

(e) *Insulating-properties of various Types of Butter-box.*—Differences of opinion have been expressed as to the extent and importance of the extra insulating effect of the thicker timber in the standard butter-box compared with the thinner Saranac box on the rate of rise of temperature in the packed butter during transport. Some information has been available on the subject from various sources in New Zealand, but records of the results have not been published, with details of the method, to provide a common ground of discussion. An investigation has therefore been made of the rate of change of temperature both inside the block of butter and at the edge on both the sides and ends when boxes of the various types were used as containers. As was to be expected, the standard box showed superior insulating-properties to the Saranac wire-bound boxes, but it is considered that the differences shown were not of sufficient magnitude to affect the quality of the butter except under poor conditions of transport. Attention was drawn to the necessity for care in the transport of butter from factory to store and from store to ship's hold (compare report from this Institute, 1931, and Report of Dairy Commission, 1934).

(f) *Storage of Butter.*—Extensive experiments have been made on the storage of butter. One-pound pats wrapped in various papers such as parchment, cellophane, and parchment backed by tin and aluminium foil have been placed in storage at various temperatures and in various containers such as white-pine boxes, tins, and tins under vacuum.

Chilling: Butter held at $40^{\circ} (\pm 5^{\circ})$ F.—i.e., under poor commercial conditions of chilling—were very stale after three months' storage. The 1 lb. pats held in vacuum tins were better than those held in boxes, but mould was present on the surface of most of the samples.

Samples held at 32° F. for three and a half to five months were distinctly better. All the pats held in boxes were badly tainted by fruit-taint, the store having previously been used for the storage of apples. All the tinned samples were free from taint, but were stale, particularly on the surface. Those packed in tins under vacuum were usually more attractive than boxed samples when the tin was opened, the surfaces being of better colour and flavour. When the pats were left in the opened containers for one or two weeks at 40° to 50° F. these original advantages of vacuum packing were found to disappear.

Butter stored (even in tins) for three and a half months at 32° F. which was originally first grade was found to have deteriorated nearly to second grade, and when kept for a week more at 40° to 50° F. was definitely stale. After five months' storage at 32° F. the surface of all of the butter-samples was so stale as to render the pats almost unsaleable.

Frozen samples: These were of the same types outlined in the foregoing section, and were held for three and a half to six months in a meat store at 14° F.

When the containers were first opened the judges showed no consistent preference for the quality of the interior of the tinned samples, or vacuum tinned samples, but the surfaces of the tinned samples were frequently preferable to those held in boxes. After holding the samples in their opened containers for one to two weeks at 40° to 50° F. the initial differences disappeared.

General remarks: (1) Tinning of butter is an advantage, as it is a means of providing butter with a perfect container, which eliminates the chances of absorption of outside taints and the development of surface-desiccation, producing "Primrose" colour.

(2) The vacuum has little, if any, permanent benefit.

(3) "Primrose" colour is definitely related to surface desiccation; not only the wrapper is concerned, but the wood of a white-pine has a definite hygroscopic action.

(4) Metal foils, such as aluminium and tinfoil, are effective in retarding development of surface-colour and taint in butter, except in the presence of strongly tainting substances such as volatile matter from fruit. Tinfoil is rather better than aluminium foil, but is more expensive.

(5) While the packing of pat-butter in parchment wrappers in tins certainly eliminates risk of absorbed taint and drying out during storage, these defects may develop as soon as the tin is opened. The use of metal foils backed with parchment is nearly as effective as tinning for storage, and, further, it markedly retards the development of defects when the butter is exposed to the air after opening up the tin.

(g) *Effect of Storage on the Body of Butter.*—The change in the body of butter during cold storage was investigated by means of extrusion pressure determinations. Conclusive evidence was obtained to show that the body of butter becomes definitely firmer when it is subjected to prolonged treatment at the normal cold-storage temperature.

(h) *Feed-flavours.*—It has been well known for long that certain plants, especially certain supplementary crops and weeds, cause undesirable flavours in butter. Some observant factory-managers have also maintained that at some seasons of the year difficulty is experienced in securing cream free of food taint when cows are fed only on good pasture. In the past it was uncertain whether this was attributable to the feed or to bacterial contamination, arising possibly from scouring of the cows, particularly in the spring months.

Investigations carried out at the Morrinsville Co-operative Dairy Co.'s factory, with the collaboration of the company and the Plant Research Station, have clearly shown that certain pastures impart a definite and characteristic flavour to the milk of cows grazing thereon. This flavour is quite independent of the extent of bacterial contamination of the cream. It is more intense in the cream produced at the evening milking than at the morning milking, a fact attributed, but not yet definitely proven, to be due to the proximity of the last feeding-period to the time of milking.

The flavour is especially prevalent when clover predominates in the pasture. It appears in cream from high-class pastures in the spring months when clovers tend to dominate perennial rye-grass and reduces in intensity as the rye-grass increases. Pastures in which clovers predominate for a longer time are correspondingly associated with the defect. Top-dressing with quick-acting phosphate manures has been commonly blamed, but careful investigation by officers of the Plant Research Station do not substantiate this belief. On the one hand, pastures brought to a high state of fertility by top-dressing and adequate stocking become dominant in perennial rye-grass, and although they give trouble for a short time in spring they soon get over the difficulty.