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THE PRODUCTION OF FIRST GRADE CREAM

BY ROY C. POTTS
DEPARTMENT OF DAIRY HUSBANDRY

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The farmers of Oklahoma are invited to ask questions regarding their farm problems, which the Station staff is expected to answer.

Assistance will be freely given whenever it is possible.

Address all correspondence to the Oklahoma Experiment Station, Stillwater, Oklahoma.

THE PRODUCTION OF FIRST GRADE CREAM IN OKLAHOMA

BY ROY C. POTTS

POOR CREAM BRINGS LOW PRICES

The market value of cream depends primarily upon its quality; also the market value of the product manufactured from it. According to statistics of Oklahoma for the year 1914, approximately 95% of the cream produced was manufactured into butter on the farm or in creameries to which it was sold.

Oklahoma has the reputation of producing a very poor quality of dairy butter, and the price received for Oklahoma cream sold to creameries is acknowledged to be the lowest of any State in the Union. The cause of the poor quality of farm-made butter and the low prices received for the cream sold to creameries is generally conceded to be due to the poor quality of cream produced.

BUYING OF CREAM BY GRADE

The buying of cream by grade and the paying of a higher price for the better grades has been ackuowledged to be the only just and equitable method of buying cream. It is evidently unjust to pay the same price for two cans of cream, one of which is sweet, clean-flavored and fine quality, and the other is sour, badly fermented and unwholesome. Cotton, grain and other farm products are today bought and sold according to certain standard grades which have been established. In a number of States standards for grading cream have been adopted and high prices are paid for the better grades of cream. Standards have been adopted in Oklahoma, and a differential of three cents established between first and second grade cream. (A copy of the rules and regulations for buying and selling cream in Oklahoma may be obtained from the State Board of Agriculture at Oklahoma City.)

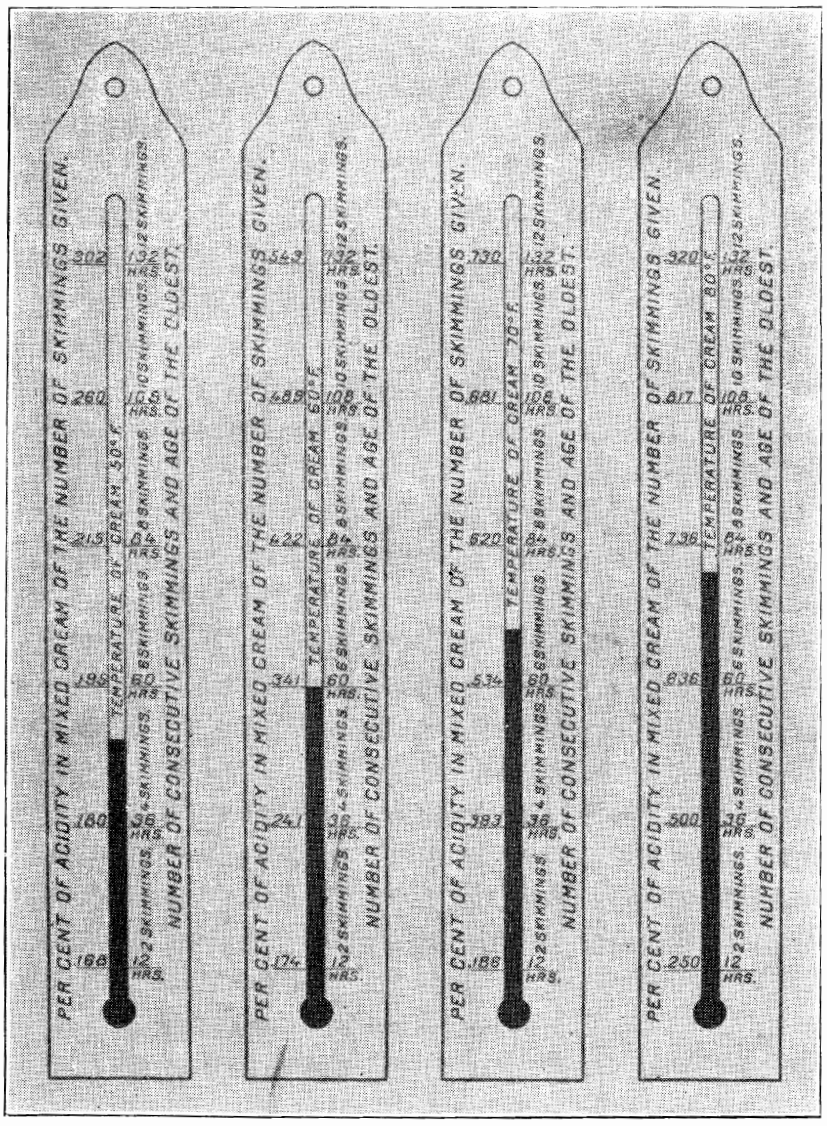
REQUIREMENTS FOR PRODUCING FIRST GRADE CREAM

First Grade Cream, as generally accepted, is cream which has a good, clean flavor, smooth,even texture, is free of foreign material, contains at least 25% butterfat, and not over 4-10 of 1% of lactic acid.

Proper care and handling of the cream, with sanitary methods of production, and the cream screw of the separator set to skim a rich cream, will enable the cream producer to produce a cream which will meet all the requirements of first grade cream except possibly the last.

The development of lactic acid or acidity in cream is due to the bacterial action or chemical changes caused by the growth and development of certain bacteria in the cream. Some forms of bacteria change the milk sugar in milk or cream into lactic acid and thereby the milk or cream becomes sour. Other bacteria produce fermentations which decompose the curd; others develop acids and the butterfat becomes rancid; others produce gas and the cream becomes gassy and foamy. The conditions in cream which hasten the development of lactic acid are temperatures above 60° F., and the presence of dust particles, foreign material, or filth, all of which may contain large

numbers of bacteria. The reverse of these conditions will result in less lactic acid developing. It is unnecessary to describe in detail all that is necessary for the production of clean milk and clean cream. It is sufficient to say that if the milker has clean hands, the cow's udder and teats are clean, the milk pail is clean, and the atmosphere in which the milking is done is free from dust and odors, that clean milk can be produced. If this clean milk is run through a clean separator, clean cream will be obtained. It is entirely possible for any farmer to produce clean cream if he will observe these requirements.



First grade cream should not contain over 4-10 of 1% (.400) lactic acid.

The higher the temperature at which cream is kept, the quicker it will sour and the more frequently it should be delivered to the creamery or churned into butter on the farm.

The thermometer will tell how long the cream may be kept, provided clean methods of production are used.

According to results obtained, cream kept at 80° F. should be delivered daily; cream kept at 70° F. should be delivered every other day; cream kept at 60° F. may be delivered every third day, and cream kept at 50° F. would be sweet if delivered twice a week, and first grade, if delivered every fifth day, or possibly once a week.

LOW TEMPERATURES ABSOLUTELY ESSENTIAL

In the chart shown below on this page, it will be noted that lactic acid developed very rapidly in cream kept at the higher temperatures. Cream kept at 80° F. in the first twenty-four hours developed nearly .7 (7-10) of 1% lactic acid, or became sharply sour, while cream kept at 50° F. was still sweet at the end of thirty-six hours, and at the end of six days contained less than .6 (6-10) of 1% lactic acid. This fact is very interesting, for if cream of a low acidity is to be

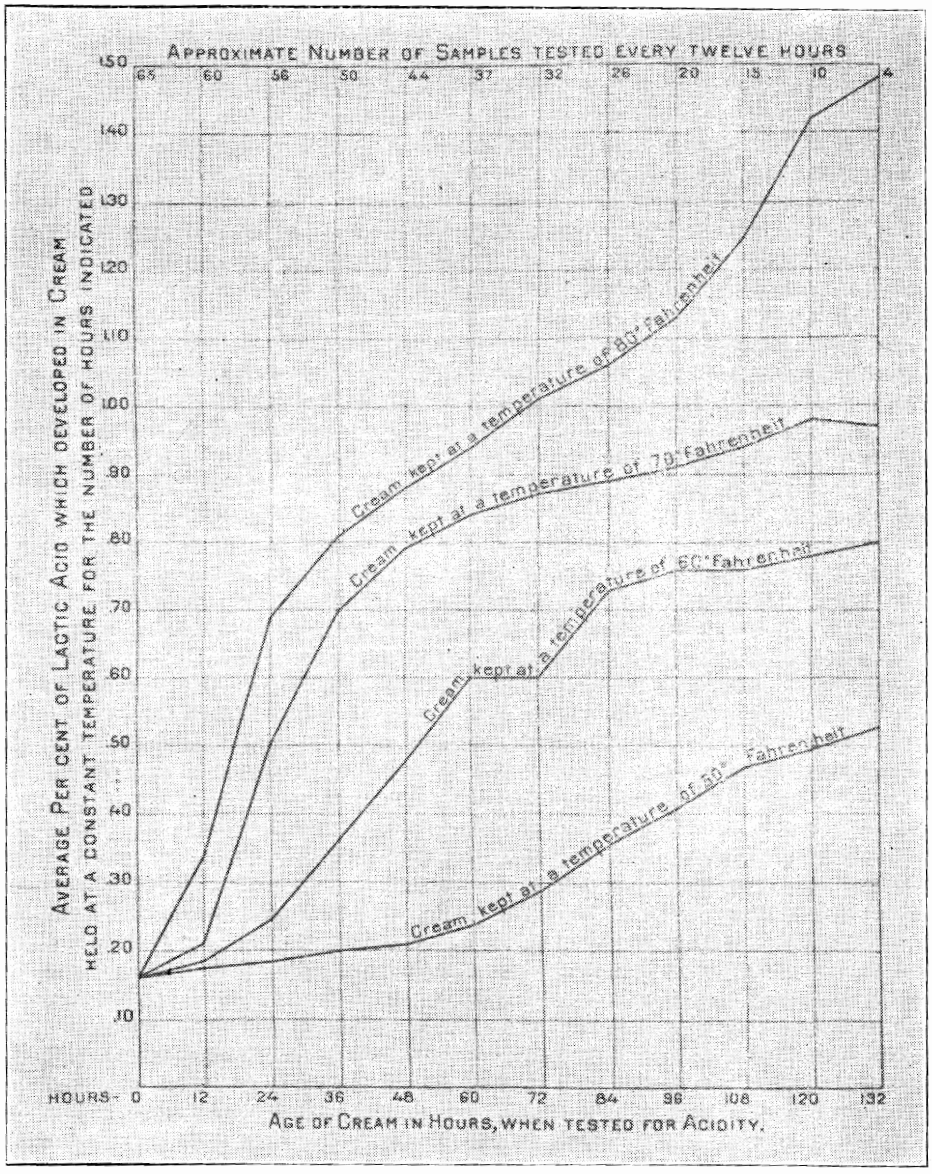


Chart 1—Showing Rate of Development of Acidity in Ordinary Cream

Cream held at low temperature sours very slowly. Note that the development of acidity took place very rapidly in the cream kept at temperatures of 70° and 80° Fahrenheit. This was particularly true during the first twenty-four hours. Cream kept at 50° F. was sweet at the end of thirty-six hours, and at seventy-two hours was slightly sour.

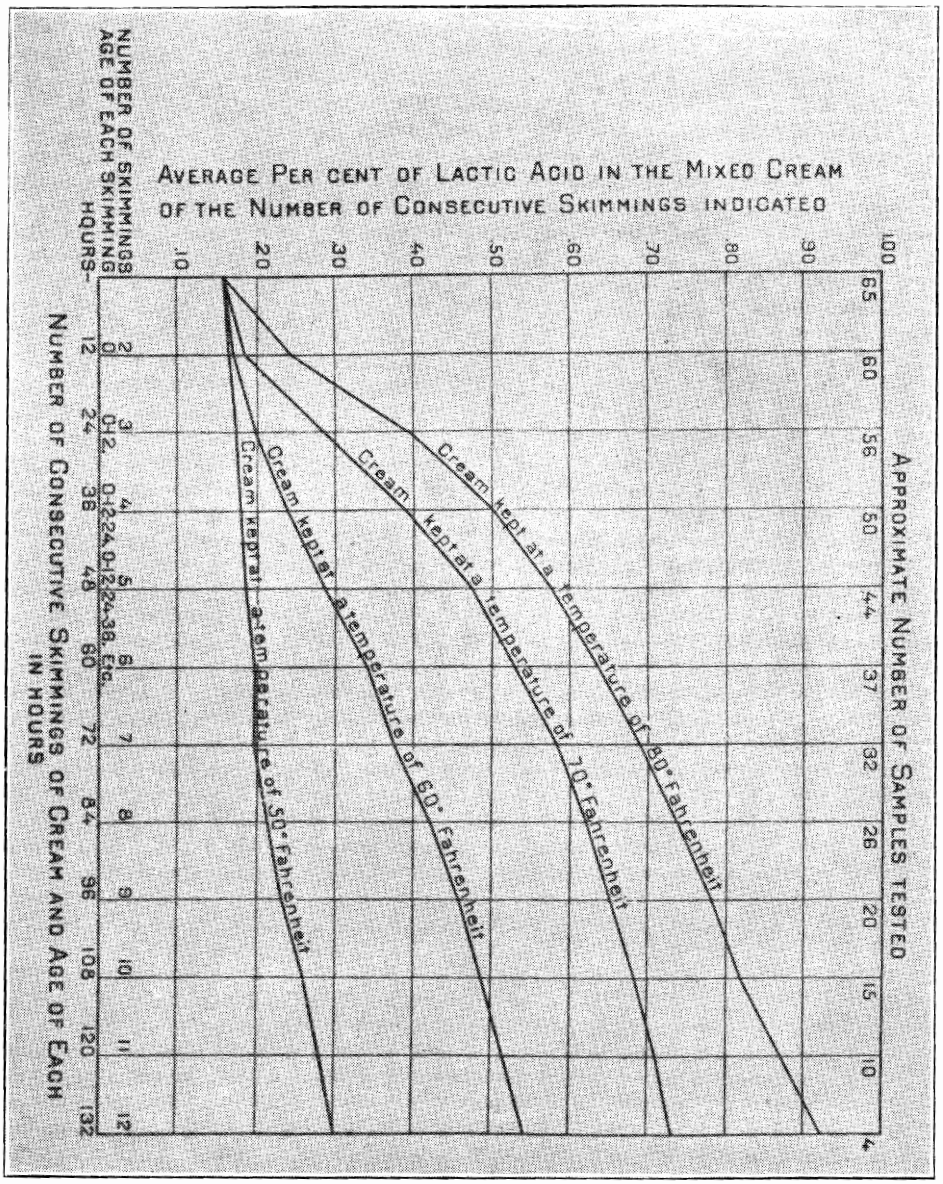


Chart 2—Showing the Acidity of Cream Kept at Different Temperatures (50°, 60°, 70° and 80° F), and Containing a Number of Consecutive Skimmings

Cream containing six consecutive skimmings would on the morning of the last skimming, if kept at 50° F., contain .195% acidity; if kept at 60° F. contain .534% acidity, and at 80° F. could contain .636% lactic acid. (See discussion of this chart in the paragraph entitled, "Acidity of Mixed Cream".

produced, it is evident that the development of acidity must be checked in the fresh cream by cooling it immediately to a temperature near 50° F. To fully emphasize the importance of this point, we repeat—**fresh cream must be cooled to a temperature near 50 Fahrenheit.** If the fresh cream is not cooled immediately and kept separate from the general lot until it is cold, it will raise the temperature of the general lot when it is added and the result will be that the acidity will increase very rapidly. Cream kept at 60° F. will contain .4 (4-10) of 1% acidity in about forty hours, while at 50° F. it would require nearly ninety-six hours to develop nearly the same amount of acidity. These are for single skimmings of cream produced under ordinary sanitary conditions which had been cooled to the desired temperature (50° or60° F.) immediately after skimming and kept at these temperatures throughout the entire time. They were not mixed with any other cream or any other cream mixed with them. The acidity which would exist in the mixed cream each time a fresh skimming was added to the general lot, or of mixed skimmings of different ages, is shown by the chart on page 6.

ACIDITY OF MIXED CREAM

The acidity shown by the chart on page 6 does not run as high as in the chart on page 5. This is because the chart on page 5 shows the acidity of mixed cream of different ages, such as consecutive skimmings of cream for one or more days which have been kept at a uniform or constant temperature. At the end of three days, six skimmings of cream would have been obtained. By reference to the chart, it will be observed that if this cream was kept at 50° F. it would have an acidity of less than .2% lactic acid, or still sweet. At 60° F. it would contain .34% lactic acid and be first grade. At 70° F. it would have an acidity of approximately .53%, and at 80° F. it would contain between .63% and .64% lactic acid. There were thirty-seven trials or lots of mixed cream tested to determine the average acidity of cream of this particular age and temperature. Similar observations for cream containing a different number of skimmings at these temperatures may also be made by a careful inspection of the chart (2). If it is desired to deliver first grade cream, cream kept at a temperature of 80° F. should be delivered every day; cream kept at 70° F. should be delivered every other day; cream kept at 60° F. may be delivered every third day, and cream kept at 50° F. would be sweet if delivered twice a week, and first grade if delivered every fifth day, or possibly once a week.

AGENCIES FOR KEEPING CREAM COLD

The maximum, minimum and average temperature taken at **Stillwater** by the **Agricultural Experiment Station** for each month for the year 1914 was as follows:

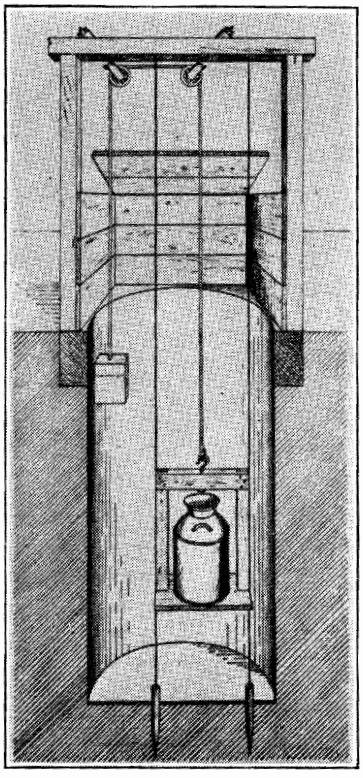
	January	February	March	April	May	June	July	August	September	October	November	December
Maximum	75	76	85	91	87	102	108	101	96	88	83	55
Minimum	16	3	16	23	40	56	67	60	47	28	21	2
Average	41.6	35.3	48.7	57.5	66.2	82	85.9	80.5	75.2	59	52	29.2

From the above data it will be observed that during the months of May, June, July, August and September it is useless to expect to obtain a temperature of 60° F. in the cream when the average monthly atmospheric temperature is considerably higher than this, unless some method of obtaining lower temperatures is used. Caves and cellars are used quite generally as places for keeping cream. They are not subject to such wide fluctuations in the daily temperature as more open and exposed places. By opening the cave at night and closing it during the day, temperatures approximating the minimum atmospheric temperatures may be obtained. Extremely low temperatures cannot be obtained in caves, although they often feel cooler than they actually are. This unusual coolness is due to the dampness which is mistaken for coolness. The cave in winter is, however, a good place to keep cream from freezing, if it is free from foul odors and mould.

Well water is another agent which is used to cool cream and keep cream cold. The temperature of well water in Oklahoma, particularly open, shallow wells, is in the summer usually between 70° and 80° F. In deep wells, temperatures of 60° F., or approximately that, have been found. Where well water of a temperature near 60° F. can be obtained, it should be used as a means of keeping the cream cold, for where cream is kept at 60° F. it may be delivered to the creamery or cream buyer every third day and be first grade.

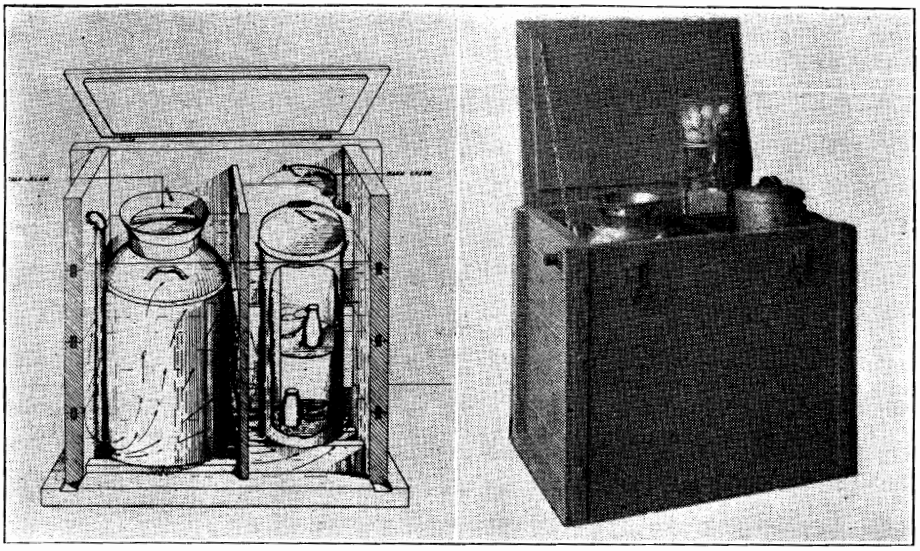
COOLING CREAM WITH WELL WATER

Two methods are employed for cooling cream with well water. One, which is the simplest and most effective where the well is two or more feet in diameter, consists in using a windlass to lower the two cans of cream down into the well, either to the water or near it. The larger can contains the mixed cream from several skimings. It is lowered first and closely following it, and fastened to the same cable, is a smaller can which contains the last skimming. The purpose of the two cans is to keep the fresh cream separate from the older cream until it is cold. Each time a new lot of cream is added to the older cream, it is a good plan to give the mixed cream a thorough stirring or mixing. In this way the cream is kept smooth and of an even texture. Lumps will be prevented from forming and a smoother, better quality of cream will be produced. A cream stirrer made of a saucer-shaped, galvanized or tin disk attached to a quarter-inch galvanized handle makes an excellent device for stirring cream.



Cream Cooling Pit (Courtesy University of Nebraska

The other method of using well water to cool the cream consists of interposing a cream tank, such as is shown in the cut on page 9, between the pump and the house, or stock water tank. By this means the water which is pumped passes through the cream tank before it goes to the other tanks. By keeping the cans of cream in this tank



Cross-section and Exterior View of Cream-Cooling Tank Designed at the Nebraska Experiment Station. (See description in paragraph, "Insulated Refrigerator Cream Tanks".)

and protecting the tank from exposure to the hot rays of the sun, quite a satisfactory means of keeping the cream cool is obtained. In Oklahoma and the warmer sections of the United States this method will not be found to be as effective as the windlass and deep well unless water of a very low temperature (55° F.) is obtained. The efficiency of such tanks will depend upon the temperature of the water which flows through the tank, the perfect insulation and protection given the tank and the frequency and amount of water passed through the tank. A further discussion of the use of cream tanks is given under the following heading:

INSULATED REFRIGERATOR CREAM TANKS

During the past year several styles of insulated refrigerator cream tanks have been devised. One of the cheapest and most suitable for construction on the farm or by a local carpenter was devised by Professor J. H. Frandsen of the Nebraska Experiment Station. A cut of this tank, commonly known as "Frandsen's Cream Tank", is shown on this page. This tank is constructed of two-inch, planed cypress planks, with the exception of the cover, which is constructed of two layers of one-inch cypress with a sheet of rubberoid roofing between, one layer being laid crosswise of the other to prevent warping. The outside of the tank is given two coats of paint and the inside is oiled. The interior of the tank is divided into three sections. In one section is set the can of mixed cream and in one of the smaller sections the can of fresh cream is cooled before mixing it with the general lot. The third section may be used by the housewife for the keeping of eggs, butter or other food materials which may need refrigeration. By having a tight-fitting lid to this latter section, odors from the foods may be prevented from coming in contact with the cream. The following is a list of the materials required, also specifications for the construction of this insulated cream tank:

List of Materials

4 pieces 2x8-in.x10 ft. (sides)
1 piece 2x6-in.x12 ft. (bottom)
2 pieces 1x10-in.x14 ft. (cover double)
6 rods ½x27-in., threaded each end
4 band irons 1½-in.x¼-in.x28-in. with three ½-in. holes in each
Sheet rubberoid 21-in.x30-in.
1¼-in. intake pipe with E11, 4-in. nipple and lock nuts
1½-in. overflow pipe with lock nuts
1-in. drainpipe with lock nuts and cap
Hinges, cover clamps, chain, nails and spikes
Estimated cost of material, not including labor, $10.00.

At this price it will be found economical for obtaining low temperatures in the cream. At the Oklahoma Experiment Station it was found that with an insulated cream tank and food refrigerator combined in the same cabinet that 100 pounds of ice was sufficient to keep sweet ten gallons of cream which was produced during four days. Ten gallons of cream will contain, if the cream tests 40%, about thirty-two pounds of butterfat. This is a cost of approximately 1¼ cents per pound butterfat. If cream of first grade was produced instead of perfectly sweet cream, still less ice would have been required. With a differential of 3 cents per pound, or possibly more, between the price of first and second grade cream, it is evident that it is economical to purchase ice and produce a first grade cream.

There is still another additional advantage in using the refrigerated cream tank, even if ice must be used, and that is in the economy of cost of delivering the cream to market. Trips to market with the cream cannot be made without taking a horse and some person away from the farm work, where they may be needed. The cost of delivering cream where trips are made several times a week, and particularly where small quantities of cream are produced, is very expensive. This cost is worthy of consideration by the farmer if he has work on his farm which must be left undone because of making frequent trips to market with the cream.

There is then not only the increased price which is received by producing first grade cream, but also it is delivered to market at a lower cost in time and expense if low temperatures are maintained in the cream, and there must be an added pleasure from the production of a product which is clean, pure and wholesome. These facts should, if they are fully appreciated, be an inducement to the cream producers of Oklahoma to produce a **first grade cream.**

SYNOPSIS

Cream is a perishable farm product. Its quality and market value depend upon the care exercised in preserving its quality and the market value of the products manufactured from it. Sanitary or cleanly methods of production are essential to the production of cream of first grade quality. First grade cream must be of a good, clean flavor, smooth, even texture, free of foreign material, contain at least 25% butterfat, and not over 4-10 of 1% lactic acid.

The development of lactic acid in cream is due to bacterial action or chemical changes as the result of the presence of bacteria and a temperature in the cream which is favorable to their growth and development. The buying of cream by grade is ackuowledged to be the only just and equitable method of buying cream. A copy of the rules and regulations for buying and selling cream in Oklahoma may be obtained from the State Board of Agriculture at Oklahoma City.

First grade cream in Oklahoma is worth 3 cents more per pound butterfat than second grade cream.

Ninety-lve percent of the cream produced in Oklahoma is made into butter, either on the farms or in factories. Poor quality of cream is one cause of low prices for it. Cream kept at low temperatures sours very slowly and keeps sweet longer.

If freshly skimmed cream is cooled to a temperature of 50° F. and kept at this temperature, it will keep sweet for thirty-six hours or longer, while at 80° F. it sours in a few hours.

If it is desired to deliver first grade cream, cream kept at 80° F. should be delivered every day; cream kept at 70° F. should be delivered every other day; crea mkept at 60° F. should be delivered every third day, and cream kept at 50° F. should be sweet if delivered twice a week, and first grade if delivered every fifth day, or possibly once a week.

Atmospheric temperatures in Oklahoma from April 1 to October 1 are usually too high to obtain temperatures in the cream below 70° F. unless water, ice or other cooling agents are employed. A cream cellar, cave or milk well is quite a convenient place for keeping cream to obtain low atmospheric temperatures.

Deep wells and cream tanks into which the cream is set in cans and where the temperature of cold water is obtained are very efficient means of cooling cream and keeping it cool. When cold water cannot be obtained, ice may be used for cooling cream in an insulated refrigerator cream tank. The use of the refrigerator cream tank will lower the cost or expense of delivering the cream to market.

A higher marget price, lower cost of marketing, and the pleasure of producing a clean, pure and wholesome product should be an inducement to the cream producers of Oklahoma to use modern methods and equipment for the production of **first grade cream.**

TABLE I

This table shows the relation of temperature and age of cream to the development of acidity in each separate skimming:

Cream Kept at Temperature of 50° F.			Cream Kept at Temp. of 60° F			Cream Kept at Temp. of 70° F.			Temp. of 80° F. Cream Kept at		
Number Samples	Age of Samples by Hours	Percent Acidity	Number Samples	Age of Samples by Hours	Percent Acidity	Number Samples	Age of Samples by Hours	Percent Acidity	Number Samples	Age of Samples by Hours	Percent Acidity
65	1	.160	65	1	.160	65	1	.160	65	1	.160
60	12	.177	61	12	.187	62	12	.212	59	12	.341
56	24	.184	56	24	.250	57	24	.500	55	24	.690
50	36	.200	50	36	.367	52	36	.700	47	36	.810
44	48	.210	45	48	.480	47	48	.790	43	48	.880
37	60	.240	39	60	.600	41	60	.840	37	60	.940
32	72	.290	33	72	.600	35	72	.870	31	72	1.010
26	84	.360	27	84	.730	29	84	.890	25	80	1.060
20	96	.410	21	96	.760	23	96	.910	19	96	1.130
15	108	.470	16	108	.760	17	108	.940	14	108	1.250
10	120	.496	11	120	.780	13	120	.980	9	120	1.420
4	132	.530	5	132	.800	7	132	.970	4	132	1.480

Chart I in page 5 is a graphic representation of the data given in this table.