

In carrying out this programme of work the Institute has the hearty co-operation of the Massey Agricultural College, the Dairy Division, and the New Zealand Dairy-produce Board. The National Institute for Research in Dairying at Reading, England, has kindly co-operated in the examination of selected lots of produce in England. The laboratories attached to the Taranaki Federation of Co-operative Dairy Companies and the New Zealand Co-operative Dairy Co. have also collaborated with the Institute in certain sections of the work, and they have carried out independent investigations for which they have received financial assistance from the funds of the Institute.

Since practically all dairying problems are affected by the collective results of chemical, bacterial, and manufacturing conditions, the policy of investigating these three aspects simultaneously when working on any one problem has been continued. This has necessarily involved independent laboratory studies before they could be attempted on a manufacturing scale in some cases, and, in others, carefully controlled factory experiments before they could be followed up in the laboratory. But the main aim has been to elucidate facts from different angles concerning problems on which all three sections of the Institute have concentrated. In all questions affecting the quality of produce no attempt has been made to offer judgment till the promises of laboratory investigations have been confirmed by experiments carried out on a factory scale. The produce manufactured for this purpose has been carefully examined at regular intervals. Part of it has subsequently been exported under conditions similar to those which the Dominion export produce is exposed, and reports as to its suitability for the Home market have been received from Britain through the kind co-operation of the Dairy Division and the New Zealand Dairy-produce Board. Corresponding lots of produce have been held in the dairy-factory stores, so that the effects of conditions of transport could be measured.

One of the greatest difficulties in analysing the results of experiments on the production of milk and the manufacture of dairy-produce is the necessity for repeating the same experiment a number of times. In any process where living organisms are involved it is impossible to keep an absolute control of all the varying factors from day to day. In dairying one has to reckon with variations in the milk consequent upon variations in the cow, and in bacterial contamination at all stages. Furthermore, for every experimental procedure there must be some normal procedure which is taken as standard for purposes of comparison. Since uncontrollable variations have to be reckoned with, both in the normal and in the experimental procedure it is obvious that conclusions cannot be drawn from only one or a few experiments. In cheese-making, for example, milk and starter are two of the principal raw materials used. Milk, as is well known, varies from day to day, although it may exhibit no visual change. Starters may also vary in vitality without showing any apparent differences in acidity, flavour, or texture. Hence the results obtained on consecutive days of any one experiment do not necessarily show the same differences between "experimental" and "control." It is, then, only by carrying out trials over an extended period and comparing numbers of cheeses made under the same experimental conditions that reliable conclusions can be drawn. Thus experimental work must be slow unless it is carried out on a very large scale.

CHEESE PROBLEMS STUDIED.

In view of the disconcerting reports received from Home on the quality of New Zealand export cheese, special attention has been devoted to problems affecting the manufacture, curing, and transport of cheese. Openness in cheese has been the principal subject of the Institute's investigations. Conditions affecting the standardization of cheese milk, digressions necessary from normal practice in the manufacture of standardized milk-cheese, and the analysis of the standardized product have also been closely studied. Through the kind co-operation of the New Zealand Dairy-produce Board and the shipping companies, a careful record has been made of the variations in temperature to which export cheese is exposed aboard ship, and the results of these have been followed up by the examination of special lots of cheeses held at different points in the holds of the ships by the London officers of the Dairy Division and the National Institute for Research in Dairying at Reading. Experiments have also been carried out with a view to accelerating the rate of ripening of cheese.

Openness in Cheese.

All associated with the cheese industry realize the importance of this defect to New Zealand. It has been stated to mean an estimated annual loss of a million pounds sterling to the Dominion. This loss is possibly overestimated, because other factors have to be considered in comparing the published prices of New Zealand cheese with that of other countries. The defect, however, is undoubtedly serious, and it is essential that its cause or causes should be definitely known before it comes to be regarded as a characteristic blemish of New Zealand cheese. The problem is no simple one to overcome. Many remedies have been suggested, and, while these have been of assistance in some directions, they have not succeeded in eliminating the trouble.

Openness in cheese is by no means a new defect. It has been known since the earliest days of cheddar-cheese making in Great Britain, America, and New Zealand. It is referred to in the earliest dairy reports of the New Zealand Department of Agriculture by Messrs. Sawers and Laing, and in later reports by Messrs. Ruddick and Singleton, and the advice is there given to make good-bodied cheese with as much acid developed as possible at the time of salting the curd. It is interesting to observe that when Mr. Wright took up his duties in London in 1914 he called attention to the openness in texture present in a large proportion of New Zealand cheese. At this time the pasteurization of milk for cheesemaking was just coming into vogue, and he mentioned that, although pasteurization effected great improvements in cheese flavours, it did not improve texture. It would appear that within recent years an even greater proportion of New Zealand cheese shows openness in texture. Whatever the cause or causes may be—for there are possibly many factors at work—this comparatively recent development synchronizes with the period of most rapid increase in dairying. During this