

Quality in Frozen Lima Beans

effects of processing on table-quality of frozen Concentrated Fordhooks studied in series of tests

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Concentrated Fordhook lima beans—subjected to experimental variations during processing, freezing, and subsequent cooking—were adversely affected by increased delay time after vining, decreased blanch time and temperature, increased freezing temperature, decreased cooking time, and increased calcium content of the processing and cooking water.

Present United States Standards for Grades of Frozen Lima Beans are largely based on ratings of color and on absence of defects, but in addition, there are requirements covering flavor, odor, and tenderness.

When the standards were established, varieties of lima beans were commonly used that gradually lose their green color as their physiological maturity advances, becoming white when fully mature. In recent years, new varieties have been developed, many of which retain their green color at all stages of maturity. This situation has made it increasingly difficult to determine quickly and accurately the quality of frozen lima beans under United States Standards.

One phase of a recent study—conducted in co-operation with the Western Utilization Research Branch of the United States Department of Agriculture under a contract supervised by the Agricultural Marketing Service—was to eval-

uate a number of objective tests with the aim of finding one which could replace or supplement the color and the tenderness ratings in the present United States Standards for Grades.

Samples of Concentrated Fordhook lima beans—with about 10% white—were vined, size-graded, washed, brine-floated, washed again, and cooled at a commercial processing plant. These were then placed in 32° F storage and processed in successive experiments. The total elapsed time from vining to blanching of the last sample was 48 hours. Subsequently, the beans were made more homogeneous by separating in sugar solutions; those floating in 25% sugar and sinking in 18% sugar were used after removal of those that were white or pale green.

Processing Treatments

In the standard procedure, the beans were blanched—scalded—in steam at 212° F for 180 seconds, cooled 30 seconds in soft tap water, sealed in No. 2 cans, frozen, and stored for seven months in circulating air at -10° F. In each experiment, only one of the above processing conditions was varied. Before taste-testing, all samples were cooked for 12 minutes in distilled water.

One series of beans was given three

different blanching temperatures—190° F, 200° F, and 212° F. Another series underwent different periods of blanching—0, 90, 180, 270, 360 seconds. A third series was cooled in water of varying calcium concentrations of 0, 50, 100, 200, 500 ppm—parts per million—and subsequently cooked in water of the same concentrations for tasting and analysis. A fourth series was frozen and stored for seven months in still air at temperatures of -30° F, -20° F, -10° F, and +10° F. The fifth series was subjected to different periods of delay at room temperature—0, 1.25, 3.0, 5.5, and 7.5 hours—before blanching and further processing. The sixth and final series was cooked for different periods of time—four, six, nine, 13, and 18 minutes—before tasting and physicochemical analysis.

From the data obtained by the tests, it was apparent that variations in the processing and cooking of frozen lima beans may markedly influence the textural quality of the product. Also, the effects of the experimental variations were readily detectable to the members of the taste panel. However, of the objective tests applied, only the tenderometer value of the cooked beans reflected the changes in eating quality at the 1% level of probability. The tenderometer value appeared to be particularly sensitive to toughening due to calcium in the cooking water.

The tests for alcohol-insoluble solids—AIS—and for per-cent moisture had values closely correlated, but neither appeared to be correlated with cotyledon—embryo—texture scores. This indicates that these two tests did not clearly reflect differences in textural quality introduced by the variations in the handling, processing, and cooking conditions investigated in this study. The correlation between starch content and AIS value is significant at the 5% level of probability. While AIS and moisture determinations have been well established as indices of the physiological maturity of lima beans, they do not measure the textural quality of the cooked frozen product under the conditions of the present study. The United States Department of Agriculture color scores remain at an unvaried level which is not significantly related to any of the factors employed.

Concluded on next page

Organoleptic texture scores for frozen lima beans undergoing variation in processing.



