HENRY E. STUDER · H. P. OLMO

Effect of CANE SEVERANCE *on quality of* MACHINE HARVESTED RAISINS

MECHANICAL HARVESTING of Thompson Seedless raisin grapes by means of vibration has been under study at the University of California since 1968. During this time, machines have been developed for uniformly distributing the fruit onto a continuous paper tray (see photo) and for collecting the raisins from the tray after drying.

The key to the success of the system is cane severance, whereby the fruiting canes (second year wood) are cut with hand shears 4 to 6 days prior to harvest. The cut is made at a point near the juncture of the cane with the vine head. The purpose of cane severance is to induce easy separation of the fruit as single berries from the vine. The vibratory type grape harvester machines normally detach the fruit as single berries but, if the canes are not cut first, the capstems of the berries are usually pulled from the berry leaving an open wound from which juice exudes. On the other hand, when canes are severed, the capstems dry and become brittle. During harvest, they break from the rachis and are generally retained by the berry. Consequently, damage to the harvested fruit is reduced and free juice is minimized.

The effect of cane severance on the quality of the harvested fruit has been studied extensively. The purpose of this article is to present some of these results so that the importance of the operation can be appreciated adequately by growers who may be considering mechanical harvesting of raisin grapes.

TABLE 1. SUBJECTIVE EVALUATION OF RAISIN TRAYS FOR *THE PRESENCE OF CLUSTERS AND LEAVES*

		Plot 1				Plot 2			
		Clusters		Leaves		Clusters		Leaves	
Treatment		C*	NC	C	NC	C	NC	C	NC
Replication	1	6†	10	4	10	4	6	4	6
	2	6	10	4	8	4	8	4	10
	3	5	8	4	8	2	8	2	8
	4	4	7	2	7	4	8	4	8
	5	6	8	4	8	4	8	4	6
	6	5	10	4	10	4	10	4	10
	7	4	10	4	9	2	10	2	8
	8	2	9	2	8	4	10	2	8
Means:		4.8	9.0	3.5	8.5	3.5	8.5	3.3	8.0

TABLE 2. EFFECT OF CANE SEVERANCE AND DEFLORATION ON DEGREE OF SPOTTING OF THE RAISIN TRAY PAPER

		Average spot count	(no. spots/ft³)
Treatment		C*	NC
Replication	1	25.0	103.5
	2	27.5	69.5
	3	21.5	60.5
	4	20.0	71.5
	5	19.5	80.0
	6	25.0	68.0
Means:		23.1	75.5

TABLE 3. EFFECT OF CANE SEVERANCE ON PERCENTAGE OI MECHANICAL DAMAGE IN THE RAISIN SAMPLES

		Percentage of mechanical damage							
		Plot A		Plot B		Plot C		Plot D	
Treatment		C*	NC	C	NC	C	NC	C	N
Replication	1	2.3	9.4	0.9	7.7	2.4	1.5	1.8	7.
	2	1.8	5.0	2.3	3.7	2.2	2.4	1.1	4
	3	2.3	3.6	1.7	2.7	0.7	3.0	1.3	3
	4	1.6	4.8	0.8	2.0	1.0	10.3	3.1	5
	5	3.8	12.6	1.1	2.4	4.0	2.1	2.4	3
	6	2.0	4.5	1.3	3.9	1.7	3.1	1.8	6
	7	1.4	2.2	1.5	2.3	0.8	2.2	..	.
	8	0.5	3.6	1.4	4.5	1.9	2.0	..	.
Means:		2.0	5.7	1.4	3.6	1.8	3.3	2.0	5

*C — Canes severed prior to harvest
NC — canes not severed prior to harvest
†Code: very low = 2
low = 4
medium = 6
high = 8
very high = 10

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TABLE 4. EFFECT OF CANE SEVERANCE ON PERCENTAGE OF LEAF FRAGMENTS IN THE RAISINS

Treatment	Percentage of raisins with embedded leaf fragments C*	NC
Sample 1	5.7	27.3
Sample 2	4.0	13.6
Sample 3	2.2	17.2
Sample 4	0.2	2.6
Sample 5	4.1	5.1
Sample 6	2.8	51.4
Mean:	3.2	19.5

TABLE 5. EFFECT OF CANE SEVERANCE ON MOLD PERCENTAGE IN RAISINS PRODUCED UNDER FAVORABLE DRYING CONDITIONS

	Mold percentage							
	Plot A		Plot B		Plot C		Plot D	
Treatment	C*	NC	C	NC	C	NC	C	NC
Replication 1	0.9	1.3	0.0	1.3	1.4	0.8	1.0	2.5
2	5.3	1.3	0.4	0.3	0.4	0.5	2.1	3.3
3	1.3	1.5	0.4	0.3	0.4	1.5	1.8	1.4
4	4.1	2.0	0.5	0.3	4.5	3.0	1.0	2.3
5	1.6	0.8	0.6	0.5	0.3	0.4	1.6	3.0
6	1.4	1.6	0.5	0.8	1.6	1.1	1.0	4.5
7	0.5	0.4	0.4	1.4	0.5	2.6	..	..
8	0.6	0.8	0.6	1.1	0.8	1.5	..	..
Means:	2.0	1.2	.4	.8	1.2	1.4	1.4	2.8

TABLE 6. EFFECT OF RAIN ON MOLD PERCENTAGE WHEN RAIN OCCURS LATE IN DRYING PERIOD

	Mold percentage	
Sample no.	No rain	Rain
1	1.5	3.6
2	1.6	1.5
3	1.8	8.5
4	1.5	2.1
5	2.0	2.1
6	1.3	1.3
7	1.5	1.9
8	1.1	2.3
9	2.6	2.8
10	0.8	3.3
11	2.0	..
12	1.6	..
13	1.3	..
14	0.6	..
Mean:	1.5	2.9

TABLE 7. EFFECT OF TRAY ELEVATION AND CANE SEVERANCE ON MOLD PERCENTAGE IN RAISINS WHEN RAIN OCCURS EARLY IN DRYING PERIOD

	Mold percentage							
	Plot I				Plot II			
Sample location	LOW		HIGH		LOW		HIGH	
Treatment	C*	NC	C	NC	C	NC	C	NC
Replication 1	72.9	49.3	3.3	10.4	21.4	18.3	3.1	21.4
2	49.5	46.3	4.1	7.8	15.6	41.4	7.7	12.2
3	55.6	27.2	12.3	11.8	13.2	31.8	9.0	7.6
4	56.7	62.7	11.2	26.1	9.2	59.8	7.3	10.2
5	50.7	43.8	8.1	36.7	41.4	42.1	5.9	20.6
6	51.5	34.1	7.8	16.1	11.6	22.9	9.8	8.3
7	35.7	63.3	17.8	16.5	8.9	14.2	7.7	8.2
8	51.0	62.9	12.1	11.5	11.4	31.6	6.0	15.1
Mean:	53.0	49.0	9.6	17.0	16.6	32.7	7.1	13.0

TABLE 8. EFFECT OF CANE SEVERANCE ON FLAVOR OF MACHINE HARVESTED SUNDRIED RAISINS

		Number of samples judged by USDA as having a non-typical sundried flavor	
		Treatment	
Plot A	Replication	C*	NC
	1	1	2
	2	1	2
	3	0	2
	4	0	2
Plot B	1	0	2
	2	0	0
	3	0	1
	4	0	1
Total with non-typical flavor:		2	12
Total no. of samples judged		16	16

Clusters and leaves

Two vineyard plots in the Biola district were evaluated for the presence of clusters and leaves on the tray after machine harvest. The canes were severed on a portion of each plot, the remainder was untreated. The results are shown in table 1. Significantly more leaves and clusters were found on the trays after harvest in the untreated controls. Clusters or cluster parts dry more slowly and more unevenly than single berries. Leaves deposited on the tray can create some shading problems. Fruit from the cane-severed plots dried more uniformly (less variation in final moisture content) and overall drying time was reduced. Generally the drying time required for cane-severed fruit varies from 11 to 14 days, depending on the depth of fruit spread on the tray and on weather conditions.

Mechanical damage

Some juice from berries which are damaged during harvest is absorbed by the tray paper. Samples of tray paper were collected after raisin pickup and spots or discolorations of the paper were counted. These spot counts (per square foot of tray paper) are tabulated in table 2. These data imply that much more free juice is present when canes are not cut.

Raisin samples were collected from four plots and evaluated by USDA for mechanical damage. The results are shown in table 3. In each case, the fruit from severed canes exhibited less mechanical damage than fruit from untreated vines. Moreover, all of the samples from severed canes were well below the maximum allowable value of 5% mechanical damage, while nearly 25% of the samples from untreated vines exceeded this 5% maximum value.

Embedded leaf fragments

Normally, the amount of leaf material on the tray during the drying period is quite small. In some instances, a severe leaf fall from the vines may occur because of vine management problems, but these leaves can be easily removed from the raisins at pickup time by pneumatic machinery. Nevertheless, adherence of leaf fragments to the raisins is an indication of damage done to the fruit during harvest since the raisins produced from damaged fruit are sticky (see table 4). As shown in table 4, raisin samples from severed canes contained considerably less fruit with embedded leaves than those samples from untreated vines.

Part of raisin mechanization includes development of machines for uniformly distributing fruit on continuous paper trays and for collecting the raisins from the trays after drying (photo above and cover).

Mold

Mold on raisins is related to the weather conditions during the drying period. The maximum allowable mold content is 5% by USDA standards. The data in table 5 was collected during 1970 and 1971, when drying conditions were quite favorable. In general, the data suggest that cane severance may have some beneficial effect on reducing mold under favorable drying conditions, but none of the samples exceeded the maximum allowable value, and the average mold levels in the fruit were quite low.

The data in table 6 was collected in 1971 and shows comparative mold levels in raisins exposed to rain toward the end of the drying period as opposed to other raisins which received no rain. Cane severance was employed in both cases. The data indicates that a rain late in the drying period may increase the mold percentage in the fruit but in only one sample was the maximum allowable mold content exceeded. The average mold percentage for all samples was well within the tolerance limit.

The data in table 7 was collected in 1972. In this case, very poor drying conditions existed due to a heavy rainfall two days after the fruit was laid on the tray. Raisin samples were collected from well drained areas of the tray (labelled HIGH) and from poorly drained areas of the tray (labelled LOW).

Several conclusions can be drawn from the data in table 7. First, adverse weather conditions early in the drying period can result in considerable mold growth. However, the mold percentage in those samples which were harvested from severed canes was generally significantly lower than in the fruit from untreated vines, irrespective of whether the samples were drawn from well-drained or poorly-drained areas of the tray. Secondly, the mold percentage in those samples drawn from well drained areas of the tray was significantly less than for samples from poorly drained areas. Thirdly, the mold percentage in samples drawn from well drained areas of the tray and also from cane-severed fruit was comparable with that found in hand harvested samples collected from the same vineyard. Consequently, the data suggest that use of a sloped tray is highly desirable to minimize mold development and that cane severing is definitely advantageous in limiting mold development under adverse drying conditions.

Flavor

Raisin samples from cane-severed plots and check plots were evaluated for flavor by USDA during normal incoming inspection. The samples were judged as exhibiting either a typical, or a non-typical, sun-dried flavor. The results of these judgments are shown in table 8. Considering those samples from the check vines, 75% were judged to have a non-typical flavor whereas only 12% of the samples from cane severed vines were so judged. Consequently, it appears that cane severing does promote the development of the characteristic flavor of California sun-dried raisins.

The data collected from machine-harvested plots indicate that cane severance is a desirable operation, and can result in a reduction of mechanical damage, mold infection, embedded leaf fragments and stickiness of machine-harvested raisins.

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SYSTEMIC INSECTICIDES

for control of

CITRUS MEALYBUG

in

GARDENIAS

J. L. BIVINS · A. S. DEAL

Citrus mealybug *Planococcus citri* (Risso) is a serious pest attacking many greenhouse grown crops. Cottony masses of the insect occur in great numbers on the growing tips of the branches of plants (see photo). The greatest numbers occur in the summer, fall, and early winter months, causing the most serious damage to plants. The mealybug is a gregarious feeder ultimately killing the tender shoots.

A number of natural enemies have been successfully introduced that are important in keeping the citrus mealybug in check. Among these, the two species most frequently used are *Leptomastidea abnormis* (Girault) and the beetle *Cryptolaemus montrouzieri* Muls. However, the parasites and predators are not always available. Occasionally, it is impossible to colonize them in sufficient numbers to contain the infestation of citrus mealybugs. Where biological control fails, the only suitable alternative has been chemical control.

In the past, sulfotepp was widely recommended and used for citrus mealybug control in greenhouses. Recently, other organophosphate materials—malathion and diazinon—have been used to control citrus mealybug. Interest has also been stimulated in the new systemics, utilizing more effective, highly-specialized

Citrus mealybug on a leaf of Mystery gardenia.