Table 6. Quality ratings of precooled sweet corn after 10 days of storage at 5°C (Test 6).

	Appearance quality[z]				Eating quality[y]	
Precool method	Husk color (1-5)	Husk drying (1-5)	Silk app. (1-5)	Kernel app. (1-5)	Kernel taste (1-5)	Kernel texture (1-5)
Vacuum	2.7a[x]	2.7a	1.8c	1.7a	3.7a	2.9b
Slush ice	2.8a	2.7a	3.0a	2.3a	3.9a	3.5a
Hydrocool	2.6a	2.8a	2.4b	2.3a	3.7a	3.2ab

[z]Ratings as in Table 2.
[y]Based on ratings from 6 ears per container, 3 containers per treatment: kernel taste, 1 = bland, watery or starchy, 5 = fresh, sweet corn taste; kernel texture, 1 = flaccid, tough, 5 = turgid, tender.
[x]Means in columns followed by the same letter are not significantly difference by DMRT (P>0.05).

Summary

All three precooling methods are valuable first steps in proper temperature management for sweet corn. However, each has advantages and disadvantages. Slush ice cooling appears to be a viable precooling alternative for sweet corn. The cooperating packinghouses are doing a good job of precooling. The performance of existing systems can be improved if the operators make adjustments suggested in this study. Additional study is needed and planned to provide more thorough advice to the packinghouse precooling operators.

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STORABILITY OF CALIFORNIA AND FLORIDA CRISPHEAD LETTUCE II. FUNGICIDE TREATMENTS

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Abstract. **Crisphead lettuce cultivars Salinas and South Bay were grown on both mineral and muck soil in Florida with fungicide applications of Maneb, Bravo, and Rovral, in combination with copper as compared with untreated check plots. The same cultivars were also grown on mineral soil in California using their standard commercial practices. At maturity, heads were commercially harvested, packed and vacuum cooled. California lettuce was shipped by refrigerated truck directly to Florida with a transit time of 4 days.**

Lettuce was stored for 2 weeks at 5C. The amount of trim loss (damaged and disease tissue) to prepare the heads for retail display was determined before and after storage. Disease assessment was quantified for all plant diseases occuring on heads of lettuce. These "disease severity ratings" (DSR) for Downy mildew and pink rib caused by *Bremia lactucae* Reg. and physiological disorder, respectively, were determined at 2 and 3 weeks storage.

Florida lettuce grown on mineral soil and stored for 2 weeks required less trimming than heads produced on muck soil; DSR was also less at this storage interval on lettuce produced on mineral soil. Severity of decay and trim loss was greater on cultivar 'Salinas' than 'South Bay'. Both cultivars grown in California had a higher DSR and trim loss than those grown in Florida. Field applications of fungicides did not reduce trim loss of lettuce which had been stored for 2 weeks, compared to no fungicides. However, the DSR was less on fungicide-treated lettuce as compared to the control after 3 weeks storage.

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Crisphead lettuce in Florida is produced on 11,700 acres of organic soils with a reported value of $59.7 million (3). Florida ranks third in the national production of lettuce. Florida crisphead lettuce is field-packed, film wrapped or packed naked, then vacuum-cooled soon after harvest and stored under refrigeration prior to shipment. The majority of shipments terminate east of the Mississippi River with an in-transit time of 2 days or less.

Because of postharvest quality and storability, western-grown lettuce enjoys a better reputation in the marketplace, as compared to lettuce grown in Florida. Variables of production and handling of eastern and western lettuce, which may account for quality/storability differences, have been investigated (3, 6, 7,). Overpacking and inadequate precooling are major contributors to poor storability; overpacking results in excessive physical damage and incomplete precooling favors fungal and bacterial pathogens in degradative breakdown. Florida letture production variables of cultivars, cultural practices, soil type, and microclimate are different from western-produced lettuce and therefore could impact on lettuce quality.

The recommended holding temperature for lettuce is 1C (4), however, during commercial transit and terminal handling, product temperature ranges normally from 3 to 6C. Adequate precooling is mandatory as transit and storage facilities are designed for "holding" instead of "reducing" product temperature. Proximity of Florida to eastern terminal markets should favor a better arrival condition over western lettuce, because of a shorter transit time.

It has been demonstrated that Florida lettuce stores well for a period of 2 weeks if properly trimmed, packed, and precooled (1, 3, 6). Results of preliminary tests on storability of Florida lettuce indicated that postharvest decay may be more prevalent on lettuce grown on organic soil (3).

The objective of this study was to evaluate storability of eastern and western type crisphead lettuce produced on Florida organic and mineral soil, with and without field applications of fungicides, and to compare Florida-grown lettuce with the same cultivars grown in California.

Materials and Methods

Crisphead lettuce cultivars Salinas (a western type) and South Bay (an eastern type) were direct seeded in both mineral and organic soils of Florida on December 6 and December 12, 1988, respectively. Methods and cultural practices were identical for both soil types in the Florida experiments. Beds containing 3 rows were on 6.5 ft centers. Beds were fumigated with methyl bromide (98%) and Chloripicrin (2%) several weeks prior to seeding. Before planting, 80-200-80 lb./A of N, P, K, plus micronutrients, were incorporated in the bed top (4 ft. wide). Two additional sidedressing were made each of 25-0-22 lb./A N, P, K. Lettuce in California was grown by A. Duda and Sons (Gene Jackson Farms, Oxnard, CA) using standard cultural practices for that area.

The experiment was arranged in two soil types in a split plot design with three replications. Soil types, cultivars and fungicide treatments were main plots, sub-plots and sub-sub-plots, respectively. Subplots of each treatment consisted of 40 ft. sections of lettuce bed. Fungicides were applied at 30 psi with a CO_2 backpack sprayer equipped with three hollow-cone nozzles on January 23, 30 and February 7. Fungicide treatments consisted of Bravo 720 (1.5 pt/A), Manex II (2.5 qt/A), and Rovral (2.0 lb./A) and an untreated check in combination with Cu as Kocide 101 at the rate of 2 lb./A. At optimum horticultural maturity, both California and Florida lettuce was harvestd, commercially trimmed to normal wrapper leaves and packed naked, then vacuum-cooled to 5C. In Florida, cultivars South Bay and Salinas were Harvested February 17, and 20, respectively; California-grown lettuce was harvested April 21, 1989. Shipment of California lettuce to Florida, storage treatments, evaluation, replications and statistical design/analysis were as previously described (3). The Horsfall-Barett system (5) was used for estimating DSR, with a range of 0-11 representing decay at 0 to 100%.

Results and Discussion

Florida lettuce grown on mineral soil stored better for 2 weeks than lettuce produced on muck soil (Table 1, 2). The increase in trim loss (all non-edible leaves, consisting of wilted, broken and decayed) during storage amounted to 3.4% for mineral-grown in comparison with 7.3% for muck-grown lettuce. Percent external decay was 3.3 and 4.6% for the mineral- and muck-grown lettuce, after 2 weeks of storage, respectively (Table 2). The major disease encountered was Downy mildew. At 3 weeks of storage, disease severity had increased substantially and there was no significant difference in the amount present on external leaves due to soil type (Table 2). However, the internal condition of mineral-grown lettuce, stored 3 weeks, was much worse than that of organic-grown lettuce due to an excessive amount of pink rib.

On the basis of trim loss, there was no difference in storability between cultivars (Table 1). However, Florida 'South Bay' stored better than 'Salinas' based on DSR (Table 3). Percent decay for both cultivars after 2 and 3 weeks of storage averaged 4 and 24, respectively. Although there was not a substantial difference in external appearance between the 2 cultivars, the internal DSR for 'Salinas' and 'South Bay' was 25.9 and 2.6%, respectively. Again, the internal disorder was pink rib. Therefore, this disorder was most severe with 'Salinas' grown on mineral soil (Table

Table 1. Storability of Florida crisphead lettuce as a function of cultivar, soil type, and fungicide treatment. Stored 2 weeks at 5C; average of 3 replications.

			Trim loss (%)		
Cultivar	Soil	Treatment	Before storage	After storage	Storage loss[z]
Salinas	Mineral	Check	21.2	22.6	1.4 b
		Maneb	20.9	25.9	5.0 a
		Bravo	23.6	26.5	2.9 b
		Rovral	18.3	19.9	1.6 b
	Muck	Check	24.6	31.1	6.6 a
		Maneb	21.9	29.7	7.8 a
		Bravo	22.0	31.7	9.7 a
		Rovral	23.2	31.5	8.3 a
South Bay	Mineral	Check	22.2	25.7	3.5 b
		Maneb	20.7	27.0	6.3 a
		Bravo	21.3	24.5	3.2 b
		Rovral	24.4	27.6	3.2 b
	Muck	Check	21.5	27.1	5.6 a
		Maneb	21.7	29.3	7.6 a
		Bravo	20.6	28.1	7.5 a
		Rovral	23.5	29.1	5.6 a

[z]Values in a column within a cultivar and soil type followed by the same letter are not significantly different at the 5% level.

Table 2. Effect of soil type on percent decay and trim loss of lettuce stored for 2 and 3 weeks.

	2 weeks			3 weeks	
Soil type	External decay (%)	Internal decay (%)	Trim loss (%)	External decay (%)	Internal decay (%)
Mineral	3.3	1.7	3.4	27.0	21.5
Muck	4.6	2.0	7.4	21.5	7.0
Students t[z]	0.7	NS	1.6	NS	4.2

[z]Student's t test, P = 0.05 level.

Table 3. Effect of cultivar on storability of lettuce at 2 and 3 weeks.

	Florida				California	
	2 weeks		3 weeks		3 weeks	
Cultivar	External decay (%)	Internal decay (%)	External decay (%)	Internal decay (%)	External decay (%)	Internal decay (%)
Salinas	4.4	1.8	28.4	25.9	75.0	3.6
South Bay	3.6	1.9	20.2	2.6	80.3	2.2
Students t[z]	0.7	NS	5.9	4.1	NS	NS

[z]Student's t test, P = 0.05 level.

2, 3). California-grown lettuce developed excessive decay during 3 weeks storage, ranging to 80%.

Field applications of fungicides generally did not reduce the amount of trim loss after storage for 2 weeks (Table 1, 4). Application of Maneb to either cultivar grown on mineral soil in Florida resulted in the greatest amount of trim loss, however, this was not the case with lettuce grown on muck. DSR obtained with the fungicides after 2 weeks of storage were not significantly different from the untreated lettuce (Table 4). It is recognized that the efficacy of these fungicides for providing protection against Downy mildew is minimal; however, in past years the major storage decay was bacterial soft rot, not Downy mildew. After 3 weeks of storage, DSR was significantly lower in the fungicide-treated lettuce than the control (Table 4).

Florida lettuce grown on mineral soil, without application of fungicides, stored better than lettuce produced in California (Table 5). Last year in a similar comparison, there was no difference in storability between California and Florida lettuce. Again, this year the major storage disease was Downy mildew and California lettuce had a much higher incidence. It is recognized that the results obtained relate to the specific crop and season, and therefore, generalizations cannot be made concerning storability of California and Florida lettuce. However, on the basis of results obtained from the last two years it appears that storability of Florida lettuce grown on mineral soil is comparable to California-grown lettuce.

Table 4. Effect of fungicides and copper[z] on percent decay of Florida lettuce stored for 2 and 3 weeks.

Fungicides (+ Cu)	Weeks stored	
	2	3
Bravo 720	4.6	18.5
Maneb	3.7	22.4
Rovral	3.4	20.6
Untreated	4.0	35.5
FLSD[y]	1.0	7.7

[z]Copper applied as Kocide 101 at 2 lbs./A.
[y]Fishers Least Significant Difference, P = 0.05 level.

Table 5. Storability of California and Florida crisphead lettuce produced on mineral soil. Percent trim before and after storage at 5C for 2 weeks; average of 3 replications.

Cultivar/ location	Before	After	Storage[z] loss
Salinas			
California	25.4	35.1	9.7 a
Florida	21.3	22.6	1.4 b
South Bay			
California	22.5	31.0	8.5 a
Florida	22.2	25.7	3.5 b

[z]Mean separation in columns by Duncan's multiple range test, 1% level.

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