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THE EFFECT OF MECHANICAL PREPRUNING ON YIELD AND QUALITY OF WINE GRAPES OVER A THREE-YEAR PERIOD

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Grape growers have long used various hedging or mowing methods in a prepruning operation to remove a part of the wood on vines trained to cordons. This removal of the superfluous one-year-old wood facilitates the work of the pruners who then select and leave 10 to 20 spurs per vine for fruiting. Recently, more sophisticated machines have been developed for prepruning. Their guiding systems permit removal of greater amounts of the prunings although some followup by hand pruners is required.

A project was initiated in 1979 to study the effects of such machines on wine grape productivity and fruit quality. Small numbers of six wine grape varieties planted in 1975 were prepruned at the Kearney Field Station.

The machine used in this study was a mechanical grape harvester with the picking head replaced with a pruning head. This head consists of six circular saws arranged in an inverted "U" configuration. The two upper horizontal saws had the capacity to pivot around the stake. Their height above the cordon could be constantly adjusted by an operator whose only function was to position these two saws. The positions of the vertical double saws, one set on each side of the vine, were adjusted prior to beginning operations but not while in operation. The lower of the vertical saws was 15^{o} off vertical, slanted in toward the vine trunk.

The vines in this trial represented a near ideal situation for mechanical prepruning. The cordons were straight and uniform. The arms, on which the spurs were located, had developed very little length because the vines were young. The saws, set at about five inches from the cordon wire, cut only an occasional arm.

Varying amounts of hand pruning were done following the machine pruning. The varieties were Chenin blanc, French Colombard, Barbera, Carignane, Grenache and Ruby Cabernet. The four comparisons studied were:

1. Normal hand pruning, 32-34 buds per vine.
2. Machine prepruning plus maximum hand pruning, 32-34 buds per vine.
3. Machine prepruning plus moderate hand pruning, 49-63 buds per vine.
4. Machine prepruning plus minimum hand pruning, 75-100+ buds per vine.

These treatments were chosen to test the extremes of pruning level.

1979 RESULTS

The bud numbers per vine given above are the averages for all varieties and varied considerably among varieties. Chenin blanc, for example, had 102 buds per vine with minimum pruning while French Colombard had only 54. This was due to differing bud numbers at the base of the canes. The numbers of shoots produced from these buds varied slightly according to pruning treatment with a few more developing from the vines with high bud numbers.

The 1979 results showed that in all varieties, the normal hand pruned vines and the machine prepruned vines followed by maximum hand pruning gave similar fruit quality and yields. With minimal followup, only French Colombard and Barbera produced crops of normal maturity. Chenin blanc was the most severely overcropped with low maturity. Grenache, Carignane and Ruby Cabernet showed intermediate results.

The results are reported in Table 1.

1980 RESULTS

In 1980, the same treatments were repeated on the same vines. Many more buds were left on the mechanically prepruned vines followed with minimal pruning, about 50% more than in 1979. These extra buds resulted in 25% more shoots per vine and 9% more yield with 6% lower soluble solids. With mechnical prepruning followed by maximum hand pruning, so that numbers of buds per vine were the same as on hand pruned vines, there were no differences between the two.

The contrast between the hand pruning treatment and the machine prepruning followed by moderate or minimal pruning were much less in 1980 than they had been in 1979. Leaving a lot of buds gives a substantial increase in yield the first year but much less the second year although there were still differences. Chenin blanc was notable for producing heavy yields following mechanical prepruning followed by moderate or minimal pruning. The heavy yields resulted in much lower soluble solids.

French Colombard and Grenache also produced heavy yields with somewhat lower soluble solids with the two lower pruning levels following mechnical prepruning but not as extreme as Chenin blanc. Carignane, Barbera, and Ruby Cabernet showed no differences between any of the pruning treatments.

The varietal response differed in 1980 from 1979 with three varieties. French Colombard tolerated high bud numbers better in 1979 than in 1980. The contrary was true with Ruby Cabernet and Carignane which tolerated high bud numbers better in 1980 than in 1979.

1981 RESULTS

In 1981, there were no difference between any of the pruning treatments in yield or fruit maturity. The results, while surprising to a degree, were not unexpected. Australian workers, whose trials preceded ours, reported that vines eventually accommodated to high bud numbers; that

adjustment required up to three years for some varieties. Thus, our results paralleled the Australian experiences.

CONCLUSIONS WITH YOUNG VINES

All varieties tolerated mechanical prepruning followed by hand pruning to reduce bud number to that of hand pruned vines. Where more buds were left with the less severe pruning, the response varied with variety. Of the varieties in the study, only Chenin blanc was severely overcropped during the first two years. Although the study did not deal with bud numbers that could be tolerated, it appears that all varieties would tolerate bud numbers something in the range of 25% more than had been left by hand pruning. By the third year, all varieties adjusted to high bud numbers.

TRIAL WITH OLDER VINES

Smaller simulated machine prepruning trials were also established in varieties 10-16 years old. The principal objective was to observe the effects of rather severe cuts made on arms 4-12 inches long. Normal hand pruning was compared to simulated machine pruning by using a chain saw to make horizontal and vertical cuts in an inverted "U" configuration some 4-6 inches away from the cordon.

The response varied according to variety and age. In 1979 the machine pruned 16-year-old Grenache, with well developed arms, produced only 14% of a normal crop. Ten-year-old vines of the same variety produced about half a normal crop. However, in contrast, 16-year-old Rubired produced a normal crop when machine prepruned. They had less elongated arms than Grenache, pushed many latent buds from the cordon and the bases of the arms many of which were fruitful.

Thirteen-year-old Ruby Cabernet gave equivalent crop whether hand pruned or machine prepruned. However, French Colombard of similar age suffered about a 20% yield reduction when machine prepruned.

In 1980, the vines were repruned in a manner similar to 1979. The yields for the simulated mechanically pruned vines was similar to that for hand pruned vines for all varieties except Ruby Cabernet. This variety produced higher yields with simulated mechanical pruning than hand pruned vines with soluble solids reduced about two degrees.

In 1981, there were no differences in yield between hand and mechanical pruning with any variety. Soluble solids were slightly lower with the mechanically pruned Ruby Cabernet.

CONCLUSIONS WITH OLDER VINES

The mechanical pruning of older vines with well developed arms ought not to be attempted on a large scale without preliminary trials. In general, varieties that develop long arms fairly rapidly are those that do not push very many latent buds. Cutting off long arms on these varieties will lead to severe crop reduction for one year at least. Mechanically pruning older vines with short arms would not be expected to reduce yields even the first year.

Table 1. A comparison of the effects of hand pruning with machine prepruning followed by varying amounts of hand pruning. Averages of six varieties.

		Machine Prepruned		
	Hand Pruned	Maximum Hand	Moderate Hand	Minimal Hand
1979				
Buds per vine	32 a[1/]	32 a	49 b	75 c
Shoots per vine	43 a	45 ab	46 b	49 c
Yield per vine, lbs.	43 a	42 a	50 b	56 c
°Brix	21.0 a	21.7 a	19.7 b	19.1 c
Fruit sugar per vine, lbs.[2/]	8.8 a	8.5 a	9.8 b	10.7 c
1980				
Buds per vine	34 a	34 a	63 b	116 c
Shoots per vine	57 a	57 a	63 b	71 c
Yield per vine, lbs.	66 a	66 a	72 b	72 b
°Brix	20.0 a	19.7 b	19.2 c	18.8 d
Fruit sugar per vine, lbs.	12.9 a	12.9 a	13.9 a	13.4 a
1981				
Buds per vine	35 a	36 a	63 b	94 c
Shoots per vine	59 a	60 a	66 b	71 c
Yield per vine, lbs	52 a	49 a	53 a	49 a
°Brix	21.4 a	21.7 a	21.5 a	21.7 a
Fruit sugar per vine, lbs.	11.2 a	10.7 a	11.7 a	10.7 a

1/ Numbers in each row, if followed by a different letter, are significantly different from each other at the 5% level.

2/ This figure is obtained by multiplying the yield per vines times the $\frac{°Brix}{100}$.