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ORGANIZATION, HOMEBUSH, NEW SOUTH WALES, AUSTRALIA

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The Laboratory Examination of Canned Foods

Editorial Note

It is intended to publish in the "Food Preservation Quarterly" a series of articles on "The Laboratory Examination of Canned Foods".

These articles originated as notes prepared for a short course of lectures and practical work on the laboratory examination of canned foods, arranged by Sydney Technical College, in conjunction with the Food Technology Group of the Australian Chemical Institute (N.S.W. Branch), in January-February 1945, and repeated at a Winter School in August-September 1945. Subsequently the notes were revised, and in February 1948 they were reproduced by the Sydney Technical College Union for the use of students in the Food Technology Diploma Course.

Numerous requests for copies of the notes indicated wide interest and prompted publication in the "Food Preservation Quarterly". The notes have again been revised and the literature citations brought up to date.

Readers are invited to make critical comments on the procedures described, in the light of their own experiences, and to provide information on modified or alternative methods which they have found to be useful.

I. Some General Considerations

By

J. F. KEFFORD*

Laboratory examinations of canned foods are regularly required in several fields, for instance:

(i) *Government Inspection.*—Canned foods are inspected and graded for export by the Commonwealth Department of Commerce and Agriculture, and are examined in State laboratories for conformity to the requirements of the Pure Food and Health Acts of the States.

(ii) *Contract and Tender Sampling.*—Tender samples and samples from consignments delivered are examined for conformity to specifications by purchasing authorities, such as the Armed Forces.

(iii) *Production Control.*—Routine examinations of line samples are made in cannery laboratories to ensure maintenance of quality standards.

(iv) "*Trouble-shooting.*"—In investigations of spoilage, damage or deterioration in canned foods, laboratory examinations of normal and abnormal samples are necessary for accurate diagnoses and effective preventive measures.

(v) *Research and Development.*—In the course of the development of new processes or products and in the investigation of problems of production, storage, and distribution, inspections and analyses of test packs are frequently performed.

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In general, established procedures of food analysis are directly applicable to canned foods. Therefore the discussions which follow will not include details of analytical procedures that are adequately described in standard texts. The intention is rather to review those special techniques, methods, and pieces of equipment, which have been developed in laboratories serving the canning industry to facilitate the laboratory inspection and analysis of canned foods. An attempt will also be made to provide background information on the significance in canning technology of the quantities determined, and on standards, limits, and requirements where these have been laid down.

Reports

In the examination of canned foods, the use of a standard form of report is strongly recommended. It ensures an orderly procedure of examination; it encourages neat and accurate recording; and it materially assists in the interpretation of the results.

Specimen Report Form No. 1 (p. 7) sets out a systematic record applicable particularly to the examination of canned fruit and vegetable products but also readily adaptable to other canned foods. The first entries are those necessary to ensure proper identification of the samples under test, thus:

Product: The trade description of the pack is given with relevant details as to style, grade, size, variety, etc., for example, Peaches, Yellow Cling, Halves, Fancy (Golden Queen variety).

Manufacturer: The name and location of the cannery are stated.

Label: The brand name and the stated contents weight are recorded, and also the form of the label, whether paper, embossed, ink-stamped or lithographed.

History: The purpose of the examination is briefly indicated and the source of the samples, with references to correspondence. Details of the heat process and of subsequent storage (duration, temperature, and conditions) are recorded and, in spoilage investigations, any information on the total wastage in the stacks.

Sample No.: It is usually convenient to give a serial number to each sample batch received in the laboratory.

Date Received: The date of receipt of the samples is entered.

No. of Cans: The number of cans in the sample batch is recorded.

Sampling

The entry **No. of Cans** introduces the question of adequate sample size when sampling a consignment, a stack or a production line of canned foods. In examinations of general quality, attempts to work out a valid statistical method for sampling are not profitable. Usually an empirical sampling procedure is laid down, based largely on the size of sample which can be conveniently handled in the laboratory concerned. For instance, the Agricultural Marketing Administration, U.S.A., draws samples of canned foods for quality grading according to the following formula: if x is the number of cases in the consignment or stack, one can is taken from each of $\sqrt{x}$ cases selected at random, provided that all code numbers in the consignment are represented in the sample. If one can with a particular code number is substandard, another can with the same code is taken but not more than two. Thus, in a stack of 2500 cases, one can from each of 50 cases is examined (Austern 1952).

Detailed procedures for routine line sampling of canned fruits and vegetables are given by Trace (1938, 1942).

In the experience of this Laboratory at least three cans are desirable as a sample of a product submitted for general examination. Considerably more cans may be required for purposes of " trouble-shooting ". The question of size of sample for microbiological examinations will be discussed in a later article.

Can Sizes

A conventional canmakers' system describes the sizes of cylindrical cans in terms of the overall diameter and height of the sealed can, expressed in inches and sixteenths of an inch. Thus a can $4^{1}/_{16}$ inches in diameter and $4^{11}/_{16}$ inches in height is designated 401×411.

A great variety of can sizes is in production and many canmakers have slightly different dimensions for similar types; however, some measure of standardization of the types most widely used is being achieved.

A few common can sizes are set out in Table 1.

TABLE 1
Some Common Can Sizes

Name	Diameter (in.)	Height (in.)	Canmakers' Description	Approximate Total Capacity	
				fl. oz. (Imp.)	ml.
4 oz.	$2^{11}/_{16}$	$1^{11}/_{16}$	211×111	4·2	118
8 oz.	$3^{1}/_{16}$	$2^{5}/_{16}$	301×205	7·8	222
12 oz.	$4^{1}/_{16}$	2	401×200	11·4	324
1 lb., Squat ..	$4^{1}/_{16}$	$2^{11}/_{16}$	401×211	16·3	462
1 lb., Tall ..	$3^{1}/_{16}$	$4^{11}/_{16}$	301×411	16·6	472
No. 2	$3^{7}/_{16}$	$4^{9}/_{16}$	307×409	20·3	577
No. $2\frac{1}{2}$	$4^{1}/_{16}$	$4^{11}/_{16}$	401×411	29·8	844
No. 10	$6^{3}/_{16}$	7	603×700	109	3085

Codes

It is usual for food cans to bear an embossed or ink-stamped code on the ends identifying the cannery and the product, and recording the date of packing. Many canneries use private codes, but canned foods for export are required to be coded according to regulations laid down by the Commonwealth Department of Commerce and Agriculture. The official codes include the registered number of the cannery and symbols indicating the quality grade of the product and the day or the month of packing.

To return to the routine entries on Specimen Report Form 1 (p. 7) :

Size : The common name of the can and the canmakers' description are entered.

Codes : All visible code symbols are noted.

Packing Date : The date of packing, where it is known, from the code or otherwise, is recorded.

Examination Date : The date on which the samples are examined is entered. The interval between this date and the **Packing Date** is the storage period which is recorded under **History.**

Can No. : When the examination of individual cans is commenced, each can is given an individual number in addition to the sample batch number, for example No. 654/1. In order to follow individual cans through successive stages of examination it is desirable to number each can permanently, for example, by scratching with a stylus or by etching with a suitable etching fluid, such as the following :

Copper sulphate, hydrated	170 g.
Sodium chloride	140 g.
Water	250 ml.

This fluid is applied with a match stick. It writes most readily on the solder at the side-seam of the can.

Condition of the Cans

After completion of the routine entries on the report form, the examination of the cans is commenced by recording a description of their condition. This information is frequently useful in assisting the interpretation of subsequent findings. Certain conventional terms are used in reporting **Condition,** thus :

Flat Can : A can on which both ends are well collapsed, that is flat or concave.

Flipper or Springer : A can on which one end is bulged ; when pressed in, this end springs out again or the opposite end springs out. The term "springer" is also applied to rectangular tapered cans in which the springiness is usually more evident in the sides than in the ends.

Soft Swell : A can on which both ends are bulged but yield to moderate pressure.

Hard Swell : A can on which both ends are bulged and unyielding. Very advanced swells may show permanent distortion and are described as *buckled.*

Leaker : A can showing visible leakage of the contents through the seams, or through perforations or nailholes.

Other deformities of bodies or ends, which are recorded under **Condition,** are :

Dents : Mechanical injuries which are sufficiently pronounced to cause a significant reduction in the internal volume of the can, or to deform the seams.

Panels : Flat vertical dents, observed only on the larger sizes of cans and due to partial collapse of the body under high internal vacuum.

Laboratory Examination of Canned Foods

Specimen Report Form No. 1

Product ....
Manufacturer..
Label ....
History ....
....
....
....
....

Sample No..
Date Received ....
No. of Cans..
Can Size ....
Canmaker ....
Codes ....
Packing Date..
Exam. Date ....

General Examination

Can No.	1	2	3	4	5	6
Condition						
Vacuum (in. Hg) ..						
Headspace (in.) ..						
Net Wt. (oz.)						
Drained Wt. (oz.) ..						
Count						

Chemical Examination

Syrup Density (° Brix)						
Solids Content (%) ..						
pH						
Titratable Acidity (%)						
Ascorbic Acid (mg. %)						
Metals (p.p.m.) ..						
Headspace Gases :						
H_2 (%)						
CO_2 (%)						
Other Determinations appropriate to Product..						

Quality Examination

Colour and Appearance						
Flavour and Aroma ..						
Texture or Consistency						
Defects						

Can Examination

External Condition :						
Type of Lacquer ..						
Film Wt.						
Internal Condition :						
Type of Lacquer ..						
Film Wt.						
Tin Coating Wt. ..						
Pressure Leakage Test :						
Canner's End ..						
Canmaker's End ..						

Conclusions ....
....
....

Reported by..

Palings : Narrow vertical flats round the body of the can caused by fabrication against the " grain " of the tinplate without flexing.

Peaks : Pyramidal deformities of the ends near the double seams caused by permanent strain during retorting or cooling.

Perforations : Points where corrosive attack, either internal or external, has been sufficiently active to eat through the tinplate.

Nailholes : Punctures in cans caused by case nails.

At this stage of the examination, before any of the cans have been opened, some or all of the cans in the sample should be submitted to microbiological examination. Notes on this subject will appear as Part II of this series in the next issue of FOOD PRESERVATION QUARTERLY.

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AUSTERN, H. T. (1952).—Current prospects in canned food standards. *Canner* **114** : (6), 50.

TRACE, L. H. (1938).—Canned fruits. Laboratory control of raw materials and production methods. *Food* **8** : 423 and 461.

TRACE, L. H. (1942).—Canned vegetables. Production methods and their control. *Food* **11** : 342 ; **12** : 19, 75, 103, 161, 187, 233, 271, and 329.

The Freezing and Storage of Pork

By

J. R. VICKERY*

In some meatworks and bacon factories, pork carcases and sides are first chilled in a room at about 32° F. and then transferred to a freezing room ; in others, the pork is put into a freezing chamber, without any prior chilling, and frozen at a fairly rapid rate.

Pork which is frozen without prior chilling generally loses about one per cent. less weight between dressing and the completion of freezing than pork which is first chilled and then frozen. During storage, however, pork frozen immediately after dressing tends to lose weight more rapidly than pork which is first chilled and then frozen. After some months in storage (three to nine depending on storage conditions) there is generally no appreciable difference in total weight loss due to the method of cooling and freezing. Thus, freezing without prior chilling may result in a useful saving in weight loss if the storage period is short, but not if the pork is stored for many months.

Serious losses have sometimes occurred through the development of bone-taint in pork, particularly in heavy carcases. Fast chilling helps greatly in preventing the onset of bone-taint, and therefore the conditions of temperature and rate of movement of the air in the chilling room should be such as to give rapid cooling. It is suggested that the centre of the hams should be cooled to 48–50° F. within 24 hours of slaughter.

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In Australia, the temperatures used for the frozen storage of pork have usually been too high. It has been customary to store pork at the same temperature as beef and lamb, the holding temperatures for which are usually about 8–10° F. Pork fat, however, is much more susceptible to oxidation leading ultimately to rancidity than are the fats of beef and mutton. This greater susceptibility to rancidity of pork fat is due mainly to its higher degree of unsaturation. The iodine values of the body fat of pigs are usually in the range 55–75, while those of beef carcases range from 40 to 45. The oxidation of the fat is a chemical reaction and, as such, it proceeds more rapidly the higher the temperature. In order to prevent excessive oxidation of pork fat, it is necessary, therefore, to store the carcases, sides or pieces at a lower temperature than that which is satisfactory for beef and mutton. For short periods of storage not exceeding three months, Pearce (1948) has shown that a temperature of 8–10° F. is probably satisfactory. Rancidity will often be perceptible, however, if the storage period at this temperature extends beyond four months, according to Dubois, Tressler and Fenton (1940).

Opinions differ amongst scientific investigators concerning the satisfactory maximum temperature for more prolonged storage. Cook and White (1941) recommended a storage temperature of 0° F. when pork is to be stored as long as 12 months. On the other hand, Hiner and Kauffman (1944) found that pork became unpalatable after storage for nine months at 0° F. Pearce (1948) recommends a temperature of —10° F. where the storage period is about 12 months. Since the chemical composition of the fat determines the maximum storage life at a particular temperature, it is possible that these differing opinions may be due, in part at least, to differing degrees of unsaturation of the fat of the pork carcases which these investigators used in their studies.

It is clear, however, that for storage periods in excess of about four months, a temperature of 0° F. or lower is required in order to avoid the onset of rancidity in the fat. The natural colour of the exposed lean will also be preserved better at this temperature than at the more usual storage temperature of about 9° F. Generally, there will also be a lower incidence of " freezer-burn " at the lower storage temperature.

References

Cook, W. H., and White, W. H. (1941).—*Canad. J. Res.* **19D** : 53.

Dubois, C. W., Tressler, D. K., and Fenton, F. (1940).—*Proc. Food Conf. Inst. Food Technol.* **1** : 167.

Hiner, R. L., and Kauffman, W. R. (1944).—*Food Inds.* **16** : 275.

Pearce, J. A. (1948).—*Canad. Food Ind.* **19** : (7), 12 ; (8), 18.

Cool Storage of Clingstone Peaches*

By

P. Board†

I. Introduction

Since clingstone peaches mature over a short season, peach canning lines customarily work to the limit of their capacity during the harvest period and then remain idle for the greater part of the year. Cool storage of portion of the crop presents a possible way of avoiding production peaks and of extending the canning season.

During the 1952 season, storage trials were made at the C.S.I.R.O. Food Preservation Laboratory, Homebush, to determine the maximum cool storage life of Golden Queen peaches.

Hall (1945) reported that Golden Queen peaches could be cool-stored for three to four weeks. A storage temperature of 30° F. gave better results than 32° F.

Tindale (1950) found a maximum storage life of two and a half weeks at 32° F. for Golden Queen peaches. But he also showed that " pre-storage " at 60° F., for periods up to one week, did not affect the subsequent storage life at 32° F., so that the total life in store was increased to three and a half weeks. For freestone peaches the Canadian workers, Atkinson and Strachan (1950), advocate ripening at 70-75° F. to canning ripeness before cool storage at 31° F. for two to three weeks.

II. Storage Treatments

Golden Queen peaches were graded for maturity at picking into " Ripe " and " Semi-ripe " grades and transported from Leeton to Homebush by road, a journey which took two days. There they were subjected to pre-storage treatments as set out in Table 1.

Table 1

Pre-storage Treatments

Code	Maturity at Picking	Pre-storage Treatment
Co	" Semi-ripe."	None.
C3	" Semi-ripe."	Held 68° F. for 3 days.
C6	" Semi-ripe."	Held 68° F. for 5 days until " canning ripe ".
R	" Ripe."	None.

After pre-storage all the fruit was stored at 30° F. and samples of each code were taken at weekly intervals for six weeks, ripened to canning ripeness at 68° F. and canned.

* This article is published at the request of the Fruit and Vegetable Processing Committee, which comprises representatives of C.S.I.R.O., the New South Wales Department of Agriculture, and the University of Sydney.

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III. Canning Procedure

Trimming : The peaches were halved and pitted by hand.

Peeling : The pitted halves were immersed in boiling two per cent. lye for one minute, then washed in cold water.

Filling : Peeled halves were filled into 1 lb. tall plain cans.

Syrup : Boiling 30° Brix syrup was added.

Exhaust : After five minutes steam exhaust the cans were steam-flow closed.

Process : The cans were processed for 20 minutes in boiling water, then water cooled.

IV. Quality Evaluation

Tasting tests on the canned products by a panel of 15 tasters showed no significant differences in the effect of the pre-storage treatments on the quality of the peaches. The effect of pre-storage may have been reduced because the fruit was at atmospheric temperature for two days during transit from Leeton to Homebush.

The maximum periods of storage at 30° F. and the associated pre-storage and ripening periods which gave satisfactory canned products are set out in Table 2.

Table 2

Periods of Pre-storage, Storage and Ripening

Code	Pre-storage Treatment, Days	Max. Storage at 30° F., Weeks	Ripening Period at 68° F., Days	Total Storage, Weeks
Co	0	4	4	4½
C3	3	4	3	4½
C6	5	4	0	4½
R	0	4	1	4

Peaches stored for five and six weeks at 30° F. showed some internal breakdown round the pit: Flavour changes in these peaches were slight.

V. Conclusions from Experiments

The results of this trial indicate that Golden Queen peaches stored up to four weeks at 30° F. will give canned products of satisfactory quality. The ripening period at 68° F., either before or after cold storage, represents four to five additional days of storage life.

VI. Note on Brown Rot

In certain seasons, severe wastage can occur in peaches after picking owing to the onset of the fungal disorders Brown Rot and Transit Rot. While the fungi do not grow at the recommended storage temperatures (30–32° F.), the onset of the disorders can be very rapid in the period between picking and placing in cold storage and also during the period of cooling from atmospheric to cold room temperatures ; in most cold stores the cooling period exceeds 36 hours. If peaches from infected orchards are stored, some losses from Brown Rot and Transit Rot are inevitable, and they may be severe if an attempt is made to ripen the fruit either before or after cold storage.

VII. References

ATKINSON, F. E., and STRACHAN, C. C. (1950).—Small Canneries. *Tech. Bull. Dep. Agric. Can.* No. 75 (Publ. No. 828) : 28.

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The Use of Instruments in Food Processing

By

M. C. TAYLOR*

Practices with instruments in a food processing plant need to be examined frequently if each instrument is to be used to the best advantage under changing conditions. Instruments may be divided into two main groups according to their application : those designed for the automatic control of processes, and those used to measure various characteristics of foodstuffs but not to effect control.

Let us now examine the part played by the first type of instrument. A very desirable feature of a processed foodstuff, particularly if marketed under a trade name, is uniform quality and packaging. Provided the raw material is carefully selected, the quality of the final product depends on the way in which each stage of the process is controlled. When optimum conditions have been found in the laboratory or pilot plant, there is often some difficulty in obtaining these conditions in large-scale production. Some variation may be permissible or unavoidable, but the aim should be to keep deviations from the ideal so small that they do not adversely affect acceptance of the product by the consumer. Plant and instruments designed for automatic control of the process through all stages generally give the best means of achieving this result. Automatic control gives the most spectacular results when applied to a continuous process, but it also improves batch processing where an important feature is the need to determine the end-point precisely or to close down the process quickly. Uniformity of the product is not the only advantage gained in a well designed plant. Changing over from manual control to automatic control largely eliminates the variations due to human error : it also reduces labour costs and increases productive capacity.

Some of the process variables which may be measured and controlled are pressure, temperature, flow, liquid level, specific gravity, viscosity, and concentration. The success of automatic control depends largely on the sensitive elements which detect deviations from the desired value of a process variable. For example the advantages of the electrical method of transmitting signals have led to the development of electrical conversion elements which give an electrical output corresponding to the value of the process variable. These elements can have a very rapid and

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sensitive response so that deviations can be detected early and an appropriate correction applied to the process before damage is done. Care should be taken when installing such sensitive elements to see that their advantages are not lost through unsuitable methods of installation. Although many of the older types of measuring elements give satisfactory operation, the advantages of the newer types should not be overlooked, especially when new plant is being set up or old plant overhauled. In many cases the introduction of electrical systems will make it practicable to have duplicate indicating or recording stations and allow all the important instruments to be grouped at a central location.

The choice of a controller and auxiliary equipment depends on the nature of the process and the type of plant to be controlled. The guiding principle should be to make the control as simple as possible. From this point of view the complete plant should be designed as a unit: it is not good practice to try to adapt a controller to a plant which has not been designed for it. Most of the difficulties with automatic control are introduced by those parts of a system which cause slow responses to a change. To some extent these lags are unavoidable, but they should be considered in the design of a plant and adjusted so that control is simplified. There is a wide choice of controllers depending on the type of response necessary to meet the demands of a process. Obviously the controller becomes more expensive both to buy and to maintain if it is designed to do a more difficult job. The more elaborate instruments can be adjusted to give a wide range of responses so that almost any particular requirements can be met, and the extra cost of such an instrument may be justified by its adaptability to more than one job. Advertising literature put out by the instrument suppliers is in general a reasonable guide to the performance of equipment; however, the discrimination exercised by an experienced buyer is the best safeguard against unsatisfactory installations.

Instruments in the second group, namely those suitable for testing the quality of foodstuffs, are better known—having been used more widely—than those designed solely for automatic control. There will always be a place for these, especially for selecting raw material and checking the final product. Some effort is required to keep up with advances in this field because instruments based on new ideas are being developed and well known instruments are being improved to make them more useful. Here also a worker can keep in touch with developments by checking over advertising literature and reading reviews in food journals. Care is needed in choosing the best instrument for any particular purpose, and time spent in checking the performance of an instrument before purchasing will not be wasted. The price should be balanced against the usefulness of the instrument for the purpose required.

Some workers faced with the problem of finding a suitable instrument have shown a great deal of ingenuity in adapting others to jobs for which they were not designed. Although this practice is likely to continue, an alternative method of attack may be possible where adequate facilities are available. It is common practice in most large laboratories to purchase a range of standard units which can be assembled in various combinations as required: examples are power supplies, galvanometers, potentiometers and electronic amplifiers, as well as accessory equipment. Such equipment, together with suitable measuring elements, can be assembled and adapted for a very wide range of measurements. Although this method is well suited to larger laboratories where diverse investigations are carried out by a specially trained staff, it is not likely to be practicable in a small control laboratory. Generally the small laboratory must depend on standard instruments whose performance on particular tasks is well known, and whose design is simple and relatively trouble-free. Men in charge of small control laboratories should know how to make use of the services of laboratories which specialize in testing and calibrating instruments.

The purchase and installation of a suitable instrument does not ensure trouble-free operation over an indefinite period: regular and intelligent maintenance is necessary. In other words the staff must be competent to take proper care of the equipment. There is some advantage in calling on the suppliers to maintain the instrument, but if this service is not conveniently available, alternative arrangements must be made. This important fact should not be forgotten when instruments are being purchased. It is likely that much money is wasted on instruments which cannot be used effectively by untrained and inexperienced staff. Perhaps this is the weakest link in the chain of attempts to make the most effective use of facilities available to industry. Efforts directed towards a clearer understanding of the technical problems of industry, and to a better knowledge of the application of instruments to the solution of these problems, are sure to pay dividends.

Food Science Abstracts

The abstracts printed below have been selected from " Food Science Abstracts ", and are reproduced with the kind permission of the Controller of Her Majesty's Stationery Office, London.

(1) Microbiology of " Hay Eggs ". (In German). O. Richard and A. Mohler. Mitt. Lebensmitteluntersuch. Hyg., Bern, 1950, **41** : 168.

Cold stored eggs, which were imported into Switzerland, chiefly from America and Poland, occasionally possessed a peculiar but very characteristic hay-like odour. These eggs were entirely unsuitable for cooking or baking purposes, since the odour persisted in the broken eggs and affected the entire baked product, even if only one of the eggs used showed this defect. The causes of the hay-like odour of eggs were investigated. It was established that this odour is due to certain metabolic products of bacteria which develop in such eggs; some of the bacteria were identified as strains of *Pseudomonas*, *Aerobacter*, and *Alcaligenes*. They were all capable of growing at low temperatures (1° to —1° C.). The infection probably takes place after the eggs have been laid, mostly through contamination with faecal matter, seldom through packaging material, and as a rule before the eggs are cold stored. Practical recommendations are made as to means of avoiding, through strict cleanliness, the spoilage of eggs due to this type of bacterial contamination. Since it is impossible to recognize the " hay eggs " without breaking them, it is advisable to smell the eggs before using them for baking.

(2) Interaction of Seeding Rates and Nitrogen Levels on Yield and Sieve Size of Peas. S. G. Younkin, J. B. Hester and A. D. Hoadley. Proc. Amer. Soc. Hort. Sci., 1950, **55** : 379.

Peas of small sieve size are required by canners. Increase of the seeding rate per acre from 3·2 to 4·4 bushels increased the total yield of

Deep Green Superlaska peas, but did not affect the percentage of small peas. A further increase of seeding rate to 7·7 bushels per acre did not raise the total yield any further, but increased the percentage of small peas. An increase of the amount of nitrogen in the fertilizer from 0 to 6 per cent. increased the total yield of peas substantially, but decreased the percentage of small peas. The interaction of nitrogen levels and seeding rates was such that the highest total yields were obtained with 6 per cent. of nitrogen and 4·4 bushels per acre of seed, while the largest yield of small peas was obtained with no nitrogen and 7·7 bushels of seed per acre.

(3) Selecting Hams for Canning. (In Polish.) M. Janicki and Z. Osińska. Przem. Rol. Spożyw., 1950, **4** : 89-94.

In selecting raw hams for canning purposes, the amount of intermuscular fat should not exceed 6 sq. cm., that is 110 g. A satisfactory correlation exists between the amount of intermuscular fat of the raw ham and the thickness of the inner layer of back fat over the shoulder of the pig carcases. The correlation coefficient, r, is $+0{\cdot}849 \pm 0{\cdot}027$. The regression equation for the above is $y=3{\cdot}41x+8{\cdot}76$. The thickness of the inner layer of back fat over the shoulder should not exceed 3 cm.

(4) Some Components of Quality in Canned Ham. (In Polish.) D. J. Tilgner and Z. Osińska. Przem. Rol. Spożyw., 1950, **4** : 131–135.

In scoring the quality factors of canned hams, the distinctive difference of the respective parts with regard to tenderness, juiciness, and saltiness should not be overlooked. Where juiciness is concerned, the semimembranosus, adductor femoris, and gracilis muscles are the most sensitive and least juicy parts. When estimating tenderness, semitendinosus and biceps femoris muscles should be considered as the least tender parts, while with regard to saltiness the quadriceps femoris muscle should be mainly considered. In the average Polish canned ham, quadriceps femoris muscle contains 3·8 per cent. of sodium chloride, compared with 3·26 and 2·5 per cent. in the two other muscles. The tenderness and juiciness are estimated by objective methods and correlated with organoleptic results.

(5) The Influence of Thermal Processing on Meat. (In Polish.) D. J. Tilgner and Z. Osińska. Przem. Rol. Spożyw., 1951, **5** : 393–399.

Artery-cured pork hams, after ripening, smoking, and canning, are subjected to heat treatment, which results in the loss of a certain amount of meat juice as drip. Quadriceps femoris, semimembranosus, and biceps femoris muscles showed, at 53° C., the beginning of drip, which slowed down at about 62° C. The contraction of cured pork meat takes place at 60–65° C. The more the temperature in the inner parts of the meat fluctuates below the critical temperature, the smaller the amount of drip, for example 4·4 per cent. at 52° C., 6·7 per cent. at 62° C., and 9·5 per cent. at 68° C., with total sterilization cycles increasing from 210 to 300 minutes for whole canned hams. When the temperature in the inner portions of the meat is lowered, which requires a parallel improvement of canning procedure, the time required for sterilization can be reduced. This requires better plant hygiene and more aseptic technique, and may be to the economic advantage of the producer and the consumer.

Answers to Inquiries

Canned Corned Beef

Question : What is the modern rapid method of canning corned beef ?

Answer : Under the old method, which has now gone out of favour except for brisket beef, the meat was pickled in large pieces in a salt and saltpetre brine for up to 14 days at about 40° F.

Under the new method the meat, trimmed of excess fat, is cut into 1½ in. cubes with a meat cutter. The pieces are placed in metal baskets and boiled in water for about 30 minutes. This has the effect of shrinking the meat 30–40 per cent., so that it does not lose any liquid into the can when subsequently retorted. The water from the first boiling can be used again for several more lots of meat on the same day and most canners make use of the remaining liquid for concentration into meat extract.

The pre-cooked meat, after removal from the boiling tank, is emptied out on the tables and is prepared for canning by trimming, and removing excess connective tissue which may produce too much gelatine in the can.

Following trimming, the meat is either held for a short period in a suitable curing liquid at a relatively high temperature or the mixed dry curing ingredients are added directly to the meat.

In the former method the parboiled meat is placed in a suitable tank and covered with a curing pickle of the following composition :

Water	30 gal.
Salt	18 lb.
Sodium nitrate	4 lb.
Sodium nitrite	1 oz.

At the commencement the meat and pickle are brought to between 150° F. and 160° F. and then allowed to drop to between 120° F. and 140° F. and held in this range throughout the curing period of 6–8 hours. The meat and pickle are stirred constantly at the beginning of the cure, and then at 15-minute intervals throughout the remainder of the curing period. At the end of the cure the scum, which has formed on the surface, is floated off with warm water and the meat is removed, drained and washed free from excess pickle with water at about 120° F.

In the " dry " method each 100 lb. of pre-cooked meat receives 3 lb. of the following mixture :

Salt	30 lb.
Sodium nitrate	1 lb.
Sodium nitrite	1/10 lb. (1·6 oz.)

In order to ensure that the relatively small amount of nitrite is evenly distributed in the mixture it should be first thoroughly mixed with about 3 lb. of salt and then distributed uniformly over the surface of the remaining ingredients before the final mixing. The dry mixture is then incorporated in the meat and the distribution is facilitated by using a rumbling machine for this purpose. An alternative method to ensure an even distribution of the nitrite is to dissolve it in a small amount of water and spray the solution on to each batch of meat.

The tapered cans commonly used for corned beef are filled with hot meat by means of rotary stuffing machines and are processed for about 80 minutes at 240° F. for cans holding 12 oz., and about 180 minutes at 240° F. for cans holding 6 lb. of meat. The meat should have an initial temperature of approximately 140° F.

Indian Food Research Bulletin

The Editors of the FOOD PRESERVATION QUARTERLY have observed with great pleasure the appearance of the first printed number of the monthly Bulletin of the Central Food Technological Research Institute, Mysore. Formerly entitled Technical Bulletin, the publication has hitherto been in cyclostyled form. Its fresh format marks the successful conclusion of one year of publication, and the second anniversary of the founding of the Institute.

The front cover carries a half-tone plate of the fine Cheluvamba Mansion at Mysore, in the 130 rooms of which the activities of the Institute are housed. In a foreword the Director of the Institute, Dr. V. Subrhamanyan, states that the Bulletin "is devoted to the entire field of food technology and is intended to meet the much-felt need for a technical journal for Indian food industries".

The printed Bulletin has been made more comprehensive in scope than its predecessor. It contains articles on research in food technology, abstracts of all Indian papers dealing with food and nutrition and of important foreign papers as well. A section entitled "Information and Advice" consists of answers to questions concerning the food industries. Other sections of the Bulletin set forth information on food laws and patents, news of investigations at the Central Food Technological Research Institute, and statistics of food production.

The Bulletin has made an impressive beginning with its task of forging a link between Indian food industries and the vitally important work of the Institute.

Brown or Green Bottles?

Below we reprint an interesting abstract from the "Journal of the Society of Glass Technologists". The reference to the original is:-

Brown or Green Bottles? (In German.) C. Cornelius. Sprechsaal, 1951, **84** (7): 132.

Formerly Rhine and Moselle wines were supplied in green, blue and brown bottles. This practice has now been resumed, although the brown glass costs nearly twice as much as the green owing to the high price of manganese. The empirically established fact that each wine keeps its quality better according to the glass used is now referred to pH conditions, redox potentials and the effects of light on the wine. The bacteria and enzymes are sensitive to iron and copper. Blue glass is recommended for Moselle grown on shale soil, brown for that on heavy soil of Rheingau, green for the lighter soils of Rheinhessen and Pfalz.

News from the Division of Food Preservation

Brisbane Branch Laboratory

The Brisbane Branch Laboratory of the Division of Food Preservation and Transport is on the Brisbane River at Cannon Hill, Queensland. Its history goes back to 1931, when the predecessor of C.S.I.R.O.—the Council for Scientific and Industrial Research—received a generous offer from the Queensland Meat Industry Board to build and equip a research laboratory for meat preservation investigations at the Board's Brisbane abattoir, provided that C.S.I.R. staffed the laboratory and met most of the running costs. Following the acceptance of this offer, the laboratory, consisting of three rooms and four refrigerated chambers, was officially opened in July 1932. It remained the headquarters of what was then the Section of Food Preservation till 1938, in which year a central laboratory was set up at Homebush, New South Wales.

In the first few years at Brisbane, the main investigations centred around the problem of devising means whereby chilled, rather than frozen, beef could be safely exported from Australia to Great Britain. At that time Australian frozen beef was becoming more and more difficult to sell in competition with chilled beef from South America. The duration of the voyage from Argentina to Great Britain was about 23 days, which was considered to be almost the limit for safe carriage of the highly perishable chilled beef. On the other hand, the voyage from Queensland lasted about 50–60 days. Obviously, new techniques in the preparation and transport of the meat were necessary to permit successful shipments from Queensland. Shortly after the Brisbane laboratory was opened, workers at the Low Temperature Research Station, Cambridge, showed that the "life" of chilled beef could be doubled by the use of 10 per cent. carbon dioxide in the storage atmosphere on shipboard. The Brisbane investigators confirmed this finding, but showed that even this new technique would not give a sufficient margin of safety unless certain hygienic methods were used in the preparation of the meat and it was cooled rapidly. The results of the research were applied without delay: regular shipments of chilled beef from Queensland and Western Australia began in 1934. By 1939, over one-third of the quarter beef exported from Australia, amounting to about 28,000 tons per annum, was sent in the chilled form.

The first two research workers in the Brisbane laboratory were Dr. J. R. Vickery and Mr. W. A. Empey, and they were soon joined by Mr. W. J. Scott and Mr. A. R. Riddle. Soon after the outbreak of war in 1939, most of the outstanding investigations on chilled beef were terminated and some of the staff transferred to more urgent work elsewhere. Mr. A. R. Riddle remained as Officer-in-Charge and, with a small team, devoted himself to investigations on a number of problems of significance in the war effort, such as the preparation of packaged boneless beef, and the transport of frozen meat.

It had been intended, after the war, to build up the research staff to its pre-war strength and to increase the laboratory and cold storage accommodation. However, difficulties in obtaining suitably trained staff and shortages of building materials seriously retarded the carrying out of this plan, which is only now coming to fruition. At the time of writing the staff comprises Mr. A. Howard (Officer-in-Charge), three research officers, and eleven other staff. Another research officer is being trained at the Low Temperature Station, Cambridge. When building operations now in progress are completed laboratory accommodation will be doubled and the number of constant temperature rooms increased to eight. A blast freezer is also being installed.

The major investigation at Brisbane is concerned with detailed physical and biochemical studies of the preparation, freezing, storage and thawing of frozen beef, which suffers at present from the serious defect of "drip" or "weeping" from all cut surfaces following thawing. These investigations are part of the work planned in 1949 to be carried out co-operatively with the Departments of Scientific and Industrial Research of Great Britain and New Zealand. Other investigations in progress include studies on the factors governing the rate and extent of the onset of "freezer-burn" in frozen meat and meat products; the use of very small concentrations of ozone in the preservation of chilled meat; and the techniques for the sterilization of refrigerated spaces for holding meat. The two latter studies are directly concerned with the storage and transport of chilled beef.

Personal

Dr. R. A. Lawrie, of the Low Temperature Research Station, Cambridge, has joined the team of investigators at the Division's branch laboratory at Cannon Hill, Queensland. Dr. Lawrie has been sent to Australia to assist in the joint British-Australian studies on the freezing and storage of beef.

Four holders of Senior Fellowships under the Colombo Plan are now obtaining experience and training in the Homebush laboratories of the Division of Food Preservation:

Mr. L. A. C. Alles, an officer of the Ceylon Government's Department for the Development of Marketing, Colombo, is working in the Fruit Products and Canning Section at Homebush on the processing of fruit and vegetables and the laboratory examination of canned products.

Mr. S. Kuppuswamy, of the Central Food Technological Research Institute at Mysore, India, is seeking training in the dehydration of fruit and vegetables, for which purpose he has been attached to the Dried Foods Section at Homebush. He will spend some time at the Commonwealth Irrigation Research at Merbein, Victoria, to study the drying of vine fruits.

Mr. N. L. Jain also comes from the Central Food Technological Research Institute at Mysore. He has had considerable experience in the preservation of fruits and vegetables and in other fields of fruit technology. He is seeking further experience in the Fruit Products and Canning Section at Homebush.

Mr. V. Uyenco comes to Australia from the Bureau of Fisheries of the Government of the Philippines in Manila. Mr. Uyenco has already spent a year studying fish technology in the United States, and seeks while in Australia to extend his studies in this field. In addition he is studying the technology of canned and dehydrated fruit and vegetables, meat, and dairy products.

Recent Publications by the Staff

(1) Handling, Processing, Preserving Fish and Fisheries Products in Overseas Countries. By W. A. Empey (1952).

Parts 1, 2, 3. Fish Processing in South Africa. *Fish. News Lett. Aust.* **11** : (5), 8–9, 23 ; (7), 15, 17 ; (8), 8–10, 23.

These articles describe the expansion of the South African fishing industry, methods of handling the fish, production of fish meal and oil, canning and other methods of preservation used in South Africa, with special reference to equipment, and (in Part 3) the freezing of crayfish tails.

Parts 4, 5, 6. Fish Handling and Processing in U.K. *Fish. News Lett. Aust.* **11** : (9), 10–11, 19 ; (10), 10–12, 13 ; (11), 9, 11.

These three parts describe what the author learned of practices at the main British fish ports and of research work of the Torry Research Station, Aberdeen, the Herring Industry Board, and the Ministry of Food.

(2) Some Observations on the Design of Cool Stores. By G. M. Rostos and E. W. Hicks (1952).—*Refrig. J.* **6** : 25.

In the last few years officers of the Division of Food Preservation have made detailed surveys of the performance of a number of cool stores of various designs.

Three main topics are discussed in this paper, namely :

(i) temperature distributions in the steady state,

(ii) the cooling of goods to the storage temperature,

(iii) evaporation from stored goods.

The first of these is treated in most detail. Considerations of the behaviour of fruit in storage suggest that it is reasonable to aim at uniformity of the nominal storage temperature to within 1 or 2° F. The data presented show that few existing stores quite reach this objective, though there are many in which only a small proportion of the fruit has an average temperature more than 2° F. different from the mean for the whole store. The results indicate that, except in some very old stores, most of the poorer temperature distributions observed were due to imperfections in details of design and not to the use of cooling systems which could not give good results.

(3) Short Term Prediction of Maturity and Yield of Canning Peas. By L. J. Lynch and R. S. Mitchell (1952).—*Food Tech. Champaign,* **6** (9) : 24, 28, 30.

The Maturometer, an instrument used for objective measurement of maturity in peas in the field, designed by Messrs. Lynch and Mitchell, of the Division of Food Preservation, was described in C.S.I.R.O. Bulletin No. 254 (1950), copies of which are available on request.

The Maturometer measures the pressure in pounds required to puncture a sample of 143 peas by an equal number of steel pins, and gives readings which correlate highly with the percentage of alcohol-insoluble solids in canned samples. This note describes the use of the Maturometer for predicting from field samples the best harvest time, the yield of peas, and the weight of vines. Foreknowledge of these factors allows time to arrange the harvesting, vining and canning.