

cheesemaking of selected strains of lactobacilli. This work is supplementary to that referred to above on starters. The work is yet only at a laboratory stage, but the results are very promising and are expected ultimately to be of considerable commercial value.

Recently some attention has been directed to factors affecting the keeping quality of unsalted butter. In particular, experiments have been started to study the relationship which acidity of unsalted butter bears to keeping quality, because, although it has been definitely shown that acidity prejudices the keeping quality of salted butter, it is commonly believed by scientific workers that acidity preserves the keeping quality of unsalted butter.

Some fundamental work is also in progress to get definite information on the relationship of New Zealand pasture species to the composition of butterfat. No corresponding work of any material extent has been carried out in other countries, where dairy cattle are less dependent on pasture, but it is most essential in New Zealand, since it is well known that the quality of butter is primarily dependent on the quality of the cream from which it is made and since it is evident that butter of better flavour is produced in some districts than in others. It is hoped at a later stage to correlate not only pasture type, but also soil type with the quality of butterfat.

An investigation started two years ago to determine a satisfactory method of paying for cheese milk on its cheese yielding capacity without entailing great expense in analytical work has now been completed. It has been shown that the cheese yielding capacity of milk can be readily estimated from the ten-day samples of milk that are already collected at cheese factories for determination of fat content. As an extension of this work there has been studied the influence of the suggested method of payment on the redistribution of proceeds amongst cheese factory suppliers, and the relationship of the fat content of milk yielded by cows (of different breeds) to their cheese yield. It has been shown that while the suggested method of payment would not entail considerable redistribution of factory proceeds, a few suppliers in most factories would receive a material increase in their returns, to which they are justly entitled.

A detailed study has been made of factors affecting the loss of butterfat in the manufacture of butter. It has been shown that great care needs to be taken with the handling of cream when this is highly processed.

The following statement summarizes in more detail the projects undertaken by the several workers at the Institute:—

CHEESEMAKING INVESTIGATIONS.

(a) *Starter* (Dr. H. R. Whitehead and G. J. Hunter)—During the past year a significant advance has been made towards the solution of the problem of the variation in activity of starter cultures. It had previously been shown that certain single strains of lactic streptococci isolated at the Institute served exceedingly well as cheese starters by reason of their capability of withstanding the high temperatures used during the "cooking" period. The main difficulty attending the use of the single-strain cultures has been their liability to sudden failure. The failure was known to be due to the development of bacteriophage in the cultures, but at the beginning of the past dairying season no method of obviating the failures had been found. Experience during the last nine months, however, has shown that the use of a particular technique in the maintenance of the cultures will eliminate almost entirely the occurrence of phage and that the cultures can be kept for long periods in such a state that their activity in the cheese vat is almost constant from day to day.

The basis of the new technique is the use of a relatively heavy inoculum in the transference of the culture to a fresh batch of milk. In the past, cheesemakers have tended to use as low an inoculum as possible because they believe that "over-ripening" tended to damage the culture. With the Institute single-strain cultures, at any rate, the rapid growth and early clotting of the cultures which result from a heavy inoculation do not appear to cause any harm: on the contrary, it seems possible that the great reduction in the lag period of growth brought about by a massive inoculation carried the organisms rapidly through a phase which, if prolonged, is likely to cause development of bacteriophage. Whatever the underlying cause, it is a fact that in all cases so far investigated by the Institute staff the adoption of a heavy inoculation together with the usual aseptic technique in propagating starters has enabled the single-strain cultures to be maintained successfully in any milk supply of reasonably normal composition.

Practical cheesemakers still experience considerable difficulty in reproducing these results. It is possible that there exist in certain milk supplies factors which cause failure of the cultures, but the indications are that in the great majority of cases the trouble now encountered is due to difficulty in practising daily a true aseptic technique and exerting sufficiently accurate control over conditions of cultures. If this is so, the bulk of starter trouble can now be overcome by instruction and demonstration in the factories.

As was mentioned in the last report, the use of active single-strain cultures has been found to exercise a marked controlling influence on the development of slit openness. If, therefore, it proves possible in the factories to maintain single-strain cultures in an active state over a long period, as has been achieved in the Institute and in a number of individual factories, it follows that a great reduction in the incidence of openness will automatically result.

The question which remains to be settled is whether cheeses made with the use of single-strain starters ripen normally and develop desirable flavours. The fact that the use of single-strain cultures in many cases results in the award of somewhat higher grading points for the cheese at fourteen days and the absence of any unusually adverse reports on mature cheese examined in England indicate that, in general, cheese made with the use of single-strain cultures are acceptable to buyers. It is, however, desirable to attempt to ensure the production not only of acceptable cheeses, but of cheeses showing the true Cheddar bouquet at maturity. As is indicated in a later section of this report, it