mildew."

There appeared to be no negative phytoxicity effects from any of the treatments.

From the view point of simple efficacy, the outcome was not a complete surprise given that a program of Protector and copper have previously shown remarkable efficacy against powdery mildew and activated potassium bicarbonate is best known as a pesticide for its activity to eradicate the disease.

There were 2 unusual noteworthy outcomes:

- Following very obvious berry infection, for the most part the berries did not split, raison or succumb to early botrytis, which would have been the expected outcome. The berries thickened its skin in the area of previous infection. Where the previous infection was slight, the thickening was discernable (if you looked hard enough), but otherwise the berry went through veraison normally and ripened to a normal size and colour.
- In both treatments that contained copper, the spray seemed to be attracted to the powdery mildew mycelium and the area within it, initially leaving residue on it. Overtime this residue eroded but in its place the berry formed extra-ordinary thick skin in its place. The previously infected surface was clearly altered by the infection and/or treatments, as can be seen in the photographs and the image taken by the electron microscope. The other treatments were attracted likewise but the residue was less obvious.

Application and coverage are the key issues to obtain maximum efficacy as the mode of action is contact. Research undertaken by Dr David Manktelow compares coverage achieved by single pass and reverse pass spraying. That work is published on the website. The evidence is clear in his report **in favour of adopting reverse pass spraying for eradication** – as was undertaken by the grower in the machined sprayed aspect of this trial.

Connected reports and trials:
Go to Website www.henrymanufacturing.co.nz
Protector/Research and trials

- Protector and copper for control of powdery mildew on grape – summary of 4 years of Hort Research trials
- Eradication trial (hand sprayed) on grapes – Verdelho raw results (powdery mildew)

HML^{32}/Research and trials

- Video of Powdery Mildew Eradication trial – Hawkes Bay 2014
- Best Practice Powdery Mildew Infection Eradication, January 2014
- Comparison of spray deposition – single pass or with a reverse pass. Dr David Manktelow.