

# Micropropagated Vines Establish Substantially Better in Polypropylene Shelters

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## Abstract

*Micropropagated grapevines were established in polypropylene shelters as described by Due (1990). Shelters increased growth fourfold compared to the control vines. On average, sheltered micropropagated vines grew 0.4 m along the 0.9 m fruiting wire, while the control vines fell short of the fruiting wire by 0.6 m.*

## Introduction

Micropropagation enables the rapid production of large quantities of planting material in a condition of high health. Enough material to plant a vineyard can be produced within nine months of release from quarantine of a few cuttings. Furthermore, material which has been micropropagated often grows exceptionally well, apparently due to the elimination of latent viruses (Krul and Mowbray 1984).

To take full advantage of the rapid multiplication possible with micropropagation, it is advantageous to plant the material into the field as soon as possible. This introduces two difficulties. Firstly, the small propagule lacks the reserves to aid in its response to the shock of transplantation. Secondly, the material is much 'softer' than traditionally propagated material. Ideally, a smooth transition should be guaranteed by maintaining glasshouse conditions for several weeks after planting out.

Tuley (1985) used tubular polypropylene shelters to create a glasshouse-like environment in the field. This proved effective with normally propagated forest tree species, resulting in greater growth and easier establishment. Due (1990, 1991) then demonstrated that shelters can give a several fold increase in the growth of young vines. Shelters also simplify training and facilitate weed and disease control. The advent of cost-effective, easily transportable shelters ('Gro-Guards') has made this method practicable. Shelters such as these would seem to be well suited to aid the establishment of micropropagated grapevines. This paper presents the results of a trial.

## Materials and methods

### Planting material

The planting material was Chardonnay clone G9V7 propagated by Phytotech Australia Pty Ltd. The propagation method has been described previously (Barlass and Skene 1978). The basic procedure is as follows. Sterile fragments of shoots, without roots, are grown in glass flasks on a complete nutrient medium which provides sugar, minerals, vitamins and physical support ('MS' medium, Murashige and Skoog

1962). To encourage rapid multiplication of shoots, benzyladenine, a cytokinin, is incorporated into the medium. The concentration used in this exercise was 2 mg/L. The resultant rootless shoots are then separated and transferred to more MS medium, but this time with the root inducing artificial auxin, naphthaleneacetic acid ('NAA'). The concentration used here was 0.1 mg/L. Throughout these operations the temperature was maintained at 22°C, with 16 hr days of cool white fluorescent light at 45 µE/m<sup>2</sup>s

Once the roots had formed, the extremely soft plantlets were deflasked and transferred to a fog chamber with 16 hr days and heated beds (22-24°C). After three weeks the young vines were still very soft, but capable of transfer to plastic igloos where they spent seven weeks, bottom heat (22-24°C) being provided for the first four. For final hardening the vines spent one week in the open, in full sun. The final result was a small, young vine 2-3 mm thick and 5-10 cm tall in a 50 mm tube.

### Vineyard site and preparation

The vineyard site was at Kuitpo, SA, about 50 km south-east of Adelaide. The elevation is 340 m, with a mean January temperature of 19.3°C and an annual rainfall of 830 mm. About 80 mm of rain falls over the three summer months. The soils are a podzolic duplex, with a leached loam over dense orange clay.

The standard soil preparation at this site is as follows. In the March prior to planting, the soil is ripped in each direction along the rows. The ripper has a wing 60 cm wide which lifts and cracks the sod as it moves along. The wing is placed 60 cm deep on the first pass and 1 m deep on the second pass. The ripper also places superphosphate into the furrow, together with deep litter fowlhouse waste at a rate of 30 m<sup>3</sup>/ha of vineyard area. This stabilizes the furrow, fertilizes it and provides an easy root run for the young vines.

### Planting and maintenance

The vines were ready for planting in the last week of October. By the third week of December, eight weeks after planting, losses amounted to about 15%, and it was decided to run a trial of shelters on 2 rows out of 21.



**Figure 1.** A typical, open-grown, micropropagated vine in July, after the first season of growth.

All the vines in the trial (both with and without shelters) were irrigated according to the routine procedure for young vines at this vineyard. Irrigation is carefully managed to ensure a high level of moisture without waterlogging. Usually, no watering is required for about three weeks after planting, and then vines are drip irrigated for an average of about 1 hr/day at 4 L/hr. Irrigations are daily at first, then every second day, and by February irrigation is about every third day for three hours. Urea is applied in the irrigation water at a rate of 2 g/vine per week. Vines establish rapidly with this procedure: cuttings without shelters usually cover the wire in the first season and give a crop of up to 7 t/ha, in the second season (18 months after planting).

The vines growing in shelters made good growth and were tipped 16 cm below the wire when the shoot had reached a diameter of about 3-4 mm at that height. The shelters were removed when shoots had grown out of the top of the shelters and produced at least four mature leaves in the open air. Four open-grown mature leaves are required because the leaves which grow inside the shelter die on transition to the open air. The continued growth of the vine therefore depends on the productive leaves acclimatized to the open air at the time the shelter is removed.

## Results

The application of the shelters produced a noticeable improvement in the appearance of the vines after only a few days. This was somewhat surprising, because temperatures in the shelters are about 10°C hotter than ambient on a sunny day (Due 1990), and the 86%-ile of the maximum at Kuitpo is about 33°C in December. This means that the vines were suddenly exposed to temperatures up to 43°C, which would seemingly provide a second shock similar to transplant shock.

The portion of the shoots which grew in the shelters comprised about 14 nodes; these nodes had no tendrils, as is typical of more juvenile vines (Mullins et al. 1976). This is consistent with the observation that tissue culture tends to rejuvenate plants (Mullins et al. 1976). By contrast, open grown vines did produce tendrils. Also, shelter-grown vines produced no inflorescence primordia below node 14, i.e. below the top of the shelter (33 buds from 3 vines dissected). Shelter-grown vines mostly produced more than 14



**Figure 2.** A typical shelter-grown micropropagated vine, otherwise as opposite. Shelter-grown vines retained their leaves until late June.

nodes and ran along the fruiting wire. These portions of the canes had almost 60% fruitful buds, longer canes being consistently fruitful up to node 25 (73 buds dissected, 5 vines).

Vines growing in shelters displayed strong apical dominance; most produced a single shoot, or two shoots at most with the second shoot strongly suppressed. In rare cases, two roughly equal shoots were produced.

The attempt to head the vine while the shoot was still in the shelter was thwarted due to the exceptionally strong apical dominance. The lower lateral shoot, in most cases, grew only slightly owing to strong suppression by the more apical lateral shoot.

Despite the moist conditions, shelter grown vines did not suffer from diseases or pests. This is apparently because the high temperatures inside the shelters exterminate fungi and fungal spores as well as most pests (Due 1990). Slight oidium damage was, however, observed on the portion of shoots which grew outside the shelters. This observation supports the argument that the high temperatures inside the shelter control disease.

The main objective of the shelters was to improve growth, and despite their late application, vines grown in shelters were substantially larger than the controls (Figures 1 and 2). The shoot length of the shelter-grown vines was 1.3 m on average, compared to only 0.3 m for controls. In most cases, shelter-grown vines grew 0.4 m along the fruiting wire.

## Recommendations

There is no doubt that shelters are an effective aid in the establishment of micropropagated vines. Shoot growth in shelters was four times that of open-grown vines.

As with most new techniques, the best application of shelters will involve some trial and error. Some improvements on the methods used in the above trial are immediately evident. Firstly, shelters should be placed over the vines at planting so as to reduce transplantation shock and gain the maximum duration of sheltered growth. Early planting is important to take full advantage of the available growing season.

Ideally, planting should occur when the soil temperature at the depth of the root system (only a few cm for micro-propagated vines) is above 12°C for *V. vinifera* varieties (R.

Johnstone, pers. comm.). Also, the 86%-ile of the maximum should be above 27°C at planting, so that temperatures in the shelters can confidently be expected to be high enough to kill fungi and their spores within about a week of planting. At Kuitpo, this would be about mid October.

Micropropagated vines growing in shelters seem to have unusually strong apical dominance, and if a bilateral cordon is required, should not be headed at any point inside the shelter. To this end, it has been suggested that shelters about 15 cm shorter than the fruiting wire could be supported on a special 'shelter wire'. Many growers simply lay the irrigation tube along the ground in the first year, so that the shelter wire could be moved down in the second year, and used to support the irrigation tube. Another alternative is to produce a unilateral cordon in the first year; and lay a second cane along the wire in the second year. This would seem to be quite practicable.

Given good planting conditions and the optimal use of shelters, it would seem to be possible for a micropropagated vine to cover one side of the wire in its first season of growth. A small crop might be expected in the second season.

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### **References**

- Barlass, M. and K.G.M. Skene (1978) In vitro propagation of grapevine (*Vitis vinifera* L.) from fragmented shoot apices. *Vitis*, 17, 335-40.
- Due, G. (1990) The use of polypropylene shelters in grapevine establishment—a preliminary trial. *Aust. Grapegrower and Winemaker*, June 1990, pp.29-33.
- Due, G. (1991) Vine establishment using polypropylene shelters proves effective in the field. *Aust. Grapegrower and Winemaker*, April 1991, pp.108-10.
- Krul, W.R. and G.H. Mowbray (1984) Grapes. In: *Handbook of Plant Cell Culture* 11, pp.396-434. W.R. Sharp, P.A. Evans, P.V. Amminato and Y. Yamada (eds) MacMillan Publishing Co., N.Y.
- Mullins, M.G., Y. Nair and P. Sampet (1976) Rejuvenation in vitro: Induction of juvenile characters in an adult clone of *Vitis vinifera* L. *Ann. Bot.* 44, 623-7.
- Murashige, T and F. Skoog (1962) A revised medium for rapid growth and bioassays with tobacco tissue cultures. *Physiol. Plant.* 15, 473-97.
- Tuley, G. (1985) The growth of young oak trees in shelters. *Forestry* 58, 180-95.