CIHM
Microfiche
Series
(Monographs)

ICMH
Collection de
microfiches
(monographies)

Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

Technical and Bibliographic Notes / Notes techniques et bibliographiques

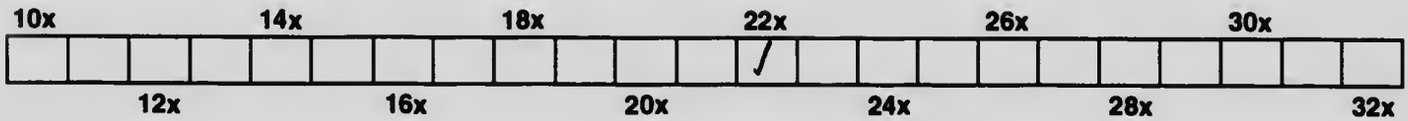
The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming are checked below.

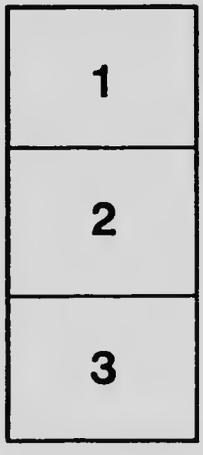
- ☐ Coloured covers / Couverture de couleur
- ☐ Covers damaged / Couverture endommagée
- ☐ Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- ☐ Cover title missing / Le titre de couverture manque
- ☐ Coloured maps / Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- ☑ Bound with other material / Relié avec d'autres documents
- ☐ Only edition available / Seule édition disponible
- ☑ Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- ☐ Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from filming / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- ☐ Additional comments / Commentaires supplémentaires:

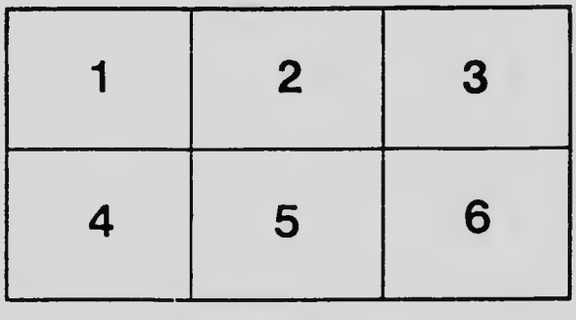
L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☐ Coloured pages / Pages de couleur
- ☐ Pages damaged / Pages endommagées
- ☐ Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- ☑ Pages discoloured, stained or foxed / Pages décolorées, tachetées ou piquées
- ☐ Pages detached / Pages détachées
- ☑ Showthrough / Transparence
- ☑ Quality of print varies / Qualité inégale de l'impression
- ☐ Includes supplementary material / Comprend du matériel supplémentaire
- ☐ Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image / Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
- ☐ Opposing pages with varying colouration or discolourations are filmed twice to ensure the best possible image / Les pages s'opposant ayant des colorations variables ou des décolorations sont filmées deux fois afin d'obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below / Ce document est filmé au taux de réduction indiqué ci-dessous.

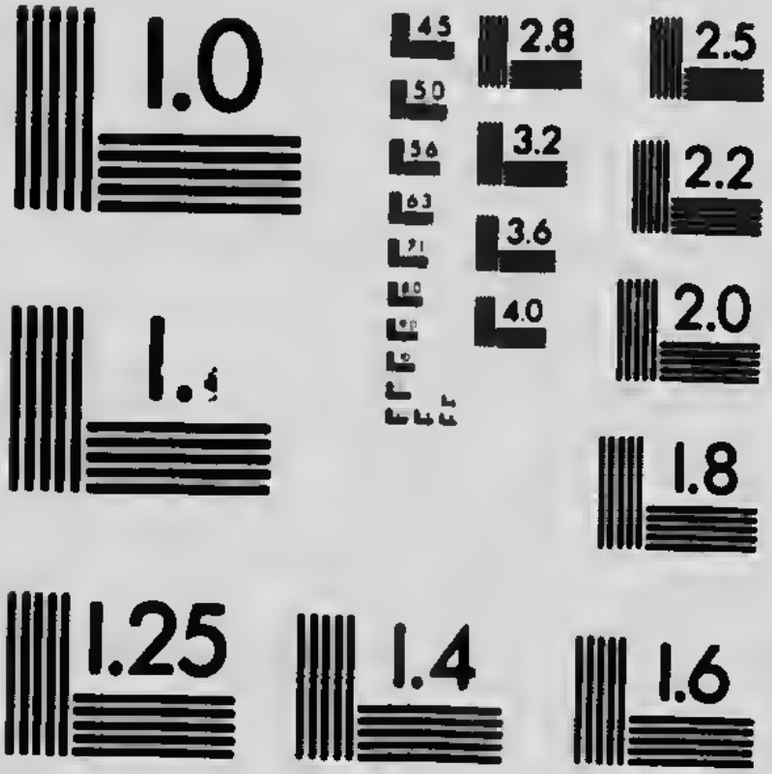






MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



APPLIED IMAGE Inc

1653 East Main Street
Rochester, New York 14609 USA
(716) 482 - 0300 - Phone
(716) 288 - 5989 - Fax

ONTARIO AGRICULTURAL COLLEGE

BULLETIN 121.

RIPENING OF CHEESE IN COLD-STORAGE

COMPARED WITH

RIPENING IN THE ORDINARY CURING-ROOM.

—BY—

PROFS. H. H. DEAN, F. C. HARRISON, AND R. HARCOURT.

ONTARIO AGRICULTURAL COLLEGE, GUELPH.

PUBLISHED BY
THE ONTARIO DEPARTMENT OF AGRIC LTURE, TORONTO.
TORONTO, ONT., JUNE, 1902.

BULLETIN 121. JUNE 1902.

Ontario Agricultural College and Experimental Farm.

RIPENING OF CHEESE IN COLD-STORAGE COMPARED WITH RIPENING IN THE ORDINARY CURING-ROOM.

By Profs. H. H. Dean, F. C. Harrison, and R. Harcourt.

Since the British market demanded a "fatter" cheese, or a cheese with softer body and texture, Canadian cheesemakers have been endeavoring to meet the demand with indifferent success, because the average ripening (or curing) room at the factory is not adapted to holding such cheese for any length of time. In hot weather, the temperature rises in the ripening-room with the rise of temperature outside. As a consequence, the cheese "go off" in flavor, and in many cases develop a mealy texture. To overcome these difficulties, better constructed ripening-rooms and better means of cooling them have been advocated, and improvements in these directions have been made by a number of factories: but the majority are not yet in a position to make cheese with softer body. The labor of bringing ice to the ripening-room and putting it into the ice-boxes makes this method very expensive. The sub-earth duct has given fairly good satisfaction as a means of cooling the air in a properly insulated room; but it does not maintain the temperature much below 65° to 70° F.

[illegible] there has been a movement in favor of central, or consolidat[illegible] orage ripening (curing) stations. This plan has at least two th[illegible] ommend it: (1) it keeps the cheese safe from the effects of hea[illegible] enables buyers to do their work at very much less expense for inspecting the cheese. The disadvantages are: (1) the expense of operating such stations; (2) the expense of shipping to them; and (3) the fact that, under such a system, the cheese are to some extent out of the hands of the salesmen—though there is no reason why one salesman should not act for several factories, instead of each factory having a salesman as at present. Co-operation and consolidation should be the watchwords of modern dairy enterprises. Too many small, poorly equipped factories which compete with one another for the small amount of milk in the locality, are a great injury to the Canadian cheese trade. Though we may not have co-operation and consolidation in manufacture for some time, there is no reason why we should not at once have co-operation and consolidation in ripening and selling. If this is secured the principle will probably extend to the manufacture before long.

It is estimated that the saving in loss of weight during ripening, and the improved quality and yield of the cheese, will more than pay the extra cost of maintaining central cold-storage stations. At present, we are not prepared to say that *all* cheese should be ripened in cold-storage; but we certainly think that cheese made during the hot weather, say in the months of July and August, should be placed in cold-storage as soon as possible after they are made. Once a week would be a convenient time to send all the cheese made in the hot weather to a cold-storage station. In the case of large factories, and factories not convenient to a central station, it may be advisable to have cold-storage at the factory.

The results which are given in this bulletin are to be considered as preliminary. The work is being carried on during the present year (1902); and a full report of the results will appear next year.

The experiments relating to the effect of ripening (or curing) cheese at a temperature of about 40 degrees F., compared with ripening cheese in an ordinary ripening-room for the whole period, and also compared with ripening for one, two and three weeks in an ordinary ripening-room and then removing to cold storage, began in April, 1901, and were continued each month during the season up to and including the early part of November. The plan of the experiments was to make some cheese each month during the season, rather than a large number of cheese at one period. The number of experiments by months were: April, two; May, four; June, two; July, four; August, three; September, six; October, three, and November, two. The quantity of milk used each time varied from 1,200 to 1,570 lbs., making a total of 37,572 pounds of milk, testing an average of 3.55 per cent. fat for the season. In most of the experiments, five flat Cheddar cheese were made from each curd. In a few cases, only four cheese were made out of the vat of milk. These cheese were marked A, B, C, D, and E, and were carefully weighed when taken from the hoops.

The A cheese were put directly into ice cold-storage, where the temperature averaged 37.8°F., and the per cent. of humidity averaged 91.6° for the season. The extreme variation in the monthly average temperature of the cold-storage from April to November was 4°, and the variation in the humidity was but 4 per cent.

The other five cheese were put into the ripening-room, and transfers were subsequently made from the ripening-room to cold-storage as follows. The B cheese, at the end of one week; the C cheese, at the end of two weeks, and the D cheese, at the end of three weeks. The E cheese were left in the ripening-room and ripened in the ordinary way at an average temperature of 63.8° F. for the season. The average per cent. of humidity in this room was 79.1 for the season. The average monthly variations in the temperature of this room were from 68.6° in July to 58.7° in November. The humidity varied from 84.3 per cent. in August to 73.7 per cent. in October. The temperature of the air outside averaged

56.9° for the season The average maximum temperature outside ranged from 85.8° in July to 39° in November.

The average minimum outside temperature ranged from 59.6° in July to 24° in November. The month of July was the hottest month of the season. August was next with maximum and minimum averages of 79.7° and 56.3°. June averaged 77.4° and 53.5°, for maximum and minimum temperatures.

The Acidity of the Milk, Whey and Cheese.

The milk used in the experiments was partly from our own herd and partly from patrons in the neighborhood of the College, and did not differ materially from milk supplied to ordinary cheesemakers.

The amount of acid in the milk at the time of setting, in the whey at various stages in the process of manufacture, and in the cheese while curing, was determined by means of a one-tenth normal solution of pot-ash, using phenolphthalein as an indicator. While it is known that the acidity determined in this way is partly due to acid salts and casein, the usual practice was followed of reporting it in terms of lactic acid. The average percentage of acid arrived at in this way in the milk at the time of adding the rennet, was .167. The whey at the time of dipping averaged .154, or slightly less than the milk. The whey, at the time of milling, salting and pressing, contained respectively an average for the season of .689, .924 and .860 per cent. of acid. The extreme variations in the acid of the milk were .153 to .189; in the whey at dipping, .135 to .189; at milling, .612 to .756; at salting, .855 to .990; at the time of putting to press, which was about one-half hour after the time of salting, .756 to .999. In some tests made of the whey pressed from the cheese, about one and three-quarters hours after salting, or at the time of "dressing," the percentage of acid had increased to nearly the same point as when salted, or an average of .868 per cent. The addition of salt to the curd reduced the percentage of acid in the whey. This was probably due to the expulsion of moisture from the curd by the salt. No free lactic acid was found in the cheese, yet the percentage of acid (determined by means of one-tenth normal solution of alkali, with phenolphthalein as the indicator, and calculated as lactic acid) gradually increased until it reached 1.6. Lot A, which was ripened entirely in cold-storage, developed acid more slowly than lot E.

Among other changes that take place during the ripening process, casein is rendered soluble; and in order to compare the rate at which this change is brought about in the two methods of ripening, the amount of casein which had become soluble in water was determined in a number of the cheese marked A and E.

In E cheese, about 20 per cent. of the casein was rendered soluble in between five and six weeks; and it required between five and six months for the casein in the A cheese to reach the same degree of solubility. It appears that cheese kept in a ripening-room at a temperature

of 60 to 65 degrees will ripen as much in one week as cheese in cold-storage, at a temperature of 38 to 40 degrees, will ripen in one month.

The most notable fact in the bacterial content of Cheddar cheese, is the very large numbers of lactic acid bacteria that are present. These bacteria are most numerous at the time the cheese comes from the press, and from then on their numbers gradually decrease. Others that are usually present, but in smaller numbers, are gas-producing and digesting bacteria, which have an injurious effect in the process of ripening.

In the cold-storage cheese, the lactic acid bacteria were the predominant species present, and they lived for a considerably longer time in the cold-storage cheese than in the cheese kept in the ordinary ripening-room. The decrease in the number of bacteria in cold-storage cheese, compared with the decrease in the number in cheese in the ordinary ripening room, may be graphically shown as in the following diagram:

Cheese A and E, both made from the same curd.
——— refrigerator cheese.
•••••• ordinary curing room cheese.
The numbers on top line represent age in days.

From this diagram it will be seen that on the 86th day the cold-storage cheese contained about ⅞ths of the total number of lactic acid bacteria found in it at the first analysis, whilst the ordinary ripening-room cheese contained only 1/40th of the total number. The significance of this fact is that there is little chance for undesirable bacteria to produce bad flavors in the cold-storage cheese owing to the large number of the lactic acid bacteria, the pronor[illegible] of the lactic acid bacteria to certain undesirable kinds being much greater than is usual under ordinary conditions.

This point was well brought out by a series of cheese made early in the season. The ripening-room cheese was not of good flavor. Certain undesirable bacteria were present, and the ratio between the lactic acid bacteria and the undesirable ones was found to be as follows: on the

first day, 97 : 1 ; on the 14th day, 85 : 1 ; and on the 30th day, 47 : 1. On the other hand, the ratio in the refrigerator cheese was on the first day, 97 : 1, and on the 49th day about the same.

If these results are confirmed, they will be of much importance, because they tend to show that undesirable bacteria are unable to grow and give trouble in refrigerator cheese; and hence cheese in cold storage will not likely be of any worse flavor when ripened than when it was put in the storage room; and it is altogether probable that the cheese ripened in this way will not go "off" in flavor after it is taken out of the refrigerator, owing to the large number of desirable (or lactic acid) bacteria compared with the undesirable ones.

Loss of Weight in Ripening.

The cheese put directly into cold-storage from the hoops (av. temp. 37.8° F.) lost an average of 2.1 per cent. in one month. Those put for one week into an ordinary ripening-room and then put into cold-storage lost 2.8 per cent. Those placed in cold-storage at the end of two weeks lost 3.2 per cent. in a month, and those put in at the end of three weeks lost 3.6 per cent. in the same time. Those allowed to remain in the ordinary ripening-room (average temperature 63.8°) lost 4.4 per cent. in one month. These percentages are greater than would occur with large cheese, as the cheese experimented with weighed only about 30 pounds each. However, the relative losses in weight during the ripening are fairly well expressed by the figures given. Cheese ripened at an average temperature during the season of 63.8° lost in one month more than twice as much as did smaller cheese put directly from the hoops into cold-storage at an average temperature of 37.8°. The saving in loss of weight from placing in cold-storage at the end of one week was 1.6 per cent.; at the end of two weeks, 1.2 per cent., and at the end of three weeks, 1.8 per cent.

The saving in weight from placing in cold storage at the end of one week would be at least ten pounds of cheese in a factory making ten ordinary cheese per day—say $1 per day when the price of cheese is 10 cents per pound.

Quality of the Cheese.

All the cheese were scored according to the following scale of points: Flavor, 40; closeness, 15; even color, 15; texture, 20; finish, 10; total, 100. They were scored ten points for finish, in order to make the results more uniform. We are indebted to the following gentlemen for assistance in scoring: R. M. Ballantyne, A. A. Ayer, A. W. Grant, D. M. Macpherson, P. W McLagan, and A. E. Wieland, of Montreal: I. W. Steinhoff, Stratford; J. B. Muir, Ingersoll; A. T. Bell, Tavistock, and G. H. Barr, Stratford.

The following table shows the average of the first scorings, and of all scorings made by months and for the full season:

Scorings of the Cheese.

Cheese.	Scoring.	Flavor. (Max. 40.)	Closeness. (Max 15.)	Even color. (Max 15.)	Texture. (Max. 20.)	Total. (Max. 100.)
April :		Av.	Av.	Av.	Av.	Av.
A.	1st scores ..	37.0	15.0	15.0	18.0	95.0
	All " ..	35.7	14.7	14.2	17.6	92.3
B.	1st scores ..	37.0	14.5	15.0	18.0	94.5
	All " ..	35.5	14.6	14.1	17.4	91.5
C.	1st scores ..	35.5	15.0	15.0	19.0	94.5
	All " ..	34.5	14.7	14.1	17.4	90.7
D.	1st scores ..	39.0	15.0	15.0	19.0	98.0
	All " ..	35.8	14.3	14.1	17.7	91.9
E.	1st scores ..	34.5	14.0	14.5	16.5	89.5
	All " ..	25.6	14.1	11.5	15.5	76.7
May :						
A.	1st scores ..	37.3	15.0	14.8	18.3	95.4
	All " ..	36.1	14.7	14.1	17.9	92.9
B.	1st scores ..	37.5	14.5	14.3	18.3	94 6
	All " ..	35.9	14.4	13.7	17.8	91.8
C.	1st scores ..	37.5	14.8	14.8	18.5	95.6
	All " ..	35.4	14.5	13.8	17 5	91.2
D.	1st scores ..	37.8	14.8	14.5	18.0	95.1
	All " ..	35.8	14.4	13 8	16.9	90.9
E.	1st scores .	32.3	13.5	14.0	16.3	89.1
	All " ..	33.9	13.9	13.9	16.2	87.9
June :						
A.	1st scores ..	33.5	14.8	14.5	17.5	90.3
	All " ..	33.5	14.8	14.5	17.4	90.2
B.	1st scores ..	33 3	14.1	14.3	16.8	88.5
	All " ..	34.3	14.5	14.1	17.1	90.0
C.	1st scores ..	33.3	13 9	14.3	16.8	88.3
	All " ..	34.0	14 0	14.0	17.3	89.3
D.	1st scores ..	33.5	13.3	13 8	16.8	87.4
	All " ..	34.1	13.8	13.9	17.1	88.9
E.	1st scores ..	33.0	14 3	14.4	15 5	87.2
	A l " ..	31.6	14.1	14.0	15.2	84.9
July :						
A.	1st scores ..	35 2	14.5	14.5	17.4	91.6
	All " .	35.5	14.4	14.6	17.5	92.0
B.	1st scores .	35 6	14.2	14.2	16.8	90.8
	All " ..	35.8	14.3	14.4	17.1	91.6
C.	1st scores ..	35.7	14.1	14.1	17.2	91.1
	All " ..	35.9	14.1	14.3	17.2	91.5

SCORING OF THE CHEESE.—*Concluded.*

Cheese.	Scoring.	Flavor. (Max. 40.)	Closeness. (Max. 15.)	Even color. (Max. 15.)	Texture. (Max. 20.)	Total. (Max. 100.)
July :		Av.	Av.	Av.	Av.	Av.
D.	1st scores ..	35.9	13.9	14.0	17.1	90.9
	All " ..	36.0	14.1	14.2	17.1	91.4
E.	1st scores ..	33.7	13.6	14.0	15.7	87.0
	All " ..	33.4	13.7	13.9.	15.9	86.9
August :						
A.	1st scores ..	36.3	14.3	15.0	17.7	93.3
	All " ..	36.2	14.4	15.0	18.2	93.8
B.	1st scores ..	36.3	13.3	15.0	17.7	92.3
	All " ..	36.6	13.8	15.0	18.4	93.8
C.	1st scores ..	35.0	14.3	14.6	17.7	91.6
	All " ..	35.2	14.2	14.6	17.8	91.8
D.	1st scores ..	35.7	13.7	14.6	17.3	91.3
	All " ..	35 8	14.0	14.6	17.6	92.0
E.	1st scores ..	34.7	14.0	14.3	17.0	90.0
	All " ..	35.0	14.0	14.3	17.3	90.6
September :						
A.	1st scores ..	36.5	14.3	14.8	18 8	94.4
B.	" ..	36.2	14.6	14.6	18.7	94.1
C.	" ..	35.7	14.5	14.6	18 2	93.0
D.	" ..	35.8	14.0	14.5	18.0	92.3
E.	" ..	32.2	13.6	13.8	16.8	86.4
October :						
A.	1st scores ..	37.7	13 6	14 0	19.0	94.3
B.	" ..	35.3	13.3	13.3	18.1	90.0
C.	" ..	36.3	13.0	13.3	18.0	90.6
E.	" ..	28.3	13.7	11.3	17.0	80.3
November :						
A.	1st scores ..	36.5	14.5	14.0	18.5	93.5
B.	" ..	36.0	13.0	14.0	18.0	91.0
C.	" ..	36.5	13.0	13.0	18.0	90.5
E.	" ..	26.5	14.0	12.5	16.5	79.5
Average for season :						
A.	1st scores .	36.0	14.5	14.5	18.0	93.0
	All " ..	35.7	14.5	14.3	17.9	92.4
B.	1st scores ..	35.7	14.1	14.3	17.6	91.9
	All " ..	35.6	14.3	14.1	17.6	91.6
C.	1st scores ..	35.6	14.1	14.2	17.7	91.6
	All " .	35.2	14.2	14.0	17.5	90.9
D.	1st scores ..	35 8	13.9	14.2	17 4	91.3
	All " ..	35.4	14.1	14.0	17.2	90.7
E.	1st scores ..	32.7	13.7	13.7	16.3	86.4
	All " ..	31.7	13.9	13.4	16.0	85.0

The cheese made during April, May, June, July, and August were scored several times during the year, some as late as January 18th, 1902. All the cheese made during September, October and November were scored but once, when three to four months old. The first scoring of the cold-storage cheese was usually made when they were three to four months old. The cheese made from April to August and ripened in the ordinary room were scored the first time when six weeks to two months old. They were scored at intervals of about one month after the first scoring until it was considered there would be no advantage in keeping them for a longer time.

Cheese Sent to Montreal.

Four cheese, made on July 8th, were sent to Montreal to be scored by cheese merchants in that city. Mr. R. M. Ballantyne, of the firm of Lovell & Christmas, very kindly took charge of the cheese, which were scored by leading men in the trade. The scoring was done on November 11th, when the cheese was four months old. When their scores were all averaged, the cheese put directly into cold-storage from the hoops scored an average of 92.1 points. The cheese put into cold-storage at the end of a week scored 89.8 points; the one put into cold-storage at the end of two weeks scored 84.8; and the one placed in storage after being in an ordinary ripening-room for three weeks scored an average of 80 points. The scorers were not told which cheese were put directly into cold-storage until after their score-cards were marked.

Mr. Ballantyne reported as follows: "They (the merchants) universally expressed surprise at the condition of the cheese that were put into cold-storage at the earliest period, as they expected to find the cheese still in a curdy condition, and probably with a bitter flavor It would appear from these as if cheese held in cold-storage from the time of manufacture would give better satisfaction than if held for some time in the ordinary curing-room before being put into cold-storage."

Writing further on the 15th November, Mr Ballantyne says, "If this experiment is borne out by other experiments, it would appear as if the best way to handle hot weather cheese would be to ship them directly after making to the cold-storage, and this would certainly mean a great revolution in the trade."

White Specks in the Cheese.

At the time of filling the ice-house of the refrigerator in which the cheese were stored, the temperature went as low as 10° and the cheese were frozen This caused the cheese then on hand to become crumbly in nature, and some time after white specks, or what looked like curdy matter, appeared in the cheese. The cheese on hand at the time of writing (April 20th, 1902,) still have the white specks. Just when the specks

appeared we are unable to say, but they were not noticed in the cheese until after they were frozen. The specks were found in cheese which had been moved from the cold-storage to a warmer room, and also in the cheese which had not been moved from cold-storage.

Possibility of Increased Yield of Cheese.

In addition to a saving of at least 2 per cent. in shrinkage, the adoption of a lower temperature for ripening cheese points to the possibility of obtaining a greater yield of cheese by cooking at a lower temperature and stirring the curd less. If such cheese are ripened in an ordinary room, they are likely to develop too much acid and be "short" and "mealy" in texture. By ripening them at 40° to 50° no such mealiness is observed, and the extra yield of cheese is equal to about one and one-quarter pounds per 1,000 lbs. of milk. If further experiments confirm these results, it means a large increase in the returns to cheese factory patrons.

Conclusions.

1. An ice cold-storage chamber, with circulation of air, may be maintained at a temperature of about 40° without moving the ice, if the building is well insulated.

2. The high percentage of moisture, 91.6 per cent., in the cold-storage made the conditions favorable for the growth of mould; yet the mould was no worse on the cheese in the refrigerator than on the cheese in the ordinary ripening-room. In both places the mould was kept in check by the use of a solution of formalin sprayed on the cheese with a hand spray-pump.

3. The acidity of the whey increased up to the time of salting the curd, when it decreased, and then increased again.

4. The saving of loss in weight by ripening at an average temperature of 37.8° for the season was over 2 per cent on cheese weighing about 30 pounds each. This is a very important item in a large factory, and would alone pay the cost of cold-storage for cheese in hot weather.

5. The quality of the cheese was in the order of placing in the cold-storage as regards time—that put in directly from the hoops standing first. *Uniformity* of quality in all the cheese placed in cold-storage was the chief point noticed.

6. An increased yield of cheese equal to at least one pound of cheese per 1,000 pounds of milk may be looked for as a result of modifying the method of manufacture and ripening at a lower temperature than has been commonly supposed necessary.

7. It has been claimed that cheese kept in cold-storage for any length of time will spoil quickly when exposed to an ordinary temperature. Such results were not observed in the experiments conducted, nor are

they likely to occur when the cheese have been ripened for the whole period at a moderately low temperature. Further experiments are being made to settle this point.

8. A cheese put directly from the hoop into a dry box and placed in cold-storage, without any turning, ripened satisfactorily. The chief defect was in the large amount of mould on the cheese. A cheese put into a box after ripening in the ordinary room for a week gave similar results. Two cheese made from the same vat of milk as the cheese put into the cheese-boxes, were placed on a shelf in the cold-storage, and the quality was similar to that put directly into a box from the hoop, and to that put into a box at the end of one week. The cheese-boxes should be well seasoned, if the cheese are not to be removed from the boxes. We would also advise spraying the inside of box, and soaking the scale-boards with formalin, to prevent mould.

9 Undesirable bacteria such as are found in cheese seem unable to grow at a temperature of 38° F., and consequently bad flavors in cheese, caused by bacteria, do not increase in cold-storage.

10. The long life of the lactic acid bacteria in cheese seem to have an important bearing on the question of ripening, checking the development of bacteria which produce bad or undesirable flavors.

11. The temperature at which cheese will cure best is not yet settled. There are involved in the question many points which require further investigation.