The Influence of "Sweating" on Postharvest Decay of Blueberries

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ABSTRACT

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No apparent increase in the rate of decay of uninoculated or artificially inoculated freshly harvested blueberries (*Vaccinium corymbosum*) resulted from condensed moisture ("sweating") following cold storage. Dip-inoculations with *Alternaria* sp. resulted in a threefold increase in decay, whereas placing a *Botrytis*-rotted berry in the center of test pints did not result in significant increases in nesting and subsequent decay.

Previous studies have indicated that rapidly cooling freshly harvested blueberries to 2 C and storing them at cold temperatures in atmospheres enriched with carbon dioxide significantly reduced postharvest disease development (4,5). Because the major factor limiting shelf life of fresh blueberries is disease (1–3,6), its control or suppression can extend the berry's shipping range to distant domestic and foreign markets. Eastern blueberry growers, however, are reluctant to ship freshly harvested blueberries at cold temperatures despite USDA recommendations (8,9). Growers believe that the condensate forming on cold berries when exposed to warm humid air during marketing will erode the fruit's bloom, and more importantly, will increase decay incidence. We are unaware of any scientific evidence to substantiate this view. Because of the serious consequences of disease on the marketability of fresh blueberries, this study was undertaken to determine if a positive correlation exists between condensate formation ("sweating") of berries and postharvest disease development.

MATERIALS AND METHODS

Twelve tests were conducted during 1979–1981 with several highbush blueberry (*Vaccinium corymbosum* L.) cultivars. Freshly harvested berries from commercial growers in New Jersey were brought to the Postharvest Research Center in New Brunswick, NJ, within 4–5 hr of harvest. The fruit was stored at 2 C overnight or for 4 days. After the cooling period, the berries were transferred to 21 C and 75–80% RH. In each test, half of the berry sample was allowed to sweat and the other half was kept dry by warm forced air, which raised the berry temperature to 21 C in 2.5 min. The berries were held at 21 C for 3–4 days and then all fruits were examined for decay. The number of pints per treatment ranged from four to 10 in a test. The data from each test were subjected to the Student's *t* analysis.

In 1980, berries in one test were dip-inoculated with *Alternaria* sp. to see if significant decay differences between dry and sweated berries would occur with a high level of decay. Berries in four open-mesh plastic pint containers were each dipped in a 5×10^4 spores per milliliter suspension of *Alternaria* sp. for 1 min, drained, air-dried at room temperature for 4 hr, and refrigerated overnight at 2 C. In one 1981 test, a berry decayed by *Botrytis cinera* was placed in the center of each of five pints to determine if sweating increased nesting and subsequent decay.

RESULTS AND DISCUSSION

Under the conditions of our tests, no significant increase in the rate of decay resulted from sweating (Table 1). Similar results were obtained whether berries were stored overnight or for 4 days at 2 C. In all cases, visible condensate dissipated in 4–6 hr. In addition, sweating had little or no adverse effect on berry bloom.

In our early tests, berries were cold-stored for 4 days, but overnight cooling in later tests made them sufficiently cold for our purposes. Dip-inoculating the berries with *Alternaria* sp. resulted in a threefold increase in decay, but significantly, no increase in decay occurred in sweated as compared with dried berries. Placing a *Botrytis*-rotted berry in each pint did not materially increase nesting or result in any significant increase in decay.

Growers commonly store berries overnight at temperatures approximating 10 C. We simulated this practice in to our other treatments and obtained results consistent with those reported here.

These tests indicate that as far as decay is concerned, sweating played a relatively minor role. A more significant factor governing shelf life is the temperature at which blueberries are rapidly cooled and stored. Our work (4) and that of others (7)

Table 1. Decay incidence of fresh blueberries after cold storage at 2 C and subsequent holding for 3–4 days at 21 C

Year	Tests (no.)	Cultivar	Sweated berries Exam. (no.)	Sweated berries Decay (%)[a]	Dry berries Exam. (no.)	Dry berries Decay (%)[a]
1979[b]	2	Bluecrop	2,063	11.8	1,966	14.6
	2	Jersey	3,168	22.1	3,544	18.8
1980[c]	1	Weymouth	1,662	9.0	1,784	7.9
	1	Bluetta	2,011	12.3	2,051	11.2
	2	Bluecrop	2,484	10.4	2,482	11.2
	1	Bluecrop[d]	914	28.2	880	31.2
1981[c]	1	Weymouth	1,411	21.0	1,195	23.5
	1	Weymouth[e]	1,559	26.7	1,267	23.7
	1	Bluecrop	2,424	15.0	2,399	17.7

[a] No significant differences were found between decay means in any test, according to Student's *t* analysis at $P = 0.05$.
[b] Berries cold-stored for 4 days.
[c] Berries cold-stored overnight.
[d] Berries dip-inoculated with *Alternaria* sp.
[e] Contained one *Botrytis*-decayed berry per pint.

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