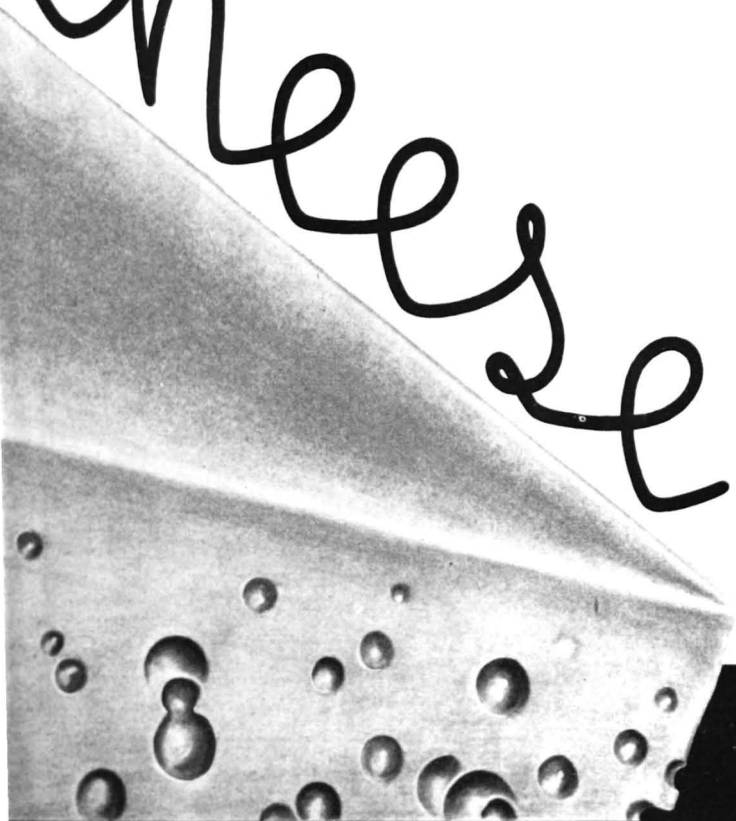


Iowa-swiss-type cheese.

IOWA SWISS-TYPE

E. F. GOSS — V. NIELSON — M. MORTENSEN

Cheddar



AGRICULTURAL EXPERIMENT STATION — IOWA STATE COLLEGE OF AGRICULTURE
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SUMMARY AND CONCLUSIONS

1. A process for the manufacture of a special Swiss-type cheese is outlined. This cheese is softer and quicker curing than a typical Swiss. The flavor is generally somewhat milder.

2. The manufacture and marketing of 25,136 lbs. of this cheese on a semi-commercial scale indicates that it may be made successfully under Iowa conditions.

3. In the manufacture of this cheese high quality milk, pasteurization and careful control of the details of the process are essential.

4. The marketing of this cheese at an advance of 6 cents per pound over the price for American cheese suggests the possibility of more profitable utilization of milk in the manufacture of Iowa Swiss-type cheese than in American cheddar. With the cost of manufacture per pound very close to the cost of manufacture of American, an added return of 50 cents per 100 lbs. of milk might be obtained over the return from the manufacture of the usual American cheese.

5. Successful marketing of bulk natural special cheeses will be aided by the education of the consumer in the proper care of such cheeses in the home, so that their fine flavor and other qualities may be preserved until the last of the cheese is used. "Cheese caddies" are suggested as helpful.

Iowa Swiss-Type Cheese

By E. F. GOSS, V. NIELSEN and M. MORTENSEN

New types of cheese for Iowa have been receiving the attention of the Iowa Agricultural Experiment Station for a number of years. A previous publication (1) described the method of manufacture which has been used in the production of many thousands of pounds of Iowa Blue Cheese. This publication deals with the process used in the Iowa State College laboratories in manufacturing a Swiss-type cheese. In the course of these experiments a total of 25,136 lbs. of the cheese has been manufactured and marketed, utilizing approximately a quarter of a million pounds of milk.

Conditions in Iowa in general have favored the production of butter rather than cheese. The reasons for this have already been discussed. 1. A recent study of trends in the Iowa dairy industry has contributed to a better understanding of the economic aspects of these problems. 2. It is hoped that special types of cheese will prove to be an additional outlet and profitable diversification in this industry.

The Iowa Department of Agriculture reported 24 cheese factories in operation producing 4,411,067 lbs. of cheese in Iowa in 1936. In 1935 there were 20 cheese factories in operation, and in 1934 the number was 11. The number in active operation at the recent low point, 1922 to 1924 inclusive, was five.

The Iowa Agricultural Experiment Station is searching for means by which the interest in cheese production may be directed toward more profitable channels than the usual Cheddar-type cheese.

The estimated cheese consumption in Iowa, based upon a national average consumption of 5.15 lbs. per person per year, would be near 11,500,000 lbs. Iowa now produces slightly less than 40 percent of the cheese consumed in the state.

Distinctive types of cheese also present interesting possibilities for the development of markets outside of Iowa. If the

¹Project 359 of the Iowa Agricultural Experiment Station.

apparent tendency to deliver milk instead of cream continues to develop in certain sections of Iowa it is hoped that special types of cheese adapted to Iowa conditions and distinctive in character will prove their worth in increasing the price which the dairy plant is able to pay the producer for milk, especially as compared with the returns from the manufacture of American cheese.

A DESCRIPTION OF SWISS-TYPE CHEESE

The conventional Emmenthaler or Swiss cheese is well known and held in high esteem by cheese connoisseurs. Its appearance is characterized by the distinctive large holes termed "eyes," the majority of which in a high grading cheese are at least 13/16 inch in diameter; otherwise the texture is entirely "close" or without openings in fancy quality cheese. A Swiss cheese possesses a distinctive pleasing sweet flavor which has frequently been described as resembling the flavor of a hazel nut. The cheese is relatively low in moisture and requires a number of months to attain its full flavor.

The Iowa Swiss-type cheese described in this publication has the characteristic "eyes" of a Swiss cheese and a similar texture. The flavor is mild in degree while in character it resembles quite closely a Swiss flavor. The body is much softer and mellower than the conventional Swiss and the product quicker curing. The softer character is due to the lower temperatures in mak-

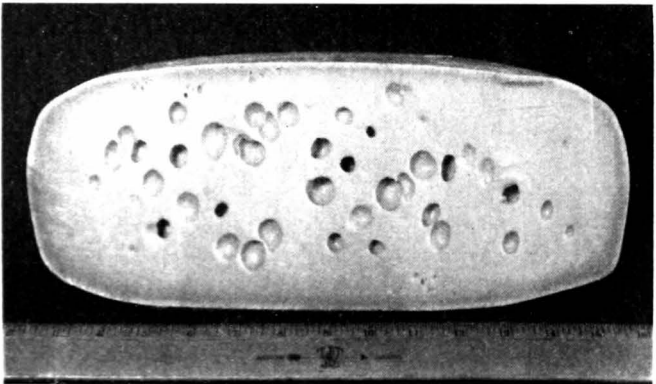


Fig 1. The characteristic holes of an Iowa Swiss-type cheese.

ing and the nature of the manipulations which depart to a considerable extent from those of a typical Swiss cheese. The designation, Swiss-type, is used also to differentiate this cheese with respect to its texture from the stirred curd type of cheese which shows many irregular mechanical openings and is without the typical Swiss appearance. Because of its relatively soft body and quick curing properties this cheese is especially adapted to medium or "short held" curing with the resultant decrease in cost of curing.

WHY SWISS-TYPE CHEESE HAS BEEN INVESTIGATED

That consumer preference is for a medium-cured flavor and a soft body is shown in a recently published study at the Wisconsin Experiment Station (3). The characteristics of Iowa Swiss-type cheese should cause it to fit in particularly well with such a consumer demand. To the knowledge of the authors this Swiss-type cheese has not been placed on the market in the United States, although it has acquired considerable popularity in Denmark and some other European countries. Since this cheese with its mild flavor and soft body is one which should have distinct possibilities for manufacture in the United States it seems that there could advantageously be more information gathered with reference to the factors to be controlled in its successful manufacture.

PURPOSE OF THE EXPERIMENTAL WORK

The purpose of this work was to study the manufacture of this Swiss-type of cheese under Iowa conditions, to draw attention to the special problems to be solved in producing a uniform product and to determine the consumers' acceptance of the cheese.

The cheese was manufactured on a semi-commercial basis and as nearly as the conditions would permit according to factory routine and with factory technique, so that this process would be transferable to plant practice on a reasonable scale. This was done with the hope that some Iowa dairy plants would be sufficiently impressed with the possibilities for the manufacture of this cheese to give it a thorough commercial trial in the

industry and that this would be the beginning of the production of a distinctive Iowa cheese which would become an important Iowa dairy product.

EQUIPMENT USED

The following is a list of the equipment used in the college laboratories for the manufacture of this cheese. From 1,000 to 2,000 lbs. of milk were used for each lot.

In the list of equipment and supplies those needed for receiving and testing milk are not included since they would already be available in the dairy plant receiving milk. Also it is expected that there would be refrigeration already on hand which could be diverted for the cheese curing room.

- 1 Acid test outfit, complete—Any standard acid test using decinormal alkali and phenolphthalein as an indicator.
- 1 Brine tank—Cypress or concrete approximately 9 ft. long, 3 ft. wide and 2 ft. deep, with an outlet in the bottom for cleaning.
- 1 Brine hydrometer—Usual type used in Swiss cheese factories.
- 1 Cheese knife—12 in., to cut the matted curd into blocks of suitable size.
- 1 Cheese moisture test outfit—This will include balance, electric oven, moisture dishes, etc.
- 1 Cheese truck—27 in. x 54 in.
- 1 Cheese vat—At least 200-gallon capacity.
- 1 Conductor head and spout—Length as required.
- 1 Curd fork—Flat, wooden for stirring curd in the whey.
- 1 Curd retainer—Wooden, to fit sides and bottom of vat closely, perforated to allow escape of whey.
- 1 Curd knife, horizontal— $\frac{1}{4}$ in. cut.
- 1 Curd knife, vertical— $\frac{1}{4}$ in. cut.
- 1 Graduate—8 oz., for measuring rennet extract.
- 8 Hoops—Wooden, 16 in. in diameter and 8 in. high with 12 approximately $\frac{1}{8}$ in. openings per hoop for drainage.
- 1 Rennet test, complete—Marschall's.
- 1 Scale—Double beam counter with 1 oz. graduations, 100-lbs. capacity.
- 1 Steam hose— $\frac{3}{4}$ in., 25 ft.

2 Thermometers—Floating, dairy, accurate to 1° F.

1 Trier—Sharp edge, $\frac{3}{4}$ in. cut cheese trier.

1 Wash sink—Round bottom, galvanized iron.

The supplies include the following:

Boxes—Fibre boxes $15\frac{1}{2}$ in. x $15\frac{1}{2}$ in. x 6 in. Those of 175-lb. test board have stood shipment.

Brushes—Stiff ox fibre hard brushes for cleaning cheeses, curing room shelves, etc.

Lactic culture—An active lactic acid producing cheese culture.

Muslin—Unbleached, medium weight for press cloths.

Oil—Boiled linseed or other oil suitable for surface treatment of the cheese.

Rennet extract—Fresh, standard strength for cheese-making.

Salt—Coarse cheese salt of good quality.

There are a number of small items of tinware, materials for cleaning and supplementary supplies which are needed in every cheese factory which are not listed.

THE MANUFACTURING PROCESS

In outlining the detailed technique for the making of Iowa Swiss-type cheese it is assumed that the persons attempting to utilize these directions will have had successful factory experience in the making of one or more types of cured cheese. Therefore, only the details which will be especially important in the making of this particular type of cheese will be noted. It is hoped that this will give one who has had the necessary practical experience enough information to visualize the process.

THE MILK

As the description indicates Iowa Swiss-type cheese is a relatively high moisture and low acidity cheese. Such a cheese calls for the best quality of milk from the sanitary standpoint; otherwise the fermentation during pressing, salting and curing will not proceed in a normal manner. Both high moisture and low acidity in the cheese contribute to difficulties in control of abnormal fermentations when the sanitary quality of the original milk is not high. It is not advisable to attempt the manufacture of this sort of cheese unless the quality of the milk is right.

Some difficulty was experienced during the summer months in obtaining a curd which would firm properly. This was a difficulty which in general was not sufficiently marked to be a quality determining factor. It is true, however, that the irregularities of this sort which appear in the milk during the summer months are likely to result in serious cheese quality defects.

The milk should show not over 0.01 percent to 0.02 percent of developed acidity calculated as lactic acid at the time it is received. The majority of the milk used in these experiments did not have sufficiently developed acidity to be detected with the acid test.

Selection of the sources of milk which promise the best results in making Iowa Swiss cheese was greatly facilitated by the use of the methylene blue and fermentation tests. The character of the fermentative changes which the milk underwent upon incubation was thus determined. By this means the milk more likely to cause trouble in the making and curing was excluded and the chances of success greatly improved. When only a portion of the milk received is used for Iowa Swiss-type cheese the producers which supply definitely superior milk for this purpose will naturally be selected.

In this work the fat content of the milk used was in general between 3 percent and 3.5 percent. No adjustment of the ratio of the fat to casein was practiced.

PASTEURIZATION

Pasteurized milk showed such marked superiority for the manufacture of this type of cheese that it does not seem advisable to attempt to utilize raw milk. Even in the case of milk which was of exceptionally good quality more satisfactory results were obtained with the pasteurized milk. The milk utilized was surplus market milk, and the equipment for pasteurizing by the holding method at 143.5° F. for 30 min. was available also for the processing of the cheese milk; therefore, this method of pasteurization was used. A good quality of raw milk, pasteurized in this manner, resulted in suitable milk for this sort of cheese. No particular difficulties in the making process as a result of pasteurization appeared although the curd required a slightly higher temperature and length of time for cooking.

The process described below relates to the use of milk pasteurized at 143.5° F. for 30 min.

RIPENING THE MILK

Ripening of the milk was accomplished by means of the usual active cheese starter or culture. The special acid-forming cultures used in the manufacture of a Swiss cheese were not employed because the cooking temperature was sufficiently low to permit the rapid growth of the usual cheese starter both during the making process and in the press. It is important, however, that the starter be active in order that such acidity as is needed for whey expulsion and control of the fermentation be produced promptly and in normal amounts.

In general the acidity developed in the milk after pasteurization and before setting was sufficient when the rise in acidity due to the addition of 1 percent starter and the subsequent holding period amounted to 0.01 percent to 0.015 percent. The usual ripening period was 30 to 45 min. The above will indicate to the experienced cheesemaker the relatively slight development of acidity which took place during the ripening period. Ripening was carried on at near 84° F.

THE CURDLING PERIOD

At the end of the ripening period the milk was set with 3 oz. of rennet per 1,000 lbs. of milk in the conventional manner. The temperature employed in this work was 84° F. A rather soft curd was desired as that was an advantage when cutting the curd finely as in the case of this cheese. The curd was not permitted to become quite as firm as for American cheese although the same tests were used to determine firmness. Commonly 40 to 45 min. passed after the addition of the rennet before the requisite consistency of curd was obtained. Both the low acidity and the temperature of 84° F. tended to prolong somewhat the period during which the curd was in a suitable condition for cutting. Slight top stirring of the milk 2 or 3 min. prior to the first sign of coagulation remixed the cream layer which had considerable tendency to form because of slow coagulation.

CUTTING THE CURD

Since the curd was to be cut finely in order to permit rather

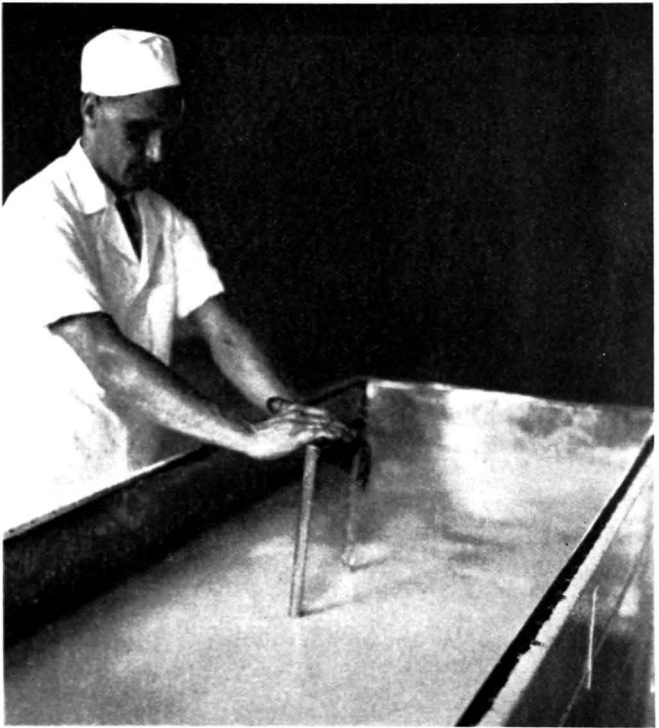


Fig. 2. Curd of Iowa Swiss-type cheese is cut very fine.

rapid expulsion of whey, it was an advantage to start the process before the curd became as firm as with American cheese. The two $\frac{1}{4}$ in. knives were used in the first cutting into cubes. Then the cutting was continued with the $\frac{1}{4}$ in. vertical knife, accompanied by a moderate amount of stirring with the wooden curd fork until the pieces of curd reached the size of grains of tapioca. The effect of fine cutting was somewhat the same as in the case of Emmenthaler cheese although the curd was not reduced to near the same degree of fineness. With the milk available in these laboratories the acidity of the whey following the completion of the cutting period was usually 0.11 percent to 0.115 percent. This was a decrease of 0.035 percent to 0.04 percent below the acidity of the milk subsequent to pas-

teurization and before the addition of starter and indicates the moderate extent of the ripening which took place.

COOKING THE CURD

Normally the temperature of a curd in cheesemaking is raised for cooking purposes by increasing the temperature in the vat jacket with steam or hot water. The method of cooking Iowa

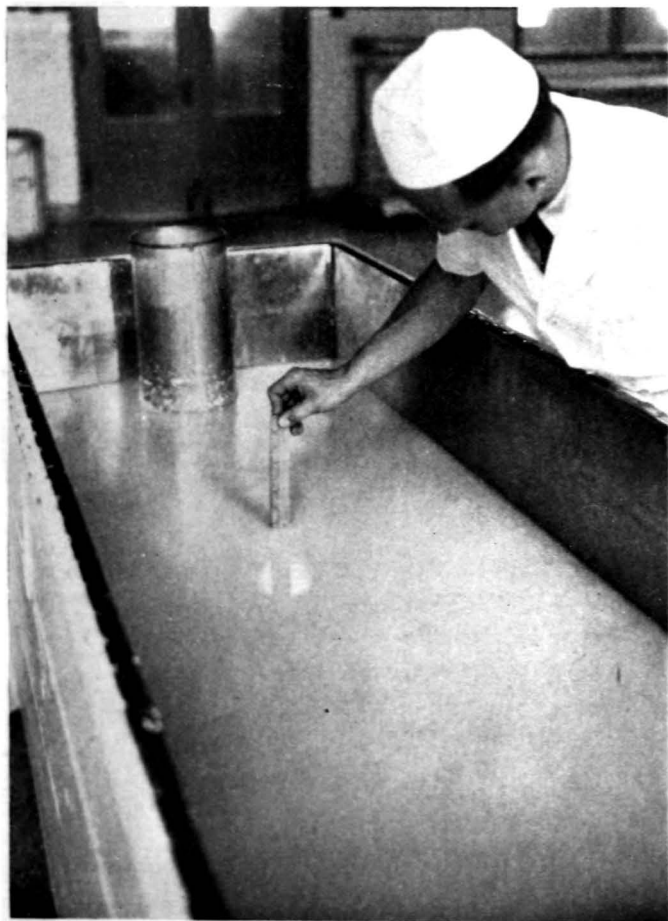


Fig. 3. A ruler is used to measure the proportion of whey to remove.

Swiss-type cheese is to remove one-third of the original whey through a regular vat strainer and for this substitute water at 150° to 160° F. equal to one-fourth of the original volume. Following completion of cutting an interval of possibly 15 min. was utilized for stirring before the first of three or four additions of water, which brought the curd and whey to the final temperature of 102° F. The addition of water consumed about 15 min. The acidity of the mixture of water and whey was 0.08 percent to 0.09 percent.

The essential factors in this manner of cooking appeared to be 1. the amount or extent of the dilution due to the removal of the whey plus the addition of water and 2. the temperature

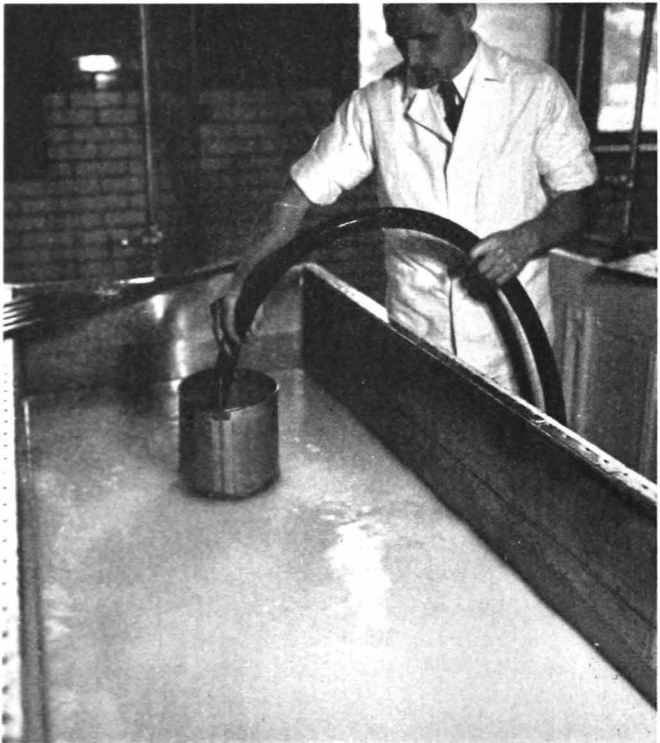


Fig. 4. Water at 150-160° F. is added to raise the temperature of the curd.

at which cooking took place; the first of these factors was likely the more important from the standpoint of cheese quality. This practice of dilution with water is sometimes employed by Swiss cheesemakers although the extent of dilution is less, and the water is usually added cold when the kettle contents have attained the final temperature, and the curd has become sufficiently firm. The reasons for this will be apparent to the cheesemaker accustomed to handling curds. In Iowa Swiss-type cheese the addition of water was more a means of adjusting the final acid and salts content of the cheese than a method of heating, although heating was effected in this manner. Desirable physical and fermentative changes were a sequel to this dilution in the case of this type of cheese.

Needless to say the fine particles of curd must be kept from matting together at any stage up to the completion of cooking if the normal effects of this procedure are to be obtained. Immediately following the addition of each portion of hot water the curd had more than the usual tendency to mat and on that account received very vigorous stirring.

COLLECTING THE CURD

Suitable firmness of curd which signaled the point at which the next operation should take place is not easily described. Tests used for Swiss cheese are not applicable because the curd described here was in a very much softer condition. Possibly the best description of the correct condition is that it was at the point where slight pressure in the hand caused the particles to adhere one to another. The curd had barely lost the mushy, soft qualities which it possessed just after heating started. The time required at 102° F. for this condition with the procedure described and the milk used was 20 to 30 min.

The method used in collecting the curd was to allow it to settle as much as possible in the upper end of the bottom of the vat, and push the remainder toward the same end with a plate perforated to allow the whey to pass through. The curd retainer was held in place by wedges against the sides of the vat and by bracing. The area of the vat bottom to be covered by the curd was determined by the quantity of milk used. It was desirable that the depth of curd be about 8 in. after the



Fig. 5. Light pressure on curd will cause it to fuse.

they had drained off so that the final blocks were of suitable thickness for the height of the final wheels of cheese. While the curd was held in the upper part of the vat floor by the perforated plate or curd retainer, the whey was removed through the vat strainer. A small quantity of curd accumulated in a strainer pail at the vat gate and this was spread evenly over the top of the curd mass. This loose and cooled curd did not fuse but showed open texture in the finished cheese. For this reason the quantity was kept at a minimum. A few pounds pressure, just sufficient to cause the curd to fuse, was applied with a rack over the curd. The time required to cause the curd to adhere well was usually around 15 min.

The above procedure resulted in the formation of a solid curd without mechanical openings. This solid continuous compact or "close" texture is characteristic of a Swiss-cheese, this Swiss-type cheese or others, where the curd is allowed to cement together at the proper consistency and temperature in the absence of air. The acidity of the whey and water mixture at this stage was 0.09 percent to 0.10 percent.

FORMATION OF BLOCKS

Next, blocks were cut of such a size that each block, without adding or taking curd from it, filled the hoop used. In the case of the vat employed in these experiments this involved cutting the curd lengthwise of the vat and finally into 4, 6 or 8 blocks as the quantity of curd demanded. Measurement of the blocks of curd with a ruler facilitated the formation of equal sized pieces and cheese uniform in weight.

The blocks of curd were placed in the hoops at once. As each block was handled it was rounded at the corners by resting it on edge on the vat bottom so that it could be placed easily in the hoop. No cloths were used on the curd when first placed in the hoops. If the hoops were cold warm water was used on them. The curd was turned two or three times during the next 15 min. as the warm plastic mass quickly conformed to the shape of the hoop with no pressure except that of the wooden follower. Temperature readings taken just before the curd was placed in the press showed between 98° and 100° F. in the block of curd, which was a drop of only 2° to 4° F. from the final cooking temperature. It is important that the surface of the cheese be kept warm so that normal drainage may occur.

PRESSING THE CURD

The normal shrinkage of the curd continued while the curd was warm and subjected to a pressure in keeping with its moisture content. To permit drainage of whey from the molds when under pressure the cheese was surrounded with a press cloth of medium weight, unbleached muslin. This was carefully folded over the cheese to avoid ridges and thereby minimize the chance of rind checks which later appear as cracks in the surface of the cheese, greatly damaging it. If the follower does

not fit perfectly the high edge formed should be carefully cut off before the final pressing.

Care was taken that the pressure was not excessive since this would have retarded normal expulsion of whey. A few pounds

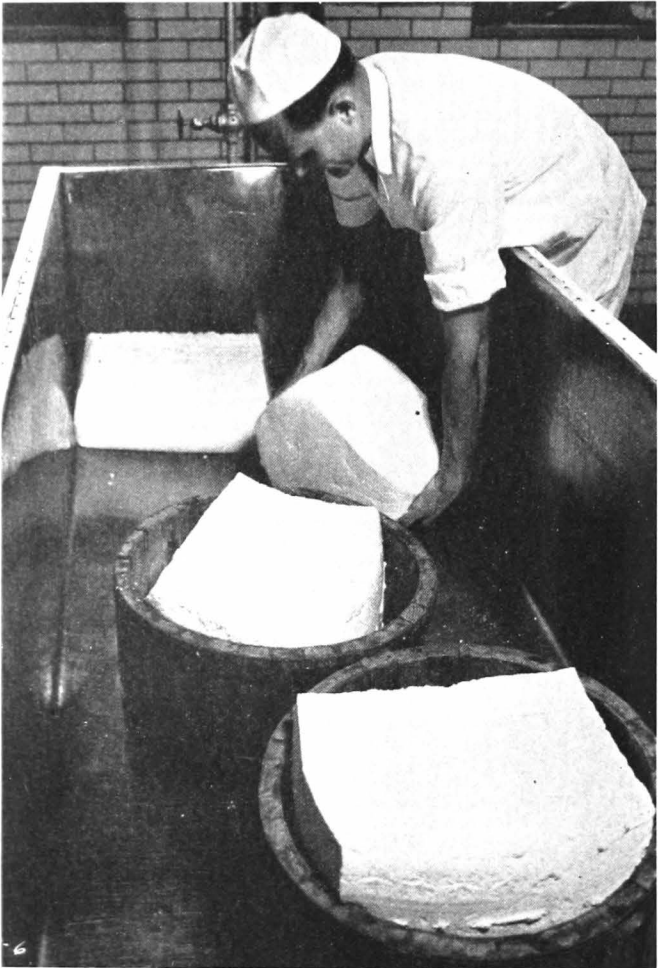


Fig. 6. If the corners of the blocks are rounded they may be placed in the hoops more easily.

was sufficient at first. Over a period of an hour or two this was increased to 300 or 400 lbs. per cheese. In this work the cheese was pressed only about 5 hours in a warm room during which interval it was turned two or three times. At each turning the cloth was removed, rinsed in clear water near the temperature of the cheese, the surplus water wrung out and the cloth again placed smoothly around the cheese before it was returned to the hoop. At the end of this period the pressing was considered complete, and the cheese still in the press cloth and hoops were placed in a cool room at 40° to 50° F. until the next day or for a period of 14 to 16 hours. This preliminary cooling permitted the salting to commence the day following making. It was felt that this early salting contributed to control of the fermentation. Cooling was slow because the hoops were of $\frac{3}{4}$ in. wood.

The hoops used were made at the college on the style of a Gouda mold and of such size as to make a 25 to 30 lb. cheese. The inside diameter was approximately 16 in. and the depth 6 in. The wood was cypress which proved fairly satisfactory. For whey drainage 12 approximately $\frac{1}{8}$ in. openings were provided in the hoop. These hoops were relatively inexpensive and serviceable.

SALTING THE CURD

Brine salting was practiced using a solution of 20 to 22 per cent salt. By slight additions of salt the concentration was kept at this point. A little salt was placed on the exposed surface of the cheese as it floated in the brine, and it was turned daily for the 3 or 4 days it remained in the brine. The tank was installed in a room which maintained a temperature of 50° to 55° F. It was the practice to neutralize the brine with lime. Just following the salting period the cheese usually carried 42 to 43 percent moisture.

CURING CONDITIONS

To cure the cheese during the initial period of 3 or 4 weeks while it was opening up, a temperature of 55° to 60° F. was used. The characteristic openness due to gas formation occurred during this period. The control of the openness was effected largely through removal at the proper point to a colder curing room

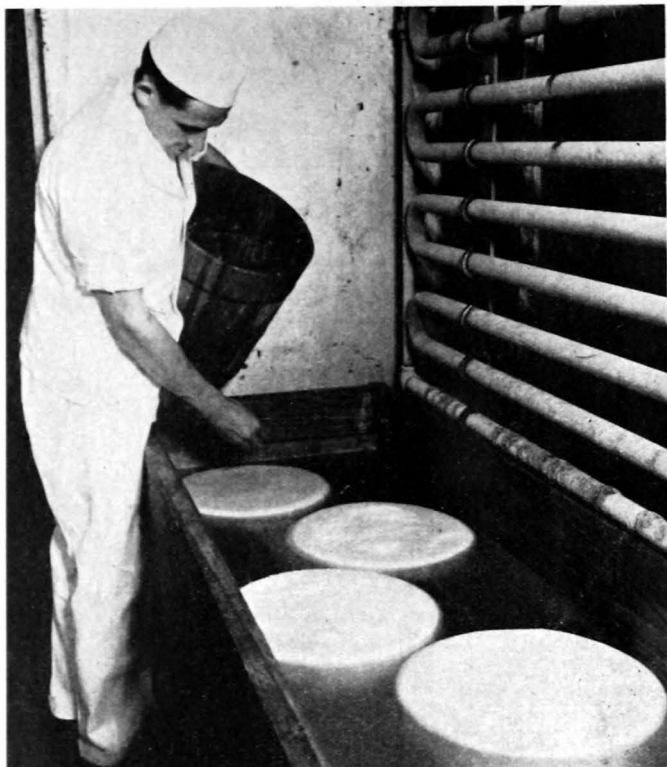


Fig. 7. The cheeses are salted in brine.

held at 40° to 45° F. The use of boiled linseed oil or other suitable coating on the cheese prior to the time it was removed to the colder room was generally practiced. The rooms used were insulated with 4 in. of cork and cooled with brine coils. A small room humidifier operated automatically by a humidistat was employed in the room the cheese occupied during the first months in order to raise the humidity, thereby preventing excessive dessication of the cheese. While close control of humidity does not appear necessary it is true that either excessive dryness or air movement are a distinct disadvantage resulting in heavy rind, tendency to cracks and excessive loss

of weight. The relative humidity was held at approximately 80 percent of saturation.

During this period the cheese were turned often enough to insure uniform rind formation and control of mold. This was two or three times per week at first and less frequently later.

A TYPICAL TIME SCHEDULE

In a somewhat different form a picture of the progress of the making routine is obtained from table 1 in which the early steps in the process are listed chronologically. For purposes of comparison at the different stages both acidity and pH values¹ are given. The former are in terms of acidity calculated as lactic acid after titration with 0.1 normal alkali using phenolphthalein as an indicator, and the latter were obtained with the quinhydrone electrode.

TABLE 1. TIME SCHEDULE USED IN MANUFACTURING IOWA SWISS-TYPE CHEESE.

Operation	Time minutes	Acidity	pH value
Starter added	0	0.15	6.58
Rennet added	30	0.16	6.36
Cutting	65	0.11	6.48
Partial removal of whey	85	0.11	6.47
Cooking temperature reached	110	0.085	6.55
Whey drawn	135	0.09	6.44
Pressing	160	0.10	6.23

THE ACIDITY FACTOR

Control of acidity, which is highly important in the type of cheese here described, was effected largely through initiating a slight development of acidity to aid in expelling the whey and then removing just enough lactose by a routine dilution of the whey with water to finish the cheese with the correct acidity when all retained sugar was fermented. The routine described here has been generally quite effective with the college milk supply, the starter used and under the conditions of the procedure employed. The value of an active starter and close control of drainage conditions has already been emphasized.

¹These determinations were made by Dr. C. B. Lane.

YIELDS

During the experiments a total of 25,136 lbs. of the cheese was produced and marketed on a semi-commercial scale. The records for 12 months of the fiscal year July 1, 1935 to June 30, 1936 give a yield of 2.99 lbs. of green cheese per pound of fat. This was the green cheese as it came from the press. The average shrinkage in 3 months of curing with 19 lots was 11.99 percent. This was a net yield of 2.63 lbs. of cheese per pound of fat or 8.94 lbs. of cheese per 100 lbs. of 3.4 percent, which was the average test of the milk used.

COST OF MANUFACTURE

A study of the cost of manufacture of Iowa Swiss-type cheese by the process used in these laboratories was made by Kiely (4). This gave 6.19 cents per pound as a total of the expenses including marketing. This cost did not include building rent or depreciation. In the same study the comparative costs of manufacture of American and Swiss-type cheese gave the cost of the latter as .6 cents per pound over the cost of the former. The supplies required are not many nor expensive. It is estimated that on a reasonable commercial scale the savings effected in supplies in the case of the Swiss-type cheese as compared with American would tend to compensate for the added labor and space required for the former, leaving the net cost of manufacture, exclusive of milk, not much higher for the Swiss-type cheese. The cost per pound for manufacture of the conventional Swiss cheese is considerably more than American cheese (5) or Swiss-type cheese. The net yield of cured cheese obtained in these experiments was 2.63 lbs. of cheese per pound of fat; this is very similar to that which can be expected from American. The Swiss-type cheese was marketed at a price 6 cents above the price for longhorn so that there was an increased return of approximately 50 cents per 100 lbs. of milk in the case of the Swiss-type cheese. This added return suggests the possibility of profitable manufacture in Iowa.

PROBLEMS IN CONNECTION WITH THE PRODUCTION OF THIS CHEESE

Many problems arise in connection with the successful manu-

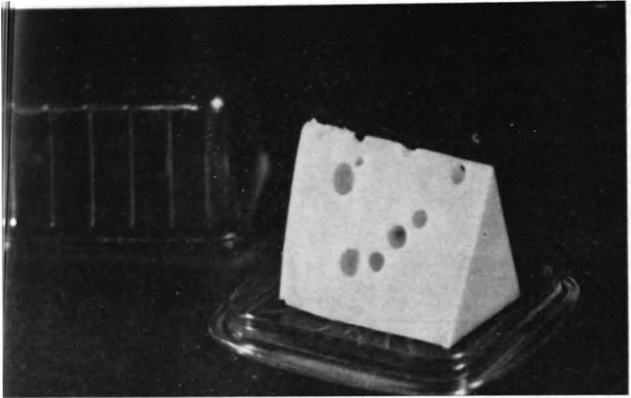


Fig. 8. A "cheese caddy" will prevent cheese from drying out in the refrigerator.

ture and commercial introduction of a relatively soft low acidity cheese such as this Swiss-type.

Considered from the sanitary viewpoint, better than average quality of milk is needed. If inferior milk is used the fermentative changes during making and curing will almost certainly result in a low quality product. This is particularly to be guarded against in a specialty cheese, since it is usually sold to a discriminating trade.

Both the rate and conditions of salting undoubtedly have much to do with the quality of the finished cheese. This is because of the indirect effect of salt upon the composition and the nature and degree of fermentative changes during the curing.

The inclination on the part of the retailer to sell package cheese, and the desire on the part of his customer to purchase cheese in the smaller units operates against the marketing of a specialty cheese in bulk or large units. The successful marketing of this cheese in smaller units in a natural form is something toward which to work. Most of the objections of the trade to this cheese have been not on the basis of its quality but the large size in which it is marketed. The satisfaction of the customer with bulk cheese such as the present form of Iowa Swiss-type might be increased by the more general use of "cheese caddies" which would preserve the cheese in the

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During the experiments a total of 25,136 lbs. of the cheese was produced and marketed on a semi-commercial scale. The records for 12 months of the fiscal year July 1, 1935 to June 30, 1936 give a yield of 2.99 lbs. of green cheese per pound of fat. This was the green cheese as it came from the press. The average shrinkage in 3 months of curing with 19 lots was 11.99 percent. This was a net yield of 2.63 lbs. of cheese per pound of fat or 8.94 lbs. of cheese per 100 lbs. of 3.4 percent, which was the average test of the milk used.

COST OF MANUFACTURE

A study of the cost of manufacture of Iowa Swiss-type cheese by the process used in these laboratories was made by Kiely (4). This gave 6.19 cents per pound as a total of the expenses including marketing. This cost did not include building rent or depreciation. In the same study the comparative costs of manufacture of American and Swiss-type cheese gave the cost of the latter as .6 cents per pound over the cost of the former. The supplies required are not many nor expensive. It is estimated that on a reasonable commercial scale the savings effected in supplies in the case of the Swiss-type cheese as compared with American would tend to compensate for the added labor and space required for the former, leaving the net cost of manufacture, exclusive of milk, not much higher for the Swiss-type cheese. The cost per pound for manufacture of the conventional Swiss cheese is considerably more than American cheese (5) or Swiss-type cheese. The net yield of cured cheese obtained in these experiments was 2.63 lbs. of cheese per pound of fat; this is very similar to that which can be expected from American. The Swiss-type cheese was marketed at a price 6 cents above the price for longhorn so that there was an increased return of approximately 50 cents per 100 lbs. of milk in the case of the Swiss-type cheese. This added return suggests the possibility of profitable manufacture in Iowa.

PROBLEMS IN CONNECTION WITH THE PRODUCTION OF THIS CHEESE

Many problems arise in connection with the successful manu-

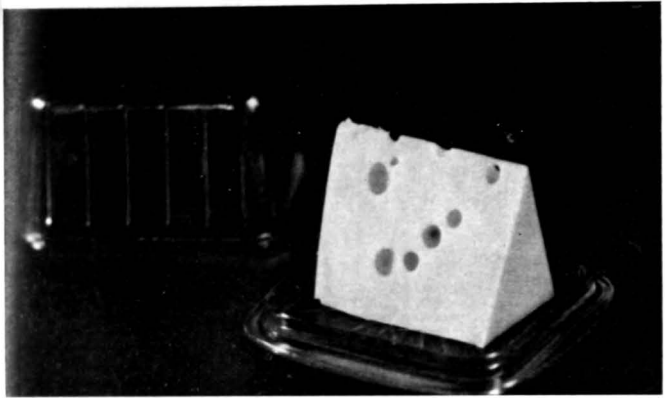


Fig. 8. A "cheese caddy" will prevent cheese from drying out in the refrigerator.

ufacture and commercial introduction of a relatively soft low acidity cheese such as this Swiss-type.

Considered from the sanitary viewpoint, better than average quality of milk is needed. If inferior milk is used the fermentative changes during making and curing will almost certainly result in a low quality product. This is particularly to be guarded against in a specialty cheese, since it is usually sold to a discriminating trade.

Both the rate and conditions of salting undoubtedly have much to do with the quality of the finished cheese. This is because of the indirect effect of salt upon the composition and the nature and degree of fermentative changes during the curing.

The inclination on the part of the retailer to sell package cheese, and the desire on the part of his customer to purchase cheese in the smaller units operates against the marketing of a specialty cheese in bulk or large units. The successful marketing of this cheese in smaller units in a natural form is something toward which to work. Most of the objections of the trade to this cheese have been not on the basis of its quality but the large size in which it is marketed. The satisfaction of the customer with bulk cheese such as the present form of Iowa Swiss-type might be increased by the more general use of "cheese caddies" which would preserve the cheese in the

home in a more acceptable manner. This has become more important with the greater use of the household mechanical refrigerators in which conditions are generally such as to rapidly dry out bulk cut cheese. A small covered glass ice box dish will serve as a "cheese caddy" for small quantities of cheese. These dishes are inexpensive and aid greatly in preserving the fine quality of natural bulk cheese.

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