"WISCONSIN EXPERIMENTS WITH SWISS CHEESE"

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Those who are familiar with the manufacture of both American and Swiss cheese recognize that it is more difficult to make a uniformly high quality of Swiss cheese than to make a uniformly high quality of American cheese. One of the reasons for this variation in ease of manufacture, and possibly the most important, is that the Swiss maker uses one kind of acid-forming organism; the American cheese maker another. The one used by the Cheddar cheese maker is the organism that causes the ordinary souring of milk. It will always be present in the milk and often in such numbers that no addition in the form of starter need be made. In other words the raw material of the American cheese maker carries the essential kinds of bacteria.

The organism which the Swiss maker uses is not found in milk, at least not in such numbers that the milk can be used with the assurance of obtaining a good Swiss cheese therefrom. The addition of materials that shall introduce the essential bacteria in good condition and in sufficient numbers is therefore necessary. This seeding of the milk with the proper bacteria the Swiss maker seeks to accomplish through the addition of some acid whey the "Sauer" and through the use of home made or whey rennet in place of the commercial extract used by the Cheddar maker. The "Sauer" is made by keeping whey from the kettle in a warm place until a high degree of acidity has developed. Such an acid whey will contain chiefly bacteria of the so-called B. bulgaricus group. These are propagated by transferring some of the acid whey to fresh whey each day.
The whey rennet is prepared by placing some of the dried stomachs in whey which is kept at a somewhat lower temperature than the "Sauer." This rennet will contain some of the same bacteria as does the "Sauer" and also the bacteria which produce the "eyes," so prominent a characteristic of Swiss cheese. It is evident that there are chances for failure in the making of both Sauer and rennet, first in regard to the development of the proper kind of bacteria in the "Sauer" and in the rennet, and, second, in regard to the successful propagation of the acid-forming bacteria in the "Sauer." The success which many cheese makers have is evidence of what can be done with care and constant attention in the preparation of "Sauer" and rennet.

During the past season the College of Agriculture has cooperated with the Dairy Division of the Federal Department of Agriculture in helping to introduce methods which are more likely to be uniformly successful than those in common use. Cultures of B. bulgaricus have been supplied to factories for the preparation of the "Sauer." The use of the culture removes one uncertainty connected with the preparation of this starter, for that is what the "Sauer" represents. In case the acidity or the flavor of the "Sauer" becomes abnormal, a new start can be made with a fresh culture. The success of the factories to which these acid-forming cultures have been supplied leads us to believe that their wider use will prove of distinct advantage to the Swiss makers.

Mr. Gere, who has been in charge of the work in the field, has assisted a number of factories in obtaining a cheap and yet satisfactory equipment by which the "Sauer" and rennet can be kept at constant and favorable temperatures from day to day. The equipment consists of a home made chamber heated by a kerosene lamp. The temperature controlling device is one used on an egg incubator. The use of such an apparatus removes still another of the uncertainties connected with the making of "Sauer" and rennet and has lightened rather than in-
creased the work of the maker. That such an apparatus would be of advantage in the Swiss industry was self evident. The satisfied users confirm the self evident conclusion.

Cultures of eye-forming bacteria have been supplied to a limited number of factories. Their use has been very successful, especially in factories in which the temperature of the curing rooms can be kept low enough during the warmer periods. The eye-forming bacteria exert a marked influence on the flavor of the cheese, imparting to it the sweet taste which characterizes the imported cheese.

Cheese made with a *B. bulgaricus* starter and with the eye-forming culture received first and third places at the Wisconsin Cheese Makers Convention held in Milwaukee January, 1923. A cheese made with these cultures won the first place at the meeting of the Southern Wisconsin Cheesemakers and Dairymen's Association held in January, 1923.

By the use of the acid-forming culture and also the eye-forming culture Swiss cheese has been made with success throughout the year. Milk forty-eight hours old has been used with good results in the winter months.

Another point that has been emphasized in the field work is the quality of the milk and the tests by which this can be determined. The tests which have commonly been used for judging milk in the Swiss industry are the fermentation test and its modification, the Wisconsin curd test. It has been recognized that there is danger in the use of these tests in that the milk that may be best for Swiss cheese will be adjudged poor. The maker is thus led to influence a patron who is already doing all he should to produce a good quality of milk to improve his methods, while a far more guilty patron is missed. A good curd in a fermentation test is usually obtained only when the milk contains a considerable number of ordinary lactic bacteria. A milk which is very fresh and which has been produced under very clean conditions will usual-
ly show a poor curd, yet there are many reasons to believe such milk is the most favorable for Swiss cheese. The few bacteria it contains can not compete with those added in a good "Sauer" and in the rennet. In other words, the Swiss cheese maker is interested not only in the kinds of bacteria in the milk, but also in their relative numbers. The methylene blue reduction test gives the maker a good indication of the number of bacteria in the milk of a patron and when the results are combined with those secured in the fermentation test, he is in a better position to judge the quality of milk supplied by any patron than if he uses the fermentation test or the curd test alone. He will also avoid, it is believed, doing an injustice to any patron, something not possible when the fermentation or the curd test is used alone. The results which have been obtained with the methylene blue test have justified the hope which we had in it.

The production of a good quality of milk for Swiss cheese is an easy matter if the farmer will pay sufficient attention to the condition of the milk utensils. It seems from our work that the milking machine is one of the chief sources of trouble at the present time. There is absolutely no reason why milking machines should not be used with success in the production of milk intended for any purpose. The cleaning of the machine, however, cannot be neglected without injury to the quality of the milk. Many farmers say they do not have the time to give toward the care of the machine. This is one of the things for which time must be taken. It is very easy for the cheese to be reduced in quality to such an extent that it will bring a number of cents a pound less than it would have brought if the milk had been of higher quality. If the farmer could be brought to realize the relation between the condition of his milk utensils and the price he is receiving for his milk, he would see that the time spent in keeping the utensils in good shape is bringing him a large return.

One of the troubles which has attracted a great deal
A Typical Green County Farm Scene
of attention in the Swiss cheese district of Wisconsin has been the so-called Stinker cheese in which larger or smaller areas of the cheese develop a most offensive odor. In the more marked cases the odor is quite similar to that of a rotten egg. This trouble has caused an enormous amount of loss in past years, especially during the summer of 1921. During the past summer there was little if any stinker cheese made. Many suggestions have been made with reference to the cause of the trouble. It undoubtedly rests upon the presence of certain types of bacteria in the milk, the source of which is unknown. In our field work it was noted that the stinker cheese did not occur when active acid-forming bacteria were used in the making of the sauer. This has lead us to undertake some experiments in which we have sought first to produce stinker cheese by the inoculation of the milk, and second to determine whether by the use of good acid-forming cultures the occurrence of this trouble in the cheese made from such inoculated milk could be prevented. We have been able to make cheese which showed a most offensive odor. The degree to which this odor develops depends to a considerable extent upon the number of bacteria which were introduced into the milk. A sufficient number of cheese have not yet been made under such a variety of conditions that one can say exactly what can be done with acid-forming cultures to prevent this trouble. All of our results, however, point to the fact that with good acid cultures there will be a marked improvement in the cheese made from any sample of milk containing the organisms which are responsible for this particular cheese trouble.

The results of the field work and of that done in the laboratory and cheese room show that much of the trouble encountered in the Swiss industry is due to faulty milk, poor Sauer, and rennet, things which are self evident, and that to avoid trouble the makers must use reliable methods for the examination of the milk and for the preparation of the sauer and rennet. All of these are more or less neglected at the present time. The whole hearted co-
operation of farmers and cheese makers is needed in order to improve conditions. This cooperation is something that is sadly lacking in many instances at present.

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