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The Export of Frozen Poultry

PART I. THE MARKETING OF POULTRY ON A TRADER TO TRADER BASIS

By
L. V. JUNIPER*

Introduction

Since the end of the 1939–1945 war an appreciable export of frozen poultry from Australia to the United Kingdom has been developed, and during the twelve months ending June 1948 approximately three million fowls, 200,000 turkeys and 150,000 ducks, of a total value of almost £A1,500,000, were exported. For several years past this poultry has been sold under contract to the British Ministry of Food. It is probable, however, that the sale of poultry will be decontrolled in the United Kingdom about the middle of 1950, in which case Australian exports will be open to competition from those of other countries supplying this market.

In this, the first of a series of two articles on various aspects of the preparation and export of frozen poultry, it is intended to present the advice and opinions of Mr. L. V. Juniper on the subject of grading and presentation of the products for sale in the United Kingdom.

Regulations governing the export of frozen poultry from Australia are embodied in Statutory Rules No. 99 (1948) under the Customs Act (1901–1947) and the Commerce Trade and Descriptions Act (1905–1937).

Grading to Quality

The first essential which is required for the successful marketing of poultry (i.e. chickens, hens, ducks, geese and turkeys) is that the birds should be packed to a uniform quality and appearance.

Poultry is a product in which the grades of quality vary more than in any other product. Furthermore birds that are equal in quality differ considerably in appearance. The difference in appearance is caused in part by breed, in part by feeding, and also by varying climatic conditions as between one centre of production and another.

Owing to the fact that poultry varies considerably in quality and appearance, a system of grading must be adopted by each packer, so that his pack shall at all seasons be uniform. Unless he produces a uniform pack, it can never be sold successfully and continuously, and without claims and repercussions, by him or his agent on both rising and falling markets. A packer needs to be fully conscious of the fact that his goods will be open to the competition of a great variety of other goods of a similar nature which arrive on the British market from all over the world. They will be judged by the retail distributor and accepted or rejected by him in accordance with his idea of the value of those goods to his clientele. Ultimately, they will be judged by the chef and the housewife.

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The opinion of a packer counts for nought against that of the buyer of the goods at the point of sale.

It must moreover be remembered that the clientele of one retailer will be of the discerning class that wants only prime selected quality, and that of another will consist entirely of consumers unable to pay more than a certain price, and who are more concerned with the price than with the quality. The retailer catering for the better class trade will only buy first class quality birds and will refuse to buy birds of mixed quality ; the retailer buying for the price-conscious consumer will buy on price rather than quality and will pay no more for a mixed pack of best and seconds than he will pay for second quality alone.

Grading to quality is therefore essential for the following reasons :

(1) to secure the confidence of buyers,

(2) to cater for all classes of trade,

(3) to secure the best over-all price for one's pack.

The minimum number of grades that a packer should make is three. This has been proved by many years of experience in countries which have specialized in the development of their poultry industry for both the home and export market.

For the purpose of simplicity, these grades may be termed A, B and C grades.

The *A grade* can be described as consisting of soft meated birds of light colour, having a plump, well rounded breast, a full, plump thigh, and showing a good percentage of well distributed fat, without a tear or blemish ; clean plucked and having no pin feathers and without signs of damage by scalding.

This grade should bear the packer's main registered brand, and it should be his object to maintain this selection to the highest standard for appearance and reliability. Every thought and care should be given to presenting this grade in the most attractive manner—by such means as using high quality box linings with coloured borders ; cellophane overlay ; coloured medallions on the wings for marking the bird with the country of origin ; adhesive coloured medallions on the breast of each bird, etc. No money or effort should be spared in the preparation of this grade. Buyers are drawn to goods that are well prepared and made attractive to the eye, and alternatively, it is difficult to arouse their interest in goods that are on first glance poorly presented, even though they be of good quality.

Buyers of A grade will pay well for good reliable quality. This grade should prove to be the money maker as against the " bread and butter line " of B grade.

The *B Grade* can be described as consisting of soft quality, reasonably well fleshed birds, carrying fat, but not of sufficient plumpness and fat to warrant placing in the A grade. Birds with minor blemishes through skin barking, slight over-scalding or small tears may be placed in this grade, as may be birds that are otherwise good, but of a rather high colour.

These are birds that generally form the majority of a pack, but which would be brought to A grade by crate feeding prior to killing.

This grade should bear a distinctive brand, preferably a registered brand, consisting of a word that is easily remembered.

The *C Grade* is necessary in order that the standard of the B grade shall not suffer from the inclusion of birds that are staggy, crooked breasted, thin, very dark in colour, badly scalded, or in any way damaged or unsightly.

There is a market for C grade poultry, but at a discount below the price of B grade. The danger of not making a C grade is that every packer of poultry inevitably has a percentage of reject birds for disposal, and if these birds are packed in the B grade, they will lower the standard and reliability of that grade to such an extent that the buyers' confidence in it will be destroyed. Moreover, a relatively small proportion of C grade, packed among the B grade, will lower the market value of the whole to a considerable extent.

It is preferable for the C grade to bear no registered packing brand. A couple of letters neatly stencilled on the case—just for the purposes of identification—is all that is desired.

Grading to Size

Strict grading to size or weight per bird is most essential in view of the fact that the needs of all classes of buyers must be catered for. On a free market, contracts are tendered for; hotels demand birds of even weight, and retail distributors in many instances want to run standard "lines" to accord with the demands of their clients.

A packer should avoid including in a case an odd bird, differing in weight from the average, which is placed there for the purpose of "filling a gap".

The Principles of Packing

The main principle that should be the aim of a packer is so to pack his goods that they shall be presented to buyers in their most attractive form. It is as true of poultry as it is of other commodities, that the better the packing and presentation, the better will be the price that is realized. The following factors need to be appreciated:

(1) Poultry should be packed so that freight costs are cut to the minimum, but at the same time this factor must not override other important considerations.

(2) Good quality poultry can be spoiled by bad packing, and alternatively, its value can be enhanced by attractive presentation.

(3) Average quality poultry can be greatly improved above its general average standard by careful packing.

(4) On a good market, the most attractive goods command the best price, and, what is more important, on a bad market they are the first to be sold.

Buyers are instinctively drawn to goods that catch the eye, and the use of a good, clean, white-wood box, bearing on it in neat lettering particulars of the contents and weight, coupled with a well designed packer's brand, is of great importance.

Boxes should be printed and not stencilled—except where necessary for the marking of the contents and weight.

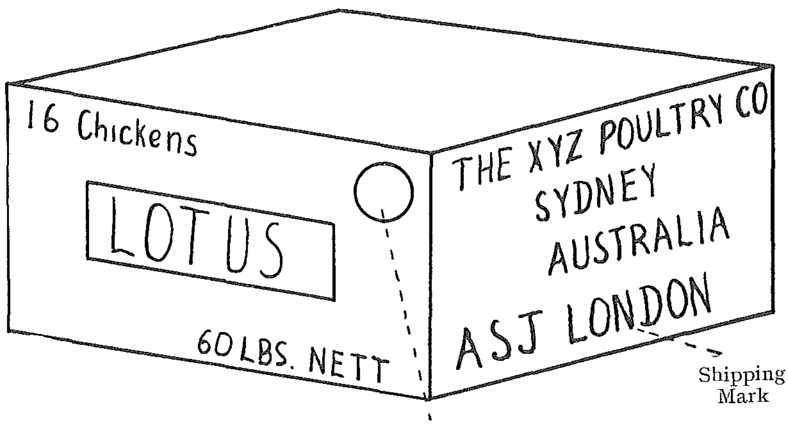
Packers' Brands

Packers' brands should be selected for their clarity, and preferably should be of one word that is both easily pronounced and easily remembered, e.g. "Lotus", "Melba", "Clover", "Darling", "Cobar", "Pirie", etc. Each packer would be wise to register two leading brands.

It is, furthermore, of the utmost importance that the packer's brand, the contents and the weight should appear on the end of the case, as illustrated below.

Private trade does not require cases to be marked with gross weight and tare, and for the sake of appearance and clarity it is most desirable to avoid any unnecessary marking on the ends of the cases.

It is obvious that many Australian packers cannot appreciate how goods are, and must be handled under free trading conditions, owing to the fact that their experience of catering for an export trade has been limited to the supplying of goods on a short market, and to government specifications. Government purchase has necessitated only bulk stowage, bulk landing, bulk storage and bulk delivery.



Private trading requires the following:

(1) Precise checking of weights, counts and contents on delivery to the ship at point of loading.

(2) Delivery to shipping marks on discharge. (Shipping marks should be clearly stencilled on the sides, not the ends of the boxes.)

(3) Stowage in store according to contents, marks and weights or groups of weights.

(4) Delivery from cold stores according to contents, marks and weights.

(A great volume of business is done by the sale of goods ex store. Sellers need to book goods to the buyer at time of sale, in order to secure a finalization of a deal, and to secure prompt payment. The seller, therefore, must know the precise details of the goods he has in store, in order to sell them and to charge them to the buyer.)

The above should emphasize the necessity of careful branding and stencilling of boxes, in view of the fact that it is obvious that private trading requires that boxes should be examined and checked far more closely and more often than is the case when business is handled by a government department.

Strength of Boxes

In general, there is no room for criticism or need for recommendations regarding the strength of Australian poultry boxes.

A box with sufficiently thick ends for the nails to grip, thus allowing for the saving of freight space by the utilization of relatively thin wood for the sides, top and bottom, is ideal.

Two good wires are needed round each box.

Lining of Boxes

Boxes should be lined with white parchment or waxed paper. Never use brown!

Packing of Birds

The principle of good packing is to show all the best points of a bird and to hide its less attractive features. The birds should be packed breast up, with the legs hidden, and the points of the breast bones facing that end of the box on which the particulars of the contents are printed, so that the boxes, when properly stacked, will open up to show the breasts of the birds and not the necks. The necks of the birds are, obviously, sometimes unsightly.

In the North and South American continents, packing on the above principle has been brought to perfection. Although it would be advantageous for the Canadian style of packing to be adopted by Australians (and it yet may come), it is felt somewhat premature to advocate an immediate change from the present practice, on account of the shortage of packing materials.

Packing should, however, be in single layer boxes, breast up, and with a sheet of greaseproof paper laid between each row of birds.

The head of each bird should be wrapped, and the feet washed clean.

Packing to a Standard Weight per Case

Although only the Ministry of Food sight the specifications of Australian poultry, it is obvious that specifications of even moderate shipments must be composed of columns of figures that need careful analysis before it can be determined what number of boxes are of a given average weight. For example, out of a shipment of 1,000 boxes a salesman must know the proportion of boxes containing 3/3½ lb., 3½/4 lb., 4/4½ lb. birds, or at times he needs to know the proportion of boxes of each weight to the nearest ¼ lb. per bird.

As has already been emphasized, a salesman must know exactly what he has to sell. A buyer, moreover, on a free market, will not buy "forward" unless he is confronted with a clear and detailed specification of the goods that are offered.

Australian poultry, as now packed, permits of two variations in contents, namely number of birds per case, and net weight per case.

When the size of the case is constant, the number of birds contained therein must vary according to the size of the birds. In the interests of economy, each packer should use a case of standard size for packing chickens and hens. By the use of a standard sized case he also would be able to achieve the object of packing each case to a standard weight.

The packing of poultry (other than turkeys and ducks) to a standard weight per case needs care, attention and practice, in order that no seriously oversized or undersized bird shall be included in a box to make the weight even. (See Grading to Size.) It can be done, however, both effectively and well, for it is the practice to pack to standard weights in several exporting countries.

The packing of birds to a standard weight per case vastly increases their saleability.

It is therefore strongly recommended that the practice of packing to a standard weight per case be instituted without delay.

Although the standard weight per case selected is not of prime importance, it would be of distinct advantage to select a weight most suited to the size box customarily used by the packer concerned, and to make the weight, say, 50 lb., 55 lb., 60 lb., or 65 lb.

A specification of 1,000 boxes would thus read somewhat as follows :

100 boxes	13/60 lb.	Average	$4\frac{1}{4}/4\frac{1}{2}$ lb.
150 ,,	14/60 ,,		
250 ,,	15/60 ,,	,,	4 lb.
400 ,,	16/60 ,,	,,	$3\frac{1}{2}/3\frac{3}{4}$ lb.
100 ,,	17/60 ,,		

Such a shipment would be readily saleable, and could be stowed in cold store on arrival in either three or five stows. When, moreover, a sale was made " c.i.f.", " ex ship " or " ex store ", the goods could be invoiced to the buyer forthwith.

Delivery instructions would be simple and straightforward, and there would be small chance of errors occurring.

Transport, cartage and other charges could, moreover, be readily calculated, when such charges are not immediately available for the prompt finalization of accounts.

Turkeys

Australian turkeys are, in general, of excellent quality and readily saleable on the British market. When, however, free imports are again permitted into the United Kingdom, Australian turkeys will meet competition from goods that are well graded and attractively packed. Competition from all sources can be met satisfactorily by Australian packers, if more attention is given to the better presentation of the goods. The present method of packing Australian turkeys leaves much to be desired.

Our strong recommendation is that Australian turkeys should, in future, be packed as per the accompanying illustration. This pack is standard for the whole of South America ; it shows the birds to perfection ; it is ingenious in so far that the waste space per box is reduced to the minimum ; it lends itself to grading to size and quality.

From our experience we would state that, on a free market, Australian turkeys, packed in the style as illustrated, would command a premium over birds of similar quality, packed in the manner which is now customary. With the object of being helpful, we give hereunder the *internal measurements* of cases used for packing turkeys as per our recommendation.

All turkeys to be packed eight per case.

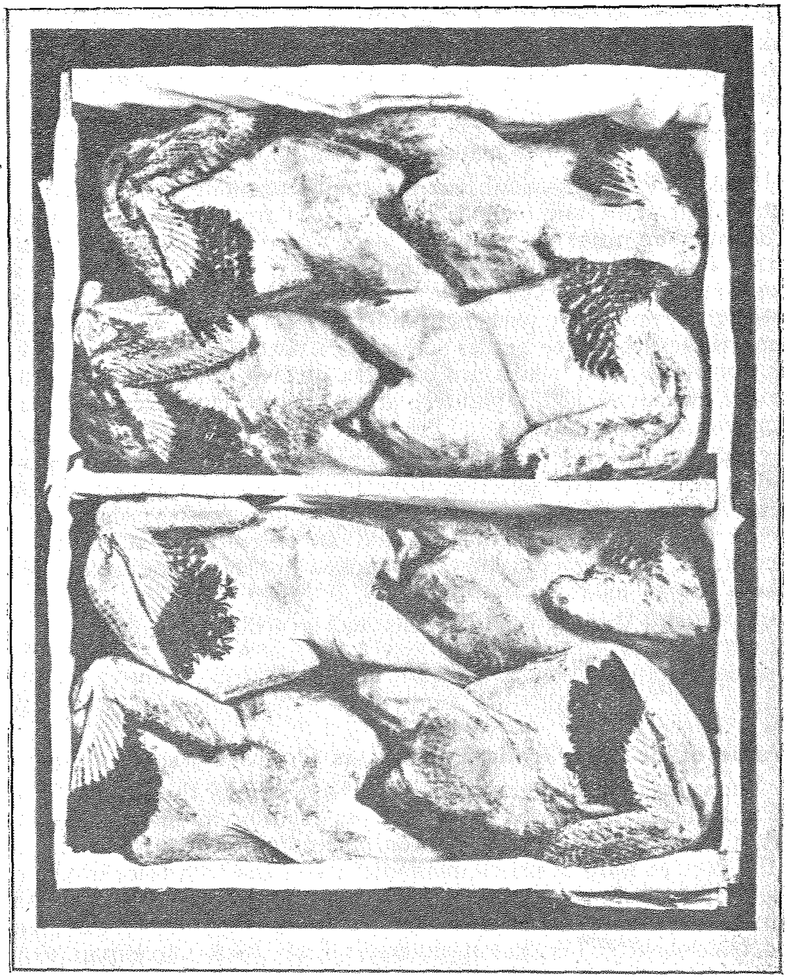
6– 8 lb.	$6\frac{1}{2}$ ins. × $28\frac{3}{4}$ ins. × $22\frac{1}{4}$ ins.
8–10 lb.	$6\frac{1}{2}$ ins. × 32 ins. × 24 ins.
10–12 lb.	$7\frac{3}{4}$ ins. × 33 ins. × $24\frac{1}{2}$ ins;
12–14 lb.	$7\frac{3}{4}$ ins. × 33 ins. × $27\frac{1}{2}$ ins.
14–16 lb.	$7\frac{3}{4}$ ins. × $35\frac{1}{2}$ ins. × $27\frac{1}{2}$ ins.
16–18 lb.	$8\frac{1}{4}$ ins. × 37 ins. × $28\frac{3}{4}$ ins.

It is apparent from the above that a grading to a 2 lb. limit is general practice for countries catering for the supply of the United Kingdom market. Traders desire to have goods packed within these limits. For fear, however, that this rather revolutionary change which we recommend may appear to cause unnecessary complications in the matter of grading to size, we would suggest that, at first, the number of weight grades be reduced to the following :

One sized case for hens, which will cover a range of weights from about 8 to 10 lb.

One sized case for cocks, to take 10 to 14 lb. birds.

One sized case for cocks, to take 14 to 18 lb. birds.



Method of Packing Turkeys for the London Markets.
Photo from A. S. Juniper and Co., 369-370 Central Markets, London.

The above will simplify the ordering of boxes and the work of the graders. It needs to be remembered, however, that on a free market all turkeys are not of the same value. At certain times hens are worth more than cocks, and vice versa. Again, 14–16 lb. cocks are often worth more than those of either lighter or heavier weights. The market often finds a distinct demand for 8–10 lb. and 10–12 lb. hens, 12–14 lb. and 14–16 lb. cocks, whereas there is considerable difficulty in selling heavy cock birds, especially any that weigh over 20 lb. Close grading to weight is, therefore, most desirable, in order that every advantage may be taken of the variation in the demand for specified weights.

While on the subject of the value of different weights of turkeys, we would strongly recommend that packers use extreme caution, in future, before committing themselves to the purchase of heavy cock turkeys, weighing 20 lb. and over, unless the price is very reasonable. On a number of occasions both in Great Britain and the U.S.A. heavy cock turkeys have become a drug on the market and have only been brought into consumption with the greatest difficulty and at a great sacrifice of price.

Grading to Quality

It is obviously essential that two grades of quality should be made, that is, first grade and second grade. Apart from these two grades, it is furthermore most advisable to pack old turkeys separately from young, and not to include old turkeys among the young second grade. There are outlets for second grade young turkeys quite distinct from those for old turkeys. Some packers in different parts of the world pack their young turkeys to three grades; there is a distinct advantage in doing this, for those birds which are of extra quality, fine, fat and without damage, when packed separately from the general average quality, command a premium.

Although at this early stage of change from control to decontrol we do not urge a finer selection being made than that of two grades of young turkeys and one of old, any packer who makes the effort to give three grades of young turkeys would not regret the attempt. The descriptions which would best be applied to three grades of young turkeys are as follows:

Extra Quality Young (hens and/or cocks)
Prime Quality Young ,, ,,
Second Quality Young ,, ,,

Value of Second Grade Turkeys as Opposed to First Grade

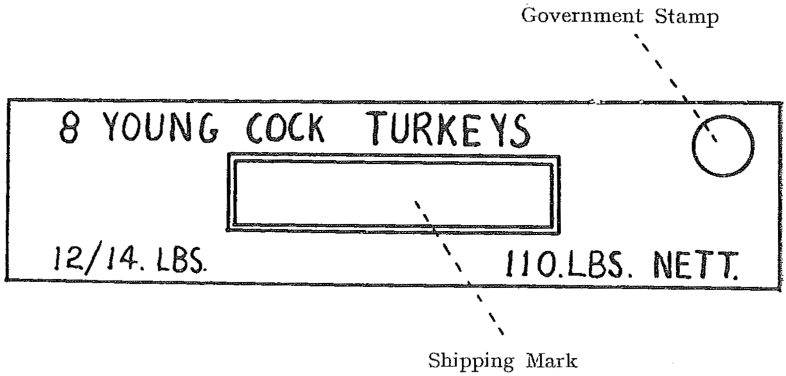
The value of second grade turkeys, as assessed by the British Ministry of Food during the period of control, in relation to the value of first grade turkeys, is liable to have been misleading to Australian packers. At the present level of prices we would assess the true price differential between first and second grade turkeys at nearer 6d. to 8d. per lb. than that which is enforced. This fact should be borne in mind when catering for a free market. We do not recommend any packer to export to this country more second grade turkeys than is unavoidably necessary.

Marking of Cases

The registered brand of the packer should appear on all grades of turkeys, and we would recommend that cases should be marked, as under.

The marking of weight grade, that is, 6/8 lb., 10/12 lb., etc., in the left-hand corner of the case is most important. The words "FIRST GRADE" need not appear on the cases when only two grades are being packed. Cases containing second grade turkeys, however, must be clearly marked with the words "SECOND GRADE". Red lettering can be used to advantage to distinguish second grade from first grade, but we advise that at all times the net weight should be stencilled in black. Red stencilling is generally difficult to decipher.

Turkey cases, when packed in the style we advise, should be marked on both ends of the case. If a packer makes three grades, the words "EXTRA" or "PRIME", as the case may be, must be added to the description of the contents in the top left-hand corner of each case.



Specifications

On a free market, a buyer insists upon being furnished with a precise specification of the goods he is offered. He wants to know the following:

(1) the proportion of cocks and hens,
(2) the weight range of hens and cocks,
(3) the quantity of second grade and old.

If, therefore, attention is given to the marking of the weight range on each case, a clear and concise specification can be easily furnished. A shipment could be described, for example, as consisting of the following:

Hen turkeys:		
	50 c/s	6– 8 lb.
	100 c/s	8–10 lb.
Cock turkeys:		
	40 c/s	12–14 lb.
	100 c/s	14–16 lb.
	50 c/s	16–18 lb.

Whereas an invoice would have to bear all details of cases, etc., a specification, as above, would provide all the information that a buyer would require, and could, furthermore, be sent by cable at little cost.

Some Packaging Principles*

By
E. W. Hicks

Dairy products are packaged for several different reasons. Packages are needed to obtain convenient sized units for handling and for sales. They are also required to prevent spilling and mechanical damage and to keep the produce clean. An attractive appearance in retail packs is desired and this affects the choice of packaging materials in obvious ways. With some products the packaging material is also required to restrict the transfer of water vapour to or from the produce. My remarks this evening will be concerned mainly with this matter. Sometimes it is necessary to have packaging materials with a high resistance to the transfer of odorous or highly flavoured substances to the produce. I shall say a few words about this too.

Water Relations of Foodstuffs

It is well known that if bread is exposed to the atmosphere it will dry out, whereas dried milk will absorb water. Evaporation of water from bread could be prevented by storing it in air at a sufficiently high humidity, and water vapour absorption by dried milk could be prevented by storing it in an atmosphere of low enough humidity. For particular samples of material there is usually a well-defined humidity at which there will be no absorption or loss of water ; at higher humidities absorption will occur, and at lower humidities evaporation will take place. The humidity at which there is no change in water content is called the *equilibrium humidity*. The equilibrium humidity of a material varies, of course, with its water content. The way in which the equilibrium humidity of dried milk varies with its water content is shown in the accompanying figure. Curves such as this are usually called *vapour pressure isotherms* or *humidity isotherms*. The equilibrium humidity varies slightly with temperature. The figure is a humidity isotherm for dried milk at 37° C. Isotherms for other temperatures would be slightly displaced from this.

The humidity isotherms for most foodstuffs are similar in form to that for dried milk, but the numerical values vary a good deal between different materials.

The humidity isotherm is one of the basic requirements for the calculation of the requirements of the packaging materials for use with produce in which change in water content must be restricted.

Dried milk is usually packed at 3% water content and we see from Fig. 1 that it then has an equilibrium humidity of about 15%. The average humidity in Sydney is about 70%, so that there is a humidity difference of 55% between the two sides of the packaging material. This

* Lecture delivered before the Australian Society of Dairy Technology (New South Wales Branch) on October 20, 1949.

may be regarded as the water vapour potential across the resistance imposed by the container. If the value of this resistance is known, Ohm's law may be used to calculate the current, or rate of transfer of water vapour.

Permeability of Wrapping Materials to Water Vapour

It is usual to specify the resistance of a material to water vapour transfer by its permeability, which is analogous to an electrical conductance, the reciprocal of a resistance.

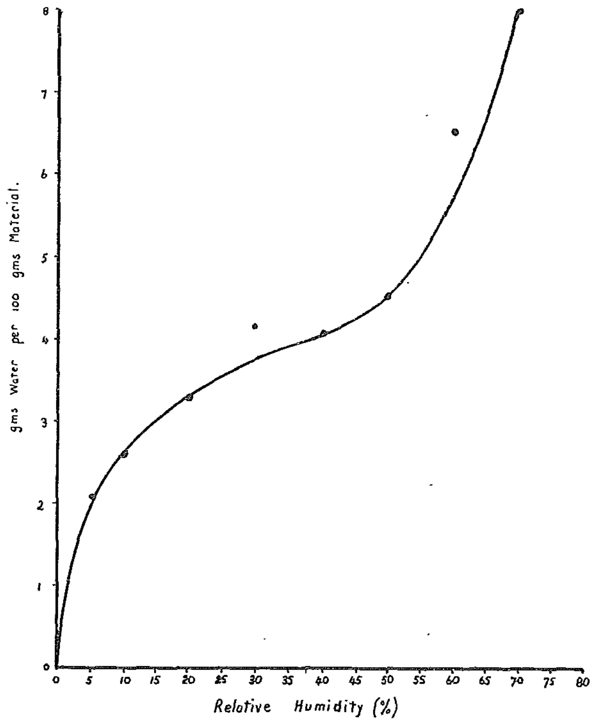


Fig. 1—Water Relations of Spray Dried Full Cream Milk at 37° C. (Gane's Data).

A number of units are in common use for the specification of permeabilities. One which is often employed is: gms. per square metre per day per mm. of mercury vapour pressure difference between the two faces. Many workers use 100 square inches as the unit of area instead of a square metre.

The use of these units implies the assumption that the rate of transfer of water vapour is proportional to the vapour pressure difference under all conditions, and this is not always true. Consequently many workers prefer to express the results of permeability measurements in the form gms. per unit area per day under specified test conditions. Whichever method of expressing the results is used, it is necessary to specify the test conditions to make the statement precise.

To understand the reasons for this it is necessary to consider the mechanism of water vapour transfer through representative packaging materials.

The mechanism is simplest with metal foils, where the transfer of water vapour is by diffusion through small holes and the rate of transfer is strictly proportional to the vapour pressure gradient. The same is nearly, if not quite, true of some of the synthetic plastic films which have negligible affinity for water.

Ordinary (uncoated) Cellophane is an example of the other extreme condition. This material is almost completely free from holes, so transfer by diffusion of water vapour is very small. Its permeability, however, is about the same as that of copper gauze. The water content of uncoated Cellophane varies with the humidity to which it is exposed in the same sort of way as dried milk and if one side of a sheet is exposed to a high humidity and the other to a low, absorption of water vapour occurs on the high humidity side, water is transferred to the other face and evaporates there. The permeability increases with increasing average water content, i.e. the rate of transfer for, say, 10 mm. Hg vapour pressure difference is not constant but is greater at high average humidity than at low.

Cardboard and most papers allow far more transfer of water vapour by diffusion through small holes than Cellophane, but the mechanism of absorption of water vapour on one face and re-evaporation on the other is often the main one with these.

Many common packaging materials are paper or modified cellulose films with surface coatings which provide the resistance to water vapour transfer. Mechanical strength, flexibility and good adhesion to the underlying films are necessary in the coating as well as high resistance to water vapour transfer and many of the mixtures used have considerable affinity for water. This means that transfer of water by the same mechanism as in plain Cellophane can be important with these and the efficiency of the barrier will vary with the average humidity.

Variations in the thickness of materials of this sort are usually due to variations in the thickness of the underlying paper or celullose film, and have, therefore, very little effect on the permeability.

In ordinary waxed papers there can be further complication due to incompletely coated fibres projecting through the wax layer. The efficiency of some types of waxed paper varies very greatly with the average humidity. They may be very efficient water vapour barriers for dry materials stored at fairly low humidities, but very inefficient for wet materials. It appears that exposure to very high humidities may lead to the swelling of fibres resulting in minute fractures in the coating, and permanent loss of efficiency.

The wrapping materials in use vary in permeability to water vapour from about 0·01 gm./m.^{2} day mm. Hg to about 250 gms./m.^{2} day mm. Hg. Materials similar in appearance may vary considerably in efficiency so that published permeability data can sometimes be misleading. For preliminary package design calculations it is probably safe to assume that most of the materials commonly called moisture proofed Cellophanes have permeabilities of the order of 1 gm./m.^{2} day mm. Hg; waxed papers vary from about 0·5 to, perhaps, 50 gm./m.^{2} day mm. Hg; the Sisalkraft products are of the same order of efficiency as the moisture proofed Cellophanes; and a rubber derivative and a synthetic film likely to be available soon in Australia have permeabilities approaching 0·1 gm./m.^{2} day mm. Hg.

Calculation of Package Life

To illustrate the application of the ideas already outlined to package calculations we shall consider a typical problem. "An ice-cream mix has water relations very similar to those of dried milk. It is packed at 3% water content and should not be allowed to rise above 5%. A package containing 4 ozs. has a surface area of 36 square inches. If a wrapper of permeability 1·0 gm./m.^{2} day mm. Hg is used, what will be the shelf life of a package at 72° F., 70% RH (average Sydney summer conditions)?"

This problem is a purely hypothetical one and the figures given probably do not apply exactly to any real problem, but they are sufficient to illustrate the principles of calculation.

The permissible water uptake is 2% of 4 ozs., or 2·24 gms. From Fig. 1 the equilibrium humidity at 3% water content is 15% and at 5% water content it is 52·5%. The average equilibrium humidity is, therefore, 34% (approx.), and the average humidity difference between inside and outside is 38%.

(The use of arithmetic means is not strictly justified, and if the final condition were approaching equilibrium with the atmosphere, the use of arithmetic means would cause serious errors. If the part of the humidity isotherm connecting the initial and final conditions can be treated as a straight line, the logarithmic mean humidity difference, of the same form as the logarithmic mean temperature difference defined in engineering handbooks, will give accurate results. In the example being considered the logarithmic mean humidity difference is

$$\frac{(72-15)-(72-52\cdot5)}{\ln \dfrac{72-15}{72-52\cdot5}}=35\cdot6\%$$

which does not differ greatly from the arithmetic mean.

In cases where the curvature of the isotherm cannot be neglected it is advisable to use a graphical or numerical integration procedure.)

The saturation vapour pressure of water at 72° F. is 20·1 mm. Hg, so the average vapour pressure difference is 38% of 20·1, i.e. 7·6 mm. Hg. 36 square inches=0·023 square metre. The time required for 2·24 gms. uptake is, therefore,

$$\frac{2\cdot24}{7\cdot6\times0\cdot023\times1\cdot0}=13 \text{ days.}$$

Moisture proofed Cellophane has a permeability of about 1·0 gm./m.^{2} day mm. Hg, the value used in this example, i.e. if this material were used, the product would have a shelf life of only about two weeks, which is unlikely to be sufficient. A material of permeability 0·1 gm./m.^{2} day mm. Hg would give a shelf life of about 19 weeks, which is probably adequate. If quick turnover can be assured, a material of efficiency between these two values might be good enough.

Transfer of Volatile Flavours

Butter is easily tainted by fat-soluble volatile substances derived from the boxes or other goods stored near by, and packaging materials which are effective barriers against these are often needed.

The fundamental principles governing the transfer of volatiles are similar to those for the transfer of water vapour. Thus materials with many holes through which vapours can diffuse are poor barriers against volatiles. Materials nearly free from holes are, however, not necessarily good barriers ; if the volatile materials will dissolve in the film or be otherwise absorbed by it, the film may have a low resistance to their transfer.

Metal foils can be very good barriers against volatiles but very thin sheets of some materials may have too many minute holes.

For volatiles which are insoluble in water there are a number of good barriers available. Protein films such as Wiley's well known casein treatment of butter boxes, are effective, and films of low porosity such as the Cellophanes are quite efficient.

BIBLIOGRAPHIES AND SUMMARIES OF INFORMATION

The following bibliographies, summaries of information and special reports have been prepared by the C.S.I.R.O. Information Service. Copies may be obtained on application to

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No.	Title.	Date.	No. of References.
B.386	Growth Regulating Substances.	July, 1949	12

Calculations for Egg Pulp Freezing Tunnels

By

E. W. Hicks, M. B. Smith and J. D. Mellor

An investigation of this matter was begun a few months ago. The mechanism of heat transfer within the cans has proved more complex than was expected and a complete analysis of the problem is not feasible at this stage. However, a number of engineers are likely to have to design new tunnels before we can provide complete data and the following estimates derived from our results may be useful to them.

Heat Load. To cool egg pulp from 50° F. to 10° F. it is necessary to remove about 130 B.T.U. per pound.

Freezing Time. The freezing time of 28 lb. cans stacked in the usual way with the large faces parallel to the air stream, with an air speed of 1000–1200 f.p.m. *over the cans*, is, approximately,

$$\frac{400}{31 \cdot 6 - \bar{\theta}} \text{ hours,}$$

where $\bar{\theta}$ is the average air temperature (°F.) near the can in question.

A change in air speed which would change the heat transfer coefficient between the air and the can surface by 20% may be expected to change the freezing time by about 10%.

In estimating the average temperature rise in the air passing through the stack of cans (in order to calculate the difference in freezing time between the ends of the tunnel), it is necessary to take account of heat leakage, and the fact that part of the air by-passes the stack. It is obviously wise to reduce the amount of by-passing as much as possible.

These results are tentative and may be modified when more data are obtained. We believe, however, that they are sufficiently accurate for engineering purposes for tunnels fairly similar to those in which our measurements were made, but they may be misleading if applied to radical departures from present design practices.

Picking Maturity of Sweet Corn for Canning

By

R. S. Mitchell and L. J. Lynch

Recognition of the important influence of picking maturity on the quality of canned sweet corn has resulted in numerous attempts to define the maturity of the growing crop with precision. Various methods adopted for the purpose include the puncture test, the yardman's measure, succulometer reading, specific gravity of grain, moisture content, and refractive index of grain fluid. It is now generally agreed that percentage of moisture provides a valuable indication of maturity, but this determination when carried out by standard oven-drying laboratory procedure takes 16 hours or more to complete. The time may be reduced to 30 minutes by the high temperature method, but when large numbers of samples are involved the amount of equipment required is excessive, while the time interval is unduly long. The refractive index determination on the expressed juice, which may be completed in a few minutes, is regarded by some investigators as an even better index of maturity than moisture percentage. The two factors are mutually related and high correlations have been obtained in an investigation by the Division of Food Preservation carried out over four seasons on material from Windsor (N.S.W.).

During the season 1944-45 moisture determinations and refractive index measurements on mixed material from sets of 20 cobs were correlated to give correlation coefficients of $-0 \cdot 924$ and $-0 \cdot 954$ from 72 and 77 pairs of observations respectively. In the subsequent seasons 1945-46, 1946-47 and 1947-48 the respective coefficients were $r = -0 \cdot 978$, $r = -0 \cdot 974$ and $r = -0 \cdot 991$ from 99, 175 and 80 pairs of observations. In the 1947-48 season an additional coefficient from a crop specially selected for its lack of uniformity gave a value $r = -0 \cdot 933$ from 69 pairs of observations.

The mathematical treatment of the 572 pairs of observations extending over the four seasons gave the following regression equation

$$\text{Moisture per cent.} = 870 - (580 \times \text{refractive index})$$

where the standard error of the coefficient 580 is 5 and the standard deviation about the regression line is 2.

The investigation showed that when a sample of 140 cobs is taken at random throughout a reasonably uniform field not exceeding three acres in area the mean moisture of the crop may be determined with an error of less than one per cent. A refractometer reading from the sample gives a corresponding moisture value within $1 \cdot 5$ per cent. with 95 per cent. confidence.

The speed of determination of moisture percentage by the refractometer method makes possible frequent field sampling as a basis for prediction of the actual date of harvest. It also permits the coverage of a wide acreage by the field officer and eliminates the tentative estimate of maturity which has been a feature in field control in the past. Finally the determination of moisture by refractive index of corn delivered at the cannery for processing enables maturity variations to be offset by suitable adjustment of the batch mix.

The full results of the sweet corn investigations have been prepared for publication for the guidance of the Australian canning industry.

FRUIT AND VEGETABLE PROCESSING COMMITTEE

A committee with the above title has been set up recently to consider technical problems involved in canning fruit and vegetables. It will also give some attention to the dehydration of vegetables. The committee is anxious to be of service to industry, and its members will therefore be happy to discuss technical difficulties with growers and processors, and to refer problems to the committee when necessary.

The committee is representative of the Commonwealth Scientific and Industrial Research Organization, the New South Wales Department of Agriculture, and the School of Agriculture of University of Sydney. The names and addresses of members are as follows:

Dr. J. R. Vickery (Chairman)	C.S.I.R.O., Division of Food Preservation and Transport, Homebush, Sydney, New South Wales.
Mr. L. J. Lynch	C.S.I.R.O., Division of Food Preservation and Transport, Homebush, Sydney, New South Wales.
Mr. J. Shipton	C.S.I.R.O., Division of Food Preservation and Transport, Homebush, Sydney, New South Wales.
Mr. R. B. Withers (Secretary)	C.S.I.R.O., Division of Food Preservation and Transport, Homebush, Sydney, New South Wales.
Mr. J. D. Bryden	N.S.W. Department of Agriculture, Sydney, New South Wales.
Mr. A. C. Orman	N.S.W. Department of Agriculture, Sydney, New South Wales.
Mr. H. R. Richardson ..	Hawkesbury Agricultural College, Richmond, New South Wales.
Dr. E. G. Hallsworth ..	School of Agriculture, University of Sydney, New South Wales.

Canning of Quinces

By

P. Thompson

Quinces are normally packed as preserves or as stock to be used as flavouring for other products. Consequently No. 10 or larger cans are most often used for this fruit.

Handling of the fruit is somewhat similar to the packing of apples, although the first step of peeling is analogous to the peeling of pears, since the irregular shape of the quince necessitates hand peeling.

The quince must be handled when ripe, and after peeling is halved, quartered or sliced as desired, and held in dilute brine to prevent discoloration. The quince contains quantities of entrapped air within its tissues and must be pretreated to prevent pinholing in the canned product.

The processes recommended are vacuumization, hot water blanch or steaming. Vacuumizing is accomplished by filling the prepared quinces into a retort containing water at 120° F. and applying a vacuum of 20 inches for 10 minutes. Air is withdrawn from the tissues and replaced by water.

In the hot water method the fruit is held in water at 120° F. for about 30 minutes, during which time the oxygen is consumed, the other gases are driven off, and water enters the fruit.

Steaming is carried out in a continuous blancher at about 180° F. until the fruit is wilted, which takes approximately 10 minutes.

After this pretreatment the fruit is packed hot into cans with (or often without) a little water, exhausted for four to five minutes in steam (eight minutes for No. 10 cans) and processed as follows:

Can Size.	Wet Pack.	Solid Pack.
No. 2½ ..	7 min. at 212° F.	15 min. at 212° F.
No. 3 ..	7 ,, ,, 212° F.	15 ,, ,, 212° F.
No. 10 ..	8–10 ,, ,, 212° F.	20–30 ,, ,, 212° F.

A useful by-product may be obtained by extraction of the cores and peelings with hot water. The residue may be pressed to get the maximum yield. The extract is heated to boiling, filled into cans and sealed immediately, or may be made immediately into quince jelly by the addition of sugar and acid and boiling to a finishing temperature of 220° F.

Answers to Inquiries

FRUIT MINCEMEAT

A number of manufacturers interested in the export market have inquired about English regulations governing the composition of fruit mincemeat.

The following information has been furnished by the United Kingdom Ministry of Food :

"The composition of fruit mincemeat is governed in this country by the Food Standards (Preserves) (Amendment) Order 1949—Statutory Instrument 1949 No. 1893. The relevant details are :

(i) Each 100 parts of mincemeat shall contain :

(*a*) not more than 0·5 part of acetic acid (80 per cent. or glacial),

(*b*) not less than 30 parts of added sugar,

(*c*) not less than 30 parts of dried fruit and peel,

(*d*) not less than 2·5 parts of suet or equivalent fat.

(ii) The percentage of soluble solids contained in mincemeat shall be not less than 65 per cent."

RECENT PUBLICATIONS

1. **Heating in Stored Wheat: (i) Respiration of Dry Grain, Insect Respiration and Temperature and Moisture Effects. (ii) Heat Production, Heat Conductivity and Temperature Rise in Grain in the Presence and Absence of Insects. (iii) Two Years' Temperature Records of Dry Grain in a Concrete Silo.** By Joan Milthorpe and R. N. Robertson. *C.S.I.R. Bull.* 237, 35 pp. (1948).

2. **The Metabolism of the Apple During Storage.** By J. F. Turner. *Aust. J. Sci. Res.* B. 2 : 138–153 (1949).

This paper gives a survey of changes in the amounts of various substances, particularly those concerned in the process of respiration, in Australian Granny Smith apples during storage at 0° C.

FOOD PRESERVATION QUARTERLY

Supplement to Volume 9, No.4, December 1949.

CANNING OF QUINCES - ADDENDUM.

The information on the canning of quinces appearing on page 74 of this issue was collected from the literature. Since that note was prepared a number of enquiries have been received on the canning of quinces and the Division of Food Preservation has made a short investigation. As a result of this work the following procedure is recommended:-

1. Peel quinces in boiling 20% lye for 3 minutes, then rinse thoroughly.
2. Trim and slice.
3. Blanch in steam 5-10 minutes.
4. Fill into cans (10 ounces in a 16 ounce can)
5. Add hot 40% syrup.
6. Exhaust 10 minutes, or close with steam flow.
7. Process 30 minutes at 220°F. and air cool. This process is considerably in excess of the requirement for stability against spoilage. It is designed to cook the product to a distinct pink color which is regarded as a desirable character. Plain cans appear to assist color development but the vacuum should be high to ensure a reasonable shelf life.