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## INSECTICIDES AND FLAVOR

# Flavor of Cantaloups as Affected by Treatment with Lindane

The flavor of cantaloups treated with lindane as a dust, wettable powder, or emulsion concentrate at the rate of 0.35 pound active ingredient per acre in each of four applications was compared to the flavor of untreated cantaloups. Results of these palatability evaluations indicate that lindane applied as a dust had no detrimental effect on flavor. The effect of lindane wettable powder on flavor of melons was less definite, but its use may contribute to off-flavor. Treatment with lindane emulsion concentrate resulted in an adverse effect on flavor of cantaloups.

THE USE OF AGRICULTURAL CHEMICALS has greatly reduced insect damage to food crops and thus has increased yield and quality of these crops, although in certain foods off-flavors have been produced.

A possible residual in the soil by lindane treatments may affect the flavor of subsequent crops grown in the same soil. Present U. S. Department of Agriculture recommendations (4) for the control of the pickleworm include the use of lindane applied as dust or wettable powder with the restriction that it not be applied within 1 day before a harvest and not be applied in fields to be planted later to potatoes or other root crops, as it may adversely affect their flavor.

Reported here are the results of a study conducted by the Human Nutrition Research Division in cooperation with the Entomology Research Division to determine whether cantaloups treated with lindane in the form of dust, wettable powder, or emulsion concentrate developed off-flavors or off-odors.

### Production and Harvesting

Cantaloups of the Hearts of Gold variety were grown at the Plant Industry Station, Beltsville, Md., by the Crops Research Division, and were treated and harvested by the Entomology Research Division. The melons were grown in three field blocks, each of which contained one plot for the untreated cantaloups and one plot for each of the three treatments. Two rows of cantaloups were grown in each plot.

The insecticide treatment was lindane applied to the vines and melons as dust, wettable powder, or emulsion concentrate

at the rate of 0.35 pound of active ingredient per acre. Cantaloups received the first application of lindane treatment the week of July 25, 1957, and treatment was continued at weekly intervals for 4 weeks. The last application of lindane was made the day preceding harvest to allow the greatest possible influence on flavor. This is in accordance with commercial practice in growing the relatively new fall crop. All samples, including the control, were sprayed with a fungicide made with 3 pounds of tribasic copper sulfate and 2 pounds of Dithane to 100 gallons of water per acre.

The cantaloups were harvested from August 26 to September 4 at the "full-slip" stage of maturity in order to obtain melons of uniform ripeness. However, upon cutting the cantaloups, some variation was found in degree of ripeness regardless of the care exercised in selection. At the time of harvest the top of each melon was marked with an X to distinguish it from the bottom, which was unmarked. The top of the cantaloup was considered that portion which did not touch the ground during growth. This procedure made it possible to separate the two portions for palatability evaluation and to ascertain whether both portions were similarly affected by the lindane treatment.

Two melons from each plot (one from each row) of a single field block were harvested and delivered daily to the Human Nutrition Research Division laboratory. The cantaloups, which were of good quality when received, were held overnight at 40° F. They were judged the day following harvest to avoid long holding, as flavor loss in full-slip, yellow melons is rapid in storage (3).

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### Procedures for Palatability Evaluations

The two melons from each of the untreated plots and each of the treated plots were cut in half; top halves were prepared as one sample and bottom halves as another. The rind was removed, any damage from cracks or bruises was carefully trimmed away, and the cantaloups were then cut into 1-inch cubes. To provide a representative sample of cut pieces and juice, the cantaloup was prepared in an electric blender. To avoid development of oxidized flavor, only one eighth of the cubes at one time were chopped for 15 to 20 seconds on low speed. All eight aliquots of a sample were transferred to a glass bowl and any pieces uncut by the blender were cut by hand with a stainless steel paring knife. The bowl was covered with aluminum foil and the melon was chilled in a refrigerator until served—no longer than 20 minutes.

Individual portions of the melon samples, approximately two tablespoons, were served in coded, white porcelain dishes to the panel members.

Palatability testing was done at individual tables in a room especially equipped for panel testing and separate from that in which samples were prepared. Five members of the staff, in no way connected with preparation of the samples, evaluated the cantaloups for flavor and odor, and were asked to identify any detectable off-flavors and/or off-odors. Separate 5-point scoring scales were used for flavor and odor: for flavor, 5 represented natural flavor or no off-flavor; 4, slight off-flavor; 3, moderate off-flavor; 2, strong off-flavor; 1, very strong off-flavor. A similar scoring scale was set up for odor.

**Table I. Mean<sup>a</sup> Panel Scores for Cantaloups Treated with Lindane Dust, Wettable Powder, or Emulsion Concentrate**

Treatment	Flavor <sup>b</sup>		Odor <sup>b</sup>	
	Top half	Bottom half	Top half	Bottom half
Untreated, control	4.3	4.7	4.5	4.9
Lindane				
Dust	4.4	4.5	4.9	4.8
Wettable powder	3.8	3.6	4.5	4.5
Emulsion concentrate	2.8	3.0	3.5	3.7
Test difference <sup>c</sup>	0.8	0.6	0.4	0.5

<sup>a</sup> Mean for flavor of top halves of untreated cantaloups is based on 25 scores (5 judges, 5 scores per judge). All other means are based on 30 scores (5 judges, 6 scores per judge).

<sup>b</sup> 5 represents no off-flavor or off-odor; 1, very strong off-flavor or off-odor.

<sup>c</sup> Difference between two means is significant at 5% level when it equals or exceeds test difference [Duncan and Bonner test (2)].

Two days of preliminary training familiarized the judges with the natural flavor of the cantaloups and the form in which they were served.

The experimental design was a randomized block plan (7) which provided for two replications of both top halves and bottom halves of the four samples from each of the three field blocks. The design provided, therefore, six scores per judge for cantaloup top halves and six scores for cantaloup bottom halves for each treatment and for the untreated melons.

Taste-testing sessions were held in mid-morning and mid-afternoon. At each session both top halves and bottom halves of the three treated samples and one untreated sample of melons representing a single field block, a total of eight samples, were rated. The samples were divided into two groups, top halves and bottom halves. The serving order was randomized, so that each group was served first four times. A 10-minute interval between the serving of the two groups of four samples allowed for recovery of the judges' sensory acuity.

### Results and Discussion

Mean scores for flavor of untreated cantaloups and lindane-treated cantaloups show that development of off-flavors may be influenced by the form of lindane treatment, whether dust, wettable powder, or emulsion concentrate (Table I).

No significant difference was found between the flavor scores for the lindane dust-treated sample and the control sample. The mean flavor score for bottom halves of melons treated with lindane dust was significantly higher (flavor more natural) than the mean score for flavor of cantaloups treated with either emulsion concentrate or wettable powder. Also the mean score for top halves of melons treated with lindane dust was significantly higher than that for which emulsion concentrate was used. Both top and bottom halves of cantaloups grown with the use of lindane emulsion concentrate were scored significantly lower for flavor and odor than the untreated sample and melons receiving other forms of lindane treatment. Cantaloups treated with lindane emulsion concentrate were said by panel members to have a "musty" flavor more frequently than other treated samples as shown at right above:

The effect of lindane wettable powder on the flavor of melons was less definite. Bottom halves of samples treated with lindane-wettable powder were significantly poorer in flavor than bottom halves of untreated samples. The top halves of lindane-wettable powder-treated melons also received a mean flavor score which was lower, although not significantly so, than the mean flavor score received by the top halves of untreated cantaloups.

Mean scores for top and bottom halves of the three treated samples were in agreement, indicating that the two portions of the melons were similarly affected by the lindane treatment.

**Frequency of Occurrence of "Musty" Flavor**

Control, %	Dust, %	Wettable Powder, %	Emulsion Concentrate, %
14	10	44	58

Mean scores for top and bottom halves of the three treated samples were in agreement, indicating that the two portions of the melons were similarly affected by the lindane treatment.

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## COFFEE CONSTITUENTS

### Carbohydrates of the Coffee Bean

THE chemistry of the coffee bean roasting process is not well understood, but is undoubtedly concerned in part with its carbohydrate content, because this amounts to 50 to 60% of the green bean. The literature on the carbohydrates of the coffee bean is incomplete and is often conflicting.

In the present work the authors (14, 17-19) have determined the free sugars present in green and roasted coffee. The

mixed polysaccharide fractions of green and roasted coffee have been isolated. Derivatives of the sugars present in the polysaccharide fractions of green coffee have been isolated and a quantitative analysis of the sugars present is reported.

#### Green Coffee Bean

Coffee beans used in this investigation were grown on Fazenda Limeira (210, 000 trees), Morais Sales, Brazil, at an

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altitude of 631 meters, in Massapé soil (clayey earth), and were classified as Santos 4's, the mildest or least harsh to taste of the Brazilian coffees.

#### Chromatographic Methods

Flowing-type chromatography on clay columns was employed for the crude fractionation of the ethanol-water (80 to 20) extracts of green and roasted coffee.