Viticulture & Enology Research Center

Research Bulletin

Methods tested to determine quality control in raisins

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New production methods tested

The field experiment was designed to provide information on the effects of rolling method, fruit temperature and moisture content on embedded capstems and cluster (rachis) stems in raisins. Fruit moisture content at the time of biscuit rolling fruit has a significant effect on embedded capstems and cluster stems.

Fruit biscuit rolled at a high moisture content (25 percent) resulted in 34 to 49 capstems per pound and 4 to 7 cluster stems per pound. The capstem and cluster stem counts decreased with moisture content at the time of biscuit rolling and the turned and cigarette rolled treatment contained no embedded cluster stems.

No significant effects of fruit temperature on embedded capstems and cluster stems were observed. However, these treatments were rolled in the early morning and late afternoon when temperatures were extreme. The temperature data indicate that maximum fruit temperature were reached at noon and air temperature at 3:30 p.m. Therefore, fruit temperature may have a significant effect on embedded capstems and cluster stems if trays are biscuit rolled from 11:30 a.m. to 2:30 p.m.

Turning technique evens drying, reduces embedded stems

Industry estimates indicate that 5 to 10 percent of the natural sundried raisin crop is turned during the drying process. Omitting this step in production is a common practice, but the fruit is biscuit rolled and left in the field slightly longer to allow for moisture equalization (2). Turning trays add costs to production (1); however, it evens drying (3, 4) and may contribute to reduction of embedded stems.

Fruit that is not turned is softer and higher in moisture content and is therefore more susceptible to being embedded by stems. Fruit maturity, fruit temperature and mois-

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Figure 1

Effects of Turning and Rolling on Raisin Quality

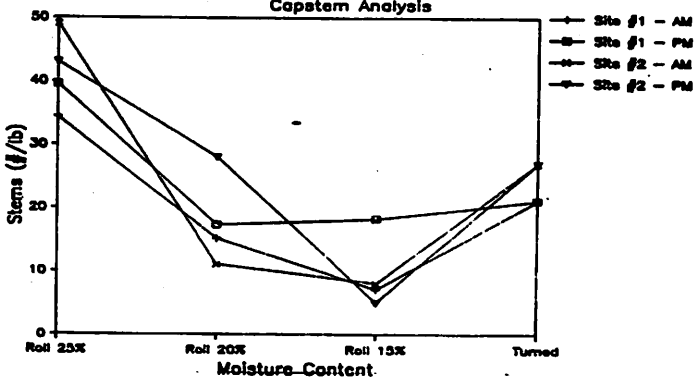

Figure 2

Effects of Turning and Rolling on Raisin Quality

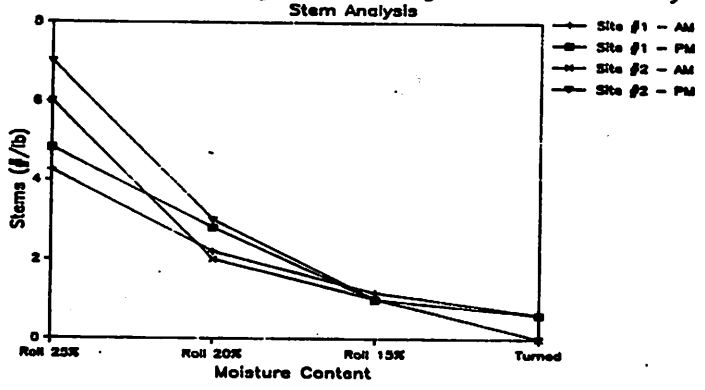

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Figure 3
Raisin Tray Temperature Data
FRUIT EXPOSED TO SUNLIGHT

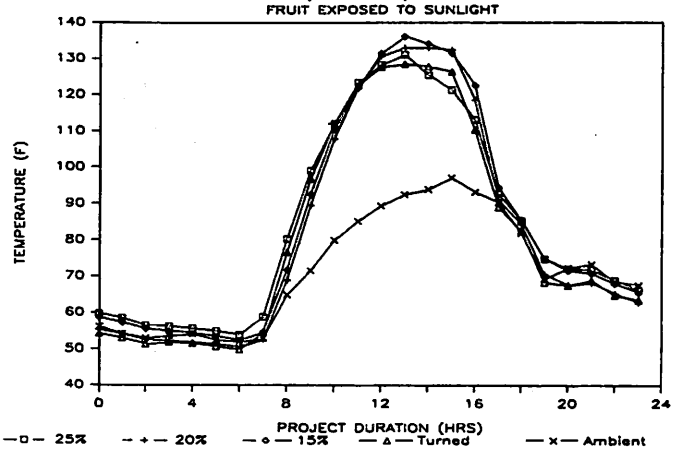
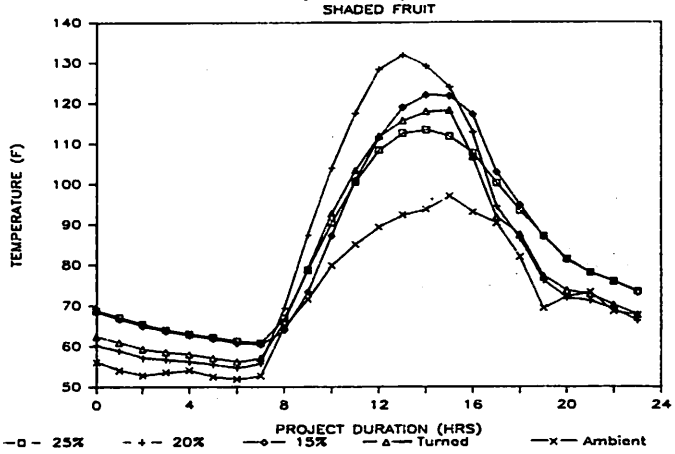


Figure 4
Raisin Tray Temperature Data
SHADED FRUIT



INTRO

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ture content when rolled contribute to the softness of raisins, which resulted in increased embedded cluster stems. This condition would be compounded if the fruit is tightly compressed into biscuit rolls. The purpose of this project is to determine the effect of these factors on raisin quality, embedded capstems and cluster stem fragments.

Goal is to improve raisin quality

The objectives of this field experiment is to cut the cost of production of natural sundried raisins while maintaining or improving quality and to evaluate the effect of fruit moisture, sugar content, fruit temperature and the amount of compaction during rolling on raisin quality and embedded capstems and cluster stem fragments.

Rolling method, temperature and moisture content observed

The field experiment was designed to provide information on the importance of the rolling method, fruit temperature and moisture content profile at rolling on embedded capstems and cluster (ranchis) stems. Embedded capstems consist of a dried berry pedicel bent into the tissue of the raisin, rendering it inaccessible to capstemming equipment.

Embedded stems are cluster stem fragments that have pierced the tissue of raisins and remain embedded. This also includes stems that have been pressed into the wrinkles of an uncured berry. Raisins with a high moisture content, or softened by heat, are susceptible to being embedded with capstems and/or cluster stems.

Fruit was harvested at two grower sites and laid down in a randomized complete block design. Each treatment was replicated eight times. Trays were biscuit rolled (not turned) at high, medium and low moisture content (Treatments 1 through 6, Table 1) and allowed to cure in the sun.

Within each moisture level, trays were biscuit rolled in the morning at relatively low temperatures (Treatments 1, 3, 5) and in the afternoon heat (Treatments 2, 4, 6). Trays in treatment 7 were turned when the top fruit was dry, and cigarette rolled when the raisins were dry.

The raisins from each treatment/replication were collected and processed through a VWM dry capstemmer. One- and five-pound sub samples were collected from each treatment/replication through a Denver splitter. The one-pound sample was evaluated for embedded capstems, recombined with the five-pound sample and evaluated for embedded cluster stems, airstream grade, mold and sand content.

Temperature data was recorded hourly at Site 1 using a field data logger for the duration of the experiment. Within each treatment, thermocouples were placed in individual berries exposed directly to sunlight and shaded berries near the tray surface.

Fruit moisture makes the difference

Both sites received rain before the low (15 percent) moisture biscuit roll, and the turning/cigarette roll treatments were completed. The rain affected USDA airstream grade and sand content (Table 2). It has not been demonstrated, yet timing and method of rolling raisins should not have an affect on airstream grade. Sand content varied among treatments in this experiment because three treatments out of seven received direct rain exposure.

Level of fruit moisture at rolling had a significant effect on embedded capstems (Level 1, Table 3). In addition, the trends were the same at Sites 1 and 2. Fruit rolled at high moisture exhibited significantly higher numbers of embedded capstems than the other treatments, except for the turned/cigarette treatment. Rain exposure increased the moisture content of the fruit in the turned/cigarette treatment; thus, even cigarette rolling the fruit resulted in higher levels of embedded capstems.

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Table 1
Effects of Turning and Rolling on Raisin Quality and Treatments

Treatment	Description
1	Fruit biscuit rolled @ 25% moisture — low fruit temperature
2	Fruit biscuit rolled @ 25% moisture — high fruit temperature
3	Fruit biscuit rolled @ 20% moisture — low fruit temperature
4	Fruit biscuit rolled @ 20% moisture — high fruit temperature
5	Fruit biscuit rolled @ 15% moisture — low fruit temperature
6	Fruit biscuit rolled @ 15% moisture — high fruit temperature
7	Control — fruit turned — cigarette rolled @ 10% moisture

Table 2
Effects of Turning and Rolling on Raisin Quality
USDA Quality Analysis
CSUF 1986

	Airstream		Mold				
Treatment:	S/S (%)	B/B (%)	Putrid (%)	Split (%)	Total (%)	Sand (units)	Remar (meets)
Site 1							
Rolled 25% a.m.	2.6	66.0ab	.5	.1	.6	.9a	meets
Rolled 25% p.m.	2.4	68.3b	1.1	.1	1.2	1.0a	meets
Rolled 20% a.m.	1.5	72.1b	.6	.1	.7	.2a	meets
Rolled 20% p.m.	2.5	71.0b	.7	.2	.9	.9a	meets
Rolled 15% a.m.	2.8	65.8ab	.7	.0	.7	11.9b	2m/6f
Rolled 15% p.m.	2.7	56.1a	.6	.1	.6	12.9b	fails
Turned	3.9	56.1	.6	.1	.6	12.9b	fails
Significance of F	ns	.05	ns	ns	ns	.01	
Site 2							
Rolled 25% a.m.	3.8bc	61.1a	.3	.1	.4	.6a	meets
Rolled 25% p.m.	3.9bc	61.7a	.4	.1	.4	1.4a	meets
Rolled 20% a.m.	1.5ab	79.2c	.3	.0	.4	.1a	meets
Rolled 20% p.m.	1.3ab	73.6abc	.3	.1	.5	.1a	meets
Rolled 15% a.m.	2.5abc	71.5abc	.5	.0	.5	6.7c	4m/2f
Rolled 15% p.m.	4.2c	63.5ab	.1	.0	.1	5.3bc	4m/2f
Turned	1.1a	78.0bc	.2	.0	.2	2.8ab	meets
Significance of F	.05	.05	ns	ns	ns	.01	

Numbers followed by the same letter within columns are not significantly different
Duncan's New Mulitple Range Test

S/S = sub standard
B/B = B or better

Table 3
Effect of Rolling Moisture on Embedded Capstems and Embedded Stems
CSUF 1986

Treatment	Embedded Capstems (#/lb)	Embedded Stems (#/lb)	Embedded Capstems (#/lb)	Embedded Stems (#/lb)
Site 1	**Rolled a.m.**		**Rolled p.m.**	
Rolled 25%	34.3b	4.3c	39.5b	4.8c
Rolled 20%	15.1a	2.2b	17.3a	2.8b
Rolled 15%	8.0a	1.0ab	5.0a	1.0ab
Turned	21.2ab	.6a	21.2a	.6a
Significance of F	.01	.01	.01	.01
Site 2	**Rolled a.m.**		**Rolled p.m.**	
Rolled 25%	49.0b	6.0c	43.0b	7.0c
Rolled 20%	11.0a	2.0b	28.0ab	3.0b
Rolled 15%	8.0a	1.0ab	5.0a	1.0ab
Turned	27.0ab	.0a	27.0ab	.0a
Significance of F	.01	.01	.01	.01

Numbers followed by the same letter within columns are not significantly different
Duncan's New Multiple Range Test

Table 4
Effect of Fruit Temperature at Rolling on Stems and Capstems
CSUF 1986

Rolling Temperature	Rolling Moisture Content 25%	20%	15%	25%	20%	15%
Embedded Capstems		**Site 1**			**Site 2**	
Low a.m.	34.3	15.1	7.1	49.0	11.0	8.0
High p.m.	39.5	17.3	18.3	43.0	28.0	5.0
Sign. of t-Test	ns	ns	.05	ns	ns	ns
Embedded Stems		**Site 2**			**Site 2**	
Low a.m.	4.3	2.2	1.2	6.0	2.0	1.0
High p.m.	4.8	10.1	1.0	7.0	3.0	1.0
Sign of t-Test	ns	ns	ns	ns	ns	ns

Means subject to analysis by t-Test (u=u hypothesis)

RESULTS

Continued from page 2

However, cigarette rolling did not compact the fruit as much as biscuit rolling (Table 3). Fruit rolled at high moisture content resulted in significantly more embedded cluster stems in all cases (4.3 to 7 cluster stems/lb). Fruit rolled at lower moisture levels with the turned/cigarette rolled treatment had no embedded cluster stems. This trend is graphically represented in Figure 2. Biscuit rolling unturned trays increased embedded cluster stem count.

The effect of fruit temperature at the time of rolling had no significant effect on embedded capstem or cluster stem counts, with the exception of the capstem count of fruit rolled at a low moisture at Site 1 (Table 4). Treatments were rolled in the early morning and late afternoon when temperatures were at extremes. Temperature data for a typical 24-hour period (Figures 3 and 4) indicate fruit exposed to direct sunlight and shaded fruit reached maximum temperatures at noon and air temperature may have a significant effect on embedded capstems and cluster stems if trays are biscuit rolled from 11:30 a.m. to 2:30 p.m.

Effects of rain, level of fruit moisture and temperature at rolling revealed

Fruit moisture content at the time of biscuit rolling has a significant effect on embedded capstems among biscuit rolling treatments. Embedded cluster stem count was significantly different among treatments, decreasing as fruit was biscuit rolled at lower moisture levels. The turned/cigarette rolled treatment exhibited no embedded cluster stems

No significant effect of fruit temperature on embedded capstems and cluster stems were observed. However, these treatments were rolled in the early morning and late afternoon when temperatures were at extremes. The temperature data indicate that maximum fruit temperatures occurred at noon, despite the fact that the air temperature did not reach maximum until 3:30 p.m. Therefore, fruit temperature may have a significant effect on embedded capstems and cluster stems if trays are biscuit rolled from 11:30 a.m. to 2:30 p.m.

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