IRRADIATION OF CALIFORNIA

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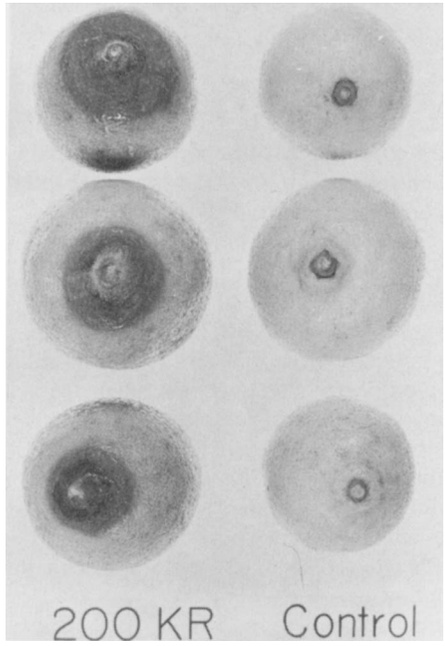
In 1954, research was started on the effects of ionizing radiation on fresh fruits and vegetables. More information was needed because the claims then being made of long shelf lives for unrefrigerated irradiated commodities were biologically questionable. This article is a summary of 15 years work, and offers an evaluation of the commercial potential for irradiation of some major California commodities. Gamma rays from cobalt-60 were used in these tests, but the results would be comparable with other types of radiation; certainly, the commercial potential would not change. Only one California commodity, strawberries, showed promise for commercial application of radiation and even with this crop its use would depend on major changes in marketing conditions.

IRRADIATION CAN BE USED ONLY where the treated commodity is much less sensitive to injury than the destructive organisms, or processes, needing control. That required difference in sensitivity was found in only a few fruits and vegetables, and even then there was not always an economic benefit resulting.

Textural damage

Textural damage to flesh and skin from irradiation was so severe that the resulting processing and shipping quality was unacceptable in apricots, avocados, cucumbers, nectarines, olives, peaches, peppers, plums and tomatoes. Visual symptoms of injury quickly appeared in lemons, lettuce, limes and table grapes. Irradiation also increased decay in lemons and grapes in storage. Apples, cantaloupes, oranges, and mushrooms were moderately tolerant of radiation but with these fruits irradiation was no more beneficial than cold storage. The ripening of bananas, sprouting of carrots, onions and potatoes, and the elongation of asparagus, was controlled by irradiation without severe loss in quality, but more economical, and equally effective methods were available for all but asparagus. The asparagus season is so short, and the industry so small, that irradiation was not considered economically feasible for that crop.



Effect of gamma radiation on "Black Button" rot of lemons after two months in cold storage.

EFFECT OF GAMMA IRRADIATION ON TRANSIT INJURY, DECAY, AND MARKETABILITY OF SHASTA STRAWBERRIES IN COMMERCIAL TRUCK AND MARINE SHIPMENTS*

Test number	Destination	Irradiation dosage	Transit injury	Decayed fruit		Unmarketable fruit	
				On arrival	+ 3 days storage	On arrival	+ 3 days storage
	city	Krads	score†	%	%	%	%
1	Minneapolis	0	1.6	1.6	4.4	5.1	9.8
		150	1.8	1.8	2.5	8.3	8.4
		235	1.8	1.1	2.1	8.5	8.8
2	Atlanta	0	1.8	4.6	11.1	6.4	13.2
		150	2.0	1.8	4.9	4.3	6.8
		235	1.9	1.7	6.4	5.2	10.0
3	Atlanta	0	1.9	11.5	9.5	14.7	12.5
		150	1.8	7.4	8.4	11.6	13.4
		235	2.0	5.3	5.5	8.9	13.5
4	Atlanta	0	1.3	12.9	54.1	15.4	54.5
		150	1.5	4.1	14.5	8.4	18.3
		235	1.5	3.9	10.1	7.3	12.9
5	Atlanta	0	2.0	1.7	12.1	5.6	14.2
		150	2.1	0.7	2.9	4.7	7.0
		235	2.1	0.9	2.7	5.2	10.3
6	Honolulu	0	1.0	49.4	80.3	50.2	80.3
		150	1.6	5.6	8.9	7.4	16.4
		235	1.7	6.9	6.4	10.1	10.0
7	Honolulu	0	1.6	1.6	6.3	4.4	14.8
		150	1.5	0.9	0.9	2.9	12.5
		235	1.6	1.1	0.9	4.9	14.8

* Shipments to Minneapolis and Atlanta, 4 days by refrigerated truck; to Honolulu 9 days by refrigerated container.

† Scored on a numerical 0–5 scale, 0 = no injury, 5 = unmarketable. Fruits were scored individually and a weighted average calculated.

Strawberries

Irradiation controlled decay of strawberries without adverse effects on appearance, taste or vitamin content in both laboratory and simulated transit tests. This report covers the response of irradiated strawberries to commercial transcontinental shipments.

Irradiated strawberries showed less decay and only a slightly greater amount

FRUITS AND VEGETABLES

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of transit injury during shipment (see table). In only two of seven shipments, however, was the improvement in fruit quality adequate to justify the treatments. And in one of these, the benefit appeared only after a 3-day post-arrival storage. Under present conditions and marketing procedures employed by the California strawberry industry, irradiation would not be economical, although it might be in the future.

Marketing losses

In 1960, marketing losses of California strawberries averaged 25 per cent and sometimes exceeded 50 per cent. In the past decade (by contrast) these losses on arrival were substantially reduced—often down to 5 per cent or less—by improved quality control at harvest, prompt cooling (in 1 to 1½ hours) to 32–36°F, unit loading, improved carrier vehicles, reduced transit and marketing time, and good temperature management. If the industry maintains or improves current marketing procedures, irradiation would not be needed except in rare instances where rot infections are abnormally high. Such instances probably occur too infrequently to justify investing in irradiation facilities.

Quality control

If quality control should revert to the 1960 situation, or if the marketing area for California berries is extended to overseas markets, irradiation might be a useful process in maintaining market quality. However, before irradiated strawberries can be sold for human consumption, the Food and Drug Administration must approve the process.

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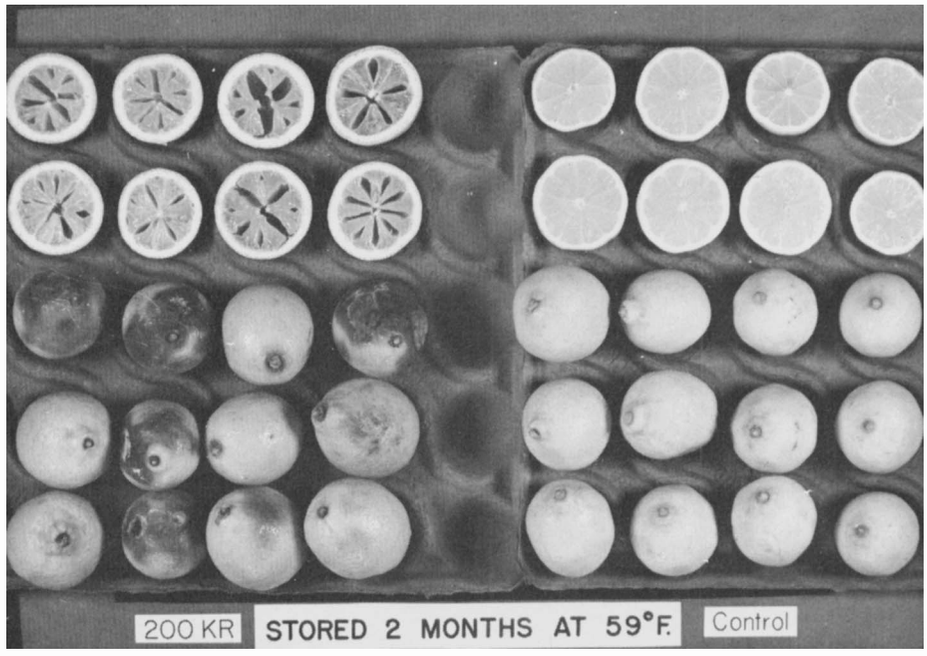
Effect of gamma radiation on lemons.



1963 photograph of untreated check fruit (left) and irradiated (right) Shasta strawberries.