

(3) It has been suggested that payment be made on the basis of the "cheese test," or estimated yield of cheese per 100 lb. milk, with a deduction at a certain rate per gallon to allow for differences in manufacturing costs of milks of high and low cheese-yielding capacity.

(e) *Adulteration of Cheese-milk by Addition of Water.*—It has been found necessary in the course of the work on payment for milk for cheesemaking to test the milk-supplies in several factories for the content of added water. The results have shown the presence, in a number of these supplies, of quantities of water which could only have been included in the milk by intentional adulteration. In factory A, for example, with thirty suppliers, one supply contained 24 per cent. added water, and a second contained 20 per cent., while four further supplies had over 10 per cent. added water. In factory B, with sixty-six suppliers, one supply contained 15 per cent., four had 10 per cent. to 15 per cent., and thirteen had 5 per cent. to 10 per cent. of added water. Suppliers should realize that the addition of water to milk, even for supply to cheese-factories, is a punishable offence. It should also be realized that by the addition of water to milk for cheese-factories no advantage is received by any one, and the whole body of suppliers is involved in a certain amount of loss due to the extra costs of manufacture and the higher losses of fat and casein, and the manager is placed in an invidious position in that he cannot obtain the expected cheese-yield and that the control of the cheesemaking process is made more difficult. Apart from these aspects of the question the addition of appreciable volumes of water of doubtful purity is a danger to the quality of the milk-supply.

(f) *Firmness of Curd.*—Difficulties due to softness of curd at the renneting stage are occasionally met with in most factories, and at times in some factories these difficulties have become of major importance. The manager is frequently obliged to add excessive quantities of rennet, with resultant deleterious effect on the quality of the cheese. The causes of the trouble are no doubt to some extent related to the feeding-conditions. Apart from the fact that dry weather may be a contributing cause, little is known in detail of the origin of the trouble. When time and opportunity have permitted, the Institute has directed attention to the problem. In some cases the curd is naturally soft, but hardens up rapidly with the development of acid in the cheese-vat. In the more difficult cases, however, the development or addition of acid only aggravates the trouble, and the only satisfactory means of overcoming it is the addition of calcium chloride to the milk before renneting. This involves some changes in the details of manufacturing procedure to prevent the development of a chippy curd.

Investigations at the Institute on the milk from individual cows of the Massey College herd have shown that, on the average, milk from Friesian cows gives softer curds than milk from Jersey cows. Furthermore, some cows have a tendency to give milk forming softer curds. This is in line with recent work in other countries on the same question.

(g) *Discoloration in Cheese.*—It is definitely established that discoloration is caused by bacterial action and that admission of air to a cheese through cracks or by the process of plugging hastens its appearance. High curing-temperatures also favour its development, as would be expected. Work during the past season has consisted in efforts to track down the responsible bacterium.

Chemical work led to the hypothesis that the sulphhydryl radicle is the chemical agent catalyzing oxidation of the annatto through the admission of air to the interior of the cheese. An appearance resembling typical discoloration could be produced by purely chemical means on the basis of this hypothesis. A search was therefore made for bacteria which produced sulphur compounds during their growth, and a selection of these were added as pure and as mixed cultures to vats of cheese-milk. Control cheeses, protected from infection, were made as usual. Examinations were made by cutting the cheeses in half after four months and six months. The results during the past season have been inconclusive. Discoloration occurred in so many of the controls that it is not possible to state with certainty that any of the added organisms had any connection with the trouble when it did occur in the experimental cheeses. It is evident that the causative organism of discoloration is of fairly common occurrence in cheese, and this fact tends to cast suspicion on lacto-bacilli, several strains of which were among the test organisms. It is evident, however, that either the responsible strain was not picked out or that some condition necessary for its action still eludes definition.

(h) *Sliminess in Milk.*—During work on discoloration in cheese numerous slime-producing organisms were isolated from milk and dairy-products. It seemed possible that these bacteria might have some connection with discoloration; their properties were therefore investigated fairly fully. They proved to have no influence on the development of acid in the cheese-vat even when present in very large numbers, and although the slimy curd produced appeared very objectionable during the making process there was relatively little effect to be observed in the mature cheeses. Some inoculated cheeses developed abnormal and undesirable flavours, but otherwise there was no difference between experimental and control cheeses, and in particular no discoloration was observed. Slime-producing organisms are more definitely objectionable in their effects in the liquid-milk trade.

(i) *Disinfectants and Cleansers.*—Several chemicals are in common use as cleansers and sterilizers for milking machines and utensils. Inefficient rinsing sometimes leaves quantities of these chemicals in machine-pipes, and hence they are subsequently found in the milk. This is undesirable; but there has been a lack of definite information as to how much trouble in cheese-manufacture is due to this cause. Cheesemakers have often considered slow acid-development in the vat to be due to the presence of chemicals used in the cleansing of milking-machines.

During the past year all the commonly used chemicals and sterilizers were added to milk in varying quantities. Vitality tests carried out on raw and on pasteurized samples of these milks enabled a determination to be made of the minimum amount of the various chemicals necessary to impede acid-production. The results demonstrated that none of the chemicals in an amount reasonably to be expected in a milk-supply gave any effect on acid-development. Trouble due to this cause in practice, therefore, would be expected only where deliberate additions were taking place.