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INFLUENCE OF POSTHARVEST TREATMENTS ON STORAGE BEHAVIOR OF HAND AND MACHINE HARVESTED BLUEBERRIES

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INTRODUCTION

Rabbiteye blueberries show potential for becoming an important commercial crop in East Texas. Environmental conditions in East Texas are suitable and many of the soils are adaptable to blueberry production. These environmental and geographical advantages combined with the general trends within the agricultural segment toward diversification should encourage blueberry production. Access to the large metropolitan areas of Texas and surrounding states and the location of East Texas in relation to major blueberry producing regions in the U.S. offer marketing and shipping advantages.

Because of the potential for blueberry production in East Texas, research was initiated at the Overton Research and Extension Center in 1982 to determine the influence of postharvest holding treatments and storage conditions on quality of hand and machine harvested 'Tifblue' blueberries.

METHODS AND MATERIALS

Fruit was either hand or machine harvested on June 29, 1982 at an ambient temperature of 22°C and an internal berry temperature of 24°C. Hand and machine harvested 'Tifblue' fruit were obtained from adjacent plantings at the Agricultural Research and Extension Center in Overton. Hand and machine harvested fruit were subdivided in the laboratory into one-pint lots and seven treatments were applied:

1) Control (no treatment)

2) Hot water dip--fruit were placed in a circulating water bath at 50°C for 3 minutes and rinsed 1 minute in tap water.

3) Wax dip--fruit were dipped for 15 seconds in a solution containing 1 part of FMC "Sta-Fresh 215" fruit wax to 2 parts water.

4) Fungicide dip--fruit were dipped for 15 seconds in a solution containing Benlate and Botran at the rates of 1/2 lb. and 1 1/2 lb. per 100 gallons, respectively.

5) Hot water, then wax--fruit were dipped consecutively in treatments 2 and 3.

6) Hot water, then fungicide--fruit were dipped consecutively in treatments 2 and 4.

7) Wax and fungicide combination--fruit were dipped into a wax solution (same concentration as treatment 3) containing Benlate and Botran (at same rates as treatment 4).

All fruit were air-dried after treatment, weighed, packaged in vented one-pint molded pulp containers, overwrapped with cellophane, and placed in 12-pint cardboard flats for storage. Storage treatments consisted of:

1) Room temperature (23°C) storage for 4 days.

2) Room temperature storage for 8 days.

3) 1°C storage for 14 days.

4) 1°C storage for 14 days followed by 7 days at room temperature.

5) 1°C storage for 28 days.

Weight loss was determined for each treatment and the sample was frozen for later quality analysis. Percent molded berries was determined for storage treatments 2 and 4.

For quality analysis, fruit samples were thawed overnight at 2°C and blended for 30 seconds. Anthocyanins were extracted from 5g of blended fruit tissue for 1 hour in 80% acidified ethanol, centrifuged, diluted, and absorbance was determined at 520 and 430 nm on a Bausch and Lomb Spectronic 600 spectrophotometer. Percent soluble solids was determined by refractometer and % acidity was determined by titration.

RESULTS

Hand harvested fruit lost more weight (moisture) and developed more mold than machine harvested fruit when means are pooled across the postharvest dip and storage treatments (Table 1). Hand harvested fruit was slightly, but significantly, lower in both % soluble solids and acidity. Color of hand harvested fruit was inferior to machine harvested fruit and the lower A_{520}/A_{430} ratio indicates more browning in hand harvested fruit samples.

Dip treatments had little effect on weight loss (Table 1). Hot water and fungicide dip treatments reduced mold development and the combination of hot water and fungicide was most effective. The treatments which reduced mold development also maintained slightly higher % soluble solids, lower acids and better color. Treatments containing wax tended to have higher mold development than corresponding treatments without wax. A possible reason for increased mold development with waxed fruit is that the surface of waxed fruit tended to remain moist after treatment, possibly due to the high humidity experienced in East Texas.

Weight loss increased with the severity of storage treatments (Table 2). Minimal weight loss occurred at 4 days at room temperature (RT) and during cold storage for 14 and 28 days. However, after 8 days at RT or 7 days at RT following 14 days at 1°C, weight loss increased and berry shriveling was evident. Little or no mold was evident after 4 days at RT or after 14 and 28 days at 1°C. However, after 8 days at RT and after 7 days at RT following 14 days at 1°C, mold development was excessive.

Percent soluble solids increased during storage due to the concentrating affect of moisture loss (Table 2). However, when adjusted to compensate for moisture loss, % soluble solids decreased with severity of storage. Essentially no soluble solids were lost during 4 days at RT or during 14 and 28 days at 1°C. When adjusted for moisture loss, acidity declined more rapidly than soluble solids with significant reductions by 4 days at RT and after 14 and 28 days at 1°C. Further reductions in acidity did not occur with increasing storage severity, which could be due to production of volatile acids by spoilage organisms. Volatile acidity would have been detected by the titration procedures.

When adjusted for moisture loss, fruit color as determined by absorbance at 520 nm, decreased during storage at RT and during storage at 1°C (Table 2). Browning also increased with storage severity.

The rate of moisture loss of hand and machine harvested fruit under the different storage conditions is presented in Figure 1. Weight loss was rapid during RT storage with or without previous storage at 1°C. During storage at 1°C, weight loss was linear for up to 28 days.

Percent soluble solids changed little during 28 days storage at 1°C (Figure 2). Hand picked fruit lost soluble solids more rapidly than machine harvested fruit during 8 days storage at RT. However, during 7 days at RT following 14 days at 1°C, machine harvested fruit lost soluble solids more rapidly.

SUMMARY

Machine harvested fruit were more acid, more highly pigmented, and had less weight loss and mold development than hand harvested fruit. The postharvest dip treatments had little effect on weight loss or fruit quality. However, hot water and fungicide treatments reduced mold development and the hot water-fungicide combination was most effective. When adjusted to compensate for the concentrating effects of moisture loss, the fruit quality parameters of soluble solids, acidity and color declined during storage. Hand and machine harvested fruit could be held up to 28 days at 1° with minimal quality loss.

Table 1. Main effects of harvest method and dip treatment on weight loss, mold and quality of 'Tifblue' blueberries, 1982.

Main Effects	Wt. loss (%)	Molded berries (%)	Sol. sol. (%)	Tit. acid. (%)	Color (A_{520})	Browning (A_{520}/A_{430})
Harvest Method						
Hand	6.3	44.6	10.9	0.49	.244	3.39
Machine	5.9	38.8	11.0	0.56	.311	3.67
LSD @ 5%	0.4	4.9	0.1	0.02	.009	0.06
Dip treatment						
Control	6.5	55.4	10.8	0.55	.256	3.34
Wax	5.7	57.9	10.8	0.56	.266	3.50
Hot water	6.3	34.6	11.1	0.51	.285	3.56
Fungicide	6.3	34.5	11.1	0.50	.295	3.60
Hot water, fung.	6.3	16.0	11.1	0.50	.297	3.62
Hot water, wax	6.1	44.5	11.0	0.54	.267	3.55
Wax-fung.	5.6	49.3	11.0	0.55	.280	3.54
LSD @ 5%	NS	9.1	0.2	0.04	.017	0.11

Table 2. Main effects of storage treatment on weight loss, mold, and quality of 'Tifblue' blueberries, 1982.

Storage treatment	Weight loss (%)	Molded berries (%)	Soluble solids (%)		Tit. acidity (%)		Absorbance (520nm)		Browning (A_{520}/A_{430})
			actual	adjusted	actual	adjusted	actual	adjusted	
Initial	0.0	0.0	10.7	10.7	0.57	0.57	.286	.286	3.54
4 days @ RT	4.0	-	11.1	10.6	0.47	0.46	.285	.274	3.85
8 days @ RT	11.9	37.1	10.9	9.7	0.51	0.45	.309	.272	3.37
14 days @ 1°C	3.2	-	11.1	10.7	0.50	0.49	.267	.259	3.74
+ 7 days @ RT	11.2	46.3	10.8	9.6	0.56	0.49	.255	.228	3.20
28 days @ 1°C	6.5	-	11.4	10.6	0.54	0.51	.264	.247	3.48
LSD @ 5%	0.7	4.9	0.2	0.2	0.03	0.02	.016	.016	0.10

[z]Adjusted to compensate for weight loss (moisture) during storage.

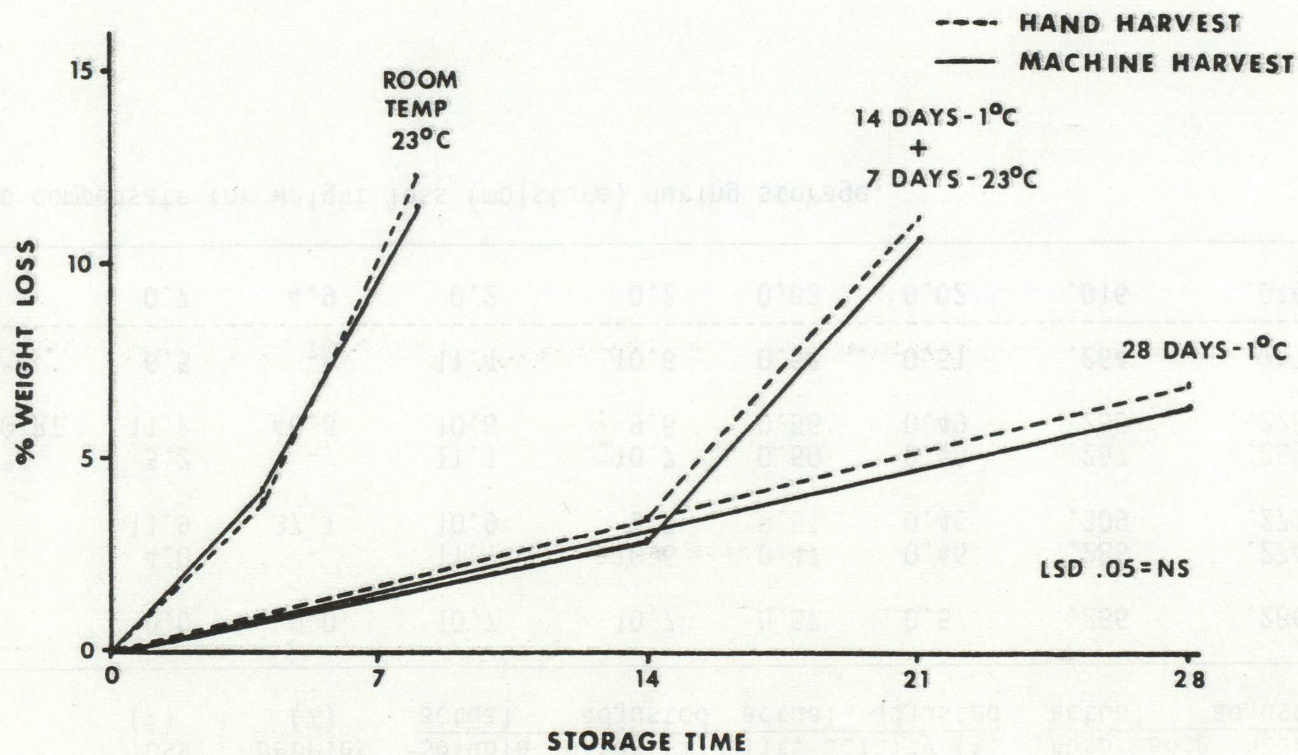

Figure 1. Interactive effects of harvest method and storage treatment on % weight loss of 'Tifblue' blueberries, 1982.

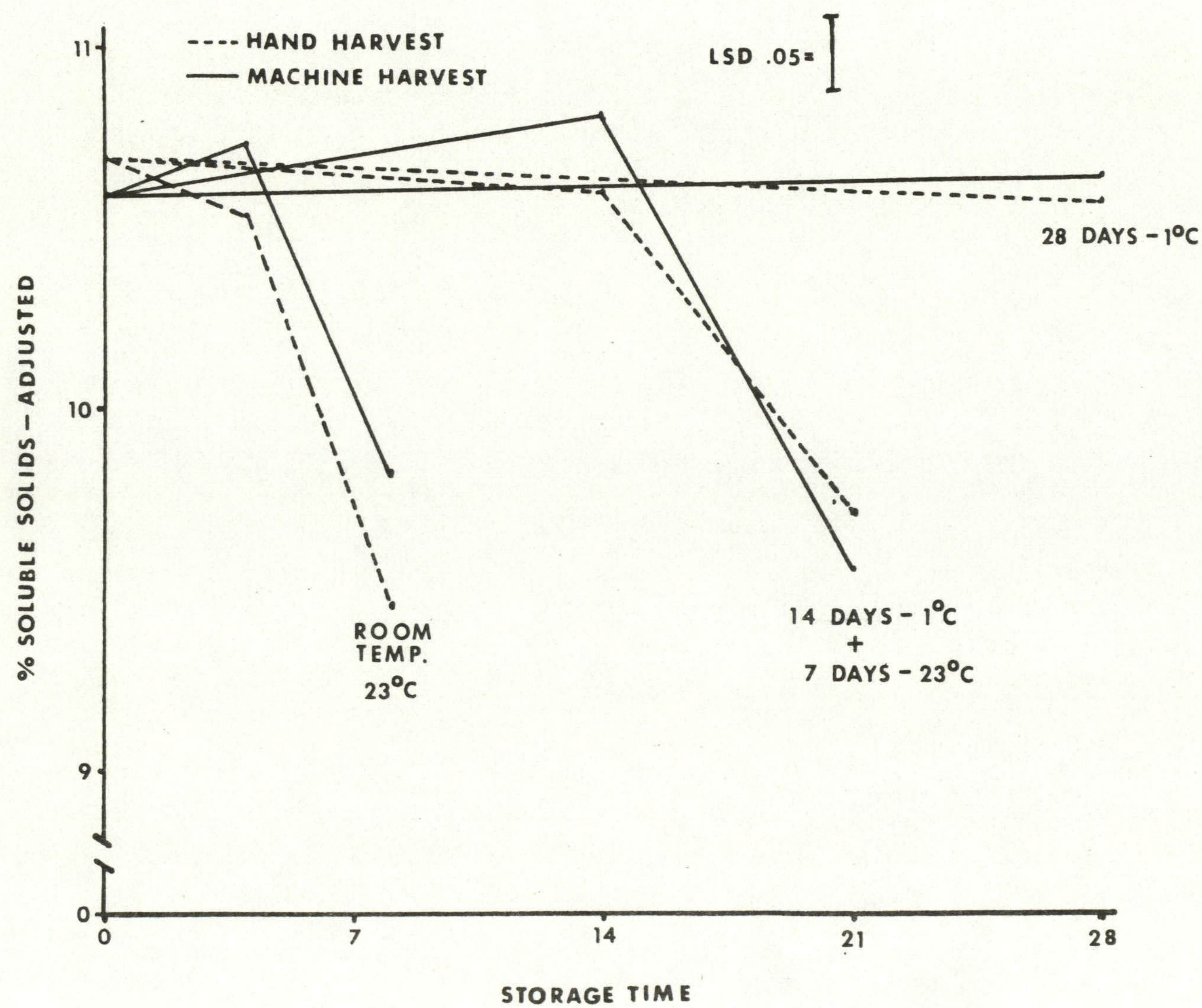

Figure 2. Interactive effects of harvest method and storage treatment on adjusted % soluble solids of 'Tifblue' blueberries, 1982.