

EXTRACTS.

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Bacteria and the Dairy Farmer

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The terms, bacterium, conveys to many people the ideas of disease, infection and death. They seldom hear it used except by members of the veterinary and medical professions in connexion with diseases of man and animals, and have therefore been led to believe that most bacteria are disease producing. Comparatively few bacteria, however, cause disease, the vast majority are harmless, and many are of great industrial importance. Moreover, if it were not for the action of bacteria in nature, conditions would quickly arise which would render animal and plant life impossible in this world.

Dairy farming is probably affected to a much greater extent by their action than any other industry, the work of the dairy farmer being largely devoted to controlling their activities in the soil, in the crops during storage and in the dairy produce.

Soil Bacteria.—The fertility of the soil is largely dependent on the bacteria which occur in it. The putrefactive bacteria bring about the decomposition of the plant and animal remains and farmyard manure, rendering their constituents available to growing green plants. In other words, they convert useless organic substance into valuable fertilizing material. If it were not for their action dung and guanos would be of no use as manures. The nitrifying bacteria act on ammonium compounds, converting them into nitrates. In this way they increase greatly the fertility of the soil, as green plants can make use of nitrates for their nitrogen requirement but not of ammonium compounds. The presence of these nitrifying germs in the soil is essential for the fertilizing action of nitrogen in sulphate of ammonia, farmyard manure, and guanos. Other soil germs, termed the nitrogen fixing, make use of free or atmospheric nitrogen for the manufacture of their food-stuffs, and in doing so cause it to combine with other substances. The nitrogen brought into combined state, or as it is popularly termed 'fixed' by them in this way ultimately becomes available to green plants which themselves cannot make use of free nitrogen. Such bacteria have therefore an important action in promoting the fertility of the soil. Some of this nitrogen fixing bacteria are peculiar in

that they can live in association with leguminous plants e. g., beans, peas, vetches and clovers. These plants benefit from this growth association, and will not thrive in soils from which such germs are absent, because they obtain their nitrogen from them. For this reason leguminous crops can be grown more successfully than other crops on soils deficient in combined nitrogen.

Bacteria in hay and silage:—Germs bring about the decomposition and heating of fodder, grain and other foodstuffs, provided sufficient moisture is present to permit of their growth and action. One of the chief objects of haymaking and harvesting operations is to secure the crops under such conditions that bacterial growth is prevented. The crops are dried in the field by exposure to the sun and wind, and then stored in stacks or sheds to protect them from rain, so that insufficient moisture is present in plant tissues to enable bacteria to feed on them. On the other hand, in the preparation of silage the crop is cut green and stored at once in the silo tower, so that sufficient moisture is retained in the plants to permit of the growth and action of the bacteria responsible for the silage fermentation process.

Bacteria in the Dairy:—Bacteria are of great importance in the production of milk, butter and cheese. Many can thrive in milk. They use its constituents as their food, and render it unfit for sale by causing it to become badly flavoured, curdled or slimy. Other bacteria are of importance not because they produce change in dairy produce, but because they are responsible for diseases in human beings and farm animals and care must be taken by the dairy farmer to ensure that the produce is free from such germs as those causing mastitis or "weed," tuberculosis, typhoid fever, diphtheria, and scarlet fever.

Lactic bacteria:—Certain germs, the so-called true lactic bacteria, are of great use in dairying in the preparation of sour milk beverages, butter and cheese. They thrive in milk causing it to become acid or sour and to curdle. Such sour milk has a pleasant clean flavour unlike that of stale milk, where the fermentation or souring may be due not only to true lactic bacteria but but also to coliform or intestinal germs. Sour milk has been used as a beverage and food since ancient times. If the fermentation is due to true lactic bacteric, not only is the milk a wholesome foodstuff but also a valuable medicinal agent for the treatment of digestive troubles.

What is a Starter? The true lactic bacteria are used in butter making to ferment or "ripen" the cream. They generally occur in unpasteurised cream, so that such cream may be allowed to ripen naturally but putrefactive and other bacteria may also be present which may lower the quality of the butter. The best results are obtained by ripening pasteurised cream with a vigorous and pure culture of lactic bacteria. Such a culture is commonly termed "starter." The germs are grown in pasteurising milk, a fresh inoculation into such milk being made daily to enable them to retain their vigor, and not to be killed by the lactic acid they produce. Some of this starter is added to the pasteurised cream, which is then allowed to ferment until it is sufficiently sour for churning. The lactic acid produced by the germs prevents to some extent the growth of other bacteria which would cause undesirable change in the cream and butter—in other words, it acts as a preserving agent in the same way as vinegar acts as a preserving agent in pickles. Butter made from cream ripened in this way generally therefore, keeps better and has a more pleasant flavour and aroma than butter made from sweet or fresh cream, unless the latter has been prepared under special conditions. Moreover more butter is obtained under ordinary conditions, from ripened cream than from the same volume of unripened cream.

Starters in Cheese—making. Starters of true lactic bacteria are used in cheese—making to ensure that the lactic germs are present in the milk in sufficient numbers and vigorous condition to cause it to ripen quickly. The ripening of the milk is necessary to prevent the growth of putrefactive bacteria in it and in the curd and ripening cheese, the lactic acid acting as a preserving agent. The bacterial population of a good Cheddar or Dunlop cheese should consist almost entirely of true lactic bacteria. The lactic acid also promotes the action of rennet, the cooking and maturing of the curd and the ripening of the cheese. Moreover the lactic bacteria have a direct action on the ripening of the cheese by producing agents which render the curd more digestible. They are also to a great extent responsible for the flavour of the cheese. Blue moulds occur along with lactic bacteria in blue-veined cheese such as Stilton and Gorgonzola, and play a part in the ripening process. Their growth is permitted by the loose structure of such cheeses. Putrefactive bacteria, in addition to lactic bacteria and mould assist in ripening some of the soft cheeses—e. g. Camembert and Limburger.

Bacteria are therefore of great importance in dairy farming, and the success of the industry depends to a great extent on their activities being kept under control. Where they produce harmful effects their growth must be prevented, where beneficial their growth must be promoted. Their beneficial effects far outweigh their harmful and the dairy farmer has therefore greater cause to regard them as friends than foes.

(From Scottish farmer dated 24-3-28)

After 35 Years,

The Secretary of State for Scotland through the Board of Agriculture asked Mr. J. R. Campbell B. Sc. Dublin to make "Inquiries as to how far agricultural education in Scotland is reaching those actually engaged in farming and is directly productive of improvement in farming practice." Mr. Campbell possesses unique qualifications for conducting such an enquiry, and he has now completed his task. Thirty-five years ago or thereabouts he was assistant lecturer in agriculture in the West of Scotland college. He was also frequently engaged in extension lecture work in the college area. He knew the beginnings of the work as these were known to few and after many days no one better qualified for making a general survey for taking stock could have been found. In a certain public capacity, but not as a journalist, we have been favoured with a perusal of the completed report. It would be as improper to criticise it at this stage as it would be for us to publish it, but without any breach of confidence we may indicate certain lines of thought suggested by its perusal.

An outstanding feature of the review is the discovery of a changed attitude towards agricultural education and research on the part of Scottish farmers generally. The attitude of aloofness with which the pioneers 30 or 40 years ago were familiar has gone. The actual results of patient teaching and guidance in matters of farm practice may be difficult to express in actual cash terms, but their cumulative effects are beyond question. The fact is apt to be overlooked that there are in Scotland approximately 75,000 agricultural holdings; of these 50,000 are of not more than 50 acres in extent; of the remaining 25,000 no fewer than 16,000 do not extend to more than 150 acres. In other words there are in Scotland not more than 9000 "big" farms. The position to-day would seem to be that while agricultural education has won many adherents among the 9000 and the 16000, it has

made little or no impression on the 50,000. The problem of the future is to how to bring the influences which have operated to good purpose with the men farming on the large scale, to bear with equal power on those engaged in the similar way.

Few parts of the work done during the past 35 years have left deeper permanent impressions than the short courses for farmers which were a marked feature of the earlier days of the agricultural colleges. The younger men who took advantage of these classes were naturally the most progressive and acquisitive of their generation. They were not afraid to put in some hard work in order to attend these short courses. In most cases they did not cease to be learners when their attendance at these courses came to an end. In the majority of cases they were the pioneers in their districts of progressive movements in the day of extension lectures, co-operative effort in buying and selling and generally the best allies of extension lecturers and country instructors. Mr. Campbell is obviously impressed by the extent to which he found this to be the case in definite areas where personal enquiries were made. The lesson deduced is that these classes should be revived and multiplied. They should be held in the central colleges and to this end these colleges should be planted, as they are in the cities of Aberdeen, Edinburgh and Glasgow. What has so deeply impressed the official reporter on his return to the scenes of his early labors was well known to some of us and largely promoted our resistance to proposals to shift the Glasgow college out of the city. The centre of an educational area is not the point where you put the stationary leg of a compass on a map and describe a circle but the point in the area most accessible to students from all quarters in the area.

In order to make full advantage of these short courses—which are attended daily by youths between 20 and 30, the primary qualification is not a scientific but a good general sound education. This is a fact which needs to be well—rubbed in in all quarters at the present day. The student who has been well grounded in English composition (which includes a thorough undertaking of the rules of English syntax) and arithmetic will assimilate the instruction conveyed by a competent teacher in short courses better than one who has been treated to a shallow acquaintance with snippets so common in modern elementary schools. The chemical, biological and economic hints conveyed during attendance on a short mid-winter course will whet the appetite of the right-minded student

for more. He will continue his studies, taking full advantage of popular expositions of scientific results to be found in the agricultural press.

Among actual results in respect of improvements in farm practice, one is impressed by the changes in laying down rotation pasture, the reduced use of perennial ryegrass and the increased intelligent use of cocksfoot and wild white clover. The influence of 40 years' teaching at the Kilmarnock Dairy School is indubitable, and in connection therewith we may say that Mr. Campbell does not hesitate to put down concrete figures as representing the enormous monetary value to the South-West of Scotland of that teaching. The great advance in profitable poultry keeping is equally marked, figures being given which show increases in numbers of all kinds of poultry kept, and in actual egg production per hen. Equally striking are the results in respect of milk production per cow due to the work of the Scottish Milk Record Association, working in alliance with dairy school and college instruction. Nevertheless there is yet much land to be possessed, as, so far, only 17 per cent of the milch cows in the purely dairying districts are as yet under the supervision of the Association.

We have said enough to indicate the discriminating nature of Mr. Campbell's report "After 35 years" and we speak for its full text an attentive hearing when it appears.

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Co-operative Marketing.

(Continued from March issue)

(2) One result of small holdings is that financing cannot be properly organised and has to be effected locally, making it at once costly and wasteful. In his evidence before the Agricultural commission Dr. Mann stated that in Khandesh the cotton growers were not dependent on money-lenders. If that is so, that is probably the only instance of financial independence of cultivators. In some outlying areas, things are very bad indeed. It has been reported by an experienced Bengal official that cardamom sold in Darjeeling at Rs. 60 to 90 a maund in 1925, whereas the cultivators obtained on an average Rs. 30, sometimes as low as Rs. 12, because they had obtained advances from the ring of Marwaries, who control the trade. This is not an exception but the rule for the system of financing is exceedingly complex, as described in the