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## Utilization of Surplus Milk in the Small Dairy Plant: 2. Soft and Semi-soft Hoop Drained Cheeses

P. A. Downs

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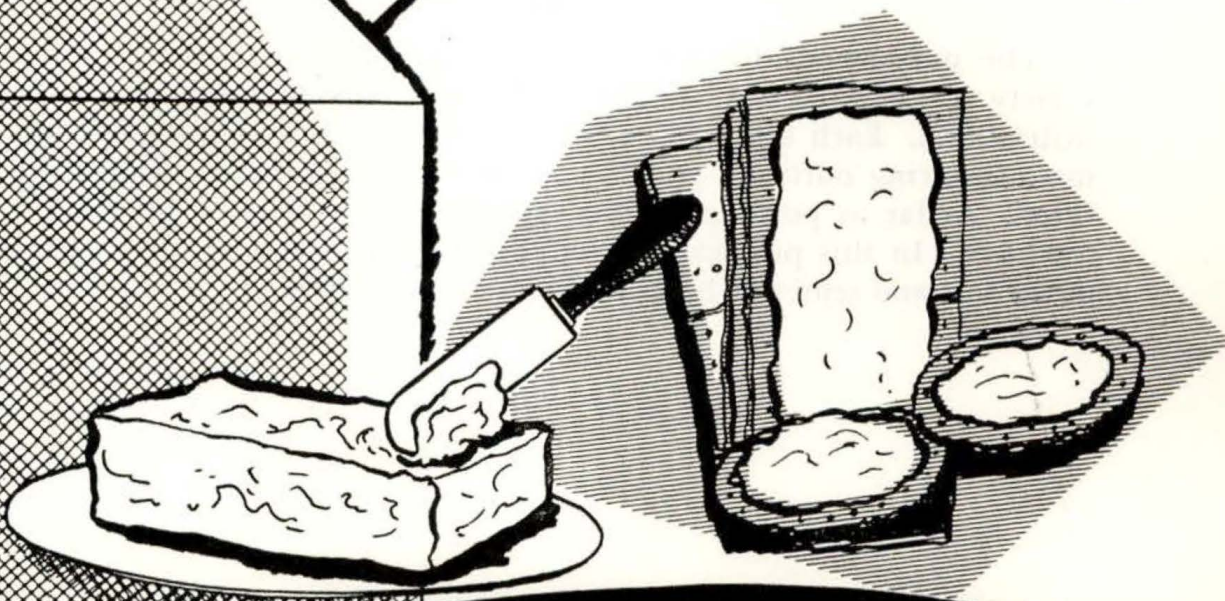
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# Utilization of **Surplus Milk** in the Small Dairy Plant

P. A. DOWNS



## 2. Soft and semi-soft Hoop Drained Cheeses

THE EXPERIMENT STATION OF THE UNIVERSITY OF NEBRASKA  
COLLEGE OF AGRICULTURE W. V. Lambert, Director; E. F. Frollk, Associate Director

## FOREWORD

The purpose of this series of publications is to describe how a variety of products may be prepared in plants to more profitably utilize milk. Each type of product is described in detail, methods of manufacturing outlined, and the equipment and supplies needed are listed. As far as possible similar equipment can be used for several products. In this publication the preparation of a group of cheeses of the soft and semi-soft hoop drained type is presented.

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# Utilization of Surplus Milk In the Small Dairy Plant

## II Soft and Semi-Soft Hoop Drained Cheeses

P. A. DOWNS<sup>1</sup>

### INTRODUCTION

A GROUP of cheeses which could well supplement the soft packaged types discussed in circular No. I of this series are outlined in this circular. Only simple equipment is needed plus the usual supply of lactic and rennet extract.

The necessary equipment consists of a receptacle in which the milk can be set with rennet and starter; suitable metal or wooden hoops for draining; and a supply of cheese cloth or draining mats. If the cheese is not to be sold fresh a suitable moist atmosphere chamber or room will be needed for curing.

Cheeses vary in size, shape and color. Without a doubt the round shape of many cheeses results from the use of round dishes for molding the cheese. Also, the round receptacle is easily made from thin metal or wood, or even baskets in which some cheeses are packed. The rectangular shapes may have come into existence in areas where lumber or boards were readily available and today where metal can be easily fabricated into that shape.

The size of the original cheese, no doubt, was determined by the amount of milk available for each cheese or group of cheeses. The color of cheese varied with the availability of coloring material and customs of the people.

It is the plan of this publication to suggest a uniform package for all cheeses with proper identification by the use of labels.

By standardizing on a rectangular shape and uniform size the same equipment can be used for several types of soft cheese.

In this way minimum equipment and package space will be required. The consumer can soon be trained to associate types of cheese by name rather than by shape of package. This should introduce greater economy in the plant and enable the plant to furnish the product at an attractive price.

### SOFT CHEESE

The four cheeses, Coulommiers, Brie, Camembert and Romadur have the same general character and differ primarily in the method of curing and flavor development. See Table I. Because of this fact they are grouped together in this circular for economy in equipment and type of package needed.

<sup>1</sup> P. A. Downs is Dairy Husbandman, Nebraska Agricultural Experiment Station.



Coulommiers Cheese, which originated in France, is a soft, mold ripened, unwashed cheese belonging to the Brie and Camembert group. A modified Coulommiers cheese as made in the United States is suitable for making in the small plant. It is usually eaten fresh or when only a few days old. If cured in a moist atmosphere for a week or two it will develop into a mellow cheese with a stronger flavor with slight mold growth on the surface.

In this state it is similar to Brie and Camembert cheese in appearance and flavor. Both of the latter cheeses require longer curing periods as they have a more acid curd. They are all cured by the action of bacteria and molds and the ripened cheese has a creamy interior with a brown-white rind and is very flavorful. All of these cheeses are made by a similar general method of draining in a hoop without pressure. The surface is not washed. These cheeses should be marketed just before they are fully ripened.

Romadur Cheese is a soft, ripened cheese originating in the Bavarian district of Southern Germany and is made from whole or partly skimmed milk. It has a sweet curd and when only slightly salted and cured in a moist atmosphere develops a mild aroma resembling that of Limburger.

The main differences in the four cheeses are variations which affect the flavor development during the ripening process.

General directions with variations necessary for the different cheeses are presented in Table II.

### Setting the Milk

High quality, fresh, pasteurized milk is desired. The quantity of milk to be used is placed in a suitable container at a temperature of 85° F. to 90° F. (Plate I) A fresh lactic starter is added in amounts as indicated in Table II.



Plate 1. Container, thermometer, and ladle for dipping the curd.



TABLE I. Characteristics of soft cured cheese.

Kind of Cheese	Appearance	Consistency	Flavor	Pounds of cheese per 100 lbs. milk
Coulommiers	White	Slightly firmer than cream cheese	Mild acid to strong	17
Brie	Light covering of white, yellow and red mold	Soft, well broken down	Snappy; slightly aromatic	14
Cammembert	Heavy covering of white mold, yellow red slime spots develop	Well broken down; creamy inside	Pleasing; over-ripe is slightly ammoniacal	15
Romadur	Wrinkled, red-yellow surface growth	Well broken down; almost creamy	Slight flavor of Limburger, but less pronounced. If a milder flavor is desired it can be washed, dried, and packaged after three weeks.	12

After the starter has been mixed with the milk, three to three and one-half ounces of rennet extract per 1,000 pounds of milk should be added and quickly stirred into the milk. The amount of rennet extract is approximately equal to nine ml., or a cream test pipette full for each 100 pounds of milk. Always dilute rennet extract 20 to 40 times with cold water before adding to the milk.

In the cheese factory, where a large volume of milk is being made into cheese, the cheapest source of the enzyme rennase is the extract. It is prepared from the stomachs of calves and is known as rennet extract. It may also be obtained in dry form or tablets. Two sizes are available, one is known as rennet tablets and the other under the trade name of Junket tablets. They vary in strength as is shown in the approximate amounts needed for different amounts of milk.

Amount of milk	Extract	Rennet Tablets	Junket Tablets
1,000 lbs.	3 oz. (90 ml.)	9	90
100 lbs.	.3 oz. (9 ml.) (2 tsp.)	1	10
17 lbs.	.04 oz. (1.3 ml.) (40 drops)	.1 (1/10)	1

It can be seen that the tablets would be convenient when handling

small amounts of milk. They must be dissolved in approximately one pint of cold water for each rennet tablet used.

After the diluted rennet extract, or tablets, has been stirred into the milk, at a temperature of 85° F. to 90° F., the mixture is allowed to stand covered until the curd is ready to dip into the hoop. The time is not critical, but as indicated in Table II one to one and one-half hours is sufficient except for Brie cheese which is allowed to set longer to form a firmer curd.

### Dipping the Curd

After the curd has set the desired time it should be dipped with a ladle into draining hoops. It will be noted in Table II that the temperature of draining rooms vary from 65° F. to 75° F. for different cheeses. The reason for this is to control the rate of draining and the acid development in the curd while draining.

When the curd has drained enough to permit turning, the cheese and hoops are turned to keep the surface of the cheese as smooth as possible. The number of times the cheese is turned, and the times and amount of salting, has an influence upon the composition of the finished cheese. The curing time and temperature vary with the different cheeses, but all require a room with high humidity.

### Draining the Curd

All of these cheeses should be drained in a rectangular hoop called a Brick cheese hoop.

In order to use the same equipment for several cheeses it is suggested that the cheeses be made into a rectangular shape and properly identified by labeling.

The Brick cheese hoop is of metal or wood, five by ten inches, inside dimensions, and six inches high. There are holes in the metal and slots in the wooden hoops to aid the draining of the curd. Such hoops can be purchased from a cheese supply house. Plate 2.

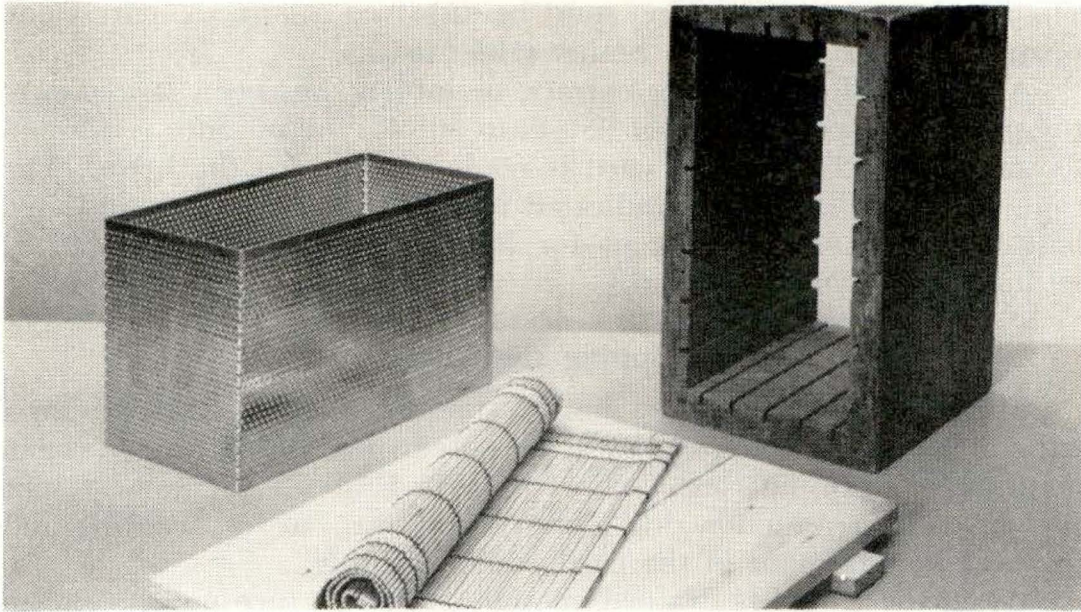
Before the curd is placed in the hoop to drain, the hoop should be placed upon a draining board which has on it a reed draining mat or several thicknesses of cheese cloth. This allows more rapid draining and makes a close surface on the bottom of the cheese. Plate 3.

The curd is ready to be dipped after it has stood the time indicated in Table II. Usually free whey will have appeared on the surface of the curd mass. With the aid of a dipper the curd is transferred from the container to the hoop resting on the mat and drain board.

As layer after layer of curd is carefully placed in the hoop the whey will run freely through the holes of the hoops and draining mat.

If it is found that the hoop will not hold all of the curd at first, the balance should be added as quickly as it settles. The time required to get all the curd into the hoop and drained to one-half hoop height will vary, depending upon the type and condition of the curd, one hour usually being sufficient.

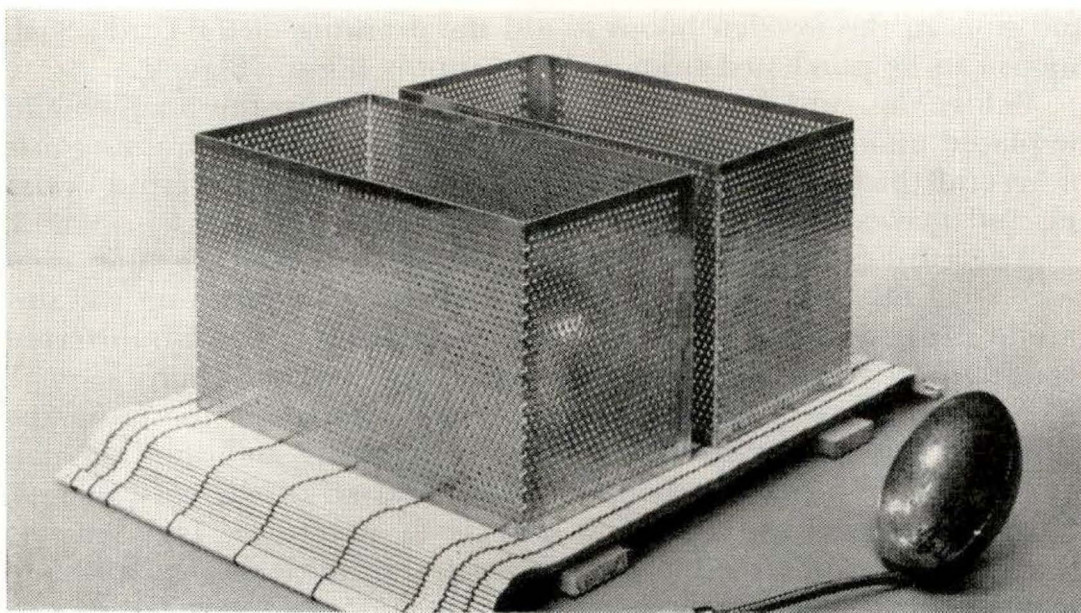




**Plate 2. Draining board and mat with metal, wooden type hoops.**

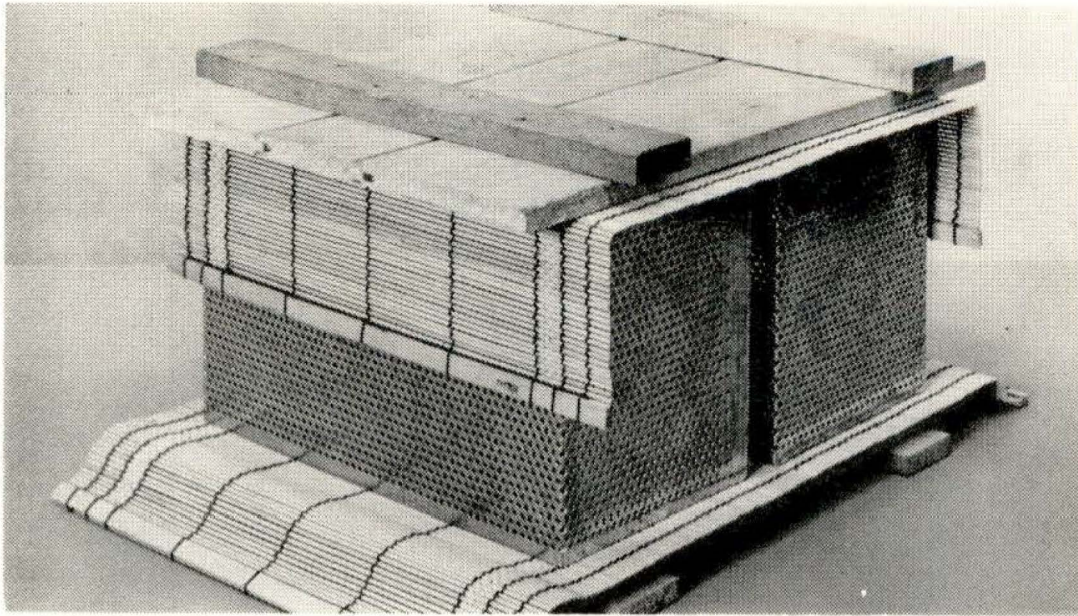
After the curd settles approximately half way in the hoop another reed mat or layer of cheese cloth is placed over the top of the hoop upon which another drain board is placed. Plate 4. With a quick movement the hoop, cheese, and top and bottom boards are inverted. The cheese should slide to the bottom of the hoop and settle into place leaving a smooth surface on top of the cheese. Sometimes if the cheese is turned too soon the surface will tear on the first turning. If this happens allow the cheese to stand an hour or more and invert again. Continue this until suitable surface is obtained. Usually three turnings are enough.

After the turning is completed and the surface is satisfactory the



**Plate 3. Metal hoops are now in place ready for dipping of curd.**





**Plate 4. Same hoops containing curd are now ready to be turned.**

cheese is left covered and directions for further turning and salting are followed as given in Table II.

After about three days in the draining room with the turning and salting completed the hoops are removed and the cheese is taken to the curing room. Plate 5.

### **Curing Process**

The temperature of the first curing room, and the length of time determine the characteristic growth on the surface that is common with each of the cheeses.

Often a second, or cooler, room is used which helps to control the



**Plate 5. Shows a loaf of semi-soft cheese as the hoop is removed.**



TABLE II. General directions showing variations.

Kind of Cheese	Set 85° F. to 90° F.			Condition of Curd at Dipping	Temperature Draining room Degrees F.	After Draining			Curing
	Starter added percent	Rennet Extract added oz/1000 lb.	Time hours			1st day	2nd day	3rd day	
Coulommiers	1	3 - 3.5	1 - 1.5	Soft	65 - 70	Turned frequently, salted lightly	Turn once salt lightly	Remove hoop	Usually sold fresh Store 32-40° F. 85% humidity
Brie	.3	3 - 3.5	2 - 3	Slightly firm	60 - 65	Turn frequently	Turn frequently	Remove hoop, salt lightly for 2-3 days	55-60° F. 7-8 days ventilated room 52° F. 2 wk. 85% humidity
Cammembert	3	3 - 3.5	1 - 1.5	Slightly firm	70 - 75	"	"	"	55° F. 3 wks. 85% humidity  48-50° F. until ripe
Romadur	.5	3 - 3.5	1 - 1.5	Slightly firm	65 - 70	Turn once	Turn once	"	45° F. 3-4 weeks 85% humidity

NOTE: If made from raw milk, the cheese must be held for not less than sixty days at a temperature of not less than 35° F., before it can be legally sold. Cheese from pasteurized milk may be sold without holding if desired.

surface development. High humidity of the air is necessary for this group of cheeses.

### **Inoculation for Flavor**

The cheeses of this type are known as soft ripened cheeses. Their particular flavor is the result of the growth of certain types of microorganisms within and on the surface of the cheese.

When high quality raw milk is used the desirable organisms may develop without inoculation. However, with pasteurized milk it is necessary to introduce the desired organisms into the milk. This can be carried out by obtaining cultures from a dairy laboratory, or by smearing a well ripened cheese of the desired type onto the surface of the fresh cheese.

Inoculation can be accomplished by inoculating the milk, salt, or by the smear method, any one of which seems to be satisfactory.

The main problem is to develop a suitable growth on the surface of the cheese and then control it so that the cheese will ripen inwardly from the surface. When completely ripened the cheese should have lost its curdy appearance and be soft and creamy.

Brie cheese should show a light covering while Camembert should show a heavier mat of white mold. Romadur should show little white mold, but a wrinkled surface growth of a different type of mold and yeast.

### **Size of Cheese**

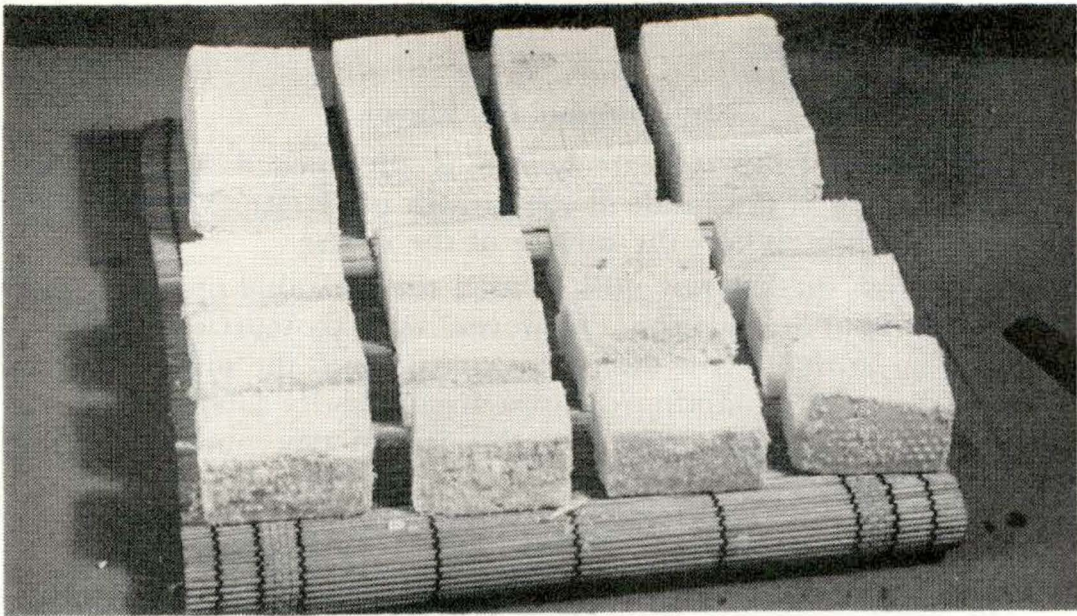
The size of the cheese will depend upon the market. Usually an eight ounce cheese is about as large as is made. The cheese is kept at a thickness which can be properly ripened during the desired curing period, usually one and one-quarter to one and one-half inches in thickness.

When using a hoop five by ten inches, the cheese, one and one-quarter to one and one-half inches thick, will weigh approximately two and one-quarter pounds. With a yield of 12 to 14 pounds of cheese per 100 pounds of milk it will require approximately 15 to 17 pounds of milk for each hoop. A convenient unit volume of milk is 35 pounds for one setting, divided between two hoops. By placing the two hoops on a single drain board a unit of operation could be maintained.

### **Cutting the Cheese**

By using the hoop as described, a block of cheese five by ten inches, weighing two to two and one-half pounds, will be obtained. As this is larger than is convenient to handle and market, the cheese is cut into four portions when the hoop is removed. Plate 6. If smaller sizes are desired these can be cut in half again, producing a cheese of approximately four ounces. Further cutting will result in still smaller sizes which are often referred to as individual portions.





**Plate 6. Picture shows loaf of cheese after the cheese has been cut.**

Regardless of size, the cheese should be separated so that the desired surface development will take place during the ripening period. By placing one inch—or more—apart on the draining mats the cheese can be easily handled, and surface growth will develop. Plate 7.

#### **Curing the Cheese**

The curing of this type of cheese consists of holding the cheese in a moist atmosphere at the desired temperature as shown in Table II.

The humidity of the air is maintained at such a point that the surface of the cheese will not dry out and become hard. In this way the surface growth will develop according to the length of time the cheese is held under a given condition. Normally this group of



**Plate 7. Cheese after it has been cut, lightly salted in curing room.**



cheeses requires an atmosphere having approximately 85% to 95% humidity.

In the case of Brie cheese it is first given about one week in a ventilated room thus drying, to a slight degree, the surface. Then it is placed in a room of high humidity to develop surface growth. This treatment retards the mold growth, resulting in a much lighter mold development than in the case of Camembert, which is held in high humidity throughout, or at least until a heavy felt of mold has formed.

In a small plant making only a limited amount of cheese the maintaining of a highly humid atmosphere in the curing room may seem difficult. However, by placing the cheese in a closed chamber in which a small amount of free water is maintained, the desired humidity can be developed.

A closed metal or wooden chamber containing moisture and kept in a cold room of the desired temperature can be used. A mechanical refrigerator or a cold room kept moist with water on the floor is also satisfactory. The placing of wet cloths over the cheese while on the curing racks helps to keep the cheese from drying on the surface.

The curing chamber should be kept free as possible from undesirable mold contamination. Daily attention will greatly aid the curing of the cheese. From three to four weeks are required to cure soft ripened cheese when held at the temperature indicated.

As this type of cheese will continue to ripen after it is packed it is often desirable to wrap the cheese ready for sale after two weeks, or when the surface growth is well developed. The cheese can then be stored at refrigerator temperature until fully ripened. If made from raw milk the law requires that the cheese must be cured at least sixty days above 35° F. Plate 8.

It is possible to store completely, or nearly completely, ripened



**Plate 8. Typical Camembert type cheese after it has been cured.**



cheese at zero temperatures when it is desirable to hold for longer than the normal storage period.

### **Wrapping, Packaging and Labeling**

The most common type of covering for wrapping this type of cheese is plastic coated aluminum foil. Cardboard boxes of the folding type also can be purchased for packaging.

Labels can be printed showing the kind of cheese and should be marked, "Pasteurized Soft Ripened Cheese." If printing is placed on a narrow strip of paper it can be glued together keeping the cheese in shape.

Labels of different colors could be used for the different cheeses so that the public will associate a definite color with a particular type of cheese.

With the yield of cheese ranging from 12 to 17 pounds per 100 pounds of milk a fairly good return for the milk can be realized when cheese is sold at current prices. If labor and packaging costs can be kept reasonable a cheese can be furnished the consumer at an attractive price. When one considers the price of other foods with equivalent food value one can appreciate the economy of cheese in the diet.

### **SEMI SOFT CHEESE**

These cheeses contain slightly less moisture than the soft ripened hoop-drained group. Table III. In order to produce a slightly drier cheese the curd is cut and stirred in the whey until it has lost more of its moisture. The size of the curd particles, the acidity of the whey, the length of time, and the temperature at which the curds and whey are heated all influence the moisture content of the cheese. This part of the process is called the cooking of the curd.

As the curd has to be cut and heated in the whey some additional equipment is required. A rectangular cheese vat and a set of curd knives for cutting the curd will be convenient. In plants where cottage cheese is made such equipment will be available.

### **Brick Cheese**

Brick Cheese is one of the few cheeses of American origin. It is a sweet curd, semi-soft cheese with a mild but rather pungent and sweet flavor. It is made from high quality whole milk. Usually it is in a brick shape, ten by five by three inches, weighing about five pounds. These cheeses are cured in high humidity rooms, salted and cured, then piled close together so as to develop a slime growth on the surface.

If this cheese is made from fresh milk with little or no lactic starter a cheese having a strong Limburger odor will result. This type of cheese is often called Limburger Brick, Old Fashioned Brick, Backsteiner, or Stangenkase.



TABLE III. Characteristics of Semi Soft Cured Cheese.

Kind of Cheese	Appearance	Consistency	Flavor	Pounds of Cheese per 100 lbs. of milk
Brick	Smooth, red-brown rind	Mellow, slices well	Not as sharp as Cheddar, not as strong as Limburger	9.5
Limburger (Backsteiner)	White, smeary, lustrous surface	Mellow, slices well	Strong Limburger	10.5

### Making Brick Cheese

The mixed night's and morning's milk, raw or pasteurized, is placed in a rectangular cheese vat and heated to between 86° F. and 90° F. About one-fourth to one-half percent of fresh lactic starter is added and the milk is set with three to four ounces of rennet extract per 1,000 pounds of milk. The curd should be ready to cut in 30 minutes. When the curd breaks clean over the finger, cut lengthwise with the horizontal curd knife. Follow this by using the vertical knife both ways of the vat. The curd has now been cut into cubes of approximately three-eighths to one-half inch in diameter.

Stir the curd for 15 to 20 minutes after which time the whey and curd is heated slowly to a temperature of 105° F. to 110° F. Usually this requires 30 to 45 minutes. The curd should be kept at this temperature and the whey drawn off until the curd begins to show above the whey. At this time the curd should be firm enough so that the whey runs out freely from a handful of curd.

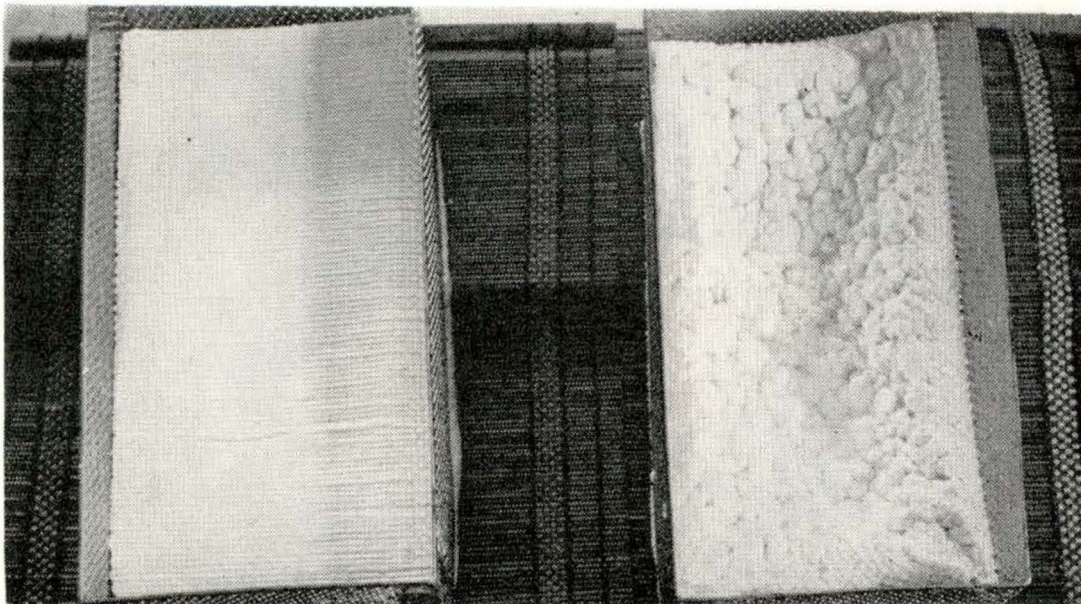
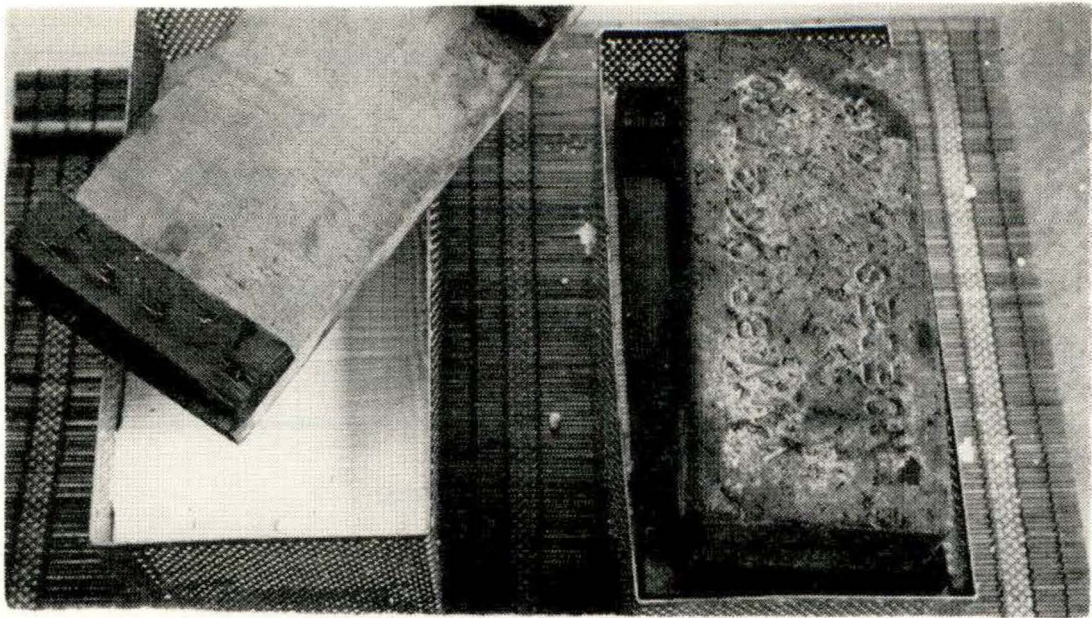


Plate 9. A curd of brick cheese in hoop before and after turning.



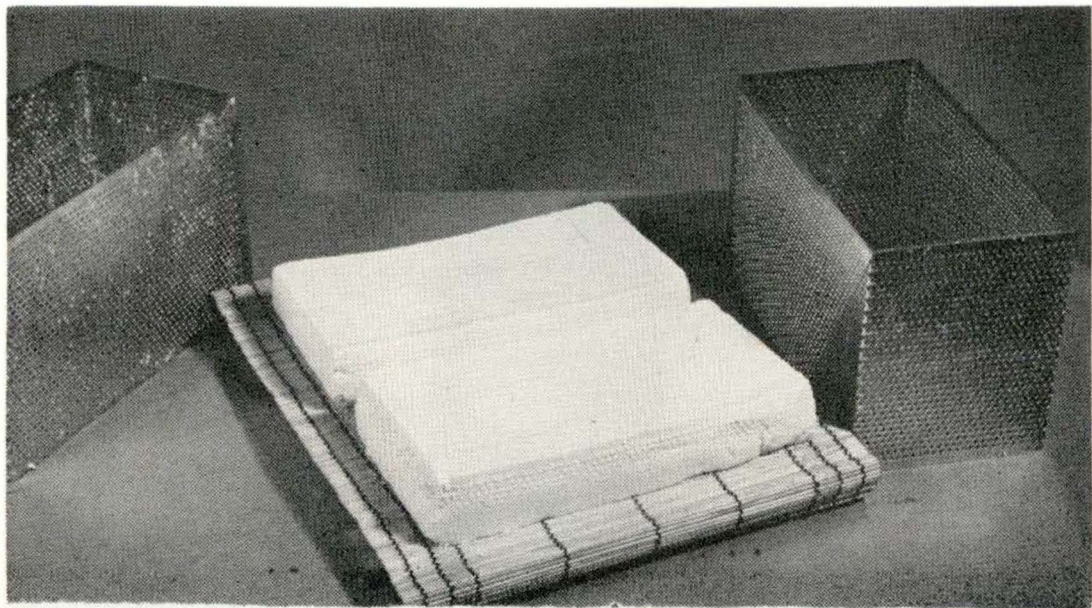


**Plate 10. Brick cheese after turning with wood followers, also in press.**

The curd is dipped into ten inch brick molds which have been placed upon the draining mat. The curd from approximately 60 pounds of milk should be placed in each hoop to produce a five to six pound cheese. Plate 9.

The cheeses are turned with the mold every 30 minutes and a wooden follower weighted with an ordinary brick is placed on top of the curd after the second or third turning. Plate 10. After four to five turnings they are drained over night at 50° F. to 55° F.

The following morning the hoops are removed and the cheese rubbed with dry salt. Plate 11. Salting is repeated daily for three



**Plate 11. Brick cheese removed from hoops, rubbed with dry salt.**



days, keeping the cheese on the broad side and scraping it smooth. They are then transferred to the curing room at approximately 60° F. with 90 to 95 percent humidity. The cheeses are piled close together for ten to 13 days to prevent cracking.

As normal curing develops, resulting in a red-brown growth on the surface, the cheese is washed with ten percent salt water. After two weeks the cheeses are separated, permitting air to circulate around them so the surface will dry slightly. This may be accomplished by placing them in a drier room. When they have dried slightly they are dipped in melted paraffin, or cheese wax, wrapped in parchment paper, then in heavier paper, and packed in boxes for curing.

Usually, curing for two to three months at 40° F. to 50° F. will produce a cheese of the desired flavor and texture. If cheese is made from raw milk at least 60 days of curing above 35° F. is required by law.

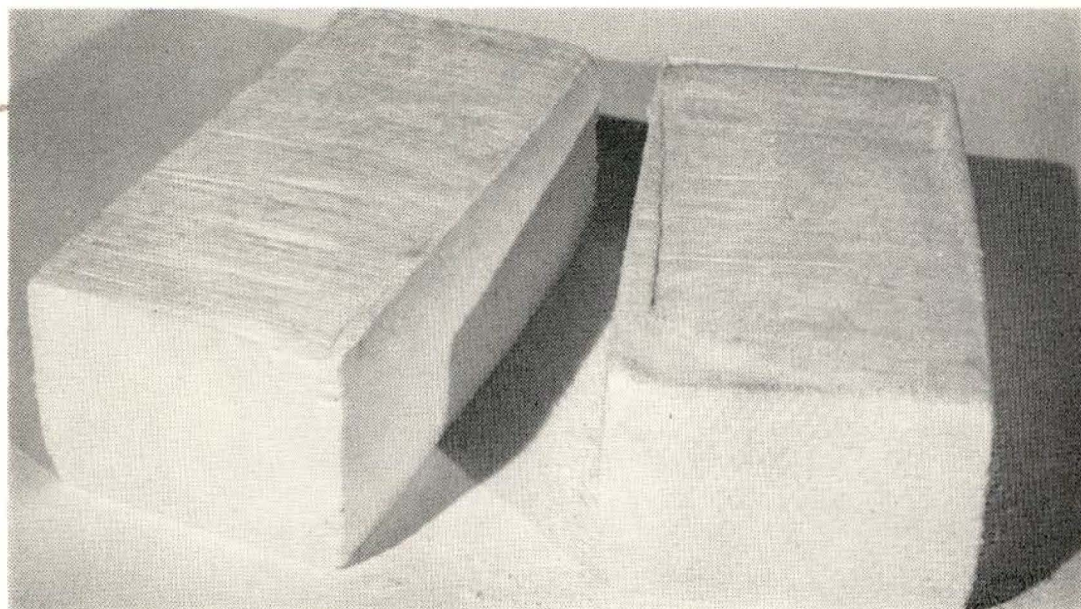
The five to six pound cheese can be cut into smaller units, if desired, when curd is draining. Each portion is then handled as outlined. This entails more labor and results in a more costly item, but may be found desirable for local trade, especially one which has not been familiar with cheese of this type. Plate 12.

The yield of cheese is approximately nine and one-half pounds per 100 pounds of 3.5 percent milk.

### **Limburger Brick**

A cheese made by the brick method, but modified slightly so it will develop a slightly more moist bodied cheese and a Limburger like flavor, is sometimes called Limburger Brick.

A similar cheese called Weisslacker, so named because of its white smeary lustrous surface, originated in Bavaria. A well ripened cheese



**Plate 12.** This picture shows a loaf of Brick cheese after curing.



of this type in some localities of this country is sold under the trade mark as Bierkäse.

### **Making Limburger Brick**

The milk used in the manufacture of this cheese is the same type as used for brick cheese. It is set, cut, and cooked in the same manner. The curd should be dipped into the hoops a little softer than for brick and probably will not need the weight of a brick to press it.

Turning, salting, and piling on the table are the same, but the cheese is not washed. The smeary surface growth is encouraged by daily handling and rubbing with the hands. After a week the cheeses are separated and cured in a moist room at approximately 53° F. They are turned frequently and wrapped in parchment or parchment lined foil after two months. The flavor is well developed in three to four months time.

The yield is ten and one-half to eleven pounds of cheese per 100 pounds of milk and the cheese is relished by many customers. A separate curing room is necessary as the odor of ripening cheese is not suitable for other dairy product storage.

### **CONCLUSION**

It is believed that the small milk plant can, if it so desires, find a profitable outlet for surplus milk by producing a limited amount of the types of cheese described.

By simplifying the equipment as much as possible very little will be needed.

The main item of expense will be the care of cheese during ripening. The success of the project will depend upon the interest of the operator and the interest of the consuming public. If these could be brought together a profitable outlet for surplus milk could result.

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