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Horticultural Research Section, C. S. I. R. O., Glen Osmond, South Australia

## Harvest pruning of Sultana vines

by

P. MAY and G. H. KERRIDGE

For the harvesting of sultana vines in the Murray Valley Irrigation areas of Australia, a large number of casual harvest hands is needed whose remuneration accounts for 27% of the total cost of producing dried fruit (1). Also, providing and employing up to 4,000 of these casual workers raises many managerial problems.

The present paper is a preliminary account of experiments on pruning sultana vines when the fruit is mature, aimed at reducing the manpower needed for harvesting.

### Experiment 1

In 1957/58 an experiment was carried out with mature sultana vines in the vineyard of the Horticultural Research Section, CSIRO, Merbein, Victoria. It was designed as a 12 times replicated randomized block, applied to vines in four adjacent rows. Each plot consisted of three vines adjacent in the row. The vines were pruned and maintained according to normal field practice until the fruit was mature. At this stage four treatments were applied, namely control (unpruned), pruned on February 14, February 28, and March 14.

Pruning (subsequently called harvest-pruning) consisted of cutting off the one-year-old canes, which carried most of the shoots and fruit, about three to six inches from the crown, as is done during winter pruning. The cutting was done with pruning shears and the canes, which had been wrapped around the trellis wire during winter pruning, were left in position.

The treated vines were harvested 14 days after cutting by picking the half-dried bunches by hand; the control vines were picked together with the third treatment on March 28. All the fruit was then dipped according to the normal commercial practice in Australia (6), dried on small trays in the semi-shade and weighed when air-dry.

During winter the vines were pruned as closely as possible to eight canes of 14 buds length. After bud burst in spring the percentage of buds burst and the percentage of shoots carrying at least one bunch were determined. At harvest the weight of fresh fruit and the sugar content of a sample of juice were determined.

The results of this experiment are summarised in Table 1. At the 1957 harvest vines pruned on February 14 yielded significantly less than control vines, but this was due to the low sugar content at the time of pruning which preceded the commencement of normal harvest by several days. When pruning was carried out after the fruit was fully mature yield was not affected. Thus no significant amounts of fruit were wasted because of the brittleness of the wilting bunch stalks. Picking was not excessively difficult or slow. Weather conditions at harvest were very favourable and the quality of the fruit was commercially acceptable.

Counts of bud burst and fruitfulness of shoots during the subsequent spring showed that neither of these values was affected by the premature removal of the majority of leaves and shoots. Likewise there were no significant differences in yield of fresh fruit or sugar content of the juice at harvest 1958.

Table 1  
Yield, bud burst and fruitfulness of sultana vines following harvest pruning

	Control	Pruned			LSD	
		14/2	28/2	14/3		
Harvest 1957					5%	0.1%
Yield (air-dried, kg)	6.05	4.70	5.75	6.15	0.61	1.10
Spring 1957						
% Bud burst	64.7	67.5	65.3	65.2	ns	
% Fruitful shoots	63.1	61.4	63.3	61.5	ns	
Harvest 1958						
Yield (fresh, kg)	17.86	19.19	17.03	16.84	ns	
Brix	26.2	26.3	26.4	26.4	ns	

The data were obtained and analysed for three-vine plots. But in the Table weight of fruit is expressed on a single-vine basis.

### Experiment 2

This experiment was commenced at harvest 1966 with young sultana vines of clonal origin bearing their fifth crop and treated hitherto according to commercial practice. There were two treatments, harvest-pruning as described above, and control (normal field management). These treatments were applied in a five times replicated randomized block experiment, each replication consisting of three adjacent vines. At harvest 1966, harvest-pruning was carried out on February 8. The fruit from the control vines was picked on that day and spread to dry between the rows (3). The fruit of the treated vines was shaken off by hand on February 17, and, together with the bunches picked from the still attached shoots, dried between the rows without dipping.

In spring 1966 the number of canes and bunches per vine were counted and at harvest 1967 the procedure of the previous season repeated, with the exception that the fruit was shaken off the harvest-pruned vines after two weeks' drying.

Yield was not measured in 1966. As no berries dropped to the ground during wilting the crop could not have been affected by the pruning treatment. The number of canes left in winter 1966 and the number of bunches in spring 1966 are shown, together with the yield of dried fruit, in Table 2. The treated vines tended to have less canes and bunches, possibly because insufficient numbers of shoots had been retained at the 1966 harvest-pruning. However this was fully compensated for by the

Table 2  
Number of canes at winter pruning 1966, number of bunches in spring 1966  
and yield of fruit (adjusted to 10% moisture) at harvest 1967 for sultana  
vines harvest-pruned in 1966 and for control vines

	Harvest-Pruned	Control
No. canes/vine (Winter 1966)	6.73	7.27
No. bunches/vine (Spring 1966)	70.5	80.9
Yield/vine (kg) (adjusted 10% moisture) (Harvest 1967)	6.96	6.53

None of the means differed significantly at the 5% level.

development of the bunches, and yield tended to be higher on the treated vines. None of the differences, however, reached significance.

#### Treatment of harvest-pruned vines with dipping solution

During harvest 1967 some vines were sprayed with dipping emulsion to accelerate drying. In one experiment, three vines each were sprayed with a hand knapsack spray two or three days after pruning, which was carried out on March 15. Three weeks after pruning the moisture content of the fruit was measured, and one week later the fruit was harvested.

In a second experiment, 21 vines were sprayed with a power spray on March 30, and of these seven vines each were either not pruned, harvest-pruned one week, or pruned two weeks later. Moisture content of the fruit was determined three weeks after spraying.

In both experiments the fruit was left attached to its shoots hanging from the trellis wires until dry and then shaken off by hand.

Fruit sprayed with dip mixture on the vine either before or after harvest-pruning dried almost at the same rate and was of similar quality and colour as fruit dipped and spread to dry on drying racks in the usual manner. Drying rates were very similar irrespective of the sequence and the time interval between pruning and spraying. Although both experiments were carried out late in the harvest season, the fruit hanging on the trellis wires had dried in both cases to 15% moisture content within three weeks, despite a light fall of rain during the drying period. Very strong winds did not cause any drop of berries or bunch portions.

Fruit still attached to vines not pruned at harvest was also sprayed with dipping emulsion. It dried almost as quickly as detached fruit having lost about 60% of its original weight one week after spraying. But at about that time portions of the bunch stem started to absciss and this led eventually to considerable drop of fruit. No such breaking up of the bunch occurred on harvest-pruned vines.

### Discussion

To make a system which combines harvest-pruning and mechanical fruit collection a workable harvest method for sultanas, the pruning treatment must not weaken the vine and thus reduce future crops. The experiments have shown clearly that applying the harvest-pruning treatment once has no deleterious effect, but observations will have to be continued for some years to determine whether there is a cumulative effect after repeated applications. However there is some evidence which indicates that plants may not suffer. In Israel vines have been made to bear two crops per year by pruning soon after harvest (2). In South and West India vines behave like evergreens and a short period of semi-dormancy is induced by pruning and leaf removal after harvest. Two crops per year, in April and November, are produced (7).

So far, harvest-pruning was carried out by hand, and harvesting by shaking the fruit by hand on to sheets of hessian spread under the vines. But the method opens up ready possibilities of mechanization.

Harvest-pruning will be greatly facilitated by modifications of the present training system. As a first measure the system of winter pruning recommended by WINKLER (9, p. 257) for sultanas in California could be used. There, two-bud spurs are left to provide next season's fruiting canes and therefore the one-year-old canes can be totally removed. As tight wrapping of canes around the trellis wire is not

necessary to maintain yield (4) the fruiting canes can be brought to the wire in a wider arch than at present, and this will allow harvest-pruning with some type of mechanical cutting device. Even the cutting of canes by hand will allow one man to harvest-prune about one acre per day.

Mechanical removal of dried fruit from the vine and its collection should be feasible. In U. S. A. machines have been developed which can shake fresh grapes from the vines (5, 8) and a much cheaper and simpler machine should be able to collect the dried grapes.

### Summary

Preliminary investigations are described which promise to ultimately lead to mechanical harvesting of dried sultana fruit. In the experiments the canes which bear most of the fruiting shoots were severed from the vine when the fruit was mature. Subsequently the fruit was treated in four different ways: (1) Picked after wilting, dipped and dried on drying racks; (2) shaken off the vines after wilting and dried on ground sheets; (3) shaken as dried fruit off the vines; (4) sprayed with dipping emulsion on the vine and shaken off as dried fruit. Treatments 2 and 3 produced dark-coloured fruit and treatments 1 and 4 golden-coloured fruit.

Treating vines once in this manner did in no way affect next season's yield. Possible means to mechanize the harvest are discussed.

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Dr. P. MAY  
Horticult. Res. Section CSIRO  
Private Bag No. 1  
Glen Osmond, S. A.  
Australia