Vineguards – How Hot Inside? By Graham Due. Victorian Viticulture News Winter 1999.

Vineguards – How Hot Inside?

Graham Due

High temperatures inside vineguards are good and bad: good because they kill fungus diseases like powdery and downy mildew, but bad because they can increase heat stress on young vines. Trials have shown that vines can easily tolerate temperatures as high as 55°C inside vineguards – provided root function is good enough to keep the leaves well supplied with water. However, temperatures much in excess of that are hazardous, and can kill the phloem tissue of the vine shoot.

It is therefore important to understand how much temperature rise you can expect from a vineguard.

We conducted thorough measurements by measuring temperature elevations on a sunny summer day, early in the afternoon, with little or no wind. These conditions gave the highest temperature rise. By using the arrangement of Fig 1, and averaging over time, it was possible to measure differences as small as 0.1°C. We used basic triangular "Corflute" tubes, 900 mm long and with 100 mm long sides.

The average temperature rise was about 10°C, but different tube design features give different temperature rises. The results were surprising:

- Blocking off the top of the tube made a difference of only 0.3°C. This proves that almost no heat is lost from the top of the tube – almost all heat loss is from the side walls.
- Venting the bottom of the tube with a 2 cm diameter hole made almost no difference: only about 0.1°C. Again, this illustrates that almost all the heat lost from the tube is from the side walls. The popular idea of putting holes in tubes to reduce temperatures is a mistake.
- Putting wet paper towelling inside the tube made no difference whatsoever. It follows that delaying the installation of vineguards until the vines have a large leaf area will not help reduce the heat stress on the young vine.
- White coloured vineguards were cooler than "clear" ones (about 3°C). (Fig 2)
- Larger vineguards (100 mm sides) were hotter than smaller ones (80 mm sides) by 3°C. (Fig 3)

That last result will surprise many readers. However, it was kindly explained to me by Dr Wasim Samam of the University of South Australia. As we saw in our first and second trials above, almost all the heat lost from the tube is from the side walls. That is because there is almost no mixing of air at the top of the tube; a "plug" of still air sits there, and that plug is a good insulator. That is why blocking off the top of the tube causes only a small increase in temperature rise. So what does that mean about small and large tubes?

Looking at Fig 4, it is easy to see that if we double the diameter of the tube, the area of the side walls is also doubled, but so is the amount of sunlight - the heat load - they intercept. So doubling the diameter doubles the heat load and doubles the tube's ability to lose that heat. The net effect of increasing the diameter of the tube would be to make no difference whatsoever if all the heat load was coming from the side.

But now look at what happens if all the heat load is coming from the top. Doubling the diameter increases the area of the top of the tube four times! It therefore quadruples the heat load. However, the area of the side walls – which is the only place heat is lost – is only doubled. So if all the heat load was coming from directly above, doubling the diameter would multiply the heat load by four, but the tube's ability to lose heat is only increased two times. It follows that if all the heat load came from above, doubling the diameter would double the temperature rise.

So theory and practice agree pretty well: larger diameter vineguards are hotter.

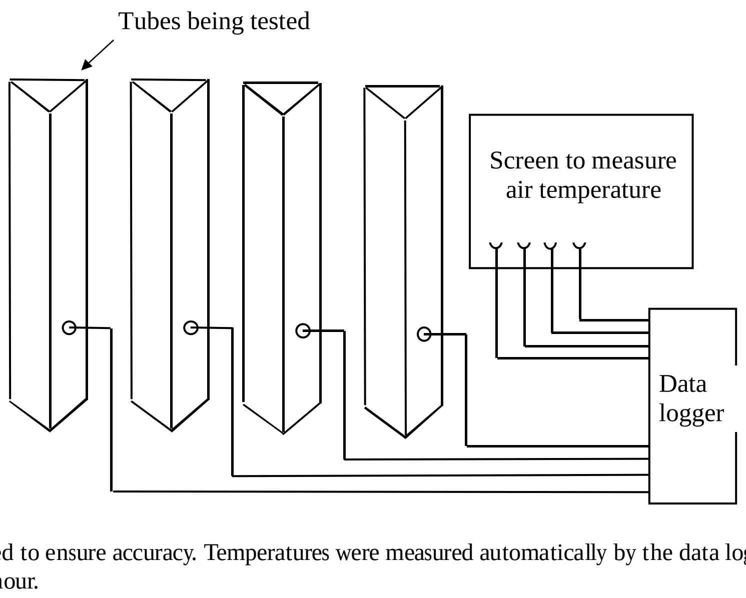

Fig 1. Test setup. Four tubes were used to ensure accuracy. Temperatures were measured automatically by the data logger every minute for periods ranging from 30 minutes to over an hour.

Summing up, the trials we conducted showed that:

- You should not delay planting in the hope that large leaves will cool the inside of the vineguard.
- Ventilated tubes have the same temperature rise as sealed.
- White tubes are substantially cooler than transparent.
- Small tubes are substantially cooler than large.

One last thing. In 1995 we tried some exceptionally clear vineguards. The area where we tried them was hot, where white vineguards would have normally been used. The weather had been unusually cool (nothing over 30°C) until one day in November when temperatures reached 45°C! This was a real temperature shock. Remarkably, there was little or no leaf burn even though the vineguards were very hot. The reason was simple: the grower had prepared his soil exceptionally well, and the vine roots were so healthy and growing so fast, that they were able to keep the shoot well supplied with water throughout the crisis. This shows once again that correct soil preparation is a key factor in getting vineguards to work properly!

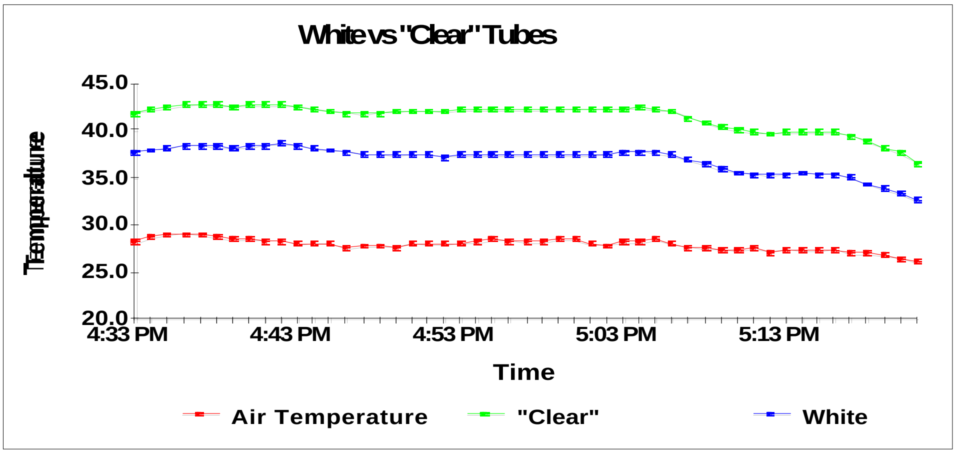

Fig 2. The temperature rise of white tubes is about 3°C less than for transparent ones.

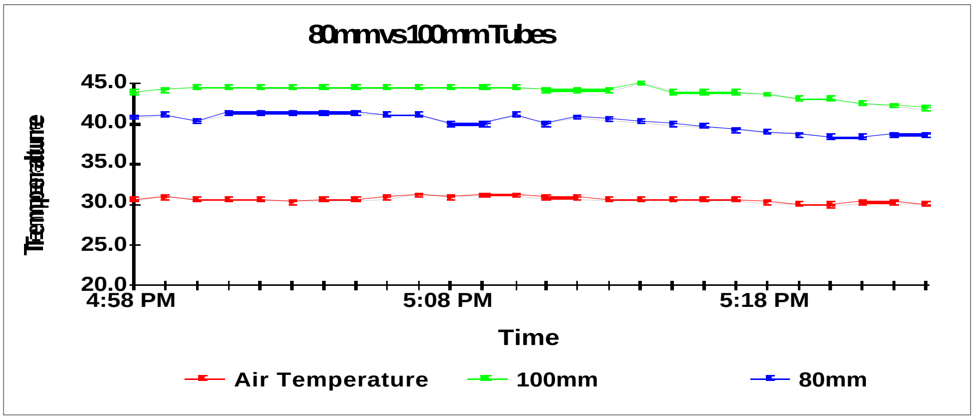

Fig 3. Larger tubes (100 mm sides) were 3°C hotter than smaller tubes (80 mm sides).

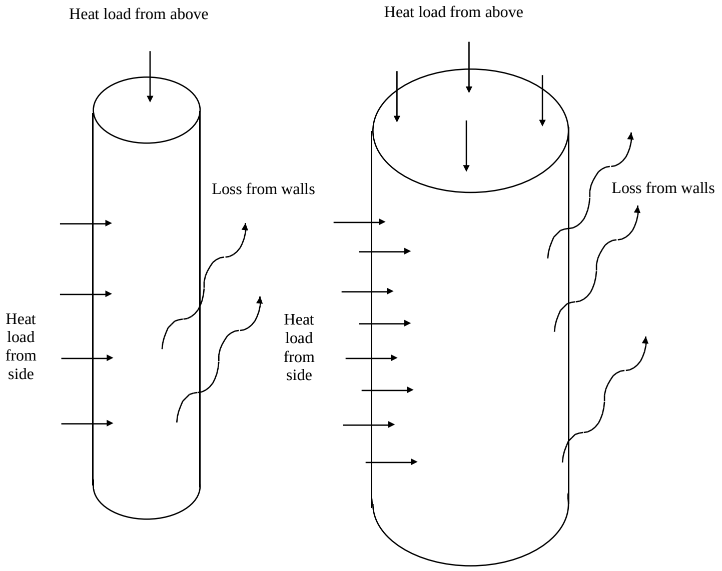

Fig 4. Larger tubes have a higher temperature rise because the top intercepts much more heat from above. If all the heat load came sideways, there would be no difference in temperature between large and small tubes because the increase in heat load is matched by the increase in the side walls, which are the main cooling surface.