

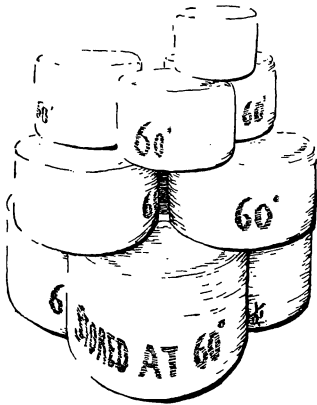
POPULAR EDITION.

BULLETIN No. 234.

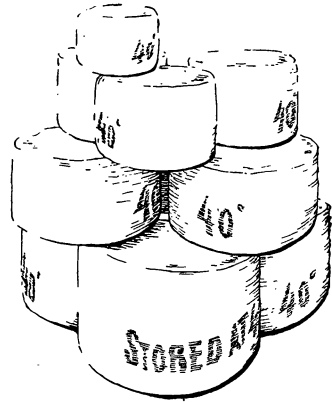
JULY, 1903.

# New York Agricultural Experiment Station.

GENEVA, N. Y.



\$11.69 PER 100 LBS.



\$12.77 PER 100 LBS.

## COLD CURED CHEESE. II.

F. H. HALL, L. L. VAN SLYKE, G. A. SMITH AND E. B. HART.

PUBLISHED BY THE STATION.

## BOARD OF CONTROL.

GOVERNOR BENJAMIN B. ODELL, JR., Albany.  
STEPHEN H. HAMMOND, Geneva.  
FREDERICK C. SCHRAUB, Lowville.  
LYMAN P. HAVILAND, Camden.  
EDGAR G. DUSENBURY, Portville.  
JENS JENSEN, Binghamton.  
THOMAS B. WILSON, Halls Corners.  
IRVING ROUSE, Rochester.  
MILO H. OLIN, Perry.  
CHARLES W. WARD, Queens.

## OFFICERS OF THE BOARD.

STEPHEN H. HAMMOND,  
*President.*

WILLIAM O'HANLON,  
*Secretary and Treasurer.*

## EXECUTIVE COMMITTEE.

STEPHEN H. HAMMOND,  
FREDERICK C. SCHRAUB,

LYMAN P. HAVILAND,  
\_\_\_\_\_,  
THOMAS B. WILSON.

## STATION STAFF.

WHITMAN H. JORDAN, Sc.D., *Director.*

GEORGE W. CHURCHILL,  
*Agriculturist and Superin-*  
*tendent of Labor.*

JOHN F. NICHOLSON, M.S.,  
*Assistant Bacteriologist.*

WILLIAM P. WHEELER,  
*First Assistant (Animal*  
*Industry).*

GEORGE A. SMITH,  
*Dairy Expert.*  
FRANK H. HALL, B.S.,  
*Editor and Librarian.*

FRED C. STEWART, M.S.,  
*Botanist.*

†VICTOR H. LOWE, M.S.,  
*Entomologist.*

HARRY J. EUSTACE, B.S.,  
*Assistant Botanist.*

HOWARD O. WOODWORTH, M.S.,  
*Assistant Entomologist.*

LUCIUS L. VAN SLYKE, Ph.D.,  
*Chemist.*

SPENCER A. BEACH, M.S.,  
*Horticulturist.*

\*WILLIAM H. ANDREWS, B.S.,

VINTON A. CLARK, B.S.,  
*Assistant Horticulturist.*

†CHRISTIAN G. JENTER, Ph.C.,

ORRIN M. TAYLOR,  
*Foreman in Horticulture.*

FREDERICK D. FULLER, B.S.,

\*CHARLES W. MUDGE, B.S.,

†F. ATWOOD SIRRINE, M.S.,  
*Special Agent.*

†ANDREW J. PATTEN, B.S.,

*Assistant Chemists.*

HARRY A. HARDING, M.S.,  
*Dairy Bacteriologist.*

FRANK E. NEWTON,  
JENNIE TERWILLIGER,  
*Clerks and Stenographers.*

ADIN H. HORTON, *Computer.*

Address all correspondence, not to individual members of the staff, but to the  
NEW YORK AGRICULTURAL EXPERIMENT STATION, GENEVA, N. Y.

The Bulletins published by the Station will be sent free to any farmer  
applying for them.

\*Connected with Fertilizer Control.

†Absent on leave.

‡In Second Judicial Department.

POPULAR EDITION\*

OF

BULLETIN No. 234.

---

COLD CURED CHEESE. II.

---

F. H. HALL.

---

**Confirmatory tests on large scale.** In Bulletin No. 184 of this Station, the data are given of some tests in curing cheese at different temperatures in the Station curing rooms. The results of this experiment were so convincing that there has been no hesitation, since that time, in recommending to New York State cheese-makers and cheese-handlers the use of some form of cold storage for ripening cheese. The cheeses in these tests which were cured at 50° F. and lower temperatures were markedly superior in quality to those cured in warmer rooms.

These tests, and others elsewhere made, were so striking that Maj. H. E. Alvord, Chief of the Dairy Division, Bureau of Animal Industry, U. S. Department of Agriculture, determined to repeat them, in part, on a commercial scale so that the benefits of cold curing might be shown to makers throughout the whole United States as plainly as they had been to makers in New York and Wisconsin. He invited this Station to cooperate with him in the tests and the invitation was accepted.

**Plan of tests.** Arrangements were perfected for the manufacture of cheeses at different factories in New York, Pennsylvania and Ohio, and for storing these cheeses in rooms provided and cared for by the Merchants' Refrigerating Co., of New York City. In October, 1902, six

---

\* This is a brief review of Bulletin No. 234 of this Station, on Experiments in Curing Cheese at Different Temperatures (in cooperation with the U. S. Department of Agriculture), by L. L. Van Slyke, G. A. Smith and E. B. Hart. Any one specially interested in the detailed account of the investigations will be furnished, on application, with a copy of the complete bulletin. The names of those who so request will be placed on the Station mailing list to receive future bulletins, popular or complete as desired. Bulletins are issued at irregular intervals, as investigations are completed, not monthly.

lots of cheese aggregating nearly 32,000 lbs., were placed in storage at 40° F., 50° F., or 60° F. About two-thirds of the amount went into the 40° room, two-thirds of the remainder into the 50° room, and the balance into the 60° room. Each lot of cheese was made at a single factory, under uniform conditions of manufacture, and cheeses from each lot were kept at each of the three temperatures. The cheeses were mostly of large size—export cheeses,—but two lots were of medium sized cheeses and part of one lot of small size; so that the influence of the size of the cheese upon curing could be determined. One lot was also used to study the effect of covering cheese with paraffin, since half the cheeses of this lot were so treated, half left in the usual condition.

The test was continued until June 1, 1903,—about 8 months—and the cheeses were weighed, scored, and sampled for chemical analysis when stored and when 20 weeks old, 28 weeks old and 35 weeks old.

Two lots of the cheese, probably owing to lateness of the season, were not of the best quality when put into storage, but the others scored well when examined by the three well-known New York experts who were selected to do this work.

The cheeses cured at 60° had to be sold when 20 weeks old as they then began to show signs of falling off in quality. Those kept at 50° were sold when 28 weeks old though still in good condition, some of them better than at 20 weeks. Those cured at 40° were excellent at 35 weeks, several of them showing their highest scores at this age.

“Almost without exception the cheese cured at lower temperatures was superior in quality to that cured at higher temperatures. Cheese cured at 40° usually scored higher than that cured at 50°, and the cheese cured at 50° scored higher, in every instance, than that cured at 60°.” The average scores at the different temperatures are: At 40° F., 95.7; at 50° F., 94.2; and at 60° F., 91.7. It will be seen from these averages that the depreciation in quality with the increase of temperature is marked; and that it is much greater between 50° and 60° than between 40° and 50°. In other words,

to secure good results in curing cheese, the temperature of the curing room should be  $50^{\circ}$  or below.

The experts were requested to place commercial valuations upon the different lots of cheese, based on the results of their scoring. The valuations given ranged from  $11\frac{3}{4}$  cents a pound to  $14\frac{3}{4}$  cents.

The experts' figures, averaged for the cheeses at different temperatures, show that, at the end of 10 weeks, the cheese cured at  $40^{\circ}$  was worth  $12\frac{1}{2}$  cents a hundred more than that cured at  $50^{\circ}$  and 35 cents more than that at  $60^{\circ}$ ; and at the end of 20 weeks the differences were  $22\frac{1}{2}$  and 60 cents respectively.

At the end of 28 weeks the cheese cured at  $40^{\circ}$  was worth 20 cents a hundred more than that cured at  $50^{\circ}$ .

**Quantity.** But improvement in quality, though the only point brought out in Bulletin No. 184, is not the only gain, nor indeed is it the greatest gain, from cold storage. The loss of weight of the stored cheese is much less at low temperatures. At the end of 20 weeks the cheese kept at  $40^{\circ}$  had lost 3.8 lbs. for each 100 lbs. put on the shelves; that kept at  $50^{\circ}$  had lost 1 lb. more; and that kept at  $60^{\circ}$  had lost 7.8 lbs. for each 100 lbs.

**Increased  
market  
value.**

If we combine the improvement in quality with the increase in quantity, we have the true measure of the value of cold curing. Stored at  $60^{\circ}$ , 100 lbs. of cheese, under the conditions prevailing at the time of the experiment, would give a return of \$11.69; stored at  $50^{\circ}$ , \$12.42; and stored at  $40^{\circ}$ , \$12.77. This is a gain of \$1.08 per hundred (more than a cent a pound) from storage at  $40^{\circ}$  rather than at  $60^{\circ}$ , or of 73 cents from storage at  $50^{\circ}$  rather than at  $60^{\circ}$ .

**Influence of  
size of  
cheese.** Other things being equal, the larger the cheese the smaller in proportion is the loss of weight. That is, there is much less evaporating surface on one 70-lb. cheese than on two 35-lb. cheeses, consequently the larger cheese dries out more slowly. This was shown very clearly in these tests. At a temperature of  $40^{\circ}$  the 70-lb. cheeses lost weight at the rate of  $2\frac{1}{2}$

lbs. per 100 lbs. in 20 weeks, the 35-lb. cheeses lost 3.9 lbs. and the 12½-lb. cheeses lost 4.6 lbs. At a temperature of 60° the loss was greater for all sizes, as already shown, and the differences in shrinkage between the various sizes was also more marked. The 70-lb. cheeses at 60° lost 4.2 lbs. per 100 lbs. in 20 weeks, the 35-lb. size lost 8.5 lbs. and the 12½-lb. size lost 12 lbs.

By paraffining the cheeses much of the loss in **Paraffining.** weight was prevented, especially at the highest temperature; and the quality was improved in some instances,—never lowered.

Half of the cheeses in one lot were dipped in melted paraffin when a few days old and were distributed in the curing rooms at different temperatures, to compare with the other half of the cheeses, which were untreated. The operation of paraffining, which is a very simple and inexpensive one, leaves each cheese coated with a thin layer almost air-tight and water-tight, of a material upon which molds will not grow. Evaporation is thus checked and the cheeses are kept free from mold.

The difference in the scores of paraffined and unparaffined cheeses was slight up to 28 weeks with the cheeses kept at 40° and up to 20 weeks with those cured at 50°; but at 35 weeks with the 40° cheeses and at 28 weeks with those kept at 50°, there was an average difference of one point on the score in favor of those paraffined. At 60° there was an average difference, when the cheeses were 20 weeks old, of 1½ points in favor of paraffining.

When covered with paraffin, the cheeses cured at 40° lost only 0.3 lb. per 100 lbs., those cured at 50° lost only 0.5 lb., and those cured at 60° lost only 1.4 lbs. "In the same kind of cheese not thus covered the loss was much greater at all temperatures. By covering cheese with paraffin, a saving in loss of moisture can be effected amounting to 5 or 6 lbs. per 100 lbs. of cheese at 60° F., and at 50° or below the total loss of moisture can be reduced to less than 1 lb. per 100 lbs. of cheese."

At 40°, the difference in favor of the paraffined cheese, counting both quality and quantity, was 51 cents for 100 lbs. of cheese stored; at 50° the difference is 63 cents; and at 60°, \$1.11. The saving is much greater at higher than at lower temperatures.

If we compare an unparaffined cheese, cured at **Possible gain.**  $60^{\circ}$ , with a paraffined cheese cured at  $40^{\circ}$ ,—which would represent the maximum of influence under the conditions of the experiment—we find a difference of \$1.76 per 100 lbs., or  $1\frac{3}{4}$  cents a pound, in favor of paraffining and low temperature.

**Conclusions.** “ Briefly summarized, the advantages of curing cheese at low temperatures are the following:

“ (1) The loss of moisture is less at low temperatures, and therefore there is more cheese to sell.

“ (2) The commercial quality of cheese cured at low temperatures is better and this results in giving the cheese a higher market value.

“ (3) Cheese can be held a long time at low temperatures without impairment of quality.

“ (4) By utilizing the combination of paraffining cheese and curing it at low temperatures, the greatest economy can be effected.”

## ANNUAL REPORTS FOR DISTRIBUTION.

The Station has in stock a limited number of cloth bound Annual Reports for the years 1892, 1895, 1896, 1898, 1899, 1900 and 1901, which will be sent free to all who apply as long as the supply lasts.