

A Comparison of the Suitability of some Milk Tests
for the Wet Tropics.

Object.

To compare the efficiency of four routine milk tests:-

1. The Methylene-blue reduction test at 37° C.
2. The Resazurin reduction test at 37° C.
3. The Clot-on-boiling test.
4. The Plate-count at 37° C.

Introduction.

The above tests are being compared with each other for their suitability as routine tests on milk produced and delivered under Trinidad conditions, the aim being to relate the tests as closely as possible to practical storage and distribution conditions. The milks used were taken from the college dairy and the tests are therefore related to a producer retailer distribution. All the milk used in this work was unpasteurised.

The tests being studied in this experiment are all standardised in the United Kingdom and rely upon specified ageing conditions of the milk at atmospheric temperatures. As shown by Wilson (1935), the reason for this is because except in extreme instances, examination of milk shortly after production does not enable a satisfactory differentiation to be made between good and bad milks. The real difference between them is latent and does not become apparent till opportunity has been afforded for bacteria to grow. The bacteriocidal power of clean milk is sufficient to keep the small numbers of bacteria from multiplying rapidly but in dirty milk the bacteriocidal power is insufficient to prevent bacteria multiplying rapidly. In Trinidad however ageing in this manner is not

possible because of the higher atmospheric temperature, milk stored at this temperature deteriorating so rapidly that routine tests are of little value. Smythe (1945) observed that any bacteriocidal property possessed by the fresh milk was without effect on the results of the methylene-blue test, of samples stored at or above 20° C. Wrigley (1945) found that milk stored at atmospheric shade temperature in Trinidad for 10 - 12 hours, in all but the very best milks, would show a reduction time of less than one hour. This deterioration is too great for reliable testing by the dye reduction test, as noted by Eddison et al (1951), for at this stage in a dye reduction test, due possibly to a factor of the dye reduction test itself, it is not possible to differentiate between milks which have just reached this point, and those which reached it much earlier. This difficulty cannot readily be overcome by introducing a shorter period of ageing at atmospheric temperatures, say for 6 hours, since in this instance the exact time of production of the milk would have to be known and one hour difference in the treatment of samples would introduce a large error. Temperatures such as the atmospheric shade temperatures used in England for ageing the milk are difficult to maintain in Trinidad and would entail costly equipment. The normal household method of storage is in a refrigerator and this is the only satisfactory method of storing in commercial distribution in the tropics.

The tests therefore have been conducted on milk after various periods of storage at refrigeration temperature. The main item of study of this experiment then will be the effect of refrigeration of milk upon the results of the four tests. The effects of refrigeration upon the bacterial flora of milk, and how this affects the eventual spoilage, has been studied by several workers, but the information available about the influence it has upon routine tests is more limited.

It is expected that the use of refrigerated storage will lead to difficulties in the use of the tests, because part of their object as routine tests is as an index of the keeping quality of the milk from a utilisation point of view. As they are carried out in the United Kingdom

there is a fairly good relationship between the dye reduction tests and the keeping quality of the milk as measured by the clot-on-boiling test, for the longer the milk is stored at atmospheric temperature the more rapidly it reduces methylene-blue or resazurin and the shorter the time to the end point of the clot-on-boiling test. When stored in a refrigerator however, as is necessary in the tropics, the refrigeration has a marked effect upon the character of the flora in the milk and also the keeping quality of the milk tends to increase as the period of storage in the refrigerator is increased up to a certain point, Hoy (1936). This then will obviously effect the relationship of dye reduction tests to the direct keeping quality test. In addition the discrepancies which do occur in the United Kingdom between dye reduction tests and direct keeping quality tests, used as an index of keeping quality, are due to the storage and ageing of the milk at $10^{\circ} - 18^{\circ} \text{C.}$, whilst the dye reduction test is carried out at 37°C. Thus the majority flora at the end point of the dye reduction test is not the same as the majority flora which would develop below 18°C. , and be responsible for souring the milk under storage conditions. This discrepancy is likely to be even more marked under the conditions of this experiment where the milk is stored at $0^{\circ} - 4^{\circ} \text{C.}$, and tests are carried out at 37°C.

It has been suggested that for the United Kingdom the discrepancy can be overcome by carrying out tests at temperatures as nearly as possible to those at which the milk is stored. For the purpose of this experiment this is not possible because of the difficulty of maintaining a water bath at 18°C. under these conditions whilst at any lower temperature, such as those at which the milk is stored, the reduction time becomes impractically long.