August 14, 1936

To the Committee on Graduate Study:

I submit herewith a thesis written by Mr. Thomas B. Harrison, and entitled "College Creameries", and recommend that it be accepted for fifteen quarter hours credit in partial fulfillment to the requirements for the degree of Master of Science, with a major in Dairying.

L. E. Wylie
Major Professor

At the request of the
Committee on Graduate Study
we have read this thesis,
and recommend its acceptance.

H. R. Duncan

Accepted by the Committee

Jos. A. Auer
Chairman

COLLEGE CREAMERIES

A THESIS

Submitted to the Graduate Committee
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science
in
Agriculture

BY

THOS. B. HARRISON

August, 1936

PREFACE

The fourteen years spent in managing the University of Tennessee Creamery and teaching Dairy Manufacturing have been of absorbing interest to the author. To see it grow from a small business, with only a few pieces of equipment and rather crude methods, into a well equipped plant and laboratory has been most fascinating. The history of the operation of creameries at the University of Tennessee has never been written. Some day those who have had a first-hand knowledge of the Cooperative Creamery and of the beginnings of the present University of Tennessee Creamery will be gone. In view of the many years of service in this connection, it is a privilege and desire on the part of the author to assemble, for future use, the information concerning the operation of creameries at the University of Tennessee.

The author's interest has not been limited to this creamery alone. Several years ago it was his great pleasure to visit college creameries at a number of State Universities including those of Kentucky, Indiana, Illinois, Wisconsin, Iowa, Nebraska, Colorado, Kansas, Missouri, Mississippi, and Alabama. Each plant visited had something outstanding about it and something helpful to the writer. A questionnaire has been sent to the Dairy Department of each State University in order to ascertain what is being done in their college creamery at the present time and to obtain information concerning some of their experiences. The results of this survey, which are included in this thesis, are of vital interest to every one handling creamery work in a State University.

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The author is greatly indebted to Professor C. E. Wylie, Mr. Wm. A. Campbell, Professor Ben J. McSpadden, of the University of Tennessee, for their kind assistance in giving information concerning the Cooperative Creamery. The generous response on the part of all Dairy Departments is gratefully acknowledged.

Thos. B. Harrison

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INTRODUCTION

In 1861, a Representative, Justice Smith Morrell, introduced into the United States Congress a bill to set aside public lands to finance the establishment of agricultural colleges in every state in the Union. The bill was passed and became known as the Morrell Act.[1] The purpose of the act was to preserve for the future generations the rich natural resources of the soil and to give to each generation an opportunity to study the production of farm products.

All the states availed themselves of this splendid plan of financing State Agricultural Colleges. All phases of agriculture were incorporated in courses of study or curricula by each college. Dairying, because it is a very important phase of agriculture, was among the subjects taught. In order to study dairying in a practical way, college herds had to be maintained for feed studies, for production studies, for breeding studies, and for judging.

With cows in a college herd giving milk, there was the problem of marketing the milk to the best advantage. This problem and the growing demand for college trained men in Dairy Manufacturing gave rise to the establishment of college creameries, which is the subject of this thesis.

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1. Survey of Land Grant Colleges and Universities, U. S. Department of Interior, Office of Education, No. 9, Vol. 1, p. 8.

PART I

CREAMERY OPERATIONS AT THE UNIVERSITY OF TENNESSEE

Early Dairy Work.

The first dairy building which was built at the University of Tennessee was a small frame structure located near the site of the present agricultural building. The milk was carried from the dairy barn to this building where it was bottled after each milking and delivered twice daily over a retail milk route in the nearby town of Knoxville. Finally an ice storage was put in and then delivery was made only once daily.

The next dairy building was built in 1900 in the rear of the club house. It was a one story brick structure much larger than the first one. It included a receiving room, a manufacturing room for the manufacture of cheese and butter, a cold storage, a boiler room, and a class room.

The first dairy Short Course was held in the new building in 1900. Mr. W. A. Campbell, now superintendent of the University Farm, attended the second Short Course which was held in 1902. Professor Andrew M. Soule was in charge and was assisted by Mr. G. A. Flicksnger who had charge of the dairy herd.

The milk used for class work was purchased from a dairy near Jefferson City. Since there were no trucks at that time, the milk came over the Southern Railroad and was hauled from the station to the dairy building by the farm wagon. It was weighed in at the receiving room as in any large plant. It flowed through a conductor into a long tank from which it could be drawn out to be used in making cheese or separated for buttermaking. During the six weeks Short Course, milk was purchased three times a week.

The University herd milk which was sold on a retail route was not bottled in the new building, but continued to be bottled in the old dairy building.

New Dairy Building



Figure No. 1. The second dairy building which was built at the University of Tennessee in 1900. A one story brick structure located in the rear of the club house.

Early Marketing.

At some later date the milk route was stopped and the herd milk was sold to the Knoxville Pure Milk Company. It soon became the custom of folks to come with buckets to the dairy barn for their milk. Usually the

children were sent after the milk and they greatly disturbed the cows with their noise and their chasing through the barn. Such disturbance became so bad that finally the orders were given that no milk would be sold at the barn. All sales were made through the creamery, which was a much more satisfactory arrangement.

The Cooperative Creamery

The University of Tennessee Cooperative Creamery was established in January, 1915, through the efforts of Professor C. A. Willson, now Dean of the College of Agriculture, and C. A. Hutton, Division of Extension. It was organized with two purposes in view; first, to furnish a market for farmers who were so situated as to make it unprofitable to satisfactorily market their cream and country butter; and second, to furnish a means of demonstrating the operation of a cooperative creamery.

The executive committee, as given on old letterheads for the University of Tennessee Cooperative Creamery, was J. R. Feezell and H. R. Magill of Maryville, J. L. Jeffries, Seymour, and C. H. Gallaher, Wheat. Professor C. A. Willson was manager with H. C. Stockwell as his assistant.

According to the records neither the manager nor his assistant was paid any salary, or even a part of a salary, from the funds of the creamery. Evidently, they did a considerable amount of work for the creamery gratis. The farmers probably never appreciated the good work done in their interests.

Beginning of Operations.

Operations were begun in January, 1915, during which month 736 pounds, or 92 gallons of cream, were received and made into butter,

making a total of 200 pounds of butter. The butter was sold for $57.70 and the buttermilk for $1.30. The patrons were paid $55.54, or 34.2¢ per pound fat, with only $3.44 being deducted from the total sales for supplies and sinking fund. No labor or plant expense was charged to the patrons.

Business picked up in February with the manufacture of 697 pounds of butter which was sold for $209.10 and the buttermilk for $4.15. Labor was paid $5.50, supplies cost $8.31, and $5.71 was set aside for sinking fund. One cent per pound of fat was the rate for the sinking fund. As stated on the creamery summary sheet, the sinking fund was for the purchase of machinery and equipment. The patrons were paid a total of $195.58, or 34.2¢ per pound fat. All the butter was sold at 30¢ per pound.

The business more than doubled in March, with 1,556 pounds of butter being made, and $434.14 going to the twelve patrons at 33.4¢ per pound of fat. $13.00 was paid for labor to Mr. Faulkner, Mr. Oldham, and students.

In the following letter to the creamery patrons, dated May 5, 1915, signed by C. A. Willson, the method of operation during the first three months is explained:

> "During the months of January, February, and March, the first three months of the management of the U. of T. Cooperative Creamery, the method employed in balancing the books each month was to determine the total amount of the sales for each month and then divide the total amount of butterfat received into that amount which would give the gross amount received for each pound of butterfat. From the gross amount received for each pound of butterfat, 3¢ was substracted which gave the factor that was used for multiplying the butterfat received from each patron in order to determine the amount due each patron. Three cents was used as a factor because of the fact that in the best creamery practice the cost of

manufacture is approximately that amount. The real cost of manufacture for those months was really more than that amount. The difference between that factor and the real cost of manufacture and that amount was, then, paid for by the Experiment Station. Beginning with the first of April, complete cost accounts were kept with the idea of putting the Creamery on a truly cooperative basis by charging the patrons for the actual cost of making.

"The accounts previous to the first of April were kept by Mr. Stockwell who was appointed to a position in the Dairy Division in this University at that date. No true determination could be made of the amount of money on hand and the amount of money in the sinking fund at that date, therefore the books were balanced on the first of May.

"The method of balancing the books on the first of May was as follows: The bank book was balanced and it was found that the total amount in the bank on that date was $637.66 and by the Ledger it was found that the accounts receivable by the Creamery was $42.10. The total resources of the Creamery at that time was then $679.76. The expenses of manufacture for the month of April was $94.79. The total sales for the month was $683.12. The expense of manufacture substracted from the total sales would leave $588.33 which was the amount due the patrons. It will be noted from the above, however, that the amount of resources minus the sales for the month was a minus quantity, or in other words there was a deficit at the beginning of the month of $3.56, which amount was due to the purchase of equipment from sales of the succeeding month. The amount left, then, was less than the expenses for the month. It was necessary then to make payment of part of the bills and hold the remainder over to be paid from sinking funds from the succeeding months.

"Attached sheets will show expenses for the month of April and the deficit that was carried over."

Mr. H. R. Duncan replaced Mr. Stockwell who went with the Division of Extension in April. Owing to a shortage in help, composite samples of cream were taken during the last half of April. Onion cream must have made its appearance about that time. In a letter to the patrons, we find this paragraph:

"Pasteurization will remove some off flavors and odors but it cannot remove onion flavor and odor. Therefore

do not allow the cows to eat wild onions. We cannot use the cream. It would not be fair to the other patrons."

2,334 pounds of butter were manufactured in April which was sold for $683.12. The expenses deducted amounted to $94.79, leaving a balance to be paid to the patrons of $588.33 at 28¢ per pound fat.

Shooks Cream Route was started in April, 1915. The driver, Mr. S. B. McMurray, was paid $2.50 a trip. There was also the freight expense in getting the cream to Knoxville. The establishment of the route helped to boost the manufacture of butter to 5,258 pounds in May. Student labor was paid $45.60 that month. In an undated letter to the patrons on Shooks route, H. R. Duncan announced that Mr. H. E. Baker had been secured as buttermaker for the coming year. He began working in the latter part of August only to quit the middle of November.

A cream route near Sevierville was started but was soon dropped because enough cream could not be bought.

Difficulties Encountered.

Evidently much difficulty was encountered in the manufacture of the butter. Some of it was of such poor quality that marketing it became a problem, as was suggested in a letter from Jellico Cream Company dated May 22, 1915, which was only a few months after the establishment of the new Cooperative Creamery. The letter must have caused some alarm on the part of the management, inasmuch as there was a memorandum on the letter stating that it had been answered by telephone on May 24. The letter is as follows:

"We received the two 30 pound boxes of butter that you shipped us yesterday and upon opening one of the boxes we find that part of the butter is badly molded. My stenographer took one of these pounds home and was unable to use it on account of being old. I took a

pound out of the other box, and it was not as bad, but seems to have a cheese flavor.

"Now I do not know what to do about this as I am out of butter, and must have some for Monday morning to send to my customers, so I have decided to carton up the best box and send it around on my route, and wait developments. Of course if my customers complain I will be compelled to take this butter up.

"I am very anxious to use your butter, but will have to see what my customers think of it. Please advise me by return mail what I shall do with the other box as it is too bad to send out. Do you suppose that your shipping clerk could have made some mistake and sent us an old box? We are storing this in our cold storage, and shall await your reply."

A letter of June 8, 1915, to patrons, informs them of an accumulation of butter:

"This month's sales have been slow. We have been offering butter at Elgin market prices but on account of the peculiar local conditions, we have been unable to sell at this figure. Elgin prices for most of the month have been 28¢ and we have held the butter at that figure. On the first of June we had on hand 2,010 pounds. The best offer we could get for it was 25¢. We found that we could put it in cold storage where it would be kept at a temperature of 25 degrees at which temperature it should keep for many months without deterioration."

On the basis of present day information, we know that 25 degrees is not cold enough to keep butter made from high acid cream longer than sixty days. At this high temperature bacterial decomposition sets in as well as mold development. Later investigations have proven that the most satisfactory temperatures for storing butter are from zero to ten below.

Poor storage facilities were responsible for the moldy condition of the butter, since ice storage is never cold enough to prevent growth of mold. The cheese flavor was caused by the pasteurization of their sour cream, that is, cream low in butterfat and high in milk solids. At a later date, G. A. Gilbert, Dairy Manufacturing Specialist for the

Division of Extension, was called into consultation concerning the poor quality of the butter being manufactured. The letter of July 3, 1915, addressed to C. A. Willson, follows:

> "I wish to report to you the result of my work at the University Creamery during the past week.
>
> "The specks of curd in the butter are due to the pasteurization of thin sour cream. Anything that you can do to improve the quality of the cream will help the curd problem. It is my judgment that this is the place to look for improvement rather than in methods of manufacture. In general, the poorest cream is coming from the Shooks route, although occasionally a can of poor cream comes from direct shippers. I would suggest that the buttermaker report immediately every can of poor cream that comes from shippers and that a letter be written calling the shipper's attention to the harm he is doing the creamery. I would suggest also that a personal letter be written to those who are sending a low testing cream. If this does not result in the desired improvement, it may be necessary to institute a grading system paying a little less for the second grade cream.
>
> "Under the present methods, your cream from the Shooks route is not cooled until about twenty-four hours after it is gathered at the farms. During this time the cream is at a temperature of about 80 degrees and for this reason much of it is churned, lumpy, foamy and a bad flavor by the time it is used. The cream should be protected while it is being gathered and it should either be cooled at Shooks and shipped in the morning, or if shipped in the evening, the train should be met at Knoxville and the cream set in the refrigerator over night. I believe the latter method the better, but in either case this needs attention. In pasteurizing I tried heating the cream slowly between the temperature of 110 and 130 degrees and pasteurizing only at 140 degrees and holding for forty-five minutes. I believe this may help a little to prevent curding.
>
> "The flavor of the butter would also be greatly improved if the quality of the cream was better and if the cream was handled sooner after reaching the station or express office. The use of starter would also help the flavor, provided the buttermaker was capable of making good starter.
>
> "The buttermilk test is too high. This is largely due to the cream being so sour when it is pasteurized. A better grade of cream and lower churning temperature will help this.

"Regarding the marketing of the butter, I am of the opinion that the surplus on hand should be sold at whatever price will move it. I would not think it best to put more in storage. In the future, the local market should be worked as much as possible and some kind of an outlet be found for the surplus.

"The accepted method of testing cream is to make individual tests of each shipment rather than use composite samples. Among other advantages, this would allow you to make daily checks on the over-run and if this is done, undoubtedly your monthly over-run would be larger. It is my judgment that a first-class, experienced buttermaker in a creamery of this size would save many losses; would solve the ordinary problems that arise; would do the work easier; and would eliminate much of the close supervision now necessary. I would be glad to discuss any or all of these points more in detail with you. I shall also be glad to help you in any way that I am able. Do not fail to call upon me if I can be of further assistance either on the route or in the creamery."

The following unsigned letter, dated August 10, 1915, gives some of the marketing troubles and a sprinkling of optimism for the future:

"First, we wish to thank you for your patience in waiting for your checks. We trust you will feel amply rewarded by the enclosed checks for both June and July. It was impossible to make settlement sooner and even now it is being made with the assumption that the 1,710 pounds of butter, which were damaged in storage here in Knoxville, will be sold at 18½¢ per pound. The checks for June were written July 22, with the hope that we would receive the straight price of 24¢ for the 10,000 pounds shipped to Scott and Company at Norfolk, Virginia, so that they could be sent to you on the date promised. This settlement was made on the basis of 25¢ but it will now be necessary to reduce this price one-half cent which will be deducted from your July check in accordance with the number of pounds of butterfat furnished in June.

"The creamery is still growing rapidly. During June, 7,943 pounds of butter were made while 10,019 pounds were made in July. For May the total number of patrons was 63, in June 103, and July 94. For June $1,703.23 and for July $2,211.55 has been distributed among the patrons. While the output of the creamery has increased 20% for July, the expenses have not increased, allowing butter to be made at a cost of only 3¢ per pound, against 4½¢ of a few months ago. The present capacity of the creamery can easily be doubled in which case the charge for making the butter would be only nominal.

"During July the butter trade was dull but at present the market is much better and at the present time we are all sold out on butter. For the remainder of this month we will probably have to sell most of the surplus at 25¢ but after that we expect a rapid increase. We are getting hold of considerable trade in places, and things look very bright for the future.

"In July, 3,660 pounds of butter were sold at 24¢ and the remainder was sold at 25, 27, 28, and 30 cents. At the meeting July 7, it was thought best, since there is no first-class storage available here in Knoxville, to sell the butter then in storage and then sell the butter as fast as made at the best possible price. We have been trying to follow this instruction.

"Some patrons still send thin cream. It is very difficult for us to handle sour cream and it is certainly no advantage to you to ship skim milk so we advise so far as possible that 30 - 40% cream be sent. During the winter, we hope to pay a good price for butterfat so we urge the patrons to prepare now to furnish cream during the winter while prices are bound to be good. We appreciate the way the patrons have stood by the creamery while the prices were low, while it was young, with no market or reputation established and we hope that you will only give your cooperation in the future as you have in the past."

Better Markets.

A month later, September, 1915, H. R. Duncan wrote a very optimistic letter to the patrons:

"The butter market is coming our way now; today we had orders for 800 pounds of butter and only about 400 to distribute. We think we could easily sell 50,000 pounds of butter a month this winter at a good price; furthermore, we are in a good position now to make good contracts for the year if we could only get the cream."

A letter to the patrons in October mentions the fall slump in the production of cream and the pick-up in the sales of buttermilk. It asks for more cream, better cream, and more patrons. The suggestion is made that the patrons get as many of their cows as possible to freshen in the fall when prices are good.

The composite sampling of cream had continued through the summer months until September 16, when individual tests were started again. The month of largest production during the year was July when 10,019 pounds of butter were manufactured.

No payrolls were given during the first five months of operation. Beginning June, the following names appeared on the payrolls:

J. M. Osteon,	June.
John Baker,	June to September.
T. H. Robinson,	June to November. December.
J. G. Faulkner,	June to November.
L. R. Standifer,	June to August. October to January.
Lucy Morgan,	June to August.
H. E. Baker,	August to December.
G. Dickens,	August.
Chas. Smith,	September to November.
Frank Russell,	October.
P. A. Bryant,	October.

Second Year of Operation.

A letter written January 10, 1916, by L. R. Standifer, who followed H. E. Baker as buttermaker, gives the year's operation and encourages production for the year 1916, which proved to be the most successful year during the life of the Cooperative Creamery.

The business grew and the hauling of cream from the stations by horse and wagon became too big a task, so a Ford truck was purchased about July 1, 1916. It was a form-a-truck with a chain drive and solid rubber tires. The truck was paid for out of the sinking fund at the rate of $50

to $60 a month.

About this time a new member was added to teaching staff of the University. His name appeared for the first time on a letter sent to the patrons on July 17, -- C. Elmer Wylie, Assistant Manager, replacing H. R. Duncan; W. H. Broome was given as Treasurer.

As shown in table II, July was the largest month in the manufacture of butter during the entire existence of the Cooperative Creamery. The peak reached was 12,614 pounds.



Figure 2. The Cooperative Creamery in the summer of 1916.

On the payrolls for the year 1916, we find the following list of names:

L. R. Standifer,	January to January.
Frank Robinson,	February to July; September to January.
M. R. Simmons,	February to April.
John Dail,	May to July.
L. J. Kerr,	June to October.
Walter Bullington,	June.
Lucy Morgan,	June. August.
J. C. Grimes,	July.
W. R. Winder,	August.
W. P. Davidson,	September.
Ben J. McSpadden,	September to January.

Third Year of Operation.

In March, 1917, an interesting letter was sent out to the prospective patrons of the creamery. The war was responsible for the high price of butter as noted in the last paragraph.

> "The Creamery made 92,960 pounds of butter in 1916. Of this, 67,690 pounds was sold in Knoxville. The demand has steadily increased until now the creamery cannot meet the local demand alone; and besides this, there is a constant demand from outside sources. The wholesale price has been as high as 42¢ at times; but even at this price, the demand could not be supplied. The butter has also stood high in the butter-scoring contests.
>
> "As warm weather comes on there is an increase in the amount of milk produced on the farms. It is also harder to handle sweet milk. The creamery offers the opportunity to dispose of the milk in the form of cream. This makes the cost of freight much less than when whole milk is shipped. When cream is shipped, the dairyman can keep the skim milk at home for feeding. This eliminates the making and marketing of butter.

During the summer it is difficult to make good butter under average farm conditions. And the average price for farm butter is very low.

"During the past year the Creamery received 312,106 pounds of cream from as many as 250 patrons. The total amount paid to the farmers for this amounted to $84,249.60. The following table shows the amount per pound butterfat. Those who ship cream direct to the creamery are called Regular Patrons. Those not near shipping places are listed on cream routes. That is, some one is paid to gather the cream from the various patrons. This cost is paid by the routes, and amounts to a few cents per pound of butterfat. This cost of gathering is deducted from the price paid the Regular Patrons:

Month 1916	Regular Patrons	Shooks Route	Maryville Route	Month 1916	Regular Patrons	Shooks Route	Maryville Route
Jan.	31	28	26	July	37½	34	28½
Feb.	32	29	28	Aug.	37½	32½	28½
March	35	32	30	Sept.	38½	28	26
April	34	30	28	Oct.	34½	31	28½
May	28	25	23½	Nov.	37½	33	29½
June	27	25-1/3	22½	Dec.	40	36½	33

"From present indications, the average price for the coming year will be higher than for the past year. Butter is selling at the highest price it has ever been known to sell. The price paid to the Regular Patrons for January this year was 40¢ per pound butterfat. This is an increase of 11¢ over the same month last year. This makes the price to the Regular Patrons 45¢. For this same month, Maryville Route received 36¢ and Shooks Route 39½¢. Of course this price cannot be maintained throughout the summer months, but it indicates that the average for the year will be higher.

"The Creamery is ready to receive cream from new patrons at any time, and would be glad to have you for a patron. Begin shipping at once, while the price is high."

The Clinton route was started in August, 1917. Mr. Standifer left for Morristown Industrial School as buttermaker and farm manager and was succeeded by Ben Joe McSpaddan who had assisted Mr. Standifer during the summer.

On the payrolls for 1917, appear the following names:

L. R. Standifer, January to September.

Frank Robinson, January to May.

B. J. McSpadden, January to December.

N. I. Hancock, June. July.

Frank Russell, August to December.

M. F. Sizer, September. October.

W. F. Hendrix

Fourth and Last Year of Operation.

In June, 1918, a committee was appointed to draw up a new constitution for the creamery. G. M. Feezell, Frank Foust, J. L. Jeffries, William Stover, and C. W. Peak were on that committee.

A letter to the patrons on July 15, 1918, announced the resignation of the buttermaker, Mr. McSpadden, who was resigning July 20 to enter the officers' training camp. His position was to be filled temporarily by Mr. Frank Oakes with Mr. W. K. Lester as the new bookkeeper. Men were being called daily to enlist in the army and to work in munitions plants. This created an acute labor shortage.

Payroll for 1918: (February missing)

Ben J. McSpadden, January to August.

B. Hendrix, January to June.

R. Gilmore, January.

S. C. Collins, March to June.

F. S. Oates, May to August.

Alvin Jackson, June.

W. K. Lester, July. September. October.

Payroll for 1918: (Continued)

Julius Faulkner, September to December.

Beulah Jackson, September. October.

E. M. Steadman, October.

C. H. Sloan, November.

The Constitution passed July 18, 1918, is given herewith:

Article No. 1. The name of this cooperative association shall be U. of T. Cooperative Creamery.

Article No. 2. The names of persons forming this cooperative creamery are: (See page 2) -- No page 2 was found --

Article No. 3. The government of this cooperative creamery and the management of its affairs while in operation shall be vested in a board of six directors, including the following officers: A President, Vice President, Secretary-Treasurer, and three other directors. Each new cream district shall be represented by one additional Director. The cream districts are as follows: Patrons shipping from Maryville, Shooks Cream Route, Patrons of Knox County, Patrons of Grainger County, and Patrons of Anderson County.

Article No. 4. The President and the Vice-President shall be selected at the annual meeting of the directors and each Director shall have but one vote. Each cream district shall elect one member of the Board of Directors at least 30 days before the annual meeting of the Board of Directors.

Article No. 5. The creamery shall be managed without pay by the instructor of dairying of the University of Tennessee, who shall be known as the manager of the creamery, and who shall be the Secretary-Treasurer of the association.

Article No. 6. New members may be admitted to the Cooperative Creamery association upon the recommendation of one member, and a membership fee of one ($1.00) dollar. The equipment of the creamery shall remain as an addition to the building, known as the University Creamery. Whenever the University deems that the operation of the Creamery becomes impractical on account of inadequate labor or otherwise, its operation may be discontinued.

Article No. 7. Whenever a member stops sending cream for more than one month and sells his cream, butter, or milk to anyone else his membership terminates and said patron must join the cooperative association in the usual way before becoming a cream patron again. In cases when a member's cows are dry he may stop sending his cream for three months without losing his membership.

Article No. 8. The funds from the one ($1.00) dollar membership fee shall be used in the sinking fund of the creamery.

Article No. 9. The Board of Directors shall provide a place for the operation of the creamery for the association.

Article No. 10. This Constitution may be amended by a majority vote of the Directors at their annual meeting. All proposed amendments must be submitted to the Manager and the Board of Directors at least three months previous to the annual meeting.

TABLE I

PRICES OF BUTTER TAKEN FROM THE COOPERATIVE CREAMERY RECORDS

	1915	1916	1917	1918
Jan.	30¢	31¢	39¢	50¢ * @ 51¢
Feb.	30¢	30¢	41¢	51¢ @ 50¢
March	30¢	30¢ * @ 35¢	41¢	50¢ @ 42½¢ (48.1) Av
April	30¢	35¢ @ 30¢	46¢ @ 38¢	42½¢ @ 43½¢
May	28¢ (23¢ storage)	27¢	36¢ @ 42¢	42¢ @ 43½¢
June	24¢	27¢	36¢ @ 40¢	42¢
July	18¢ * @ 30¢	27½¢	38¢	42¢ @ 44½¢
Aug.	25¢ @ 30¢	28¢ @ 32¢	41¢	44½¢ @ 46¢
Sept.	27¢ @ 30¢	33¢	41¢ @ 44¢	46½¢ @ 59¢
Oct.	28¢ @ 30¢	34¢ @ 35¢	45¢	59¢
Nov.	30¢ @ 33¢	36¢ @ 42¢		59¢
Dec.	30¢ @ 33¢	37½¢	50¢ @ 51¢	

* @ indicates variation in price within each month.

The price of butter during 1915 remained fairly constant at 30¢ until the surplus months of May, June, and July when the surplus butter was sold at reduced prices. Prices were generally higher in 1916. They began to soar in 1918 and had reached the high point of 59¢ when the creamery closed in November, 1918. Of course high prices were brought on by the demand for butter during the War.

TABLE II

PRODUCTION OF BUTTER TAKEN FROM THE COOPERATIVE CREAMERY RECORDS

(Pounds)

	1915	1916	1917	1918	Total	Average
Jan.	200	5,834	4,016	2,835	12,885	3,221
Feb.	697	4,868	3,269	2,210	11,044	2,761
March	1,556	4,813	3,858	2,330	12,557	3,139
April	2,334	5,941	4,322	2,645	15,242	3,810
May	5,258	11,198	6,355	4,455	27,246	6,811
June	7,943	12,090	7,110	5,129	32,282	8,070
July	10,019	12,614	8,290	5,354	36,277	9,069
Aug.	8,404	11,865	8,838	4,982	34,089	8,522
Sept.	8,504	9,045	6,000	3,219	26,766	6,691
Oct.	6,209	6,687	5,558		18,454	6,151
Nov.	4,895	4,590	3,465		12,950	4,316
Dec.	4,839	4,027	2,490		11,346	3,782
	60,858	93,570	63,561	33,139	251,128	62,782

July, 1916, was the high month in the production of butter for all four years of operation. The average per month for the first year was 5,071 pounds with an increase to 7,631 in 1916, but a decrease to 5,297 pounds in 1917, and a rapid drop to 5,682 pounds in 1918. A total of 251,128 pounds of butter were manufactured through September of 1918. The manufacturing records for October and November were lost. It is estimated from the statement of business that 3,496 pounds of butter were made in October, and 1,716 pounds in November.

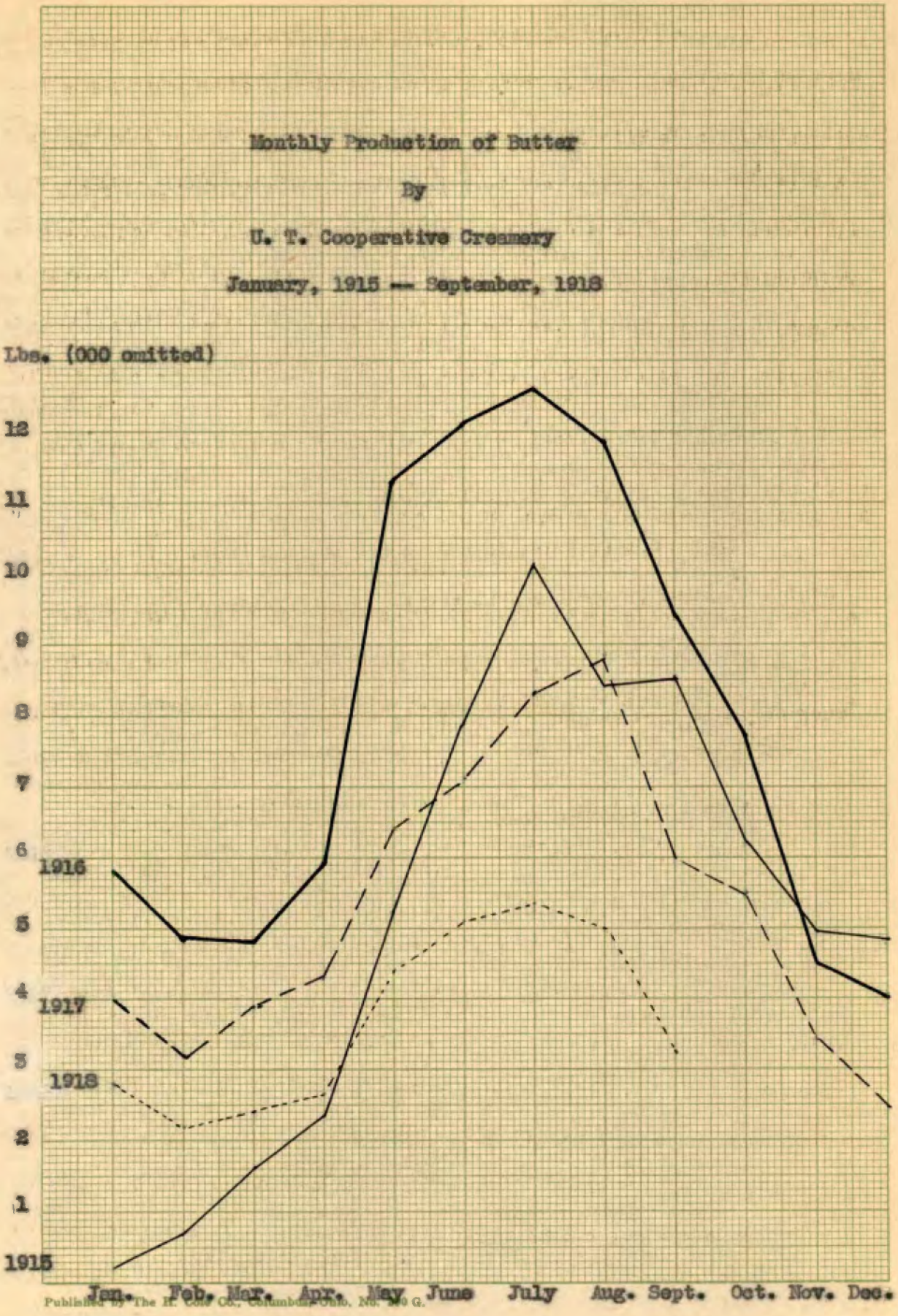

Monthly Production of Butter
By
U. T. Cooperative Creamery
January, 1915 — September, 1918
Lbs. (000 omitted)
12
11
10
9
8
7
6
5
4
3
2
1
1916
1917
1918
1915
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.

Figure 3.

Cooperative Creamery Closes.

The demand for whole milk became so great and the price for it so high that many producers stopped sending cream to the cooperative creamery and began selling whole milk in Knoxville.

The manufacture of butter dropped to such a low ebb in the spring and summer of 1918 that the cost per pound increased considerably. This meant the hastening of the day when the creamery could no longer be operated profitably.

Another contributing factor towards the closing of the creamery was the formation of plans and the appropriation of funds for a new agriculture building to be located on the site of the cooperative creamery. The following letter to the patrons on November 18, 1918, announced the end of operations:

> "A meeting of the Board of Directors of the creamery was held at Morrill Hall, University of Tennessee, November 18, 1918. The following members were present at this meeting:
>
> C. W. Peck, R. 2, Edgemoor, President.
> J. L. Jeffries, R. 4, Seymour, Vice-President.
> C. Elmer Wylie, Knoxville, Secretary-Treasurer.
> Frank F. Faust, Blaineville.
>
> "At this meeting the Board of Directors decided that the creamery should suspend operation because the receipts of cream were so small and that there would probably be a steady decline until sometime in the early spring. The decreased receipts will make the cost of making a pound of butter very much greater.
>
> "It was decided that no cream should be received by the creamery after Saturday, November 23.
>
> "Checks for cream received in November will be mailed about the first of December. The price of butter per pound is as follows:

Regular Patrons	48¢	Anderson County Route	43¢
Robertsville Route	44¢	Shooks Route	43¢ "

The University of Tennessee Creamery.

The new Agricultural Building of the University of Tennessee was completed in 1921. The first floor of the rear central wing had been designed for the use of the Dairy Department. In the rear of the wing one large room with terrazzo floors and drains was to be equipped for a creamery. A farm separator laboratory adjoining it was intended to be used also as a cheese laboratory with a curing room across the hall. No provision was made for a supply room. A sales room and milk storage room also adjoined the creamery with the dairy office next to them.

Mr. M. A. Loomis, the instructor in charge of dairy manufacturing, was not a member of the regular faculty; but was employed by the Veteran's Bureau for Vocational Training of ex-soldiers under the supervision of Mr. Jas. P. Hess, the Coordinator for the Veteran's Bureau at the University of Tennessee, and Professor C. Elmer Wylie, Head of the Dairy Department. The Rehabilitation Act passed by Congress provided for the training of ex-soldiers in vocations best suited to the needs and interests of each individual. It was the task of Mr. Myron A. Loomis to teach and train a group of men in dairy manufacturing. The government paid these ex-soldiers from $100 to $135 per month according to the number of their dependents.

Installation of Equipment.

During the summer and fall of 1921, the entire source of supply was the milk from the University herd. Very little work was actually done in dairy manufacturing except what was done with a small hand churn and bottle filler. During the late fall the following equipment was installed in the creamery: a 200-gallon Wizard pasteurizer for sweet milk,

a 200-gallon Cherry pasteurizer for sour cream, a 600-pound Dual churn, Fairbanks milk scales, a separator, a case-type bottle filler, a wash vat, a five-ton Creamery Package refrigerating system which included a compressor and condenser in the basement, and expansion coils and a brine tank in the upper part of the milk storage room. A large dairy-size separator was loaned to the creamery by the DeLaval Separator Company.

Beginning of Operation.

In January, 1922, the Wall Avenue Depot cut off a load of milk hauled by Mr. Paul Swan. He asked Mr. Loomis if the creamery could handle the entire load of milk. The creamery management had been seeking a source of supply so they were glad to obtain these new milk patrons although the supply was far in excess of their sales. The increased supply made possible for the first time the use of the new pasteurizing equipment. This was a very significant event because no milk had ever been pasteurized at the University of Tennessee.

Serious objections were raised by local dairymen, especially by the Knoxville Pure Milk Company, to the operation of the newly organized University of Tennessee Creamery but operations continued.

An uptown milk route was established by Mr. Loomis with the assistance of the Rehabilitation students. A Reo truck owned by the University was used during the early morning hours for delivering the milk over the wholesale route and the remainder of the day for general use on the University campus. The creamery was charged so much a mile which was

calculated according to each month's operation expense on the truck.

A Change in Management.

In the spring of 1922, Mr. Myron A. Loomis resigned from the Department to accept a position with a newly established cooperative creamery in Nashville. During the month of May and the early part of June, Mr. Rudoph Lawhon, a senior dairy student, acted as manager. During this time, on account of the low price received for milk and the high price paid to the milk patrons, the creamery was in the red several hundred dollars although there was no labor expense.

In June the vacancy in the Department was filled by Mr. Thomas B. Harrison, a graduate of Purdue University, who had specialized in Dairy Manufacturing and who had had practical training working in large milk and ice cream plants. His first task was to put the creamery on a paying basis which was accomplished by an adjustment of prices both to the patron and the customer.

The students objected to the delivery work, so the first employee hired by the creamery was a helper for the University truck driver. The new manager found that milk was being sold in undesirable neighborhoods, so he set about to change the route to serve only the stores of a better class.

The sale of products was seriously hampered by the poor trucking facilities. There was no means of taking care of orders after the early route. The cost of the truck operation was excessively high, sometimes running as high as twenty cents a mile. In order to cut down on the

mileage and expense of the large truck and to have available at all times a truck for special deliveries, a Ford roadster with a pick-up body was purchased in September, 1922. The wholesale route was divided into two with the little truck operating in Park City.

Complaints were made on the quality of the butter made at the creamery. The source of the trouble was the fact that the cream was not being pasteurized. Since that date, June, 1922, all butter manufactured at the University Creamery has been made from pasteurized cream.

The New Agricultural Building of the University of Tennessee
Completed in 1921.



Figure 4. Creamery on the first floor of the rear central wing.

Added Equipment in 1922.

Before Mr. Loomis resigned he had ordered through the Veteran's Bureau, a Fort Atkinson 40-quart ice cream freezer, a dozen brick trays, an assortment of ice cream cans and tubs, and the following cheese equipment: a 200-gallon vat, four 50-gallon vats, a horizontal press, a vertical press, cheese scales, knives, and hoops. This shipment was received in the fall of the year. The ice cream freezer was installed in its present location. Since the original cheese laboratory was filled with separators and the curing room was used for supplies, another location had to be found for the cheese making equipment. The basement room directly below the creamery was being used by the Horticulture Department for a laboratory and the room adjoining it for a farm shop. Professor N. E. Fitzgerald had expressed his desire to remove the farm shop from the basement because the dampness rusted the tools. The Horticulture Department was willing to move their laboratory into the room occupied by the farm shop. Funds were provided by the creamery for the construction of a partition in the barn just east of the Farm Superintendent's residence. The farm shop was moved into this section of the barn. The Horticulture laboratory was moved into the room vacated by the shop, leaving a space for the cheese laboratory. A section was partitioned off for the first curing room. The walls and ceiling were plastered and the cheese vats were installed. A few small batches of cheese were made for class instruction. The curing room was unsatisfactory because it was neither vermin proof nor fly proof, permitting mice and flies to ruin the cheese that was made.

Duties of the Dairy Manufacturing Instructor.

It was the task of the instructor in Dairy Manufacturing to teach the vocational students the fundamentals of buttermaking, ice cream making, and market milk. It was difficult to have classes with these men because their previous training differed so widely. Some could scarcely read or write while others were high school graduates. Some of them were indifferent and even lacking any desire to learn the creamery business. They could not be dismissed or failed, although complaints could be made to the Coordinator who would call them in for a conference. After the completion of their training, four out of the nine students were fairly successful in creamery work.

Regular University classes in Dairy Manufacturing included a study of market milk and ice cream making in the first term and a course in buttermaking and cheese making in the second term. The laboratory and class work was conducted by the instructor in Dairy Manufacturing.

Another of his duties was the management of the creamery which occupied a considerable portion of his time. With no office assistance he also assumed the duties of a bookkeeper, at which job he spent many hours trying to balance the books and figuring patron's accounts.

Pasteurization of Milk at the University of Tennessee Creamery.

The Early Methods of Handling Milk.

The equipment purchased for the handling of milk was not adequate for the proper handling of milk. The milk was received at the back platform, dragged into the creamery, weighed in the cans on Fairbanks platform scales, and dumped through the strainer into the 200-gallon Wizard vat. This method of handling the milk made it impossible to obtain accurate composite samples from each patron's milk. An attempt was made to get this sample by taking a little out of each can but this was not accurate.

Milk was pasteurized in the vat by turning steam into the hot water tank on the rear of the vat and circulating the hot water through the revolving coil in the vat. The milk was heated to 143 degrees and held for thirty minutes, and cooled down by passing the city water through the coil. When the temperature of the milk was down to within a few degrees of the city water, then the brine was turned into the brine coils submerged in the tank on the back of the vat. This cooled water was then circulated through the coil, thus reducing the temperature of the milk to 40 degrees.

This method of pasteurization was rather crude because the cooling of the milk between the temperature of 110 and 90 degrees was very slow, as the city water was very warm in the summer months. This slow cooling at this temperature caused a less deep cream line in the bottled milk, and fine particles of fat would rise to the surface of the milk.

The milk was pumped out of the vat, through a pump fastened to the front of the vat, and through a 1½ inch milk pipe line, to the nearby bottling machine. This machine was of the old style with a square porcelain tank under which the cases of milk were placed and then raised so

that the bottles would open the valves on the machine. The milk would flow into the row of bottles, fill them full, then the case was lowered by means of a lever and slipped over for the next row of bottles to be filled. One end of the tank was used for the filling of quarts of milk and the other end for the filling of pints.

This method was used daily but it was very crude, and one might see that it was unsanitary because the caps were put on by hand and frequently the operator's thumb would go down into the bottle of milk shooting the milk out of the bottle. The caps were often poorly seated so that as the bottle was turned on edge the milk would leak out. This slow method of bottling required the assistance of two or three men.

Milk Storage.

From the bottling machine the milk was loaded on trucks and wheeled into the milk storage room. The floor of this storage room was of terrazzo with a good slope to the drain in the center, but there was no insulation in the floor. To make matters worse the six inch steam main for the building passed directly beneath this room so close to the ceiling in the basement that it was not possible to insulate over the steam main. The floor of the storage room would feel warm to one's hand at all times showing that there was considerable loss of refrigeration through the floor. It was difficult to keep this room cool enough for the proper storage of milk.

Better Refrigeration.

One of the first jobs undertaken by the new instructor of Dairy Manufacturing was to insulate this floor with four inches of cork board with three inches of concrete on top of it. This meant the raising of the

floor about seven inches above that of the creamery floor. A step was made just inside of the door, and a wooden ramp built so that the milk trucks could be pushed up the ramp into the milk storage room. At the other door a slope was made on the inside of the room. The four inch cork insulation greatly reduced the amount of refrigeration lost through the floor, and it was much easier to keep the milk cool.

Another difficulty was encountered in the refrigeration system, in that a leak developed in the compressor. After much correspondence with the manufacturer of the compressor, they replaced the left hand cylinder with a new one and this trouble of poor refrigeration was then eliminated.

New Equipment.

In the spring of 1925, the DeLaval Separator Company loaned to the University Creamery a clarifier, as was their custom to educational institutions operating creameries. In order to use the clarifier and do away with the old method of straining the milk, a forewarmer was purchased in April. It was mounted on an iron stand high enough above the floor so that the milk would flow from it into the clarifier which rested on a concrete platform, and then into the pasteurizer. The clarifier removed much more foreign matter from the milk than did the cloth strainer, thus improving the quality of the milk. Attached to the forewarmer was a milk pump which elevated the milk from the receiving tank below the weigh can up into the tank part of the forewarmer.

Figure No. 5 shows the forewarmer mounted high on the iron stand with the clarifier just beyond it, and a milk conductor to the Wizard vat.

This change in equipment made it possible for accurate samples to be taken because all of each patron's milk was dumped together into the

weigh can resting on the scales. Milk flowed out of the weigh can into the receiving tank on the floor and thence into the forewarmer to be heated to about 90 degrees. Milk not needed for bottle milk trade was sent to the separator, the skim milk used for buttermilk, and the cream for bottle cream or for butter. The bottle cream was pasteurized by placing the 10-gallon can holding the cream in the wash tank and turning the steam into the water surrounding the can, then cooled by cold water. This was a very crude method of pasteurizing the cream.

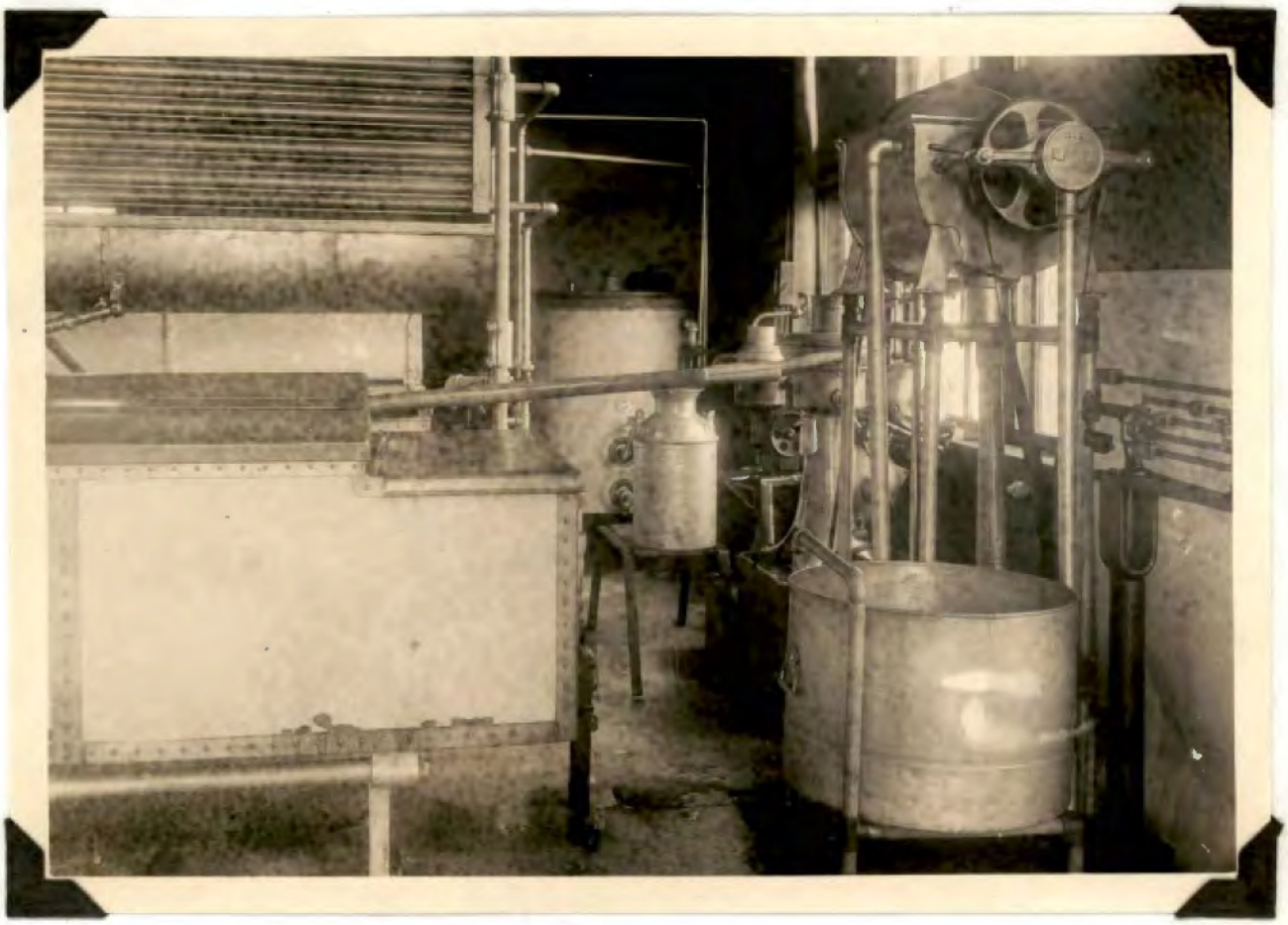


Figure No. 5. On the right side of the picture is the forewarmer mounted high on the iron pipe stand, clarifier just beyond it and a milk conductor to the Wizard vat. In the upper left corner of picture is the large bottom trough to the cooler. In the corner of the creamery is a 100-gallon glass lined vat.

Milk Cooling.

In November, 1924, a milk cooler was purchased from the Aluminum Company for about one-half price although it was still in the original crating and had never been used. The cooler was a little larger than needed at that time but as the cost was less than that of a new cooler of a smaller size, it was purchased and installed. The use of the cooler improved the cream line considerably by the rapid cooling of the milk from 140 degrees to 40 degrees.

The next step was to replace the old style filler and capper by the purchase of the Davis Rotary filler and capper in March, 1925. This machine was purchased from Chapin Sacks Corporation at a reduced price because it had been used a short while in the bottling of a chocolate milk drink. Its use cut down on the amount of labor involved in the bottling of milk and eliminated the unsanitary features of capping milk by hand.

Bottle Washing.

Previous to January, 1927, the bottles were washed by dumping the case of bottles into a wash tank containing hot water with washing powder in it, then placing the bottles on revolving brushes, and next soaking them in a chlorine solution. The bottle washing machine was purchased for the purpose of eliminating the hand washing method, and it is still in use in the University Creamery. First, the bottles are inverted in the cases and placed in the compartment of the machine where hot water, with washing powder in it, is forced up into the bottle. Then this case is replaced with the second case and the bottles of the first case placed on the brushes, thereby loosening any foreign matter that might have

adhered to the bottles. They are then placed in the compartment where a rinse water of 180 degrees is forced up into the bottles under high pressure; then the case is placed into the steam compartment where the temperature of the bottle is raised to a point where practically all bacteria are killed.

Processes Separated by Partition in December, 1929.

Up to this date, all the operations -- receiving, bottle wahing, can washing, and pasteurizing -- were carried on in the one large room. The new milk ordinance required that can and bottle washing be separated from milk pasteurizing. In order to comply with the ordinance, tile walls were built, dividing the large room into three rooms; one part for the creamery, the second one for the bottle and can washing, and the third room for butter printing. This greatly improved the appearance of the creamery and facilitated the handling of the products.

Figure No. 5, page 31, shows a large bottom trough to the cooler. This was a bad feature because the trough was so deep that the cream would rise rapidly with the result that the first milk bottled would be low in fat whereas the last milk bottled would contain too much fat. In order to do away with this difficulty and also to meet the city requirements for close-fitting cooler covers, new covers, a smaller trough, and a distributing pipe were purchased in the fall of 1930. With a small trough beneath the cooler there was no danger of cream rising; moreover it was much easier to wash this trough than the large one.

The next important improvement made in the handling of milk at the University of Tennessee Creamery was the removal of the receiving

department from the creamery proper into the print room. This change, which was made in 1932, necessitated the purchase of a preheater and filter which replaced the clarifier and the forewarmer. The clarifier was sent back to the DeLaval Separator Company and the forewarmer sold to Bradley County Cooperative Creamery. A conveyor was purchased and platform built so that milk could be received from the west of the building over the roller conveyor and dumped into the weigh can on the scales. This separated the weighing of the milk from the pasteurizing department. This method of handling of milk is used at the present time.

New Pasteurizer.

Vats will wear out and such was the case with the Wizard vat that had been in operation for about ten years. In June, 1931, it was replaced with a stainless steel vat. Just one week before the Short Course in January, 1935, a leak was discovered in the liner of the vat which permitted the milk to flow down into the cork of the vat where it produced a foul odor.

A new 200-gallon spray vat was ordered by wire to replace the defective one which was returned to the Cherry-Burrell Corporation. A credit of $500 was given the creamery on the purchase of the new vat which arrived the first day of the Short Course, exactly seven days after the order was placed.

The vat was equipped with automatic control for regulating temperatures during the pasteurizing of milk. The temperature would not fluctuate more than one-half to one degree during the holding period. This was another splendid improvement in the pasteurization because the accurate control of the temperature and the low temperature of the heating water from the sprays brought about a better cream line and greatly decreased the cooked flavor.

After eleven years of daily service, the old filler and capper was replaced in 1936 by a new bottling machine. This new machine greatly facilitated the bottling of milk because it practically eliminated capping difficulties and speeded up the bottling of the half pints. The machine came equipped with the expensive but very durable sanitary and attractive stainless steel bowl. Another feature of the new machine appreciated by the management was the freedom from gear noises. The old one had been so noisy that one had to shout to be heard above the noise it made while running.

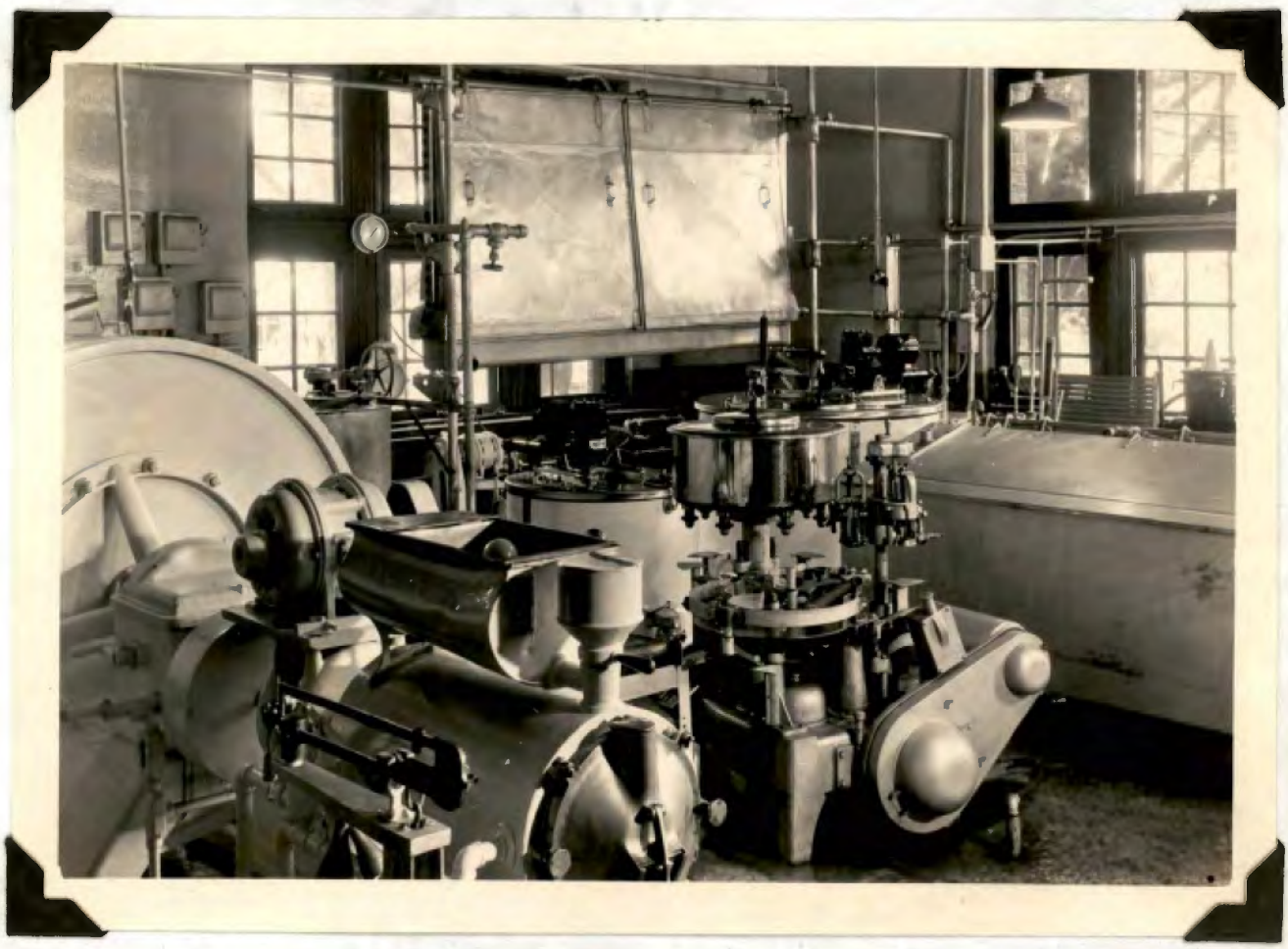


Figure 6. Part of the University Creamery with the new bottling machine near the center.

The Manufacture of Ice Cream at the University of Tennessee Creamery.

Early Methods.

Considerable trouble was encountered from the very start in the manufacture of ice cream in the new freezer. This trouble came from a slight churning that took place in the freezing of the mix causing a buttery condition of the finished product. Improvement was made through the use of a new piece of equipment called the Sharpless emulsifying unit which was sent here in the summer of 1923 by the Sharpless Separator Company of West Chester, Pennsylvania. This equipment, consisting of a 25-gallon pasteurizing tank, a Sharpless emulsifier, a small cooler, and an ice tank, was installed in the creamery. With this unit it was possible to take milk, powder, and other ingredients and make up an ice cream mix that would not churn in the freezer.

Other Improvements.

After the ice cream was frozen it was packed down in tubs with ice and salt, a very laborious method for hardening ice cream. In December of 1925, the sales room was made over into a hardening room with eight inches of cork insulation. This improvement cost about $1,000, with most of the work being done by the employees of the creamery.

The next improvement in the manufacture of ice cream came with the purchase of a mixing vat and a viscolizer in the fall of 1928. The viscolizer was a much more efficient machine in the handling of the ice cream than the emulsifying unit which had been used for five years. This machine is still in use although many repairs have been made. A new type of valve was purchased in January of 1934; and a viscolizer guage, the

type that is mounted on the wall, was purchased last year.

In February of 1929, a Frigidaire two-hole cabinet was purchased for the use of the sales room at $355. Five years later, two 3-hole ice cream cabinets were purchased at a price of $165 each for use in the University Cafeteria. These figures are given to show what a big reduction took place in the price of ice cream cabinets during that period. The evaporating coils in the hardening room were rebuilt in October of 1933, into the the flooded system which is a more efficient method of refrigerating the room.

The last piece of equipment for the improving of the manufacture of ice cream was purchased this summer to be used as a holding vat for the mix after it has been cooled, and prior to the freezing operation. It was purchased to comply with the resent city ordinance which requires that the mix pass from the pasteurizing vat, over the cooler, into the holding vat, and from thence into the freezer through a sanitary pipe line.

Buttermaking Equipment.

Early Methods.

The original equipment for buttermaking included the 800-gallon cream vat, 600-pound churn, and printing equipment. The cream was dumped direct into the pasteurizing vat where it was neutralized and then heated to 145 degrees and held for thirty minutes, and then cooled to churning temperature. After ripening over night it was pumped through the milk pump on the front of the Wizard vat into the churn. This method of cooling was very slow and the butter always had a grainy texture due to the slow cooling of cream between the temperatures of 110 and 90 degrees.

This method was greatly improved upon by the purchase of the tubular cooler mentioned in the chapter on milk. The cream was dumped into the milk pasteurizing vat where it was neutralized and then heated to 145 degrees, held for thirty minutes, pumped over the cooler into the ripening vat where it was held over night, and pumped into the churn the next morning. This quick cooling of the cream eliminated the grainy texture of the butter.

An old butter printing table, which was cracked and warped, was replaced by a maple top table which has given good service all through the years and is in use at the present time in the creamery. In 1922, a butter print balance was purchased at the price of $75. This balance is also in use in the creamery at the present time.

New Churns.

The life of the original churn was rather short. It was replaced in October of 1926 by a new Dual churn of the same type with the exception that, instead of the old roller chain drive which made considerable racket, there was the worm gear drive. This ran much more quietly and disturbed the meetings in the auditorium overhead much less than the old roller-type chain drive. The noise made by the old churn was largely responsible for its being discarded early.

Many times it was very inconvenient to pump the cream from the ripener into the churn through the milk pump so in September of 1927, a centrifugal cream pump was purchased and it has been doing satisfactory work ever since. The second Dual churn lasted about twice as long as the first one, although at times it gave considerable trouble. The most serious difficulty we had with this churn was the tearing up of rollers which occurred one day during

the working of butter. Another bad feature of this churn was that cream leaked through the large gasket at the head end of the churn, giving it a messy appearance.

In September of 1928, a new churn was bought; the single roller type with the gears running in oil in a gear box. This churn has given very little trouble. The rubber gasket around the door has been replaced once, and a new door has been made for it (the old one was cracked through the carelessness of a student), otherwise there has been no expense for repairs. The lubrication of this churn is quite simple and requires only three grease cups, whereas dozens of places needed oiling frequently on the old churn.

New Printer.

An improvement was made in the printing of butter in March, 1933, through the purchase of a butter printer that forces the butter from the hopper into the opening the size of a pound print. Prior to its purchase the small pieces of butter left from the cuttings were packed down in a Friday box and cut out the next day. The new printer eliminated this practice in as much as it was possible to force small pieces through the hopper of the machine and make pound prints. The butter print room was moved to its present location when the receiving department was changed in September of 1931.

New Pasteurizer.

The 200-gallon Cherry vat that was installed in the fall of 1921 remained in service longer than any other piece of equipment. It outlived its mate, the old Wizard vat which had a wooden body instead of steel, nearly six years. In July, 1936, a new 200-gallon lined vat was purchased

from the Pfaudler Company to replace the Cherry vat which was sold to the Riverside Dairy. Figure No. 7 is a picture of the old Cherry vat taken a few days before it was sold.

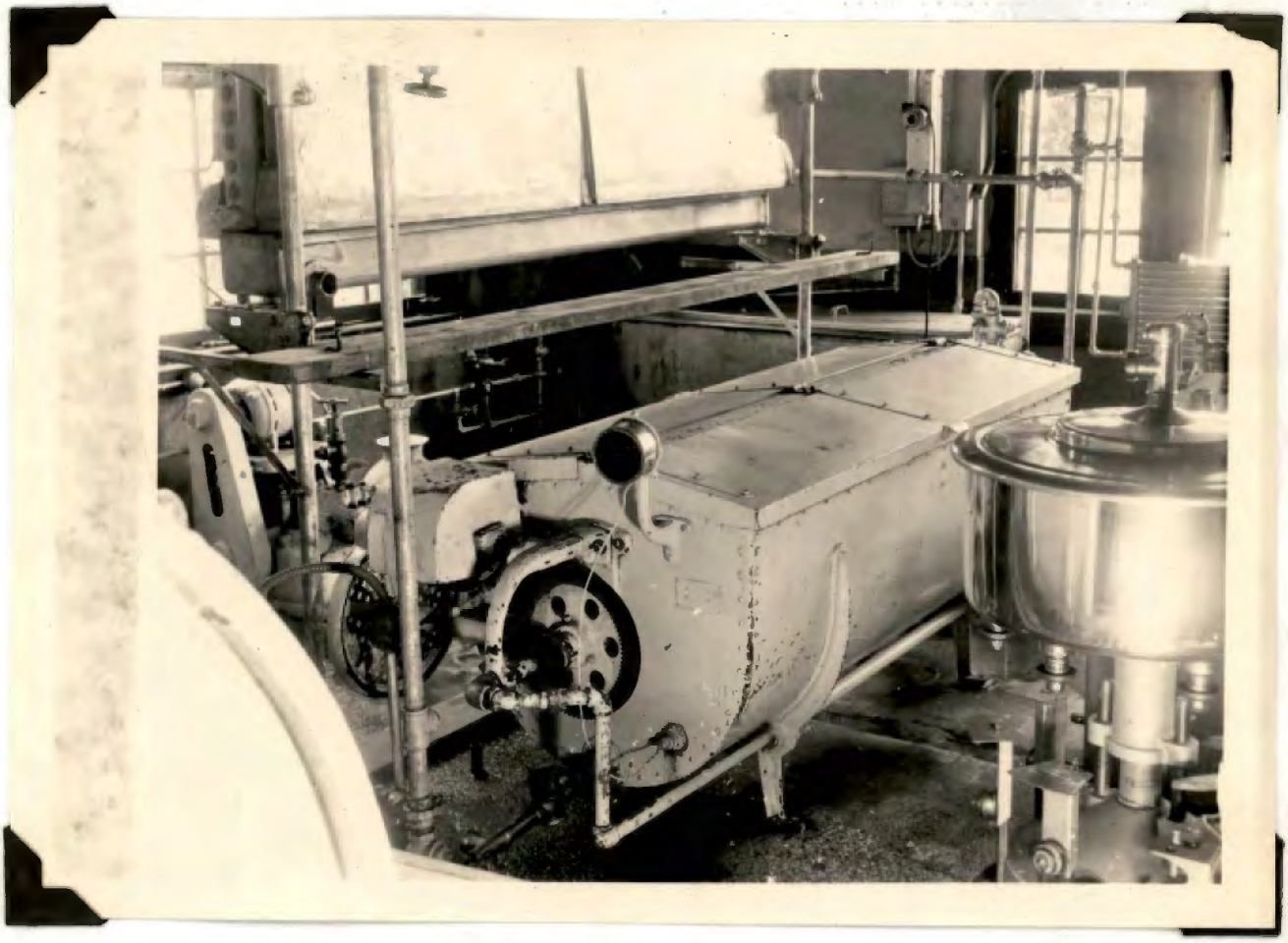


Figure 7. The 200-gallon Cherry vat that was installed in the creamery in the fall of 1921.

Methods of Handling Buttermilk.

The early method of making buttermilk in the creamery before any equipment was available for its manufacture was to allow fresh skim milk to sour naturally in the can. This was bottled up and called commercial buttermilk. When the emulsifying unit was installed, the tank was used for the making of buttermilk. At a later date the Pfaudler Company sent a 100-gallon glass lined vat to be used in experimental work for the removal of onion flavor from milk. This vat was installed in the south-east corner of the creamery by Mr. Craig who was sent here by the Pfaudler Company to experiment with the onion milk. He used a steam ejector to remove the air from the surface of the milk. The valve at the bottom of the tank was left open so that air could bubble up through the cream while it was being heated. This method would remove some of the high flavor, but badly flavored onion milk retained part of its odor.

During these experiments, and for some time afterwards, this vat was used by the creamery for the making of commercial buttermilk. Figure No. 5, page 31, shows this vat in the corner of the creamery. The milk was caught in cans at the separator and dumped into the vat to be heated 190 degrees, then cooled to 70 degrees. The milk was inoculated with a starter and allowed to remain in the vat over night. In the morning the clabber was broken up, cooled, and drawn from the vat to be bottled.

The continued use of this vat for buttermilk caused a pitting of the glass surface so that the iron became exposed, rendering the vat unfit for dairy products. In the fall of 1929, this vat was sent back to the Pfaudler Company and a 150-gallon nickel-lined Burrell vat was purchased.

Several home-made culture boxes had been built that were quite satisfactory in the handling of cultures. It was not until January, 1935, however, that a factory-built culture cabinet was purchased. It was set up in the milk storage room, and has rendered splendid service ever since.

Acidophilus Buttermilk.

Shortly after acidophilus milk first came out, an attempt was made here to manufacture it under commercial conditions. The milk was doubly pasteurized in bottles in the culture cabinet, allowed to cool, and then inoculated with a culture purchased from an Ohio laboratory. It was thought by the management at that time that this was the true acidophilus milk and it was sold as such to quite a number of customers. They continued to buy it for some time, thinking that it was the true acidophilus and declaring that they were greatly benefited by its use. Since then it was learned that the methods which were used in making the so-called acidophilus milk were too crude, and in all probability, the organism growing there was the steptococcus lacticus. About 1932, the creamery with the cooperation of the Bacteriology Department, manufactured the true acidophilus milk. An attempt was made to sell this product in brown bottles through the University Cafeteria at 20¢ a bottle. Sales were very poor, however, and this venture was soon dropped.

Processing Sweet Cream.

The early method for the pasteurization of cream has been given under the heading of "Milk Pasteurization". It was the simplest method possible -- that of heating and cooling the cream in the can by setting it first in hot water and then in cold water.

The method of cream pasteurization changed after the arrival of the emulsifying unit which was quite convenient for pasteurizing cream. It not only included a pasteurizing tank, but also an emulsifier through which the cream passed, and a cooler which reduced the temperature of the cream to bottling temperature.

When the mixing vat and viscolizer were purchased, then the sweet cream was pasteurized in the vat, and pumped through the viscolizer at 600-pounds pressure through a one inch pipe line ending in a T and resting against the upper part of the large cooler. The upper part of the T, which was not more than three feet in length, was perforated so that the cream would run down part of one side of the cooler. The reason for this was that, if the cream were spread over the entire surface, there would be a greater loss through cream frozen on the brine section. The cream was caught in cans and standardized, and then dumped into the bottling machine for bottling. This method of handling the cream was begun in 1928, and is still being used.

Cheese Making.

Cottage Cheese.

The manufacture of cottage cheese was not attempted at the University Creamery until 1930; because for many years there was a shortage of milk all through the fall, winter, and spring months. In 1930, a graduate student was given the problem of cottage cheese manufacture. A 50-gallon cheese vat

was brought up from the basement and connected to the steam and water line in the butter print room which is now the receiving room. A soft curd, rennet-type of cheese was made. Several batches were rejected before an attempt was made to place the cheese on the market. During the summer of that year the cottage cheese business grew from a few pounds a day to fifty pounds. In the fall when there came a shortage of milk, the manufacture of cottage cheese was stopped. It was not until the spring of 1931 that the manufacture began again. Since then, there has been no serious shortage of milk, and the manufacture of cottage cheese has continued up to the present time. When the partition was built in the separator room in 1932, the cheese vats were moved into this room. A new stainless steel cheese vat was purchased in February, 1934, from the Cherry-Burrell Corporation.

When the manufacture of cottage cheese was first started, all of it was sold in 8-pound crocks. That method of packing was gradually changed until now practically all of the cheese is sold in 12-ounce containers. The consumer is demanding the more sanitary method of marketing, that of individual containers.

Cream Cheese Manufacture.

In 1933, Mr. H. C. Day, a graduate of the University of Tennessee, made a cream cheese in the University Creamery by the Dahlberg process; that of using rich cream, a little skim milk powder, some gelatin and salt, and putting this under 4,000 pounds of pressure at 150 degrees through the viscolizer. The heavy, creamy mass was run into parchment lined ice cream brick trays. It was allowed to ripen at 70 degrees over night and then cooled. The gelatin and the skim milk powder gave the product about the same consistency as Philadelphia Cream Cheese. It was cut up into flat

prints and placed in butter cartons. Mr. Day paid for the use of the equipment and the price of the ingredients, did his own work, and made his own sales of the product. Under his close supervision the business grew to a point where it brought him a satisfactory income, but the sale of such product was limited in Knoxville. Therefore, when Mr. Day left the University to accept a position with the Nashville Pure Milk Company, the manufacture of this cream cheese was terminated.

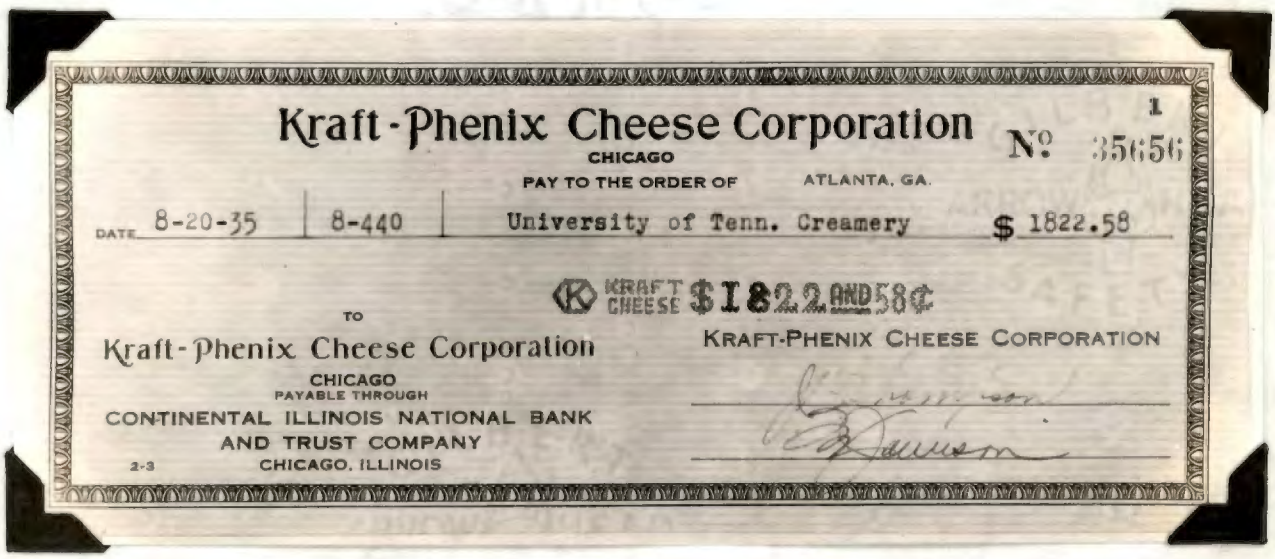
Cheddar Cheese.

Except for a few class demonstrations, the cheese equipment that was installed in the new cheese room in the basement was not used until the spring of 1935. The price of milk on the Knoxville market had been too high to permit its manufacture into cheese. However, when the Knoxville Milk Producers' Association ruled that all surplus milk would be put through one plant, much of it was sent to the University Creamery to be separated. This milk was paid for at the rate of two cents over New York extras, a price satisfactory for the converting of milk into cheese.

The old incubator room in the basement was selected as a location for the new curing room. Insulated walls and a low ceiling were constructed, the door replaced with a refrigerator door, and a one-half horse power water-cooled compressor was placed in the room beyond the curing room to furnish the necessary refrigeration. A set of evaporating coils in a cabinet was fastened to the ceiling of the curing room for the chilling of the room. Shelves were installed to hold the cheese.

Cheese-making operations began on May 17, 1935, at which time the first vat of milk was made into cheese. The manufacture of cheese

continued daily under the supervision of Mr. G. H. Tobey, the cheese specialist for the Agricultural Extension Service. At the end of two weeks, Mr. G. T. Pearson, cheese-maker, had obtained sufficient training to carry on the manufacture with only the occasional visit of Mr. Tobey. When the cheese curing room became full, the cheese was put up in fiber cheese boxes and stored in the Western Avenue Storage. This storage was very poor because moisture dripped down on the boxes. Later the cheese was sold to the Kraft-Phenix Cheese Corporation for the sum of $1,858.58



Kraft-Phenix Cheese Corporation
CHICAGO
PAY TO THE ORDER OF ATLANTA, GA.

No. 1 35656

DATE 8-20-35 | 8-440 | University of Tenn. Creamery $ 1822.58

KRAFT CHEESE $1822 AND 58¢

TO
Kraft-Phenix Cheese Corporation
CHICAGO
PAYABLE THROUGH
CONTINENTAL ILLINOIS NATIONAL BANK
AND TRUST COMPANY
CHICAGO, ILLINOIS
2-3

KRAFT-PHENIX CHEESE CORPORATION

Figure No. 8. A picture of the first check to be made out to the University of Tennessee Creamery for cheddar cheese bought by the Kraft-Phenix Cheese Corporation, which represented the first sale of cheddar cheese to be made and sold in Knoxville.

The manufacture of cheese continued daily at the University Creamery until late in October, 1935; then again, during the holidays; and the first of January, a few more batches were made. All the cheese, with the exception of sixty or seventy hoops reserved for the sales room, were sold

to the Kraft-Phenix Cheese Corporation and to the East Tennessee Packing Company.

Improvements in Refrigeration.

It has already been mentioned under the subject of ice cream making that the old sales room was rebuilt into a hardening room.

When the original refrigeration system was set up, the city water was wasted into a drain in the janitor's room in the basement. The water bills increased in amount with the development of the creamery to such an extent that the management decided a spray pond or tower should be constructed so that the water might be used over and over again. Ice plants frequently use their roofs for the spraying of water in order to cool it and use it in the refrigeration system.

The middle wing of the agricultural building has a flat roof almost tank-like in structure. Permission was asked by the management of the creamery from the University officials to use this roof for a spray pond. This request brought about more action than was anticipated. A meeting was called to discuss the matter and the following officials were present from the University: the President, Business Manager, Professor in charge of Mechanical Engineering, Dean of Agriculture, the Head of the Dairy Department, and the Manager of the Creamery. It was decided by this group to investigate the conditions existing on the roof, and all climbed out through a small window on to the roof. An explanation was made by the manager of how well this arrangement would take care of the cooling water. However, the Professor in charge of Mechanical Engineering was asked to study over the situation and report back his recommendations. Shortly

thereafter, he recommended that a concrete pond be constructed on the ground between the two wings of the Agricultural Building. A leak in the roof would do much damage to the ceiling of the auditorium, and therefore, over a period of time, a concrete pond would be cheaper.

In March of 1929, a spray pond was constructed. By using the water over and over again, many dollars have been saved in the water bills.

The increase in the amount of milk, butter, and ice cream handled necessitated the purchase of additional refrigeration. In August of the same year a six-ton York refrigeration system was installed. It was joined on to the old system so that either one could be used separately, or both used together.

Rebuilding the Milk Storage Room.

A very important detail in the construction of the milk storage room was learned by the management: namely, that no cheap construction should be permitted in any milk storage room. It has already been stated that the milk storage floor had not been insulated. Another mistake made was the lack of insulation on the walls and ceiling. Only two inches of cork was used to insulate the room. The cork ceiling was fastened to very thin wooden strips. In five or six years these wooden strips began to rot, and some of the cork came loose from the ceiling, part of which fell into the brine tank. Considerable difficulty was encountered in having the bits of cork stop up the brine pipes. Repairs were made by building a false ceiling over the brine tank, covering the space between it and the ceiling with loose cork. There was not space enough between the tank and ceiling for proper repairs to be made.

In January of 1933, the milk storage room was rebuilt completely.

A brine tank with a new type of evaporator, designed by W. R. Woolrich and T. B. Harrison, was installed in the basement. Figure No. 9 is a picture of the tank. The coils and brine tank in the milk storage room were removed, the old loose cork on the walls was torn out, the ceiling was dropped two feet, and the concrete floor that had been put in in 1922 was broken up and taken out. It was found that the cork underneath the concrete was in such good condition that it was not necessary to replace it. A marble floor was laid on two or three inches of concrete, covering up the old drain which had given considerable trouble, and sloping the floor to the door for drainage. Four inches of cork were put on the walls and ceiling and plastered with white cement and marble dust, giving the room a very white appearance.

In order to cool the room, a circulating cooling unit was hung from one corner, and a thermostat connection made with the brine pump so as to maintain a temperature of forty degrees in the room. This was a great improvement not only from the standpoint of refrigeration of the milk, but also in the appearance of the room; because the old brine tank was constantly dripping moisture down on the bottles, making them messy.

Ice Making.

Up to that time ice was bought daily for the refrigeration of the cases of milk on the trucks. Ice making equipment for fifteen 50-pound blocks of ice daily was purchased to be installed in the brine tank. Since that time the University Creamery has made all the ice it has used, thus effecting a considerable saving.

Automatic Control of Ice Machine.

In the hot summer months the refrigeration produced through the

operation of the machine during work hours was not sufficient for the proper cooling of the milk storage room or the hardening room. During hot weather, the manager made a trip to the creamery every night to shut down these machines.

In May of 1934, the York compressor was equipped to run automatically, an improvement that should have been made years ago. The York machine was selected to run automatically because its motor could start under full load. The purchase of a thermostat, a solenoid valve, a water pump switch, and a magnetic switch was all that was necessary to make this hand-controlled machine into an automatic. The only difficulty with such an arrangement was the fact that the machine had to operate under low back pressure so as to maintain a low temperature in the hardening room. Both the hardening room and the brine tank were hooked on the same suction line. This meant that at all times the brine would be below zero, a much lower temperature than necessary. In January of this year, a double squirrel cage motor, with a high starting torque, and with a Rockwood drive base, was purchased so that the Creamery Package compressor could be made to operate automatically. A magnetic switch, a solenoid valve, and a thermostat completed the necessary equipment for changing over. At the present time both machines operate automatically; the small machine on the hardening room, and the large machine on the brine tank. The thermostat on the brine tank is usually set for 18 degrees temperature, while the thermostat for the hardening room is set for 5 degrees below zero. With the new arrangement the system works efficiently.



Figure No. 9. Brine tank with a new type of evaporator designed by W. R. Woolrich and T. B. Harrison.

Sales Room.

The original sales room was located conveniently for the customers and the employees. Since it was next to the milk storage room, only a few steps were necessary to bring dairy products from the storage room to the sales counter. The room was equipped with a cash register and a counter which extended across the doorway leading into the corridor.

Under the heading of ice cream manufacture it has been mentioned that the sales room was converted into an ice cream hardening room. When this

was done it was necessary to provide a sales room and this was accomplished by placing a partition across the corridor near the office door. A marble top table, the one now in use in the corner of the print room, was built for use in the new sales room, and an ice cream cabinet was purchased.

This sales room was convenient for the customers but not convenient for the creamery, because all those entering the creamery from the corridor had to pass through the sales room. Since it was an inside room it received no outside ventilation or lighting and this was not satisfactory. However, it remained in this location from December, 1926 until September, 1932 when the separator room was remodeled into a sales room, print room, and a small laboratory.

The new location was much more satisfactory because more space was provided and there was the outside ventilation and lighting. With some one working with cottage cheese and butter in this room at all times, the customers were more readily waited upon than in the old location.

A refrigerated show case was purchased from the Knoxville Show Case Company in June, 1934. Ice placed in the bottom of it with a fan blowing the air against the ice would chill the dairy products held in the case.

In February, 1934, the cash register, which had been purchased as a second-hand machine in 1922, broke down. A new register, especially built to take care of the needs of the University Creamery, was purchased.

Office.

The following list of office equipment was purchased:

November, 1922,	roller top desk.
March, 1926,	safe.
April, 1926,	filing cabinet.
October, 1927,	Kardex file.
January, 1929,	McCaskey register.
February, 1929,	desk and chair for fellowship student.
March, 1930,	check protector. Replaced with a new one in January, 1935.
June, 1934,	bookkeeping machine.

From the time the building was completed until August, 1925, the dairy office was one large room which was not satisfactory from the standpoint of private interviews. From creamery funds, a partition was erected dividing this space into one large and one small office.

New Laboratory.

For many years the Dairy Department operated without adequate laboratory facilities. No regular microscopic or bacteriological examination of milk could be made and there was no means for weighing accurately the small samples in analyzing dairy products. In the fall of 1935, a new laboratory was planned and installed in what had been part of the separator room. A special cabinet and table were built at the cost of $130. A binocular microscope, Westphal balance, drying oven, hot plate, dessicators, chain-o-matic analytical balance, and other laboratory equipment and supplies were purchased. New electrical and plumbing installations were made, and an autoclave was obtained from the Bacteriology Department. This laboratory

not only served the purpose for which it was designed, but also provided a small class room.

Routes.

Wholesale.

For many years the wholesale route has served the University, West Knoxville, and the uptown district. The University stops have always come first because the dairy products were needed for breakfast. At first there were only two stops at the University, that of Strong Hall and Barbara Blount Hall. During the winter of 1922, the cafeteria was opened in the basement of the old South College by Mr. Jack Frost. This was operated for a short time by Mr. Frost, and then was taken over by the University and operated as the University of Tennessee Cafeteria. Sometime later the cafeteria was moved to its new quarters adjoining the new dormitories on West Cumberland. The University Hospital has always depended upon the creamery for its dairy products.

Nursery Route.

The University Creamery did not retail any milk except through the sales room for a number of years, but during that time many calls were received from mothers and doctors for University milk. These calls were turned down with the words, "We do not sell milk retail but you might purchase the milk through some of the stores." The replies frequently came back that the milk purchased from the stores was too old. They could not be depended upon.

At last in 1927, a Nursery Route was started. We furnished only

those homes that asked for their milk to be delivered for infant feeding. The demand for this milk greatly increased because the baby specialists insisted upon the mothers' buying it for their babies. The route was first opened up in West Knoxville but it soon spread to Park City, and then, when some of the good customers moved to Sequoyah Hills, it was extended to that section of the city. This nursery route gradually grew into a regular retail route through no effort whatsoever on the part of the management or the route salesmen. No solicitation was ever made, only those customers added that made their calls over the telephone or by contacting the drivers.

Butter and Cottage Cheese Routes.

The marketing of butter and cottage cheese became so extensive that special routes were developed for the handling of these products. These routes were run twice a week and included sections of the city not covered by the milk routes.

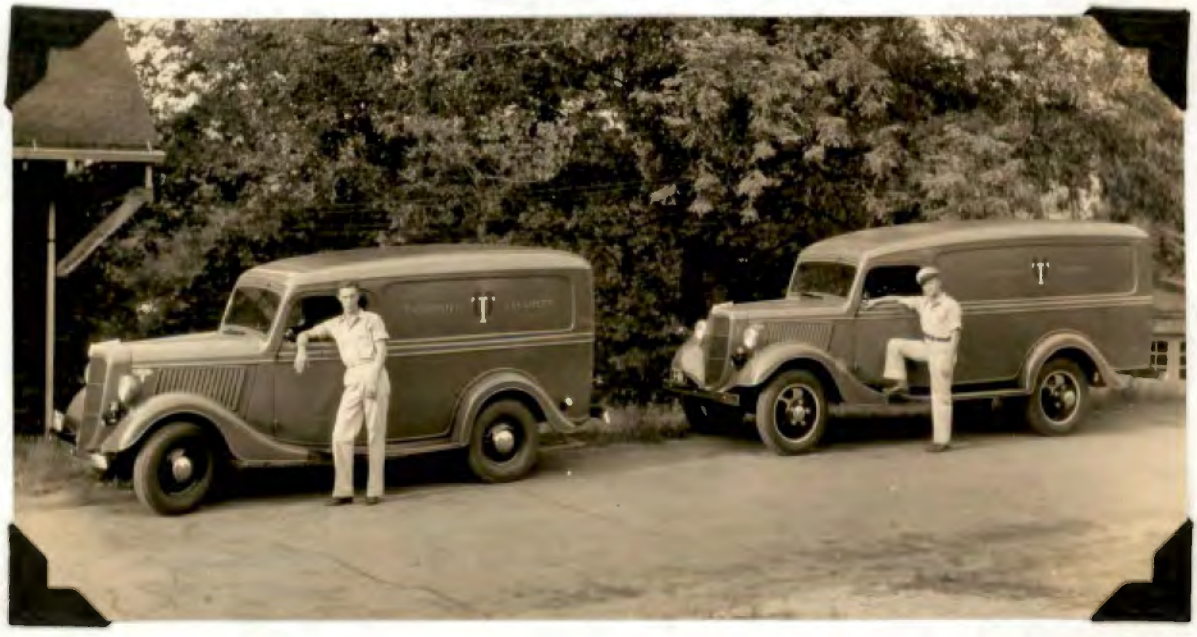


Figure No. 10. University of Tennessee Creamery trucks purchased in June, 1936.

TABLE III

UNIVERSITY OF TENNESSEE CREAMERY TRUCK RECORD

Truck Name	Type	Date Purchased	Cost	Date Sold	Trade in allowance	Expense
1. Ford Roadster	slip-on body	Sept, 1922	$ 517.56	May, 1924	$165	$ 950.48
2. Ford Roadster	"	May, 1924	438.76	Feb, 1927	100	2042.23
3. Ford Roadster	"	Feb, 1927	465.64	June,1929	125	1802.54
4. G. M. C.	1½ ton	May, 1928	1065.50	Aug, 1933	40	2845.12
5. Chevrolet	½ ton	June,1929	652.00	May, 1931	150	1213.60
6. Ford	½ ton	May, 1931	610.26	June,1933	*	1284.42
7. Dodge	1½ ton	June,1932	808.00	June,1936	151	2062.46
8. Dodge	½ ton	Aug, 1933	617.50	June,1934	365	810.89
9. Dodge	1½ ton	June,1934	802.50	June,1936	250	1190.43
10. Ford	½ ton	June,1936	718.00	**		2.87
11. Ford	1½ ton	June,1936	847.00	**		2.23
Total			$7522.72		$1,346	$14207.27

* The G. M. C. truck was loaned to the Horticulture Department when the Dodge truck was purchased in June, 1932. They used the G. M. C. truck until August, 1933, when the creamery traded it in on the small ½ ton Dodge which replaced the Ford truck purchased in May, 1931. This Ford truck was then loaned to the Horticulture Department and is being used by them at the present time.

** Figure No. 10, page 55, is a picture of the new Ford trucks purchased in June, 1936.

Cream Buying.

There have been several methods by which cream has been bought; first, by direct deliveries from the farmers which has been designated as Local Cream in all the creamery records. The second method of purchasing cream has been through cream stations. The University Creamery has operated two cream stations in the past, neither one of which is in operation today. In the fall of 1922 a cream station was established at J. B. Prater's store in Lenoir City. This operated for five or six years when the volume fell so low that it was closed. In 1926 a cream station was opened at Sevierville, Tennessee. The cream was bought twice a week by Mr. Geo. W. Atchley and was sent into Knoxville over the K & C Railroad as long as the freight schedule was satisfactory. Later the cream was brought in by truck. The Sevierville station, due to competition, finally closed its doors.

A number of patrons selling cream to the Sevierville cream station lived across the river at Kodak and asked if their cream might be sent direct to the creamery, so a cream route was established in that territory. This proved to be a very good plan because more cream has been bought from that territory than any other. The route is still in operation, buying cream twice each week even during the winter months.

The old Shooks route which had served the Cooperative Creamery began to bring cream to the University Creamery in the spring of 1922. This route has continued to operate all these years without much increase in volume but the supply has been dependable.

A new state regulation was made in 1933 which stopped the transfer of cream by the roadside as was the custom on the Kodak and Shooks route.

In order to comply with the new state regulation, three-gallon cans were purchased for the patrons and sold to them at a little less than cost. Since that time there has been no sampling and dumping of cream on the routes. All the patrons' cans come into the creamery where the cream is weighed and sampled. The cans are sent back to the farmers clean and dry, a much better practice than that of dumping the cream into cans by the roadside.

Another type of route was begun near Maynardville in the fall of 1922 by Mr. R. E. Miller who picked up the cream in the patrons' cans and brought it into the creamery. Since the individual patron's cans came into the creamery, this was classified with the Local Cream and therefore not recorded the same as the other routes. Mr. Stooksbury ran a similar route from Loyston for a number of years. Both of these routes are still being operated.

Bookkeeping.

The first creamery statement submitted to the Dean of Agriculture was dated July, 1921, and headed, "Business Statement for School of Dairying." It included the income and expenses for each week and the distribution of the products during the month of July. "Expense" was itemized on the August statement.

"University of Tennessee Creamery" was printed for the first time on the December, 1921 statement which included a "Balance Sheet". Evidently a bank account was started sometime during that month inasmuch as a list of checks drawn on the Union National Bank was included under "Expense", and a bank balance of $249.18 was given on the balance sheet.

A set of books was opened up beginning January, 1922 with the following accounts:

Cash	Purchase Account
Checking Account	Bills Payable
Sales Ledger	Bills Receivable
Operation Expense	

The above accounts were written on loose ledger sheets and placed in the letter file of the University Creamery. This system of bookkeeping was not satisfactory because it was not complete. A large ledger was purchased in September, 1922 and the system of bookkeeping revised so as to include the following accounts: Capital, Loss and Gain, Motor Operation, and Equipment Expense. The "Sales Ledger" was changed to Products Account; Operation Expense to General Expense; and Purchase Account to Supply Account.

This system of bookkeeping was continued until July, 1926 when it was revised to a plan recommended by Professor Harvey G. Meyer of the School of Commerce. A multiple columnar journal, especially printed for the University of Tennessee Creamery, was purchased.

The following list of accounts headed each column in the order given:

1. Bank	Deposits and Checks
2. Cash	Debit and Credit
3. Accounts Receivable	Debit and Credit
4. Accounts Payable	Debit and Credit
5. Merchandise Purchased	Debit
Milk	
Cream	
Miscellaneous	
6. Merchandise Sales	Credit
Milk	
Butter	
Buttermilk	
Cream	
Ice Cream	
7. Sales Returns	Debit
8. Supplies	Debit and Credit

9.	Labor	Debit
10.	Auto Expense	"
11.	Power & Water	"
12.	Equipment Repair	"
13.	Miscellaneous Factory Expense	"
14.	Office Expense	"
15.	Miscellaneous	Debit and Credit

The miscellaneous column was used for purchases or sales not included under any other heading; for example, the purchase of new equipment or the sale of a churn. The monthly totals were posted in the general ledger which included all the above accounts, also the Capital Account, Profit and Loss Account, and the inventories for trucks, products, supplies, and equipment. Individual accounts receivable and accounts payable were carried in another ledger and kept in balance with the control accounts of the general ledger.

Information contained in the general ledger was used in making up monthly financial and operating statements. These statements have been submitted to the Head of the Dairy Department without fail every month since the creamery began operations in 1921.

The system of bookkeeping was changed slightly when the banking of the creamery funds was taken over by the University Treasurer in January, 1931. Under the new plan, daily cash receipts were taken to the treasurer's office and from there to the bank to be deposited to the General Fund of the University of Tennessee. A Petty Cash Fund of $3,000 was set up to be used in paying for milk and cream purchased from the farmers. This was deposited in the East Tennessee National Bank as the Petty Cash Account of the University of Tennessee Creamery to be drawn on by checks written out in the creamery office. Reimbursement was made by the treasurer upon the receipt of patrons' records. All invoices were O.K'ed in the creamery

office by the manager and the Head of the Department and sent to the treasurer's office for payment.

The Bank Account on the books of the creamery was changed to the Petty Cash Account and the Treasurer's Office Account added. With these few changes the plan of bookkeeping continued on new printed forms in the multiple columnar journal.

The plan of making out accounts receivable was cumbersome, because all accounts had to be figured on the first of each month. In order to spread out the work of keeping accounts receivable over the entire month, a Sundstrand bookkeeping machine was purchased so that daily entries could be made from the sales slips. This change was in May, 1934 and greatly facilitated the keeping of accounts receivable.

The plan of keeping accounts in the journal and ledger was changed to the keeping of accounts through the use of the new bookkeeping machine. This plan has proved very satisfactory and is being used at the present time.

Banking.

It has been mentioned, under the heading of "Bookkeeping", that the University Creamery opened a bank account at the Union National Bank in December, 1921. A number of years later the Union National Bank merged with the Holston National Bank forming the Holston-Union National Bank. The University Creamery continued to deposit its funds with the new organization. When enough funds had accumulated, a savings account of $5,000 was opened at the East Tennessee National Bank. This proved a wise move because the Holston-Union closed its doors November 11, 1930.

Checks amounting to $4,700 had been written on the 9th to pay the farmers for milk and cream, but only a few had been cleared through the bank. The savings account at the East Tennessee National Bank was converted into a checking account and the farmers paid in full by the end of the month.

Another bank failure greatly affected the finances of the creamery when the East Tennessee National Bank closed its doors January 19, 1933, tying up the Petty Cash Fund of the creamery. Since that date there has been no balance left in the fund because patrons' checks covering the entire amount of the one check written by the treasurer are written and sent to the farmers. The Petty Cash Account has been carried at the Hamilton National Bank ever since the failure of the East Tennessee National Bank.

A Practical Laboratory.

The University of Tennessee Creamery has always been operated as a very practical laboratory for Dairy students interested in Dairy Manufacturing. Each year there have been classes in Ice Cream Making, Market Milk, Cheese Making, and Buttermaking. At the present time all Dairy students are required to take the course in Buttermaking. The freshman dairy course, required of all students in the College of Agriculture, includes some laboratory work in the creamery. Last year a class in Creamery Mechanics was added to the dairy curriculum, and Ice Cream Making was offered in summer school for the first time.

Many students regularly enrolled in the four-year agricultural course have received good training not only in the regular laboratory work of the above mentioned subjects but also practical training as employees working in the University Creamery.

In addition to the regular students, there have been many one-year students in Dairying. This course was started more than ten years ago to provide laboratory instruction in Dairy Manufacturing to those young men who had failed to complete their high school work, so that they might receive practical training to fit them for jobs in the creameries of the state. During the past decade quite a number of special students have availed themselves of this opportunity.

The Short Courses have helped a greater number of young men in the state than any other activity of the Dairy Department. If there had been no University Creamery, these Short Courses in Dairy Manufacturing would not have been attempted, because there would have been no laboratory in which to carry on the instruction and no dairy products with which to work.



Figure No. 11. Dairy Short Course Group in 1926.



Figure No. 12. Dairy Short Course Group in 1930.

The creamery also furnished the funds for bringing to the University the "Best Dairy Short Course Faculty in the World". This slogan has not been an idle one, because the faculties have included such men as Mr. O. F. Hunziker of Blue Valley Creamery, Prof. Martin Mortensen, Head of the Dairy Department at Iowa State College, Dr. E. V. McCollum of Johns Hopkins, Dr. B. W. Hammar of Iowa, Prof. H. W. Gregory, Head of the Dairy Department at Purdue University, Prof. R. B. Stoltz of Ohio State,

Prof. C. D. Dahle of Penn State, Dr. E. S. Guthrie of Cornell, Prof. A. D. Burke of Alabama, Prof. H. H. Herzer of Mississippi, and many others.



Figure 13. Dairy Short Course Faculty Group in 1930.

Employees.

A total of one hundred forty-one names have appeared on the payrolls of the University of Tennessee Creamery during the fifteen years it has been in operation. Practically all of them have been students of the University. The payrolls were very small in 1922 and 1923, because most of the work was done by ex-soldiers who were receiving training in the Dairy business. This training was quite beneficial to some of the men because they found employment in creameries and milk plants after receiving their training at the University.

When their training periods terminated in the spring of 1924, the work in the creamery was carried on by regular employees. As business grew and the kinds of dairy products manufactured increased, the size of payrolls increased. Many students were given the opportunity to earn their way through the University by working in the creamery not only as part-time workers during the school months but as full-time employees during the summer months. Some men, finding that they had insufficient funds to finance themselves through a quarter of the college year, worked full-time, saved their money, and continued their education the following quarter. Often two would cooperate in their financing plan with one working and lending money to his partner in school. The next quarter the one who had been working took up his class-work again while his partner worked in the creamery to pay back the borrowed money and to lay aside money for the next quarter. Forty-two of the one hundred forty-one who have been on the creamery payrolls have graduated from the University.

What happened to the ninety and nine? Many of them were Short Course

students who went out to work in plants over the state. Some of them went into other lines of work. About fifteen are working in the University Creamery at the present time.

One of the difficulties in the operation of the University Creamery has been the rapid turn-over of labor brought about by student employment. With the average of ten new workers to train each year to replace those graduating and going out into plants of the state, the management has been faced with many difficult situations that might have been avoided had the same employees been retained from year to year. However, the privilege of working in the University Creamery has been reserved for University students specializing in Dairying, because they have needed the financial help and the dairy industry has needed well-trained men.



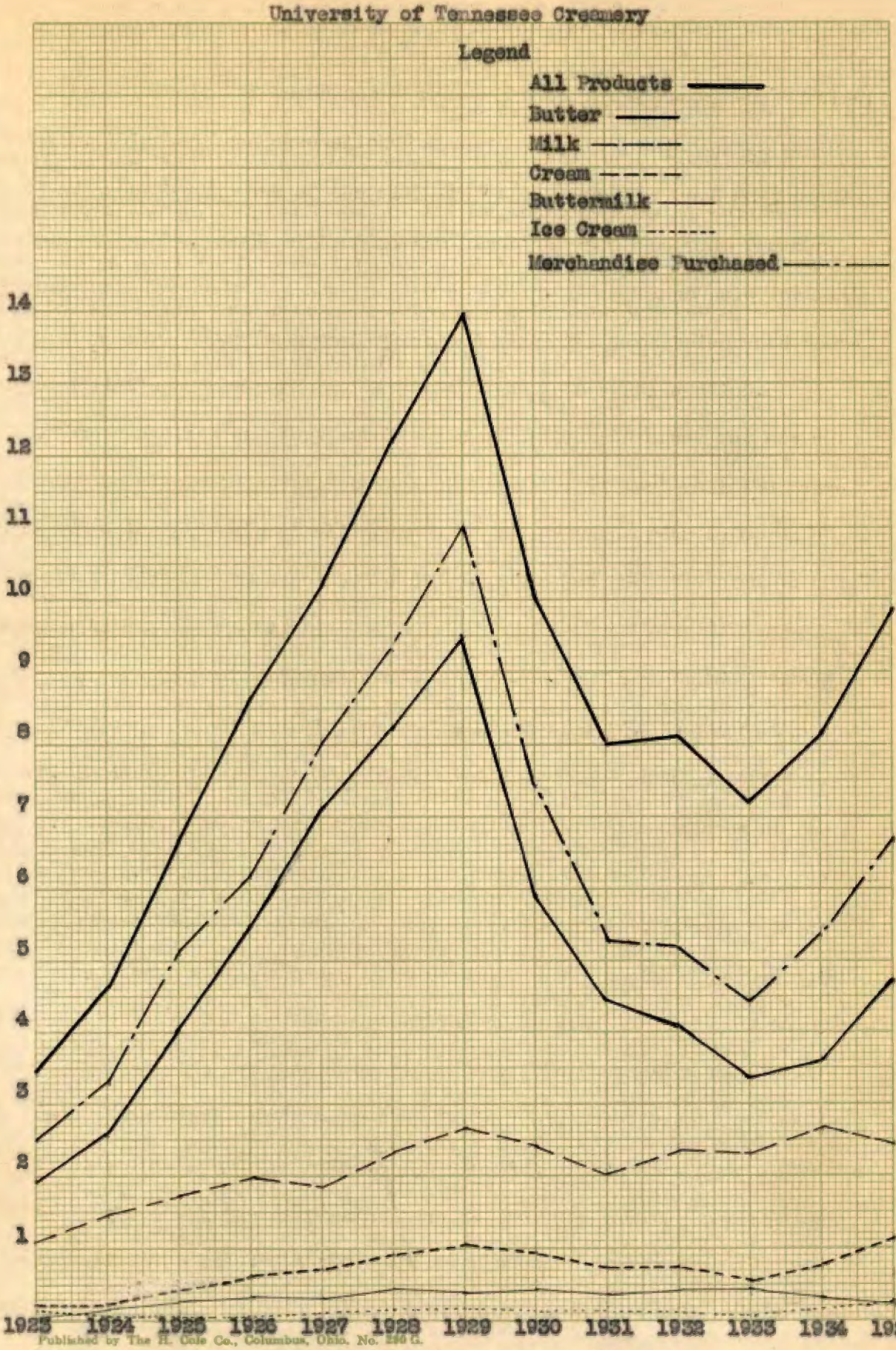
Figure No. 14. Personnel and Employees of the University of Tennessee Creamery, June, 1936.

Purchases and Sales.

The University of Tennessee Creamery has always been self-supporting. However, this has been accomplished by operating on a much larger scale than afforded by the use of the milk from the University herd as the only source of supply. Much milk and cream has been purchased from farmers living in Knox County and surrounding counties. The prices paid for milk and cream have always been as high as the regular market prices and sometimes a little higher where quality was taken into consideration.

When a college creamery purchases enough milk and cream for adequate teaching requirements at all seasons of the year, it must sell the manufactured dairy products at all seasons of the year in order to operate without unnecessary expense to the state. This has been the plan at the University of Tennessee.

The purchases of milk and cream increased each year up to 1929 and then declined in four years' time to the level of 1924. The last two years, 1934 and 1935, have brought the total purchases back to the 1927 level. The total sales have risen and fallen with the purchases as shown in Figure No. 15. Butter sales have accounted for the rather wide fluctuations in purchases and sales; whereas, milk, buttermilk, cream, and ice cream have been fairly uniform. The volume of milk pasteurized has not changed very much during the fourteen years the creamery has been in operation, but the price has varied considerably. The depression and local "price war" were responsible for the dip in 1931, when prices went as low as six cents per quart wholesale. The adoption of the Milk Code under the AAA in 1934 brought the milk sales back to the 1929 level. Cream sales were high in 1935 because large quantities of sour cream were sold to local creameries.



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Figure No. 15. Purchases and Sales of Dairy Products.

Sales Dollar.

How much of the sales dollar has been paid to the farmer? Figures have been compiled for the years 1923 to 1935 inclusive and a graph has been made to illustrate the percentage of the sales dollar that was paid the farmers as shown in Figure No. 16. The highest percentages occurred in 1927, 1928, and 1929 when prices were high. When prices began to fall in 1930, expenses did not fall accordingly, therefore the farmer received a smaller portion of the sales dollar.

The percentage of the dollar for labor in 1923 was very low because the ex-soldiers in training worked without labor charge part of that year and therefore the payroll was small. All the work was done by paid help, beginning in 1924, as shown by a steep climb in the graph from 1923 to 1924. The decline in 1926 and 1927 was brought about by the increase in the amount and value of dairy products handled. The percentage of the dollar for labor increased steadily with the decrease in the total purchases of milk and cream until 1933 when prices reached a low point. Figure No. 16 shows that the part of the dollar expended for supplies did not fluctuate much, but the little variation which did occur was inversely proportional to merchandise purchased except in 1934 and 1935 when the NRA increased the cost of butter cartons, cheese cartons, etc.

General Expense included the depreciation of equipment and trucks, office expense, equipment repair, truck operation, and power and water. These items were combined into one on the graph because they were too small to be given separately.

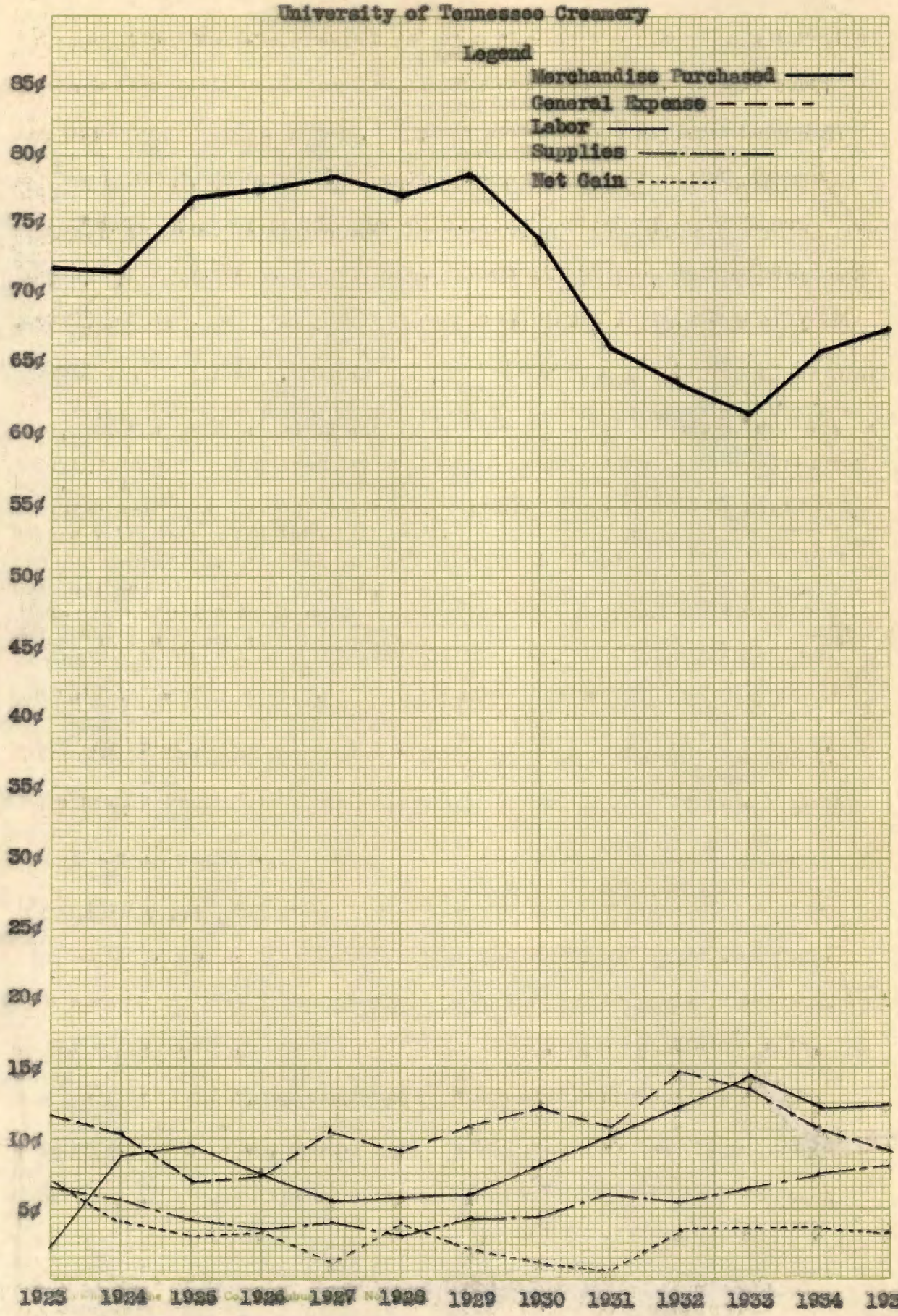


Figure No. 16. The Sales Dollar.

PART II

SURVEY OF COLLEGE CREAMERIES

In order to obtain first-hand information from all the State Agricultural Colleges concerning the operation of college creameries, a questionnaire and letter were sent to each of the other forty-seven states. A questionnaire filled out for Tennessee was inclosed to serve as a sample. The response was excellent with only the one state, Nevada, failing to send a reply. The questionnaire was made easy and simple so that those answering would not have to dig back through old records for information. The specific questions dealing with figures asked for the April reports in order that the information would be easily available and comparisons for all creameries could be drawn for the same month. The questionnaire includes six divisions with five to ten questions in each division.

Section I. Operation.

Question No. 1. Does your Dairy Department operate a college creamery?

The term "creamery" was considered in the broad sense of a plant handling one or more of the dairy products, milk, butter, condensed milk, cheese, or ice cream. A plant handling milk is commonly known as a "milk plant", one handling condensed milk is called a "condensery", one handling ice cream is called an "ice cream plant", but one handling butter is known as a "creamery". Mississippi's (2) answer was, "No, only market milk and ice cream department." The answer was recorded as "Yes", because market milk and ice cream are processes in that plant.

College creameries are operated in thirty-seven states. Some of these do not operate "off the campus", that is, they do not sell products to the

general public. At least two of the nine that reported that they do not operate college creameries, Kentucky[3] and Minnesota,[4] have buildings designed to take care of commercial operations. Florida[5] stated that they do not operate a college creamery but are planning a "dairy products laboratory within the near future."

Washington has a unique arrangement that puts it in a class apart from any other college creamery. The questionnaire was not returned but an explanatory letter gave the details of its operation. The following letter was received from Prof. R. V. Ellington:

> "Dear Professor Harrison: I have your questionnaire regarding the operation of our college creamery. Since our operation is a little bit different from the practices in common use by many of the dairy schools, I will attempt to give you the particulars of our set-up.
>
> "The State College of Washington formerly operated a college creamery from which butter and ice cream were manufactured and retail milk distributed. The State College of Washington is located in a section of the state in which competition for dairy products is very keen and we were in continual conflict with the commercial organizations in this part of the state. There has been considerable criticisms because of the fact that a state institution was competing with privately owned businesses.
>
> "With the completion in 1926 of the new dairy building, it occurred to me that a cooperative arrangement might be made with the existing commercial plant in the city of Pullman which had about 90 per cent of the business. Such a cooperative arrangement was perfected and has been in force to date; in the main, it has been entirely satisfactory. I will give you the main features of this set-up.
>
> "Our agreement has the following introduction: In order to provide for the students of the State College of Washington, a creamery plant with an output greater than it would be advantageous for the college to operate, and yet secure to the students conditions and production as nearly like those which they will find in creameries where they will later be employed, and in order to avoid competing with local companies in the purchase of dairy products for the laboratory work of the students of the State College, and in order to provide adequately for experimental and investigational work in the processing and manufacturing of dairy products, this cooperative agreement is made and

entered into this____day of May, 1926, by and between the Board of Regents of the State College of Washington, hereinafter designated the College, party of the first part, and___and____ doing business under the firm name of the Milk House, of Pullman, Washington, party of the second part. In this agreement, the following were some of the main provisos:

(1) The College furnishes certain of the manufacturing laboratories with equipment with the understanding that the manufacturing or processing may, at the option of the Head of the Dairy Department, be done by the student classes, without pay, as laboratory practice work and that the manufacturing space in the building shall be always available for student instruction.

(2) The college maintains and keeps in repair all equipment and adds processing and manufacturing equipment from time to time; the college furnishes steam, light and power to operate the equipment.

(3) The plant superintendent employed by the Milk House is subject to the orders of the Head of the Dairy Department in all matters which pertain to cleanliness of the building or which affect the dairy department. All labor costs incurred in the processing and manufacturing of products to be paid by the Milk House.

(4) The College reserves for the use of the members of the staff, the use of such products as are necessary for class instruction and for experimental purposes. Goods rendered unfit for sale by such use are to be paid for by the College at prevailing wholesale prices.

(5) The Milk House agrees to give preference to students in the dairy department whenever student labor is employed. Of course it is mutually understood that this provision is to apply only so long as the preferred students perform their work in a workmanlike manner.

(6) The Milk House in advertising the sales of its products, does not refer by any trade mark or brand to the fact that its manufacturing is being done at the State College plant.

(7) The grading of products processed and manufactured by the Milk House in the manufacturing laboratories of the State College shall be under the direction of the Head of the Dairy Department of the State College and it is mutually understood that this direction is exercised only in compliance with accepted good plant practice.

(8) This contract does not interfere with the sale of the milk from the College dairy herd to the College dormitories. All milk

produced by the herd is pasteurized and processed without cost by the Milk House and delivered to the dormitories, the compensation for the sale of this milk going direct to the dairy department.

"In this cooperative agreement the Milk House pays to the dairy department of the State College a specified monthly sum which has been adequate to take care of all repairs and maintenance of the equipment of the building and adding and replacing manufacturing equipment. This arrangement has met the approval of the majority of the manufacturing concerns within the state and as a consequence we have a very close cooperation by that section of the dairy industry which we are attempting to serve, both by the training of plant men and through the medium of our experimental program.

"If there are any further details in which you are interested in connection with this plant, we would be glad to advise you. As I say, it has proven quite satisfactory to both parties concerned. No difficulties of a major nature have arisen during the ten years this agreement has been in force."

Question No. 2. Does it operate twelve months out of the year?

Unlike other farm products that can be marketed once or twice a week, milk must be delivered daily throughout the year. No college creamery operating less than twelve months out of the year could be classified as a commercial creamery. Only two college creameries operate less than twelve months - Oklahoma, ten and one-half to eleven months, and North Carolina, ten months.

Question No. 3. How many years has it been in operation?

In the year 1892, Iowa State College opened the first college creamery, which was followed the next year by the establishment of a creamery at the University of New Hampshire. Pennsylvania State has operated a creamery "over forty years". Connecticut and Wisconsin began creamery operations during the same year, 1896. Two years later, Ohio State opened its creamery. Missouri, New York, Oregon, and Virginia all established creameries in 1901; Illinois in 1902; Kansas in 1906; South Dakota in 1907; and California in 1908.

The years of operation for all the thirty-three states reporting totalled 829, or an average of twenty-five years.

Question No. 4. Is it a cooperative creamery?

All answers to this question were "No". When the writer visited Mississippi A & M College in 1934, he learned that for many years Mississippi operated a cooperative creamery until it became so large that it was moved into its own building at the edge of the campus. Financially, it is now entirely separated from the Dairy Department but has retained the name, Mississippi A & M Cooperative Creamery. The college creamery handles all dairy products except butter. Students receive their training in buttermaking in the cooperative creamery, having two four-hour laboratory periods a week. With the two-hour lecture periods, they receive six hours credit for their work.

A cooperative creamery was operated during the period of the World War at the University of Tennessee. A full description of its operation is given elsewhere in this thesis.

Washington State has a plan that might be classified as cooperative, because they do cooperate with an outside party in the operation of its creamery. A true cooperative, however, distributes its profits among its patrons. This is not the case at Washington.

Question No. 5. Does the creamery manager teach?

This question was asked in order to show the relationship of teaching to the creamery operation. Is the creamery being operated in a practical way by a member of the teaching staff so that daily problems in operation can be presented to classes?

The term used for manager varies somewhat. For instance, the creamery manager at Iowa is the head of the department. Their plant super-

intendent would correspond to the manager in other institutions.

Nevertheless, twenty-five creamery managers or plant superintendents, that is, the one directly in charge of the operation of the creamery, teach classes. The number of hours they teach varies all the way from two hours a week to one hundred hours a year. One institution reported thirty-three clock hours, or twenty credit hours. Another reported one-half to full time. Table No. IV, page 78, gives information from all the states. Where a state is not given, no creamery is operated.

Question No. 6. Pounds of butter manufactured in April?

This question clarifies the answer as to just how many college creameries are creameries in the true sense of the word, in that they manufacture butter. Some made so little that one good sized churning would turn out all they made in the entire month.

Twenty-seven states reported the amount of butter manufactured which totalled 134,351 pounds or an average of 4,794 pounds. The University of Wisconsin, one of the leading dairy states in the Union, heads all the others in the manufacture of butter with a record of 21,349 pounds, practically all of which was made from separated fresh milk. Purdue, Pennsylvania State, and Iowa produced nearly equal amounts of butter; 13,387, 13,229, and 12,071 pounds respectively. Nebraska, California, and Arkansas made approximately 10,000 pounds each. Then follows Oregon with 8,000 pounds; Michigan with 7,000 pounds; Tennessee with 5,929 pounds; South Dakota with 4,640 pounds; and Ohio with 3,238 pounds.

There seems to be no geographic reason for some college creameries to manufacture large quantities of butter and others none. For instance, Wisconsin heads the list and her sister state, Minnesota, which is also a butter state, does not manufacture butter in her college creamery.

TABLE IV

TEACHING HOURS OF CREAMERY MANAGERS

State	Does Creamery Manager Teach	How many hours a week.	Notes
Alabama	No		
Arkansas	No		
California	Yes	2 units	Supervises practice work.
Colorado	Yes	19 hours	
Connecticut	Yes	4-10 hours	
Florida	Yes	5 hours	"Dairy Manager"
Georgia	Yes	20 hours	33 clock hours.
Idaho	Yes	18 hours	
Illinois	Yes		
Indiana	Yes	2-4 hours	"Creamery Superintendent"; Head of Department Manager.
Iowa	Yes		"Creamery Superintendent"
Kansas	No		
Louisiana	Yes	18-20 hours	
Maryland			Short Course only.
Massachusetts	No		
Michigan	Yes	1/2 - full	
Mississippi	Yes	18 hours	"Clock hours"
Maine			Assists with laboratory work
Montana	Some	3 hours	
Nebraska	Yes	3 hrs-fall 4 hrs-spring	Short Course; 20 hours laboratory; 3 hours lecture
New Hampshire	No		
New Mexico	Yes		
New York	Yes	12 hours	"Winter course only"
North Carolina			
North Dakota	Yes	8 hours	
Ohio	Some	16 hours	
Oklahoma	No		
Oregon	Yes	2-4 hours	"Laboratory"
Pennsylvania	No		
South Carolina	No		
Tennessee	Yes	8 hours	
South Dakota	Yes	9 hours	
Texas	Yes	4 hours	
Utah	Yes	12-16 hours	
Vermont	Yes	6-9 hours	Credit hours and station work.
Virginia	No		
West Virginia	No		
Wisconsin	Yes	100 hours a year.	

The state of Arkansas does not produce much butter, yet the college creamery stands seventh in its manufacture of butter. Tennessee ranked tenth in butter manufactured.

Question No. 7. Gallons of whole milk pasteurized in April?

Not all of the college creameries pasteurize milk. Thirty-two pasteurized a total of 236,387 gallons, making the average 7,387 gallons. The large amount, 36,000 gallons, for Penn State raised the average considerably. Tennessee ranked sixteenth in the amount of milk pasteurized. Eight college creameries pasteurized ten thousand gallons or more; thirteen, between 10,000 and 5,000 gallons.

In Arizona the milk is sold raw directly from the dairy to the college cafeteria. At Kentucky the milk and cream from the dairy is cooled, bottled, and sold raw on retail routes.

At Rutgers (New Jersey), 13,330 pounds were pasteurized for the dining hall, 10,320 pounds of vitamin D milk, 12,990 pounds of special raw milk, and 9,675 pounds of bulk milk were sold through a city dealer. Alabama, North Carolina, Oregon, and Vermont also reported that their herd milk was being sold raw.

Question No. 8. Pounds of cottage cheese manufactured in April?

Nebraska leads all other college creameries in the manufacture of cottage cheese with a production of 22,078 pounds. California follows far behind with a production of 4,329 pounds. Tennessee is third with 3,478 pounds; followed by Purdue (Indiana) with 2,318 pounds; Iowa with 1,996 pounds; Wisconsin with 1,485 pounds; and Vermont with 1,200 pounds. The total production of the twenty-eight states was 44,676 pounds, an average of 1,595 pounds of cottage cheese for the month of April.

Question No. 9. Pounds of cheddar cheese manufactured in April?

TABLE V

CHEDDAR CHEESE PRODUCTION AT ELEVEN COLLEGE CREAMERIES

Institution	Pounds
1. Pennsylvania	6,795
2. Nebraska	1,760
3. Wisconsin	1,110
4. California	843
5. Iowa	512
6. Louisiana	350
7. Ohio	320
8. Oregon	200
9. Kansas	150
10. Utah	60
11. Texas	50

For several years the University of Tennessee Creamery has handled all the surplus milk for the Knoxville Milk Producers' Association. All the fat was manufactured into butter in the summer of 1934.

In the spring of 1935 a curing room was built and a cheese-making department organized. The manufacture of cheddar cheese was begun in May and continued into the fall. A total of 39, 586 pounds of cheddar cheese was manufactured. A shortage of milk owing to a spring drouth prevented the manufacture of cheese in the spring of 1936 at the University of Tennessee.

Not many college creameries manufacture cheddar cheese. The eleven that reported had a total "make" of 12,140 pounds, an average of 1,103 pounds for the month of April.

California reported the manufacture of 5,298 pounds of brick cheese.

Question No. 10. Any additional points of interest?

This space on the questionnaire was left blank in many cases but interesting information was given in others.

Colorado mentions the fact that the herd milk is processed the year around. Other products are manufactured only in the semester in which the subject is taught. "Note: very unsatisfactory. A serious problem of procurement, timely availability, and disposal of product."

TABLE VI

ADDITIONAL POINTS OF INTEREST AT TWENTY-ONE COLLEGE CREAMERIES

Institution	Notes
Purdue - - - -	"1,500 gal. ice cream - 855 gal. sweet cream"
Iowa - - - -	"1,588 gal. ice cream"
Louisiana - -	"1,500 gal. ice cream; cultured buttermilk, malted milk, condensed milk"
Maryland - - -	"Pies, cakes, macaroons, and fudge are made by present students or graduates"
Michigan - - -	"Considerable ice cream and ice cream mix made and sold
Pennsylvania -	"Ice cream mix, 21,880 pounds"
New Mexico - -	"491 gallons of ice cream, 195 gallons of orange juice, 66 gallons of chocolate milk"
North Dakota -	"40 gallons of ice cream"
Ohio - - - - -	"Butter is only one-half of normal for this time of yn"
Oklahoma - - -	"600 gallons of ice cream"
Oregon - - - -	"500 gallons of ice cream"
Pennsylvania -	"Ice cream 1,070 gal.; chocolate milk, cultured buttermilk"
Rhode Island -	"A college dairy is operated but not a creamery"
Tennessee - -	"We manufacture the surplus milk of the Knoxville Milk Producers' Association into butter and cheese"
South Dakota -	"We make a chocolate milk drink and ice cream"
Texas - - - -	"1,014 gal. ice cream, 1,105 gal. buttermilk, 50 gal. plain condensed milk"
Utah - - - - -	"200 gallons of ice cream was made in April"
Vermont - - -	"Sell our own farm milk raw. Buy other only to supplement supply for manufacturing when short"
Virginia - - -	"Butter and cheese are used only on a small scale for class. We handle milk, cream, and ice cream"
West Virginia	"500 gallons ice cream"
Wisconsin - -	"12,550 gal. milk used for market cream; 1,295 gal. of ice cream mix made; 1,152 gal. of ice cream manufactured"

Section II. Sales for April, 1936.

Question No. 1. Are dairy products sold in town?

The answer to this question largely determines whether or not the college creamery is operated on a commercial basis. The creamery selling only to the dining halls can not be classified as a commercial enterprise, while one having a salesroom where towns people purchase creamery products can be considered as semi-commercial. However, those operating routes in town can be classed as commercial in operation.

Twenty-seven reported that they sell dairy products in town and thirteen reported that they do not. Nine failed to send a reply.

Question No. 2. Does the University purchase dairy products for its dining halls and cafeteria from the college creamery?

There are no dining halls or cafeteria at Alabama Polytechnic Institute for the college creamery to supply with dairy products. Colorado also reports no dining halls. An unusual plan for furnishing their dining halls is in operation at the University of Minnesota where the herd milk is bottled by their "Service Department". About five hundred quarts of milk are bottled daily under this plan. The Dairy Division has nothing to do with it except in an advisory way.

The contract which the State College of Washington(6) has with the local milk company "does not interfere with the sale of milk from the college dairy herd to the college dormitories". All milk produced by the herd is pasteurized and processed without cost by the Milk House and delivered to the dormitories. The compensation for the sale of this milk goes direct to the Dairy Department.

No answers were received from Delaware, Nevada, and Wyoming. All other state colleges not mentioned under this heading purchase dairy products for their dining halls and cafeterias from the college creamery or the dairy.

Question No. 3. Is a salesroom operated for the students and towns people?

TABLE VII

SALES ROOM OPERATION

Yes		No	No Reply
Alabama	Nebraska	Colorado	Arizona
Arkansas	New Hampshire	Florida	Delaware
California	New York	Idaho	Kentucky
Connecticut	North Dakota	New Mexico	Maine
Georgia	Ohio	Oklahoma	Minnesota
Illinois	Oregon	Rhode Island	Montana
Indiana	Pennsylvania	Virginia	Nevada
Iowa	South Carolina	Washington	New Jersey
Kansas	Tennessee		Wyoming
Louisiana	South Dakota		
Maryland	Texas		
Massachusetts	Utah		
Michigan	Vermont		
Mississippi	West Virginia		
Missouri	Wisconsin		

Question No. 4. How many trucks are owned and operated?

A total of 36-1/3 trucks are owned and operated by 27 college creameries. The Dairy Department at Utah has one-third interest in a truck. Purdue, Illinois, and Penn State each have three trucks. Nebraska, Ohio, and Tennessee operate two trucks each and the remainder one truck each. Twelve college creameries do not own and operate trucks. No reply was received from nine states.

Question No. 5. Is the University herd milk sold through the creamery?

"Yes" was the reply from thirty-five states. No reply was received from nine states. "Only the surplus" at the University of Georgia is sold through the creamery.

The answer from New Hampshire was not clear because it was "No", whereas, further down the questionnaire the number of pounds of milk purchased from the University herd was given. The herd milk from Florida goes direct to the dormitories while at Kentucky it goes direct to a retail route.

Question No. 6. Do local dairymen purchase dairy products at the college creamery to sell in town?

The majority of the college creameries do not sell milk to local dairymen. There are twenty in this group. Ten college creameries reported that they sell milk to local dairymen when there is a shortage. Two wrote that very little milk was sold this way.

At Michigan, milk is sold wholesale to a single distributor who sells it over three routes.

This part of the questionnaire from New Mexico reads, "Products are sold to a student who owns his own truck and makes his own collections except sales to dormitory with student getting a commission for delivery. Local dairymen make a few purchases in case of shortage. We sell a few quarts of goat milk regularly to a local dairyman and at one time sold him a considerable amount of all products."

One creamery retails the milk for the college creamery at Oregon. However, the college name is on the cap.

Question No. 7. Underline products sold: Milk, coffee cream, whipping cream, butter, buttermilk, cottage cheese, cream cheese, cheddar cheese, ice cream, ice cream mix, orange juice, chocolate milk, condensed milk.

Milk was underlined on forty questionnaires, whipping cream on thirty-six, ice cream on thirty-five, buttermilk on thirty-three, and cottage cheese on thirty. Coffee cream, butter, and chocolate milk all tied for fifth place in the sale of dairy products at our land-grant colleges. Cheddar cheese is sold by college creameries in nineteen states, cream cheese in eighteen, ice cream mix in twelve, and condensed milk in eight.

Orange juice, which is not a dairy product, is sold by dairymen every where except in Utah where the sale of it is prohibited by law. However, only five college creameries, all in the Southern and Southwestern section of the United States, are bottling the so-called "orange juice". Florida and California are not included in this group. The products from the citrus fruits are used in flavoring ice cream and sherbets, but the bottling of ground-up oranges mixed with sugar water is not a function of the college creamery.

At Illinois, Nebraska, Penn State, Kansas, and Wisconsin, all the dairy products listed are sold. Although they sell nearly all the dairy products, the most important one, butter, is left off by Maryland, Mississippi, New Hampshire, and Cornell (New York). Ohio State according to the questionnaire sells no ice cream. Colorado gave the information that, outside of milk and cream, other dairy products are sold only in the semester in which the subject is taught. In January, 1935, the Board of Regents limited the sale of products at Georgia to their dining halls and a retail sales room.

Section III. Purchases for April, 1936.

Question No. 1. Milk from University Herd?

The best response received in the entire survey was to this question. The herd production was obtained from every state except two, Delaware and Nevada. Table VIII gives the production all over the United States.

TABLE VIII

HERD PRODUCTION AT FORTY-SIX COLLEGES

Institution	Pounds	Institution	Pounds
1. Cornell	130,628	24. New Hampshire	32,948
2. Illinois	96,000	25. Michigan	31,000
3. Louisiana	85,000	26. Washington	30,000
4. Texas	79,189	27. North Carolina	29,240
5. Iowa	74,324	28. California	28,291
6. South Carolina	64,526	29. Rhode Island	25,806
7. Idaho	64,500	30. Utah	25,462
8. Connecticut	57,791	31. Indiana	25,149
9. Massachusetts	55,311	32. North Dakota	23,253
10. Missouri	53,471	33. Minnesota	22,622
11. West Virginia	52,600	34. Colorado	22,551
12. Virginia	51,000	35. Maryland	19,083
13. Wisconsin	51,000	36. Kentucky	18,335
14. Mississippi	47,300	37. Florida	16,841
15. New Jersey	46,225	38. Pennsylvania	16,797
16. Oklahoma	45,900	39. Alabama	15,359
17. Maine	45,285	40. Arkansas	15,000
18. Kansas	44,798	41. Tennessee	14,599
19. South Dakota	42,800	42. Arizona	13,506
20. Nebraska	41,947	43. Oregon	12,750
21. Ohio	38,006	44. Montana	12,213
22. New Mexico	34,824	45. Wyoming	11,425
23. Vermont	34,000	46. Georgia	3,683

Total pounds of milk, 1,802,319
Average pounds of milk, 39,181

There does not appear to be a determining factor for high production geographically. Cornell reported 130,628 pounds and their neighbor to the south, Penn State, reported only 16,797 pounds. Louisiana's herd produced 85,000 pounds of milk in April against Minnesota's 22,622 pounds. Taking the United States as a whole there is no correlation between the number of pounds of milk produced by the state university and the total milk production of the entire state.

Question No. 2. Milk purchased from local dairymen?

Twenty-three of the college creameries purchased during the month of April, 2,537,254 pounds of milk with an average of 110,615 pounds for those reporting. A list is given of those purchasing 50,000 pounds or more.

TABLE IX

POUNDS OF MILK PURCHASED FROM LOCAL DAIRYMEN FOR APRIL, 1936

Institution	Pounds	Institution	Pounds
1. Wisconsin	778,882	7. Tennessee	82,559
2. California	416,848	8. Texas	75,981
3. Pennsylvania	287,699	9. Ohio	66,375
4. Nebraska	230,110	10. Kansas	65,671
5. Indiana	129,096	11. Utah	51,953
6. Michigan	114,000		

Question No. 3. Sour and sweet cream purchased for buttermaking?

Twenty college creameries purchased 75,377 pounds of fat in sour and sweet cream for buttermaking. Table X gives a list of those purchasing more than 1,000 pounds.

TABLE X

POUNDS OF BUTTERFAT PURCHASED AS CREAM FOR APRIL, 1936

Institution	Pounds	Institution	Pounds
1. Indiana	11,503	7. Tennessee	4,011
2. Iowa	11,282	8. South Dakota	3,684
3. Pennsylvania	10,182	9. California	3,437
4. Arkansas	7,000	10. Ohio	1,959
5. Oregon	6,400	11. Georgia	1,817
6. Michigan	5,500	12. Wisconsin	1,675

Colorado makes this statement: "We have always run as a whole milk plant, separating our own cream for buttermaking. This has always proven to be very desirable for our set-up. Surplus skim milk disposed of to hog department at nominal price. Skim milk previous to 1933 made into cottage cheese and surplus sent to hog department."

Ohio: "We also do custom churning for other local dairies, that is, receive and churn their cream and return to them butter."

Question No. 4. Are the patrons paid direct from a bank account of the creamery?

To this question, nineteen reported "No", eight reported "Yes", and nine reported "No Patrons".

Question No. 5. Remarks.

Maryland makes this remark: "Money received each day is turned over the next morning to the University Treasurer's office. We cannot even pay a fifty-cent bill for freight. All bills have to be vouchered and payments are made from the State Treasury."

A very good plan is in operation at Michigan: "This is handled by the

college treasurer depositing from our creamery funds money in the local bank to our credit and check use. We requisition through college purchasing agent and comptroller for all purchases and supplies the same as for all other departmental funds. We deposit daily with the college treasurer all funds collected."

Georgia: "Patrons who deliver their cream are paid in cash. Their receipts are presented to the University Treasurer for reimbursement. Cream shippers are paid by University checks."

Illinois: "Checks are made out by the creamery on a Revolving Fund of the University."

Indiana: "Quality basis for payment for milk for five years. Returning sediment discount to cream patrons with dirty cream."

Oregon: "Cream cottage cheese and some other materials are purchased from creameries in town by requisitions on Dairy Department Revolving Fund in chief clerk's office."

Tennessee: "Patrons accounts are sent to treasurer and a single check covering the entire amount is deposited to the Creamery Petty Cash Account; checks are written by the creamery for each patron."

Vermont: "Sales room has own bank account audited by University comptroller's office. It pays for all products handled except some purchased expressly for class work."

Wisconsin: "Payroll is sent to State Treasurer and he sends checks back to the creamery."

Table XI, page 91, gives the ranking of each college creamery as compared to all the rest in various phases of their activities. Herd production is given first because more reports for this item were received than for any other. The figures obtained for herd production do not include milk used for calf feeding. In most cases it represents the milk purchased by the creamery from the college herd. Where no college creameries are in operation, it is the herd production that is used in the table.

The third column gives the placing of each state reporting the amount of milk pasteurized. The fourth column gives the placing of each college creamery as to the pounds of milk purchased; etc.

In order to find the rating of any college creamery, all one has to do is to read along the spaces opposite the name of the state in which it is located. For instance, Purdue (Indiana) ranks thirty-first in herd production, eighth in the gallons of milk pasteurized, fifth in the pounds of milk purchased from local dairymen, fourth in the pounds of cottage cheese manufactured, second in the pounds of butter manufactured, first in the pounds of fat purchased, and first in the amount of the payroll.

TABLE XI

PLACING OF EACH COLLEGE IN RESPECT TO ALL THE OTHERS IN THEIR PRODUCTION OF MILK, ETC. IN APRIL, 1936

Institution	Herd Production	Gal. of Milk Past.	Milk Purchased	Cottage Cheese Mfd.	Cheddar Cheese Mfd.	Lbs. of Butter Mfd.	Fat Purchased	Payroll
Alabama	39	raw	--	27	--	21	17	35
Arizona	42	--	--	--	--	--	--	--
Arkansas	40	--	--	--	--	7	4	21
California	28	25	2	2	4	6	9	5
Colorado	34	24	17	--	--	24	--	28
Connecticut	8	14	--	17	--	--	--	11
Florida	37	--	--	--	--	--	--	--
Georgia	46	--	21	25	--	16	11	29
Idaho	7	12	--	--	--	--	--	34
Illinois	2	5	--	15	2	15	13	10
Indiana	31	9	5	4	--	3	1	1
Iowa	5	2	13	5	5	4	2	--
Kansas	18	23	10	26	9	14	--	16
Kentucky	36	--	--	--	--	--	--	--
Louisiana	3	15	--	18	6	23	--	15
Maine	17	--	--	--	--	--	--	--
Maryland	35	21	12	11	--	--	--	6
Massachusetts	9	13	--	21	--	25	--	14
Michigan	25	10	6	10	--	9	6	4
Minnesota	33	--	--	--	--	--	--	--
Mississippi	14	19	--	--	--	--	--	24
Missouri	10	18	--	19	--	19	16	26
Montana	44	30	19	22	--	26	18	30
Nebraska	20	--	4	1	2	5	15	7
New Hampshire	24	26	16	--	--	--	--	17
New Jersey	15	27	--	--	--	--	--	--
New Mexico	22	22	20	20	--	--	--	25
New York	1	3	--	--	--	--	--	8
North Carolina	27	raw	--	--	--	--	--	31
North Dakota	32	32	--	23	--	20	--	33
Ohio	21	4	9	9	7	12	10	12
Oklahoma	16	29	--	--	--	13	14	32
Oregon	43	raw	18	--	8	8	5	18
Pennsylvania	38	1	3	6	1	3	3	2
Rhode Island	29	--	--	--	--	--	--	--
South Carolina	6	11	--	24	--	27	--	27
Tennessee	41	16	7	3	--	10	7	9
South Dakota	19	20	--	13	--	11	8	19
Texas	4	6	8	16	11	17	16	14
Utah	30	28	11	12	--	18	--	22
Vermont	23	raw	22	8	10	22	19	20
Virginia	12	8	15	--	--	--	--	--
Washington	26	--	--	--	--	--	--	--
West Virginia	11	17	14	14	--	--	--	23
Wisconsin	13	7	1	7	3	1	12	3
Wyoming	45	--	--	--	--	--	--	--

Section IV. Employees in April, 1936.

The number of employees in most plants will vary from month to month. This survey, however, is a comparison of certain activities of college creameries during the month of April. Therefore, the number of employees and the type of employees, that is, part-time and full-time students and non-students, should be definite for the one month so that an accurate comparison can be made.

Question No. 1. How many full-time?

Only five institutions reported the employment of full-time students with a total of fourteen. Seven of those are at Tennessee. Thirty-two colleges gave employment to one hundred and thirty-three non-students.

At Tennessee the students are given the opportunity of using the co-operative plan of earning their way through the University. By this plan students pair off, one working full time one quarter and lending money to his partner in school that quarter. The next quarter this is reversed, the one in school taking the job of the one working and paying back the money borrowed. In this way they are able to earn their way and graduate eventually without being heavily in debt.

Question No. 2. How many part-time?

In this class we find the greatest number of employees, two hundred forty-four at twenty-three colleges, most of whom are students. Only three institutions have part-time help that are not students and there are only thirteen employees in this group.

Question No. 3. How many have never been students in dairying?

At fifteen colleges all the employees on the payroll in April had been students in dairying at one time or another. Replies were not

received from eleven states on this question. Eight states had only one on the payroll who never had been a student in dairying; five states had two, six had three, and one had as many as fifteen. This is a large number but the explanation was given that they were all routemen or girls.

Question No. 4. How many have been Short Course students?

At Michigan all the employees had been Short Course students. No reply was received from seventeen states. At twenty-one institutions no employee had been a Short Course student.

Question No. 5. What was the Creamery Payroll, April?

Not all the college creameries reported their payroll and two asked that it be treated confidentially. The total for the thirty-five reporting was $17,399.25 with the average of $497.12. Table XII gives a list of those reporting payrolls above the average.

TABLE XII

PAYROLLS ABOVE THE AVERAGE AT THIRTEEN COLLEGE CREAMERIES

Institution	Payroll	Institution	Payroll
1. Purdue	$1,678.69	8. Cornell	$778.00
2. Penn State	1,450.00	9. Tennessee	770.00
3. California	1,409.85	10. Connecticut	644.00
4. (Confidential)	1,126.71	11. Ohio	614.65
5. Michigan	1,110.00	12. Massachusetts	558.27
6. Maryland	865.92	13. Texas	535.00
7. (Confidential)	797.95		

Question No. 6. What is the rate per hour for student labor?

There is a variation all the way from 15¢ to 50¢ per hour for student labor. At Ohio State a student may earn as much as 50¢ per hour at piece work. At one institution 30¢ is paid beginners and 45¢ to experienced

seniors. A large majority of the institutions pay from 25¢ to 35¢ per hour with the higher rates predominating in the eastern states.

Question No. 7. Do students receive University credit for work?

"No" is the reply given on thirty-six of the questionnaires. "Yes" was given by three -- Maryland, North Carolina, and Utah.

Question No. 8. Remarks.

Louisiana: "Students specializing in Dairying are employed only."

Colorado: "Full time man ranked as assistant. Responsibility is limited to processing, helping to get things ready for manufactures laboratories, cleaning up and keeping manufactures laboratories and equipment in shape."

Michigan: "We use three full-time men, one sales clerk, and a full-time bookkeeper. These men supervise all work and such student help as used."

Utah: "The management and operations class do all the work in the creamery at half pay. The class is limited to eleven students."

Wisconsin: "Commercial salaries - The department payroll is divided between commercial, teaching, and research."

Section V. Finances.

Question No. 1. Indicate agency through which purchases are made: State Treasurer, University Treasurer, Department Head.

The answers to this question cannot be classified satisfactory because it was not clearly stated, therefore a variety of interpretations were made. Several indicated the Department Head as the agency because the purchases must be O.K'ed by him first. Others indicated some administrative office of the University as the agency such as the business manager, purchasing agent, and college treasurer. Colorado, Connecticut, Kansas, Maryland, Massachusetts, North Carolina, Oregon, South Dakota, and West Virginia indicated the State Treasurer as the agency. The Department Head, University Treasurer, and State Treasurer were all underscored on several questionnaires. The question must have puzzled a few because they did not attempt to answer it.

Question No. 2. Does the creamery do its own banking and bookkeeping?

Only four college creameries have the responsibility of doing their own banking, but twenty-six keep books.

Question No. 3. Is the manager paid through funds obtained in creamery operation?

The managers are not paid by the creamery at fifteen of the colleges. At thirteen institutions the entire salary is paid through funds obtained in creamery operation. Eight states report that the manager or plant superintendent is paid amounts varying from one-sixth to one-half their salary through the creamery funds.

Question No. 4. Does the University supplement the fund from creamery operation?

In twenty-one states they do not and in seven states the creamery

funds are supplemented by the University. Four universities pay the managers' salaries.

Colorado makes this statement: "Yes, with small budget which our profits must greatly supplement in order to function. The strictly manufactures budget not segregated. College budget only sufficient to take care of other class work outside of manufactures. Creamery really helps college budget."

New Mexico: "College gives the department as a whole, an appropriation, but production and manufacturing funds are not separate on the college books.

Question No. 5. Do the profits from creamery operation go into the University Treasury?

Nineteen replies were "No", fourteen "Yes". The profits go to the State Treasury in one case. "No profits" is given by another.

In answer to this question, Illinois makes this notation: "Budgeted to budget - balance of the department subject to rules and regulations of the comptroller's office."

Question No. 6. Are profits from creamery operation set aside for the exclusive use of the department?

Eighteen replied "Yes" and eleven replied "No". "Not necessarily", "Revolving Fund", "Supposedly", "Nearly All", and "Partly" are given by others.

Section VI. Services Rendered to the State.

Glassware is tested at the following State Colleges: Idaho, 7,416 pieces, Purdue 45,380, Maryland 7,707, Nebraska 19,300, and New Hampshire 597. Table XIII shows the number of institutions that test glassware, score butter, etc., the number that do not, and the number that made no reply.

TABLE XIII

SERVICES RENDERED

	Yes	No	No Reply
Testing Glassware - - - - - - - - -	5	20	13
Scoring Butter - - - - - - - - - -	32	3	13
Scoring Milk - - - - - - - - - - -	24	10	14
Scoring Ice Cream - - - - - - - - -	25	8	15
Composition - - - - - - - - - - - -	31	2	15
Filtration Tests - - - - - - - - -	18	15	15

California charges $10 for the scoring and testing of thirty samples of butter per month. The testing includes the yeast and mold counts, the filtration test, and the composition test. Under this plan they scored and tested 1,335 samples of butter during 1935.

Illinois and Idaho charge 5¢ per sample for testing milk, whereas the charge at West Virginia is 10¢ per sample. Kansas, Missouri, Ohio State, and Penn State charge $1.00 for running the composition test on butter. The charge at Iowa is 50¢, South Dakota 40¢, and Wisconsin 20¢.

Comments from Letters Returned with Questionnaire.

The subject of "College Creameries" can be fairly well developed through questionnaires, but not completed without letters that give information impossible to include in a questionnaire. The following letter, stating the purpose of the questionnaire, asking for experiences and history, and giving our experiences, was sent out to all land-grant colleges and universities.

> "We are making a study of College Creameries both as to operation and design of plants. Enclosed is a questionnaire - three copies, one for you to fill out and return at your convenience (let it be soon) and the other two for your files. If there is any information in the questionnaire you wish to be treated confidentially put a check mark after it and we shall respect your wishes.
>
> "A letter giving some of your experiences in the operation of college creameries would be quite welcome. We would like to know a little of the history of your creamery and the attitude of local plants and dairymen toward the operation of it. If you have any small pictures of your building inside and out, they would add much to our study of college creameries.
>
> "In 1922, the University of Tennessee Creamery began operation in the rear center wing of the new Agricultural Building. The old Cooperative Creamery had been razed so that its site could be used for the new building. The Cooperative Creamery, which handled only the one product - butter, had not been entirely satisfactory. When the new creamery began operation, milk and cream were bought outright from the farmers. Some objections by dairymen were expressed at the time operations began but they soon ceased. Once in awhile we hear of objections now, but they are never serious. We have received splendid cooperation from the plants. A friendly spirit has always existed because we have tried to assist them in every way possible, such as giving advice, providing them with cultures, loaning them supplies, running tests for them, and teaching them how to make cottage cheese, etc.
>
> "What are the main difficulties in the operation both within and without your plant? If you know of any published or any unpublished articles on "College Creameries" we shall be glad to hear about them.
>
> "We want to thank you for the time in answering this questionnaire and we hope that we can be of service to you sometime."

Some of the questionnaires were returned with no letters, others sent letters but made no comments except to acknowledge the receipt of the questionnaire, but the majority sent very interesting and enlightening letters.

Attitude of Local Plants.

Alabama. The question concerning the attitude of local plants and dairymen brought out some interesting comments. Burke[7] from Alabama writes:

> "When we first started up with our creamery we experienced quite a lot of difficulties and antagonism from the producers in this vicinity who believed we were in direct competition with their activities. We finally succeeded in overcoming their objections and are now working on friendly terms. The college assists them whenever possible with their problems and supplies milk and dairy products in periods of shortage. I believe these difficulties are typical of most college creameries when they first begin operation. Under our present arrangement we do not solicit trade. Furthermore, we do not sell any of our dairy products outside the city of Auburn. We always cooperate in maintaining prices. Under these conditions we are getting along nicely."

Professor Burke brought out an important point concerning the difficulty in which a college creamery finds itself when it first begins operations. The difficulty is that of getting customers without stirring up ill feeling. There are only two ways to get new milk customers, one is to take them away from local dairymen or milk plants and the other is to watch for new people moving into the community and go after their business. Either way brings disappointment to those already established in business. When it is a tax-supported institution that is taking the business then there is bound to be ill feeling on the part of the local dairymen or milk plants. They may feel their loss so keenly that they petition the college authorities or even the state legislature to stop the operation of the creamery.

Utah. The Dairy Department at Utah[8] met with difficulties in the sale of products from the college creamery. Quoting letter of June 25, 1936:

> "We have had considerable trouble with commercial dairies in the sale of our products and have had to fight it out in the legislature two or three times."

North Dakota. At North Dakota[9] they succumed to the objections of local interests.

> "About five years ago the Department began operating a milk route indirectly, that is, we sold milk to a couple of students who in turn operated their own milk route. This practice was carried on for about two years when pressure from the local dairymen became so strong that we found it advisable to discontinue this business. Now we purchase no milk or cream. We utilize the milk obtained from the college herd of approximately thirty to thirty-five cows and the products are sold over the retail counter. The one dairyman that obtains milk here purchases our surplus skim milk but does not buy any whole milk. We have found it advisable to market our products through our own retail store as more or less dissatisfaction is likely to occur if we were to sell our milk to one dealer in the city. Fargo is the home of a large number of dairies and milk plants. Consequently the existing plants are vying for the volume of business and any attempt of the college to enter into commercial activities is looked upon unfavorably and rather than gain the ill will of the local industry, we are staying pretty much within our limits."

Arkansas. A similar situation existed at Fayetteville, Arkansas[10] several years ago where "actual milk routes" were operated but were discontinued for "some reason". "The attitude of the local producers toward us is quite good now. We will not arouse their antagonism so long as we bottle milk which is actually produced by the University herd."

Colorado. Colorado has had some sad experience with the local dairymen. At Fort Collins they had a fire back in 1927 and a new laboratory was built in 1929. When the writer visited the plant in 1930 he was impressed with the arrangement of the plant not only for the carrying on of a commercial operation but also for the instruction of students. The

refrigerating plant was used jointly by the creamery and the Animal Husbandry Department which had meat cooling rooms. A sales room for dairy products and meat products would seem quite ideal.

But trouble was ahead as is given in the letter from Professor Locke:(11)

> "This worked admirably and certainly was constructive to good instruction.....However in 1933 due to some disconcerted local dairymen and other factors, we were practically closed up. We had a ruling handed down that we were to process only college herd milk and buy outside raw products only in the semester in which the subject was taught. This has been a nightmare, far from being efficient or economical, and has certainly lost us availability of proper facilities for good instruction as well as limited student interest in Dairy Manufactures."

Virginia. The Department of Dairy Husbandry at Virginia Polytechnic Institute met with difficulties a number of years ago in the sale of sweet cream to hotels and restaurants outside the city of Blacksburg.(12)

> "When the creamery industry in the state of Virginia developed to a point where they began looking for outside trade of this character, some of the creamery operators in this section of the state thought that they should have this business and raised some objections to the college creamery. After discussing this matter for some time we decided to confine our business to the college and town and have done so ever since 1921."

Illinois. Large institutions as well as small ones have been affected in their operations by local interests.(13) A letter from Prof. H. A. Ruehe at Illinois tells of difficulties not only in the milk business but also in the butter business.

> "About two years ago the farmers' organization felt that we were doing too much business in the fluid milk business since they felt we were a competitor for their fluid milk. A year ago I asked the President to appoint a dairy commission to study this problem and after weeks of deliberation they handed in a report, the main features being that the creamery should operate on the minimum scale that would give the proper facilities for class and research. If possible we should confine our fluid milk to that of our own herd and they recommended that we be permitted to enlarge the herd up to 125 milking animals."

"Since the first of February we have been operating on a new basis which was developed in accordance with the commission's report. We increased our herd somewhat so that we obtain an average of 3,200 pounds of milk per day. We are not buying any milk from the farmers. We have reduced our bottle trade to about 550 quarts per day....

"Two years ago the farmers in this region started their own cooperative creamery and during their first year they manufactured one and one-half million pounds of butter. Since they are using the hauling system they have practically eliminated our cream patrons so that now we are only receiving about 1,200 pounds of fat per month in the form of farm skimmed cream. In fact, it is necessary for us to purchase cream from the Beatrice Creamery Company plant in order to supply our needs. We have tried to purchase cream from the cooperative plant but the price which they have made us has been prohibitive. I should like to state, however, that we have always had a cooperative feeling between our creamery and the local commercial plants. We have helped the local cooperative plant considerably but we do not feel quite as close in our operations with that plant as we do with some of the others."

Pennsylvania. From the largest college creamery, Pennsylvania,(14) comes this message which exhibits an attitude quite different from the rather meek ones already given.

"We probably have the largest college creamery in the country from the standpoint of volume of business done. Our peak volume was reached in 1929 when our sales amounted to well over $500,000. We are doing as much or more business now but due to the prices received our sales will not go much over $200,000 at the present time.

"We have around 300 patrons, approximately 250 selling gathered cream to us and the rest selling fresh milk.

"We operate our own business without much supervision from the college. The local dealers would love to see us to broke or be forced out of business. On several occasions they have petitioned the legislature and the governor to put us out of business. However, we have been in business longer than any of them in State College and feel that we are not competing with anyone but that these dealers are competing with us as we were here first. The community has a wholesome respect for our creamery and our products. The farmers from whom we buy are our very good friends."

At other institutions the competitive sentiment has not risen to the point where the operations of the college creamery has been limited to campus trade nor brought to the attention of the state legislature.

Kansas. Professor Martin[15] writes from Manhattan, this paragraph on local opposition:

> "From time to time we have had certain amount of opposition to the operation of our plant on the part of local dairies and for this reason we have always made it a policy not to operate on any larger scale than was absolutely necessary for the conduct of our classes and research work."

New York. Professor H. E. Ross[16] writes from Cornell this paragraph:

> "We do get objections from local people who are engaged in various forms of dairying. However, in the main I do not think that the objections are serious. They spring up from time to time, and we try to meet them as best we can."

Maryland. The University of Maryland is located about eight miles from the Capitol Building in Washington, D. C., and along No. 1 Highway leading from Maine to Florida. Naturally there is much travel along that highway. They have developed perhaps the largest retail salesroom of any college creamery in this country. Their ice cream cabinet holding twenty-four 5-gallon cans was installed last year; also a refrigerated display case.

Not only do they sell dairy products, especially ice cream, but pies, cakes, macaroons, and fudge which are made by students or graduates. The opposition to their operation does not come from the ice cream plants but from operators of restaurants and a drug store. Professor H. L. Ayres[17] writes this paragraph:

> "The usual argument is that the University does not pay taxes; our view is that as the University gets any profits, the State gets the benefit. The Maryland-Virginia Milk Association thinks we should charge 13¢ per quart (the same as the Washington dealers charge for delivering out here). One Maryland dealer

is delivering for 10¢ per quart. We charge 11¢ per quart and a 5¢ deposit on each bottle taken out. We do not deliver and claim there is more profit in our plan and it is a demonstration of what might be made a saving to both consumer and dealer."

New Hampshire. As is the case at Maryland, considerable ice cream trade is conducted at the University of New Hampshire in Durham. Prof. K. S. Morrow[18] writes: "We have been subjected to some criticism for our competition with privately owned ice cream makers."

Nebraska. Prof. H. P. Davis[19] of Nebraska writes:

"From time to time some person or plant raises some objection to some phase of operation of the college creamery, but we have always been able to show that we are using this plant primarily for instruction and for research work and that a volume of production is necessary in order that these two objectives could be carried out in the proper manner."

New Jersey. Prof. F. C. Button at Rutgers[20] tells of an unusual plan they have in operation:

"Twenty years ago it seemed wise to let a local distributor handle our deliveries and retail sales. We have continued to bottle 'Rutgers Special Milk' here in our market milk laboratory but the local dairy supplies the clean (?) bottles, cases, and cans. We cap and load the milk and deliver it to his plant.....Quite a bit of milk is produced beyond our bottle needs. This surplus goes as bulk milk to the distributor's plant where it is used as a part of his special pasteurized milk. We have about ten cows on irradiated yeast feeding and this vitamin D milk goes to the dealer in bulk where it is pasteurized for vitamin D bottle trade."

California. Professor Roadhouse[21] at California tells of a plan that is well-worth remembering in dealing with local plants in the purchase of milk.

"You ask for a statement of our main difficulties both within and without the plant. I cannot say we have any difficulties of more than usual importance. Occasionally when we want more milk and take a patron away from a creamery, it causes some feeling. We try not to make any drastic changes. My experience after nineteen years of supervision of our plant has taught me that gradual changes are easiest to carry out without friction. If we are increasing the amount of milk handled by our plant, this is usually done gradually, and, if possible, by encouraging the dairymen to add more cows rather than take patrons away from other creameries."

Cooperation With Local Plants.

Michigan. Such a splendid letter was received from the Dean of Agriculture, E. L. Anthony,[22] of Michigan State College, that it is given below in full. The policies outlined for the operation of their creamery have helped them to avoid difficulties found elsewhere.

"I have your letter of May 14th with the attached questionnaire asking for information regarding the operation of our college creamery. I have filled out the attached questionnaire and am returning it to you and trust that it may give you some helpful information. Inasmuch as I suppose that you will perhaps prepare a summary from the questionnaires returned, I will be very glad indeed to have you send me a copy of such a summary when it is completed.

"The practice of operating a creamery is one that calls for a considerable amount of careful administration. From my knowledge and observation of a number of institutions, the operation of such a college creamery in many cases has brought about a good deal of criticism and strife within the institution. We are very proud of the fact that ever since the incorporation of our college creamery here we have had the finest of cooperation on the part of competing business organizations and the finest support of the dairy interests in this territory and throughout the state as a whole.

"I believe much of our success in this matter has been due to the fact that we have always adhered to the policy of never underselling our competitors. We keep a very close business relationship with the other commercial concerns in this locality and always follow their price schedules rather than setting price schedules ourselves. We always aim to sell for as much or a little more than any of the rest of them and always pay exactly the same price for the milk or dairy products which we buy. In this way we have avoided either price favoritism to our producers or price competitors.

"We have also always observed the policy of never advertising our products and when any comparisons are made always to hold that our products while of good quality were not necessary superior to that of our competitors. We have also avoided much difficulty, I believe, in the past by selling all of our material to a wholesaler who in turn distributes this material on retail routes throughout the locality. In this way the matter of collections and credits and dissatisfaction are generally taken up by an intermediate person and relieves the college of some unnecessary criticism.

"We have also avoided many financial difficulties by having had a very far-sighted policy developed years ago by our local college treasurer in seeing that all of our accounts of our college creamery are systematized and handled through the comptroller's office of the institution. In this way there is never any suspicion on the part of the State Board of Agriculture and others that our business methods are not in conformity with that of the institution or not instantly available to them at any time. Through the use of what is known as a Creamery Revolving Fund it has been possible for our business transactions to all be handled through the comptroller's office but handled with the freedom equal to that of having the entire responsibility for handling these funds by the creamery itself. Each month the college comptroller deposits the amount of money from our revolving fund which it is estimated will be necessary to cover our daily purchases direct from farmers. This money is deposited in a local bank to our checking account. Upon the return of the cancelled checks by the bank, they constitute the record for the additional deposit for the next month. This makes it possible for us to pay our farmers at the dairy each day for the milk without unnecessary delay or red tape and yet have the whole system completely under the control of the college.

"All the purchases which we make are made through regular requisitions as is the case of all departmental funds. While our college creamery has always been considered profitable, we make no large amounts of profits due to the fact that the creamery furnishes such a large amount of service and materials to the Dairy Department proper both for teaching and research. Such materials and facilities as the creamery can offer to the Dairy Department for teaching and research are lumped together as an offset against such services as light, heat, and general administration which the college furnishes to the creamery. This, we have found to be a very excellent system as it avoids a lot of unnecessary detail and relieves us of a lot of hair-splitting which always causes misunderstanding and dissatisfaction.

"Trusting that this material will be of service to you, and being much interested in a summary of the survey which you may make, I am "

Idaho. At Idaho they have a very satisfactory agreement with the local creamery by which they can supplement their own laboratory facilities with work in the plant of the local creamery.

Texas. Professor Shepardson[23] gives the following information concerning the college creamery at Texas:

"I might explain that our institution is a little unusual in that the college is located five miles from the town of Bryan and College Station is a small community made up almost entirely of college people. We have never attempted to make deliveries in Bryan and consequently have had no difficulty with merchants in Bryan over our business enterprise. There is one small plant in that town and we have always worked in close cooperation with them. At our retail counter we sell to anyone who calls, and at present we have many customers who drive out from Bryan to secure dairy products."

Connecticut. Professor Anderson[24] of Connecticut tells of good co-operation with a local ice cream plant:

"In regard to ice cream we cooperate with an ice cream concern in Willimantic. We sell most of the ice cream purchased in the college community. The Williamantic ice cream manufacturer serves two stores adjacent to the campus. We cooperate with each other in regard to taking up the slack in either plant. By that I mean during vacation periods when we have a surplus of milk he may buy cream from us and at other times when he is short of ice cream we accomodate him until his production makes up the difference."

Should A College Operate A Creamery?

More than ten years ago a study of this question was made by a committee on "The Operation of College Creameries" and their report[25] given at the twentieth Annual Meeting of the American Dairy Science Association, October 13, 1925, Hotel Severin, Indianapolis, Indiana. The committee was composed of Professor M. Mortensen of Iowa State College, Prof. A. A. Borland of the Pennsylvania State College, and Prof. P. M. Brandt of the Oregon Agricultural College.

This study was quite comprehensive in that it included Collegiate Courses, Short Courses, Extent of Laboratory Training, High Cost of Dairy Instruction, and Consideration of Self-Supporting Creamery. Its recommendations were as follows:

> "1. Laboratory instruction in dairy manufacturing work must be conducted under conditions closely resembling those existing in a commercial plant if it is to adequately round out the course of instruction.
>
> "2. The completeness with which factory conditions are imitated should be determined by needs of the industry in each state, as seen by the institutions concerned.
>
> "3. Where an institution cannot meet the cost otherwise it is justified in operating a self-supporting plant, buying and selling on the open market.
>
> "4. The extent of operation should not go beyond the point that is necessary for educational purposes and where sufficient volume is handled to make the operation of the unit safe from a business standpoint."

The report of that committee was made nearly eleven years ago. Opinions change in that length of time as we discover in the comments made this year on the subject.

From Professor J. H. Frandsen,[26] Head, Department of Dairy Industry, Massachusetts State College comes this word:

"My own personal comment is that I think perhaps there has been a tendency for some institutions to go into commercial work further than actual teaching needs demanded. This I think is a mistake. On the other hand, I would fight to the last ditch for an opportunity for dairy departments to do enough commercial work to give the students the needed practical work to make them proficient and skillful in dairy practices."

Virginia Polytechnic Institute. Professor Holdaway,(12) Head of the Dairy Department, Virginia Polytechnic Institute, gives his version of the problem in these words:

"I believe that college creameries will always meet a certain amount of criticism if they engage in outside business in competition with creameries. However, it is certainly to the advantage of the college creamery to operate on a large scale if they can do so without too much antagonism, and I have always maintained that it is distinctly to the advantage of the industry in the state to have a large creamery operation at its agricultural college. If the industry can see this thing in the right light, they should consider the college creamery as being a training school and laboratory for its own men, and thus would consider it a necessary part of their own plant and equipment, but they do not want to look at it in this way where they have mercenary ideas."

North Dakota. Professor Jensen(9) at North Dakota Agricultural College makes this statement:

"After several years of teaching this type of work, I am fully convinced that a department of this type should be engaged in the manufacture of dairy products in order to give the students the proper type of instruction."

South Dakota. Teaching is more practical according to Professor T. M. Olson,(27) Head of the Dairy Department at South Dakota State College. His words are as follows:

"Because of our commercial business I feel that our own teaching can be made more practical and we are confronted with practical problems of creamery operation which we could not theorize on. So personally I feel that it is a splendid thing for a state institution to operate a commercial plant."

Oregon. Professor C. H. Wilsten[28] of Oregon attacks the problem from the angle of state appropriation:

> "We have pointed out to the creameries that it is necessary to operate a creamery at the State College on a small commercial basis and since we are not receiving any state appropriation, it is necessary to have a sufficient volume so that the operation will be economical.....We feel that it is absolutely necessary to have a small creamery in order to give adequate instruction to our students in Dairy Manufacturing. Without such a creamery we would be unable to render as great service to the state as we are now."

New York. At Cornell no special appropriation is made for the purchase of milk and therefore the creamery should be self-supporting, according to Professor H. E. Ross.[16]

Georgia. According to information received from Georgia, the creamery there operates on the smallest volume of any in commercial operation. The letter from Professor Bennett[29] gives it as the main difficulty in these words:

> "The main difficulty which we are having with our plant is a small volume of material handled and lack of complete equipment. Our volume is so small that it is not possible to make butter as often as is desirable to maintain the highest quality in our butter. The volume is also so small that frequently material is needed for laboratory work when it is not on hand."

Colorado. The longest comment was received from Professor Rush B. Locke[11] of Colorado where they have had trouble with local dairymen over the operation of the creamery. His opinion and experiences are these:

> "1. A college creamery that is an actual going concern is fundamentally essential to the proper instruction of Dairy Manufactures student. This permits the students to actually 'get the feel' of the Dairy Manufactures industry, and acquire some of its skills and arts and apply their factual and technical information.
>
> "2. It guarantees the raw product will always be available for class work.

"3. It permits the students access to various steps in manufacture which class periods do not always permit time to accomplish.

"4. It oftentimes permits students part time work on a remunerative basis.

"5. It keeps the dairy manufacturing staff constantly alert to the common problems of the dairy industry as well as keeping their skill in the art of manufacturing at a keener tempo.

"6. Keeps facilities always available for greater services to the industry.

"7. It makes for efficiency, uniform disposition of by-products and greater dispatch of routine or added duties.

"Granting a college creamery as a going concern I question very seriously the statement that the department is in the dairy business in the full sense of the word. The manufactured or processed dairy products are nothing more or less than a by-product of their particular type of teaching, research, and investigation.

"Regarding the disposition of these by-products of Education. In my opinion, the product should be disposed of in the most satisfactory and economical way in order to guarantee a steady, dependable, uniform and economic outlet. The retail sales method has always seemed the best procedure to me. This gives the college the assurance of the necessary disposition of its products at all times. (In this regard I would say the public is not quite as fickle and treacherous as an individual or one track outlet which may leave you high and dry, figuratively, overnight.)

"Competition. Neither do I consider the college in competition with the industry men. The services rendered by the college to the dairy people of the state more than offset any possible liability that could be inferred on this point. However, if the word competition must be admitted into the problem of education, I most sincerely submit that it is the cleanest, most healthful type of competition in existence, namely, no price wars, always selling at the prevailing prices or above, and the setting of a quality standard very unassumingly. This is as it should be, for these are part of the many problems we are continually assisting the industry people with.

"Then there is another service. The visits by grade schools, home economics departments, both high school and college, Smith-Hughes boys, etc. This is a direct asset to the dairy industry in the state. There is usually ample room in the college creamery because such arrangements have been provided to facilitate student instruction.

"Therefore a college creamery is fundamental. Without it your problems and worries are magnified many fold. Your dairy student enrollment dwindles and the boys gradually drift off to dairy schools in other states. The dairy industry men loose their interest, particularly in short courses, feeling, I presume, that they do better than that in their own plant.

"In brief, the teaching of Dairy Manufactures without a college creamery is a dilemma. It is a continual hunt to find ample raw material; it is often extremely difficult to have it available on time for classes, your refrigeration and coolers are off, your churn and all other wooden equipment and utensils dry out and crack, rust spots on cans intensify. You can't control quality and have to take what you can get, and the disposition of the product is a problem.

"In summary I would say that with any favorable support whatsoever from one's college officials, and they certainly should be the ones to think of the dairy industry in its entirety, that the running of a college creamery efficiently for the purposes of instruction, will cause far less problems and worry to the departmental personnel than to try to offer a creditable course in Dairy Manufactures without a college creamery. It will also do much constructive lasting good to the dairy industry in its entirety.

"Hence we could go on indefinitely. The above gives some of the major problems, let alone the lack of mention of minor details, inconveniences, and worry. Figuratively speaking, one cannot teach Dairy Manufactures out of a bucket."

Summary of Questionnaire on College Creameries.

Section I. Operation.

Question:	Answer:
1. Does your Dairy Department operate a college creamery?	"Yes" 37. "No" 10. No reply 1.
2. Is it operated 12 months out of the year?	"Yes" 35. "10 to 11 months" 2.
3. How many years has it been in operation?	"6 years" to "44 years".
4. Is it a cooperative creamery?	All answers, "No".
5. Does the creamery manager teach? How many hours per week?	"Yes" 25. "3 hours" to "full time".
6. Lbs. of butter mfd. in April?	27 reported total 134,351. Largest 21,349.
7. Gallons of whole milk pasteurized in April?	32 reported total 222,269. Largest 36,000.
8. Lbs. of cottage cheese manufactured in April?	28 reported 44,676. Largest 22,078.
9. Lbs. of cheddar cheese manufactured in April?	11 reported 12,140. Largest 6,795.
10. Any additional points of interest?	Gallons of ice cream were given here by many.

Section II. Sales.

1. Are dairy products sold in town?	"Yes" 27.
2. Does the university purchase dairy products for its dining halls and cafeteria from the college creamery?	"Yes" 40. (Including the college dairies)
3. Is a sales room operated for the students and towns people?	"Yes" 30.
4. How many trucks are owned and operated?	27 operate 36-1/3 trucks. (see note)

Section II. Sales (Continued)

Question:	Answer:
5. Is the University herd milk sold through the creamery?	"Yes" 35.
6. Do local dairymen purchase milk at the college creamery to sell in town?	"No" 20. "In case of shortage" 10. "all to one distributor" 1. "student has route" 1.
7. Underline products sold:	Milk 40; Coffee Cream 29; Whipping Cream 36; Butter 29; Buttermilk 33; Cottage Cheese 30; Cream Cheese 18; Cheddar Cheese 19; Ice Cream 29; Ice Cream Mix 12; Orange Juice 5; Choc. Milk 29; Condensed Milk 8
8. Remarks: Question No.4:	One Creamery has 1/3 interest in trunk.

Section III. Purchases for April, 1936.

1. Milk from University herd?	1,802,319 pounds. 46 reporting. Average 39,181 pounds.
2. Milk purchased from local dairymen?	2,537,254 pounds. 23 reporting. Average 110,615 pounds.
3. Sour and sweet cream for buttermaking?	75,377 pounds. 20 reporting.
4. Are the patrons paid direct from a bank account of the creamery?	"No" 19. "Yes" 8.

Section IV. Employees in April, 1936.

1. How many full time?	"15" students reported by 5. "133" not students reported by 22.
2. How many part time?	"244" students reported by 23. "13" not students reported by 3.
3. How many have never been students in dairying?	"All" (15). "1" (8). "2" (5). "3" (6).
4. How many have been Short Course students?	"None" (21). "All" (1).
5. What was the creamery payroll, April?	"$17,399.25" (35). Average $497.12.

Section IV. Employees in April, 1936 (Continued)

Question:	Answer:
6. What is the rate per hour for student labor?	Varied from 15¢-50¢. Ave. 25¢-35¢.
7. Do students receive University credit for work?	"No" (36). "Yes" (3).

8. Remarks: (The figures in quotations are the total employees and figures in parenthesis the number of creameries reporting)

Section V. Finances.

1. Indicate agency through which purchases are made: State Treas., University Treas., Dept. Head.	(Too much "red tape" to summarize)
2. Does the creamery do its own banking and bookkeeping?	"Banking" (4). "Bookkeeping" (26).
3. Is the manager paid through funds obtained in creamery operation?	"Partly" (8). "Yes" (13). "No" (15).
4. Does the university supplement the fund from creamery operation?	"No" (21). "Yes" (7).
5. Do the profits from creamery operation go into the university treasury?	"No" (19). "Yes" (14).
6. Are profits from creamery operation set aside for the exclusive use of the department?	"Yes" (18). "No" (11).

Section VI. Services Rendered to the State.

	No	Yes	Charges	Number of samples in 1935.
Testing Glassware - - - - -	30	5	3¢-5¢	
Scoring Butter - - - - - -	3	32		
Scoring Milk - - - - - - -	10	24		
Scoring Ice Cream - - - - -	8	25		
Composition tests on butter	2	31	20¢-$1	
Filtration tests - - - - -	15	18	0¢-25¢	
Other tests - - - - - - - -		1	0¢-10¢	
Other services - - - - - -	(Nothing to "Multitudinous")			

CONCLUSIONS

1. There is considerable variation in the operation of college creameries in the land-grant colleges of the United States, not only in the plan of operation but also in the volume and kind of products manufactured.
2. There are no strictly cooperative creameries operated by Dairy Departments in any of the land-grant colleges today, although several were started a number of years ago.
3. The size of the creamery should be determined largely by local conditions such as the local market for the sale of the products, the number of dairy manufacturing students, and the amount of dairy products purchased by the university cafeteria and dining halls.
4. Colleges should operate creameries of sufficient size to provide adequate and practical instruction at all times to dairy students according to the opinions expressed by virtually all representatives of college creameries.
5. College creameries should give employment to worthy students not only for the purpose of providing an opportunity for them to work their way through college but also to give them practical training not included in regular courses so that they can gain experience in handling practical problems.
6. There should be whole-hearted cooperation between college creameries and all other local dairy interests, including manufacturing plants, health departments, and dairymen, as well as similar agencies throughout the state.

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