AN EVALUATION OF NEW VARIETIES OF BEETROOT FOR CANNING PURPOSES

The most popular variety of beetroot used in Queensland for canning purposes is Detroit Dark Red. It was the purpose of the experiment reported here to evaluate, for canning purposes, new varieties and strains which have been brought to Queensland, using Detroit Dark Red as a control. The beetroot for the experiment were obtained from a planting of several new varieties on a property in the Redlands district, near Brisbane. The following were selected on agronomic features: Detroit Dark Red; Detroit Dark Red, U.S. Selection 1; Detroit Dark Red, U.S. Selection 3; Detroit Dark Red, Dundas Selection 96; Chieftain; and Chieftain Selection.

Methods and Materials

Grading.—Observations during preliminary work indicated that small beetroot are progressively more susceptible to heat damage, which is evidenced by softening during blanching. This is possibly due to the overheating of the small beetroot while endeavouring to heat the larger sizes sufficiently. To overcome this effect the beets were graded into three sizes:—Size A up to 2½-in., B from 2½ to 4½-in., and C above 4½-in.

Treatment.—The beetroot were steam-blanched at 210°F for 20 min (Size A), 25 min (Size B) and 35 min (Size C). All sizes were then cooled in running water, peeled and sliced transversely into discs of approximately ⅛-in. thickness. Epoxy-resin lacquered 307 x 309 cans were filled with exactly 10 oz of beetroot and covered with 6 oz of hot brine, composed of 25 per cent. sugar, 1·25 per cent. salt and 1·25 per cent. acetic acid, at 200°F. Cans were immediately vacuum sealed and retorted at 240°F for 30 min. After heat processing, the cans were cooled in the retort with cold running water. Cans in this experiment were not exhausted prior to closing, since Lucas, Rice, and Weckel (1960) report no difference in pH, colour of liquor or colour of slices between beetroot which has been exhausted and that which has received no exhaust treatment.

Colour Evaluation.—The evaluation of red colour of raw and canned beetroot has been mainly by descriptive means, terms such as "brighter" and "darker" being used. Lack of positive definition of the chemical nature of the red pigment (called betanin) precludes the use of a more precise method of evaluation. Pucher (1938) and Pucher, Curtis, and Vickery (1938) failed to

establish a structural formula for betanin, for in addition to containing nitrogen, it differs from the anthocyanins of known structural formula. "Betanidin," the sugar-free form, is not stable after acid hydrolysis as are the anthocyanidins, and the alkali degeneration of betanidin does not yield phloroglucinol and organic acids. Peterson and Joslyn (1960) have postulated in detail that the nitrogenous red pigment is a pyrolle derivative.

As the use of the descriptive terms "brighter" and "darker" is quite unsatisfactory for development or control purposes, objective means were used to gauge the intensity of colour within the canned product. The beets were drained from the cans and the liquor diluted 1 to 100 with distilled water. Samples were placed in an Optica CF4 spectrophotometer and readings taken to obtain the wavelength of maximum absorption. This was found to be 520 mμ. This wavelength and the dilution of 1 to 100 were used for optical density readings on all samples of canned beet liquor.

Although Lucas, Rice, and Weckel (1960) reported that equilibrium was reached within 24 hr, the canned beetroot liquor was analysed for colour two weeks after processing to ensure that the pigment of the beets became equilibrated with the liquor.

Sensory Evaluation.—To observe the effect of different blanching times on the texture and colour of the beets, a taste panel was used to determine if there were any significant differences between the three sizes processed. A panel of 12 people was employed, using a hedonic scale (Peryam and Pilgrim 1957) with four replicates. The results were set out and analysed by the method of Mahoney, Stier, and Crosby (1957), assigning numbers 9 to 1 in descending order to a "like extremely—dislike extremely" scale.

Results and Discussion

The analysis of the means of optical densities of Sizes A, B, and C for all varieties is shown in Table 1: this shows the colour intensity to be highest in the small sizes than in the larger ones. Overall, colour intensity within the three sizes is most marked in Chieftain and Chieftain Selection, with the Detroit Dark Red, Dundas Selection 96 showing the poorest colour. A visual examination of all varieties resulted in the following observations.

Detroit Dark Red: Bright acceptable colour.

Detroit Dark Red—U.S. Selection 1: } Darker in colour than Detroit Dark.
Detroit Dark Red—U.S. Selection 3: } Red, with tendency towards dark areas throughout the three sizes.

Detroit Dark Red—Dundas Selection 96: Dark and dull in appearance; not attractive.

Chieftain and Chieftain Selection: Bright colour; very attractive.

TABLE 1

OPTICAL DENSITY READINGS (means)

Variety	Size A	Size B	Size C	Means
DDR—Detroit Dark Red	0·283	0·210	0·156	0·216
DDR/1—Detroit Dark Red, U.S. Selection 1	0·247	0·187	0·174	0·203
DDR/3—Detroit Dark Red, U.S. Selection 3	0·289	0·251	0·230	0·259
DDR/D96—Detroit Dark Red, Dundas Selection 96	0·216	0·188	0·177	0·194
C—Chieftain	0·388	0·299	0·261	0·316
CS—Chieftain Selection	0·358	0·241	0·203	0·247
Means	0·297	0·241	0·203	0·247

Sizes: A > B > C.

Varieties: C > CS > DDR/3 > DDR > DDR/1 > DDR/D96.

The interaction term is highly significant. For the different sizes varietal effects are as follows:

Size A: C > CS > DDR/3, DDR > DDR/1 > DDR/D96.

Size B: C, CS > DDR/3 > DDR > DDR/1, DDR/D96.

Size C: C > CS, DDR/3 > DDR/D96, DDR/1, DDR. DDR/D96 > DDR.

(Significance at 1% level in all cases)

The taste panel showed slight preference for the medium-sized beets, i.e. Size B (2½ in to 4½ in.), for both texture and colour; however, the preferences statistically were not significant. Size grading of the beets, followed by appropriate blanching times, had the effect of producing an evenly textured beetroot throughout the various sizes by avoiding heat damage to the smaller sizes.

Though an analysis for colour was carried out on each of the three grades or sizes, taste panel preferences for any particular one was not significant enough to evaluate a variety from the point of view of one size only. The combined colour from the three different sizes was therefore taken into account. Chieftain, Chieftain Selection and Detroit Dark Red, U.S. Selection 3 were of better colour than Detroit Dark Red, while Detroit Dark Red, U.S. Selection 1 and Detroit Dark Red, Dundas Selection 96 were inferior in colour. However, Detroit Dark Red, U.S. Selection 3 had a large percentage of the beet slices with darkened areas, which detracted from the appearance of the canned product. Only Chieftain and Chieftain Selection can be considered comparable or superior to Detroit Dark Red for canning purposes.

Though soil type, location and season of harvest may affect the colour of canned beetroot (Lucas, Rice, and Weckel 1960), the overall colour intensity shown by Chieftain and Chieftain Selection was so much greater than that for other varieties that it is doubtful if the factors mentioned would alter the results to any great extent.

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(Received for publication May 30, 1963)