

# *Dairy Substitutes*

## **IN MISSOURI**

Production

Consumer Reaction

Probable Effects on Dairying

UNIVERSITY OF MISSOURI      COLLEGE OF AGRICULTURE  
AGRICULTURAL EXPERIMENT STATION

BULLETIN 658

J. H. LONGWELL, *Director*  
COLUMBIA, MISSOURI

JULY, 1955

## TABLE OF CONTENTS

Reasons for the Growth of Dairy Product Substitutes in Recent Years .....	3
Effect of This Development on the Dairy Industry .....	4
Pricing Differentials Between Dairy Products and Filled Counterparts .....	7
Volume of Farm Products Used in Ice Cream-Type Filled Dairy Products .....	8
Nutritional Aspects of Filled Dairy Products .....	10
Consumer Attitudes Toward Dairy Product Substitutes .....	12
Summary .....	17
Literature Cited .....	18
Appendix Table, Production of Ice Cream and Mellorine-Type Frozen Dessert .....	18

This bulletin reports on Department of Agricultural Economics research project No. 167, "The Change in Demand and Supply Relationships of the Dairy Industry in Missouri." The study was financed in part by the Missouri Farm Bureau Federation.

# Dairy Substitutes In Missouri

STEPHEN F. WHITTED

The dairy industry is being subjected to powerful economic forces which are bringing about changes in it. These changes are due to many factors and interactions with the rest of the economy. An examination of some of these factors should be of interest to the individuals who are concerned with the dairy industry of Missouri.

During 1953, the issue of filled dairy products received widespread publicity and attention both within and without the dairy industry. Nine states permitted the manufacture and sale of vegetable fat frozen dessert in that year, which was an increase of five over the previous one (Alabama, Arkansas, California, Illinois, Missouri, Montana, Oklahoma, Oregon, Texas). California, one of the nine, did not allow this

product to be "manufactured, processed, frozen, handled, distributed, or sold in any place where ice cream or ice milk is manufactured, processed, frozen, handled distributed, or sold."<sup>1</sup>

Several states legalize the sale of such products but require full disclosure of their character. Their laws usually require that the amount of other fats or oils and their type be clearly indicated on the label.

In developing a public attitude toward these products the interests of all the citizens should be considered. "Legal and administrative control should insure proper and uniform labeling and disclosure of contents. Then, if a person prefers to buy vegetable or animal fat "filled" dairy products, he can exercise his freedom of choice."<sup>1</sup>

## REASONS FOR THE GROWTH OF DAIRY PRODUCT SUBSTITUTES IN RECENT YEARS

Most of these substitute products have their milk fat replaced with vegetable fats which reduces the demand for butterfat and so tends to depress its price. This can have serious repercussions on the dairy industry, since at the present time the price of milk is largely based on its fat content. A pertinent factor in this changing situation is the fact that there are fairly close substitutes for the fat portion of the milk. In 1952, per capita consumption of butter in the United States was 8.8 pounds, compared to 7.8 pounds of margarine and it is expected that this trend of substitution will continue. Furthermore, most of the other major dairy products can also be manufactured with vegetable fat substituted for the milk fat.

*Not a New Development.* This is considered to be a new development by many people but filled cheese (then called oleo cheese) was made in New York State as early as 1880.<sup>2</sup> In these early instances, lard was usually substituted for the butterfat since in those days it was more plentiful and cheaper than vegetable oils. This early product was hard to distinguish from real cheese when consumed shortly after manufacture, but when held a short time it deteriorated rapidly. In 1884 New York outlawed this process. Other states continued to manufacture and export filled cheese until 1912 when the business died for want of buyers.

*Introduction of Mellorine-Type Frozen Desserts.* One of the newest and most dramatic developments

in this field is the introduction of the Mellorine-type frozen dessert. This is made with fats or oils other than butterfat in combination with certain milk solids. The 1952 production in the four states of Illinois, Missouri, Texas, and Oklahoma where it was legal totaled 11,008,000 gallons.

The production of frozen desserts made with fats other than butterfat got its start in Texas in the last few years, but the volume produced was small until the Texas Department of Health by regulation authorized its production under the name of Mellorine.<sup>3</sup> This term is also used in some other states to designate a product similar to ice cream but made with animal or vegetable fats or oils, or both, instead of butterfat. The terminology for this new product is not comparable in all states and much remains to be done in setting standards and in developing uniform terminology.

The production of frozen desserts using vegetable fat doubled between January and December 1952 in the 4 states which permitted its sale (Illinois, Missouri, Oklahoma, Texas). Production continued to increase in those states during 1953 and frozen desserts were legalized in 5 additional states.

The manufacture of filled evaporated milk which has vegetable fat in place of milk fat is permitted in 4 states.

*Vegetable Fats Can Be Produced Cheaper than Butterfat.* Of the vegetable oil used in these products, nearly all is either soybean or cottonseed oil. Today,

<sup>1</sup>See "Literature Cited," page 18.

6 hours of labor expended on an acre of land can produce enough soybeans to yield 220 pounds of oil. This is 36 pounds per man hour and 220 pounds per acre.\*

Allowing 3 acres of cropland and 2 acres of pasture for a dairy cow with the average production of cows in Dairy Herd Improvement Association herds of 366 pounds of butterfat, production is at the rate of 73 pounds to the acre. With 120 hours of man-labor per cow, the production is 3 pounds of butterfat per man-hour. Some modern, efficient dairymen use as little as 90 hours of man labor per cow. At this rate, the production would be 4 pounds of butterfat per man-hour.

These data point out in a dramatic manner the reason for the wide price discrepancy between butterfat and cotton seed and soybean oils. Unless it becomes evident that butterfat is more valuable for human nutrition than the vegetable fats, or preferences for it increase in relation to those for the vegetable fats more than has been evident in the past, it is inevitable that the vegetable oils which can be more cheap-

ly produced will continue to replace the more expensive butterfat. Consumers, in the aggregate, are interested in securing the greatest amount of palatable nutrition per unit of land, labor, or capital expended and will endeavor to do so without regard for the welfare of the dairy industry. As long as the consumer can obtain a product which he considers equivalent to the original at a lower price and as long as the manufacturer finds it profitable to make this product, it will continue to gain in popularity.

*High Support Prices Encourage Increased Production of Substitutes.* The practice of high government support prices on butterfat undoubtedly has contributed directly to the growth of substitute products. As long as a manufacturer can separate the butterfat from his milk, manufacture it into butter and sell it to the government for 57 cents per pound and then replace this with vegetable fat which can be purchased for 23 cents, he will follow this procedure to the greatest possible extent.

## EFFECT OF THIS DEVELOPMENT ON THE DAIRY INDUSTRY

For a great many years we have been using nearly all of our milk fat for human consumption, but as late as 1923 only a little over half of the non-fat solids was utilized for this purpose (Graph 1). This means that the dairy industry had been geared to produce the amount of fat which was required and the excess non-fat solids had been used for animal feed. In fact a considerable part of the non-fat solids has been fed to calves, chickens, and hogs on the farms. The cream was separated from the milk on the farm, the cream sold, and the skimmed milk fed. In other instances the whole milk was delivered to the creamery where the separation was performed and the skimmed milk returned to the farms. The non-fat solids in excess of human needs, which found their way into the market, were converted into animal feeds such as dried skim milk, and semi-solid buttermilk. The solids used for animal feed were regarded as a by-product and were valued lower accordingly. This has resulted in milk being priced principally on the basis of its fat content.

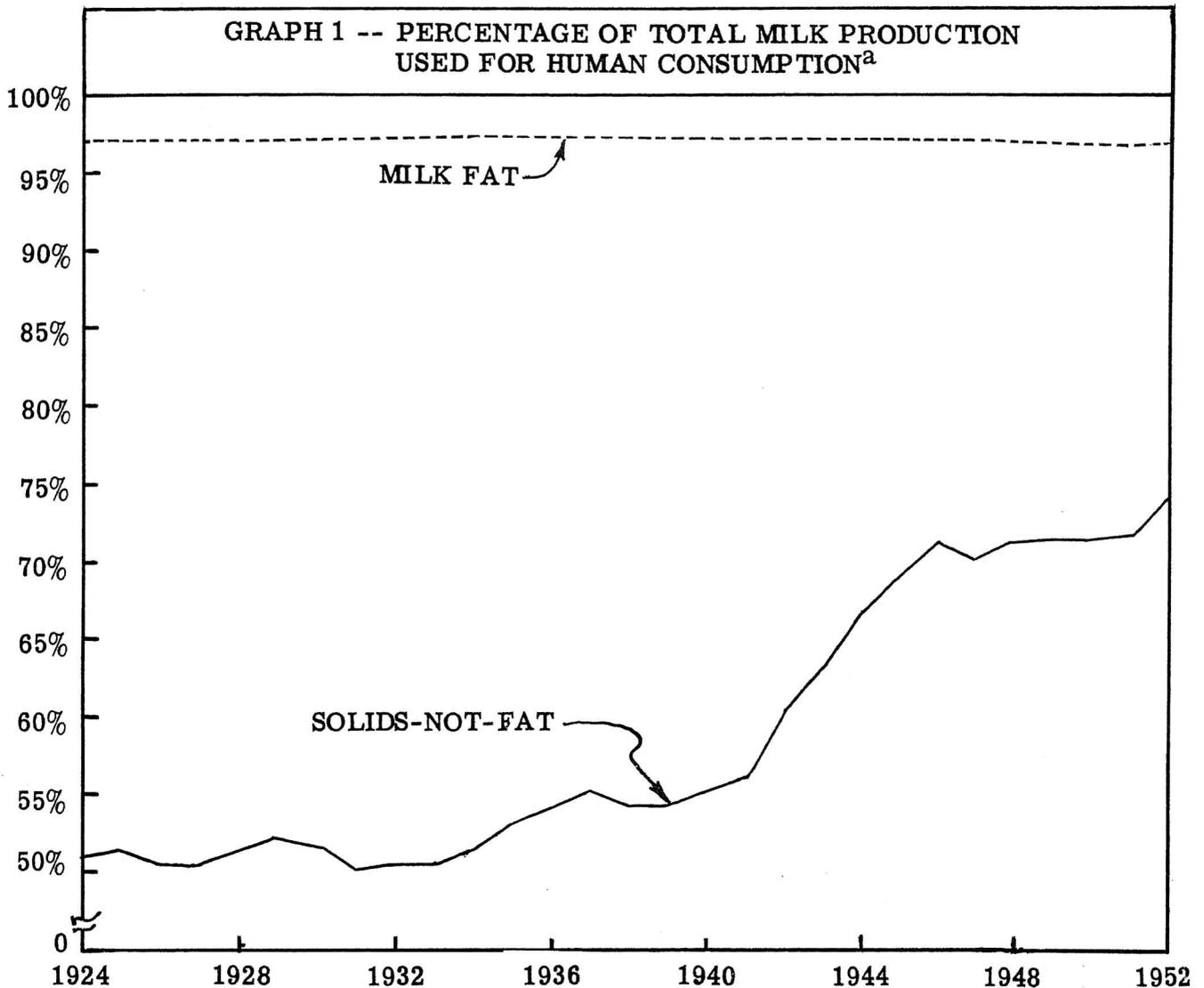
Since 1923 an increasing part of the non-fat solids has been used for human consumption. (Graph 1) This trend continued until, in 1952, about three-fourths of the non-fat solids produced in the United States was used for human food. It is estimated, how-

ever, that in spite of a growing population, per capita consumption of non-fat solids could be maintained at the present level until 1975 without any increase in milk production if these solids were more completely utilized for human food.<sup>4</sup> This would mean, of course, that there would be less to feed to the calves, chickens, and hogs.

*More Milk Marketed from the Farm in Whole Form.* The growing use of the non-fat portions of milk for human consumption and in commercial channels has had an important influence on the manner in which milk is marketed from the farm. In 1924, only 29 percent of the milk was marketed from the farm as whole milk while 33 percent was sold as farm separated cream. (Graph 2). As the demand for the non-fat portions of milk increased, this was modified until in 1953, 69 percent was marketed as whole milk and only 14 percent as farm separated cream.

*Since Milk Is Priced on Basis of Fat Content, Substitution of Vegetable Fats Has More Than Proportionate Influence on Price.* It is, of course, improbable that all milk will ever be marketed from the farm in its whole form since the sale of cream fits in well with the organization of many of our farms. However, as long as enough whole milk is marketed

\**Cull the Cow That Culls Your Profits*, U.S.D.A., PA-250, June 1954, p. 4 The figures for both soybeans and butterfat are at the farm level and do not include labor expended on transportation or processing after the product leaves the farm. The soybean figures are based on an assumption of a production of 22 bushels per acre and a yield of 10 to 11 pounds of oil per bushel.

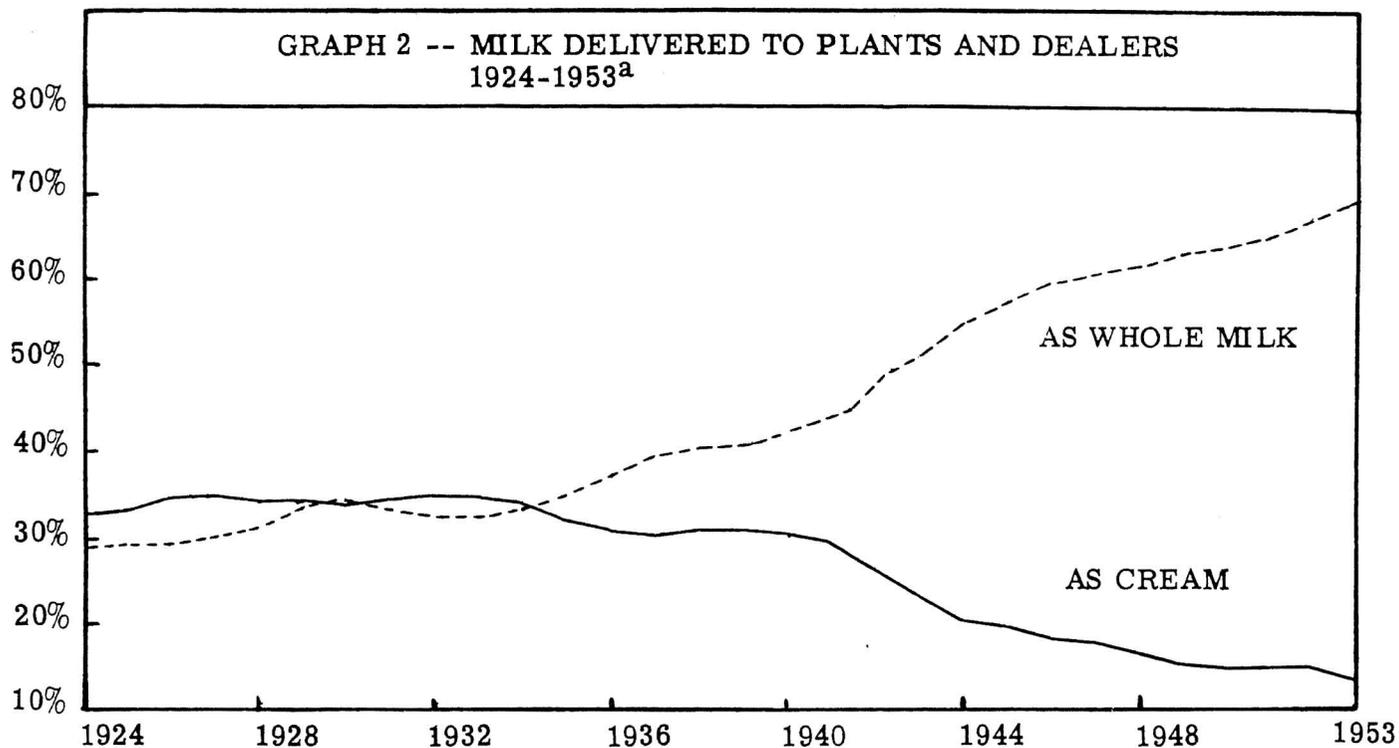


<sup>a</sup>Data obtained from Dairy Statistics and Related Series, United States .  
Department of Agriculture, Bureau of Agricultural Economics,  
Statistical Bulletin No. 134, October, 1953, pp. 69-70

to produce more of the non-fat solids than is demanded for human food, the price of these solids will tend to be based on their value as animal feed. This will cause milk to be priced principally on the basis of the component, fat, which is almost completely utilized for human consumption. It is unfortunate for the dairyman that this is true, since butterfat is coming under stiff competition from outside sources. This is the reason why the introduction of products that utilize vegetable fats, which can be more economically produced, in place of the traditional butterfat can have an influence on price more than proportionate to the volume produced and sold.

In the past, milk production has been geared to produce the amount of butterfat required by the economy. As long as this is true each pound of vegetable fat used to replace a pound of butterfat will destroy the market for about 25 pounds of farm milk. If this is considered from the viewpoint of the producer it is unfavorable but from the viewpoint of the consumer it is advantageous since he can obtain the same amount of satisfaction with less expenditure.

*Makes Possible Greater Output of Dairy Type Foods with no Increase in Milk Production.* This same problem can be approached in a different manner. In the past, the output of dairy products has been



<sup>a</sup>The Dairy Situation, U.S.D.A., Agricultural Marketing Service, Washington, D. C., June 17, 1954, p. 7. Milk not delivered to plants and dealers was used on farms or retailed by farmers. That utilized on farms has declined from 27 percent in 1924 to 14 percent in 1953 and that retailed by farmers has also declined -- from 7 percent in 1924 to 3 percent in 1953.

determined largely by the amount of milk fat produced. Non-fat solids in excess of human needs were channeled into lower value uses. Even now, about one-fourth of these non-fat solids are being used in this manner. (Graph 1.) With this new technology which makes it possible to combine vegetable fat with these previously excess non-fat solids and produce palatable, nutritious food, it is possible to increase the output of this type of food without a comparable increase in milk production.

An increase in supply without a corresponding increase in demand will tend to depress prices. Therefore, this new technology which makes it possible to increase the output of dairy type foods without increasing the productive resources devoted to milk production is not an unmixed blessing. Even though it enables consumers to have additional amounts of palatable, nutritious food with very little additional inputs, it tends to depress the farm price of milk. This problem of depressed farm prices for milk is a situation which will tend to work itself out over a period of time as the growing population comes into balance with the dairy output. But this problem cannot be

ignored until it is solved by time. If it had been possible to easily curtail production to present needs, the problem would probably never have arisen, but due to the high fixed costs involved in dairying and the difficulty of rapidly adjusting production, a reduction in output is not a ready made solution.

This problem should not be allowed to seriously harm the industry since dairying is an enterprise which can be but slowly rebuilt after a serious setback. Any measures which are taken to lessen the impact should be carefully examined, however, to ascertain that the remedy is not more harmful than the disease. Markets, once lost, may be difficult or even impossible to regain. In this connection, the fact should not be overlooked that butterfat consumption still carries in the minds of consumers a certain implication of prestige. With a little judicious promotion and with price a little more in line with that of the competition, the genuine products can undoubtedly hold their own in the struggle for sales volume. Recent butter sales seem to bear out this contention. With the lowering of butter prices this spring, sales picked up while sales of margarine tended to decline. This in spite of the fact

that the average price of butter was over twice that of margarine.

*May Lead to Improved Stability and Higher Prices in Long Run.* Even though the practice of substituting vegetable fat for butterfat may cause some painful readjustments in the short run, the long run effects may not be so detrimental. As vegetable fat is combined with the previously excess non-fat portions of milk to make food products, it will be possible to utilize a progressively greater portion of these non-fat solids for human consumption. As this occurs, the dairy industry will be on a firmer foundation since a larger part of its output will be used in the higher

value outlets for human consumption. This will allow the price of milk to be based more and more on the most nutritionally valuable parts of the milk for which there is no known substitute. This change in pricing practices, however, cannot feasibly be brought about as long as the production of non-fat solids greatly exceeds the demand for human consumption.

In the Boston market, the Federal Milk Order bases the price of milk on wholesale commodity prices, department store sales, feed prices, and labor costs. This is one method being used in some sections by the dairy industry in an effort to get away from the precedent of pricing milk and dairy products almost entirely on the basis of fat content.

### PRICING DIFFERENTIALS BETWEEN DAIRY PRODUCTS AND FILLED COUNTERPARTS

High quality cream such as is used in the manufacture of ice cream can be bought for about 80 cents per pound of butterfat at the present time. A first quality vegetable fat which may be used in the production of frozen dessert can be purchased in small lots for about 23 cents per pound. With this information at hand, it is possible to compute the difference in the value of the fat in a quart of ice cream and in a quart of vegetable fat frozen dessert.

*Difference in Value of Fat in Quart of Ice Cream and Fat in Quart of Vegetable Fat Frozen Dessert.* A quart of ice cream mix weighs about 36 ounces. With an average overrun of about 80 percent, a quart of ice cream would weigh around 20 ounces or 1.25 pounds. Most ice cream will contain about 12 percent butterfat. This would require 0.15 pound of fat in a quart of ice cream or vegetable fat frozen dessert. At 80 cents a pound, the butterfat in a quart of ice cream would cost 12 cents. At 23 cents a pound, the vegetable fat in a quart of frozen dessert would cost about 3.5 cents. The butterfat in a quart of ice cream would cost about 8.5 cents more than the vegetable fat in a quart of frozen dessert.

If it is assumed that the manufacturing costs are about the same, the price differential between the two products should be only about 8.5 cents per quart. If the costs involved in separating the butterfat from the milk and in adding the vegetable oil are considered, the differential would be a little less. If the vegetable fat dessert is subject to less stringent controls and con-

tains a lower proportion of fat, the spread between the two products is correspondingly greater.

*Difference in Value of Fat in Evaporated Milk and Filled Evaporated Milk.* The difference in the value of the fat contained in a tall can of evaporated milk and in one of the comparable filled product can be computed by the same process. Such a can contains 14.5 ounces or 0.90625 pounds of evaporated milk which is required by law to test 7.9 percent butterfat. Each tall can of evaporated milk contains 0.072 pounds of butterfat which would cost 5.76 cents at 80 cents per pound. The vegetable fat in a comparable can of the filled product would cost 1.66 cents at 23 cents per pound. At present prices, therefore, the butterfat in a large can of evaporated milk costs 4.1 cents more than the vegetable fat in a can of filled evaporated milk.

*Action Which Will Widen Spread Between Price of Butterfat and Price of Vegetable Fat Will Encourage Increased Substitution.* The fat in a quart of filled fluid milk would cost nearly 4 cents less than that in a quart of whole milk. It readily can be seen that with the present wide differential in the prices of the two types of fat there is a strong economic incentive both on the part of the processor and the consumer to encourage the production of the filled products. Any action which tends to maintain or widen this differential will encourage growth in the use of these products.

## VOLUME OF FARM PRODUCTS USED IN ICE CREAM-TYPE FILLED DAIRY PRODUCTS

In 1952 the production of Mellorine-type frozen dessert increased tremendously both in Missouri and in the United States. Although production in the United States doubled in 1953, it leveled off in Missouri with only a 39 percent increase. (Table 1) Sixty-eight Missouri plants produced an average of 26,000 gallons per plant in 1952. The increase in 1953 was due partly to the entry of three more plants but mainly to a 35 percent increase in output per plant.

Production per plant was greater in 1953 than in 1952 in each of the four states which permitted the manufacture and sale of this product in both years. The greatest increase was made by Illinois plants, (100 percent) and the least by Oklahoma plants, (5 percent). The increase per plant in the United States was 25 percent.

The relative increase in total production was greatest in Oklahoma with a gain of 309 percent and least in Missouri with a gain of 39 percent. The tremendous gain in Oklahoma production was due to the great increase in number of plants which manufactured this product.

California plants had the greatest output per plant, producing an average of 188,333 gallons each in 1953, compared to the smallest output of 20,000 gallons per plant in Oklahoma and 40,000 gallons in the United States. The large output per plant in California is probably due to the fact that California law does not permit this product to be manufactured in a plant which manufactures ice cream. The total output of the 6 California plants consisted of Mellorine. This is in contrast to most of the plants in other states which produce both ice cream and Mellorine.

According to the seasonal pattern of ice cream production, January and December are nearly the same. The Missouri production of Mellorine-type frozen dessert in December 1952 was over six times that of the January production (Graph 3). It should

be noted, however, that Missouri production in 1953 fell into a fairly normal seasonal pattern. This could mean that the growth of the industry in Missouri is nearly complete and further increases in production will not be as rapid as those which have occurred in the past. The increase in United States production over the same period of time was 119 percent.

*Production of Frozen Dessert in Missouri in 1952 Utilized More Than 11 Million Pounds of Skimmed Milk.* A total of 347 plants in four states, Illinois, Missouri, Oklahoma, and Texas, produced the entire output of this product in 1952. Missouri's 68 plants produced 16 percent of the total. The 1,780,000 gallons of frozen dessert produced in Missouri used about 1,068,000 pounds of non-fat milk solids. This would be equivalent to about 11,866,700 pounds of skimmed milk.

In 1953, Missouri's 71 plants produced 2,477,000 gallons of vegetable fat frozen dessert which was 11 percent of the total production. This 2,477,000 gallons of frozen dessert utilized approximately 16,513,300 pounds of skimmed milk.

It should be remembered, however, that the sale of this frozen dessert probably displaced the sale of some ice cream so that it cannot be considered as a net gain in consumption of non-fat solids.

If it is desired to take a pessimistic viewpoint of this situation, it could be stated that about 1,446,500 pounds of butterfat were displaced by the sale of frozen dessert in Missouri in 1953. The average fat test of ice cream manufactured in the United States from 1946-1953 was 11.68 percent. This percentage of the 12,385,000 pounds of frozen dessert produced in Missouri in 1953 will approximately equal the amount of butterfat which would have been contained in an equivalent volume of ice cream. It should be kept in mind, however, that the lower price of the frozen dessert may have stimulated consumption so that a small-

TABLE 1 -- PRODUCTION OF MELLORINE-TYPE FROZEN DESSERT, 1952 AND 1953<sup>a</sup>

State	Production (Thousand Gal.)		Number of Plants		Prod. Per Plant (Thousand Gal.)		Percent Change '52 - 53		
	1952	1953	1952	1953	1952	1953	Pro- duction	Number Plants	Production Per Plant
Illinois	2,457	5,300	100	105	25	50	116	5	100
Missouri	1,780	2,477	68	71	26	35	39	4	35
Oklahoma	542	2,215	29	109	19	20	309	276	5
Texas	6,349	10,870	150	206	42	53	71	37	26
Other States <sup>b</sup>		1,632		68		24			
United States	11,128	22,494	347	559	32	40	102	61	25

<sup>a</sup> Production of Mellorine-Type Frozen Desserts, 1953, U.S.D.A., Agricultural Marketing Service, July 23, 1954, Washington, D. C.

<sup>b</sup> Alabama 19 plants 56,000 gallons, Arkansas 17 plants 106,000 gallons, California 6 plants 1,130,000 gallons, Montana 11 plants 79,000 gallons, Oregon 15 plants 261,000 gallons.

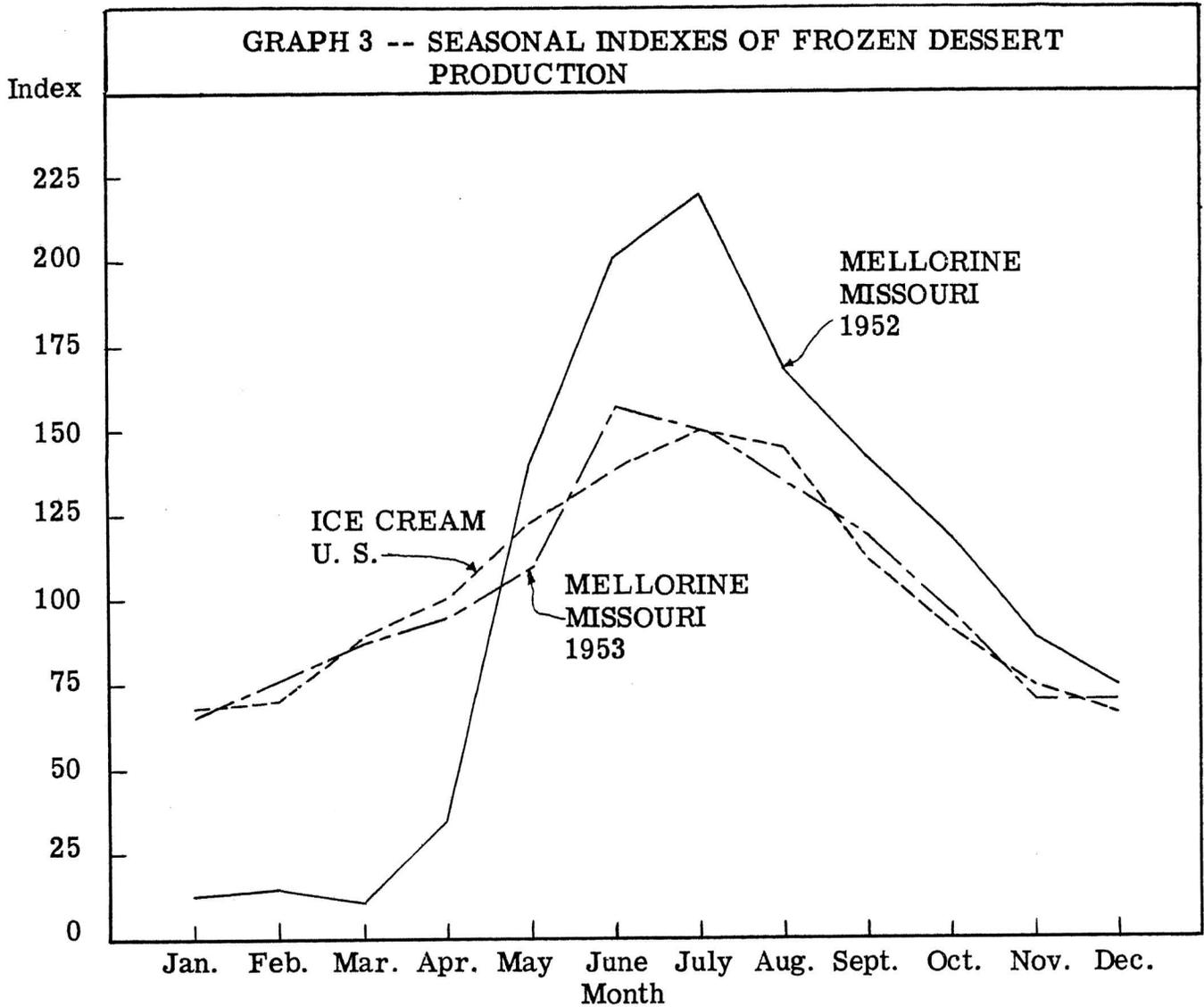


TABLE 2 -- PRODUCTION OF ICE CREAM AND MELLORINE-TYPE FROZEN DESSERT; U.S. COMPARED WITH FOUR STATES WHICH PRODUCED FROZEN DESSERT IN 1952<sup>a</sup>

	Production of Ice Cream		Ice Cream and Frozen Dessert 1952	Increase Ice Cream and Frozen Dessert 1951 to 1952 (Percent)
	1951	1952		
	(Thousand gallons)			(Percent)
Illinois	32,814	32,394	34,851	6.21
Missouri	16,495	16,348	18,128	9.90
Oklahoma	6,193	6,280	6,822	10.16
Texas	24,466	22,155	28,504	16.50
Four State Total	79,968	77,177	88,305	10.43
United States	568,849	591,576	602,704	5.95

<sup>a</sup> Production of Manufactured Dairy Products, 1952, U.S.D.A., Agricultural Marketing Service, Washington, D. C., p. 13. Production of "Mellorine-Type" Frozen Desserts, 1953, July 23, 1954, U.S.D.A., Agricultural Marketing Service, Washington, D. C.

er volume of ice cream was required to replace it. Therefore it is quite likely that a considerably smaller amount of butterfat than estimated here was displaced by the sale of the frozen dessert.

**Interaction Between Production of Ice Cream and Mellorine-Type Frozen Dessert.** Nearly 10 percent of the total (ice cream and frozen dessert) Missouri production in 1952 was vegetable fat frozen dessert but only about 2 percent of the total United States production was made up of this product. In 1953, the frozen dessert portion of Missouri production increased to 14 percent and for the United States it had increased to 4 percent of the total.

Production of ice cream declined in three of the four states which manufactured frozen dessert in 1952 while United States production increased. If the frozen dessert production is included in the total, however, production increased nearly twice as rapidly in the four states as in the United States as a whole. (Table 2.) The average increase in the four states was 10.43 percent, compared to 5.93 percent for the United States. This appears to indicate that the introduction of frozen dessert encouraged an increase in consumption of this type of product. When it was tested statistically, however, there was no significant difference between the increased consumption in the four states and in the United States.

In 1953, data were obtained from nine states on the production of frozen dessert. Production of ice cream declined in all but two of these states, California and Alabama, and here the increase in ice cream production was very slight. (Table 3.) The average reduction of 4.7 percent in the production of ice cream in the states which permitted the manufacture and sale

TABLE 3 -- CHANGE IN THE PRODUCTION OF ICE CREAM AND OF THE TOTAL OF ICE CREAM AND MELLORINE-TYPE FROZEN DESSERT<sup>a</sup>

State	Ice Cream		Ice Cream and Frozen Dessert	
	1951-52	1952-53	1951-52	1952-53
	(Percent)			
Illinois	- 1.3	- 8.01	+ 6.21	+ .72
Missouri	- .9	- 3.4	+ 9.90	+ .82
Oklahoma	+ 1.4	-16.8	+10.16	+ 9.05
Texas	- 9.4	- 9.4	+16.50	+ 8.56
Total all four	- 3.5	- 9.2	+10.43	+ 3.92
Alabama	+ 5.8	+ 1.5	-----	+ 2.31
Arkansas	+ 3.7	- 3.6	-----	+ .73
California	+10.8	+ .77	-----	+ 3.27
Montana	+ 9.2	-10.7	-----	- 8.01
Oregon	- 1.1	- 6.1	-----	- 2.09
Total of five	+ 8.5	- .54	-----	+ 1.99
Total of nine	+ 1.6	- 4.7	+ 9.62	+ 3.10
U. S. Total	+ 3.99	+ 1.8	+ 5.93	+ 3.74

<sup>a</sup> See appendix Table I for basic data.

of Mellorine-type frozen dessert is particularly noteworthy when it is compared with an increase of 1.8 percent for the United States as a whole.

When the 1953 total production of ice cream and frozen dessert for the nine states is studied, the increase over the previous year is only 3.1 percent compared to an increase of 3.7 percent for the United States as a whole. This suggests the possibility that the greater increase in total production in the four states where sales of frozen dessert was permitted in 1952 was a chance occurrence.

The 1953 data indicate that the introduction of Mellorine-type frozen dessert leads to a reduction in ice cream production with only a compensating increase in output of the substitute product. Apparently the sales of frozen dessert in 1953 displaced approximately equal amounts of ice cream.

## NUTRITIONAL ASPECTS OF FILLED DAIRY PRODUCTS\*\*

The vegetable fat problem is primarily one of competition rather than of nutrition. Aside from established habits, people tend to choose the product which tastes the best, presents the best appearance, sells for the best price and which they believe has the highest nutritive value.

Most of the nutritional research up to the present time has had to do with comparisons between butter and margarine but these findings should be valid in relation to the filled dairy products since the comparison here is also between vegetable fats and butterfat.

An early study by Boutwell, et al., in 1943, reported that rats fed levels of 25, 30, and 35 percent butter-

fat increased in rate of growth in direct proportion. When fed the same proportions of corn oil, they decreased in rate of growth as the ration percentage was increased. The greatest difference in nutritive value of the two fats appeared at the 35 percent level. A lack of uniform growth was observed in the corn oil group.<sup>5</sup> All of these levels of fat are in excess of the average proportion found in the human diet, and so application of these results to humans is questionable.

Studies conducted by Euler and Hanz in Sweden, of the growth, fertility, and longevity of rats over four generations, showed no significant difference between butter and margarine in these respects. Other studies

\*\*The data in this section were assembled by Dr. Margaret Mangel, Professor of Home Economics, University of Missouri, and the summary here presented has been checked by her.

conducted in California by Dr. Deuel covering 25 generations of rats indicated that hydrogenated vegetable margarine fat had a nutritive value equal to that of butter fed with an otherwise adequate diet.<sup>6</sup>

In an earlier experiment, rats were fed different lots of milk containing butterfat, corn oil, cottonseed oil, and soybean oil. The milk filled with vegetable oils was homogenized in all cases. Good growth was obtained in all cases but the rats receiving milk containing butterfat made better gains, had finer fur and produced stronger young.<sup>7</sup>

Growth response to margarines was even better than to butter in some other animal experiments conducted by Dr. Deuel. These experiments were designed to measure the essential fatty acids found in a number of different fats. Good growth response also was obtained from vegetable oils and most hydrogenated fats.

Long term experimental evidence of the effects on human beings of eating vegetable fats is difficult to obtain but surveys of groups of people in which the second generation is eating margarines, show no deficiencies attributable to the use of this fat.

It is true that in some Minnesota experiments conducted by Dr. Gullickson, calves could not be raised on the substituted-fat mixtures fed.<sup>8</sup> Workers at Iowa State College, however, reported excellent results in raising young dairy calves on a filled milk containing hydrogenated soybean oil.<sup>9</sup> The growth of the calves fed the filled milk equaled that of those receiving whole milk.

The calves fed filled milk made by adding crude expeller soybean oil or without added vitamins did not grow well and suffered scouring and high mortality.<sup>10</sup> These studies would seem to indicate that butterfat is not materially superior to a number of other fats from a nutritional standpoint provided vitamins A and D are adequate.

In fact the erroneous belief that butterfat is higher in caloric value than vegetable fat is encouraging increased consumption of frozen dessert in some instances. Some of the individuals who were interviewed in the consumer preference study stated that they preferred vegetable fat frozen dessert to ice cream because it was less fattening. Of course, some low fat frozen desserts such as the sherbets and the ice milks are available but most of the Mellorine-type frozen desserts have a fat content comparable to that of ice

cream. An ounce of one type of fat will put on just as much weight or provide just as much energy as an ounce of the other.

Recently there has been evidence that the incidence of heart disease is related to fat consumption. This is thought by some workers to be due to the cholesterol contained in the fat and early indications seem to indict butterfat as a chief offender. Dr. Keys of the University of Minnesota says that it is the total fat intake which is important rather than the kind of fat included.<sup>11</sup> The normal human body seems to be able to synthesize cholesterol so that its intake may not be too important in this respect.

It is not possible to overemphasize the importance of looking to impartial studies when seeking information of this type since there are many pseudo-scientific reports issued by agencies which are financed by interested parties. In many cases these reports are nothing more than pure propaganda based on half truths and statements by reputable research workers quoted out of context. Any such report should be studied with a critical eye, and knowledge that it is written to influence the reader should always be kept in mind.

Dr. Margaret Mangel says, "I do not believe that the combination of milk solids and a nutritious vegetable fat in filled milk, or frozen desserts for that matter, is nutritionally harmful."<sup>12</sup> She further states that we at present have no nutritional substitute for the non-fat portion of milk and that in cases where the purchaser cannot afford a sufficient supply of milk, she would recommend the form in which the most non-fat milk equivalent could be secured, provided vitamins A and D are available.

To be realistic, a purely vegetable fat diet is not important since few individuals subsist entirely on such fare. The question which needs answered is, "Does vegetable fat in the diet produce harmful effects on human beings?" The answer seems to be that it does not. Humans have been consuming vegetable fats in various forms without apparent harmful effects, since the beginning of time.

In fact if the filled product can be sold at a price which is low enough to enable individuals of limited means to consume more non-fat milk solids than would otherwise be possible, a definite benefit may be realized because the parts that are most valuable nutritionally are in this portion.

## CONSUMER ATTITUDES TOWARD DAIRY PRODUCT SUBSTITUTES

Consumers in seven areas of the state were interviewed in an attempt to ascertain their attitudes toward certain dairy products and their substitutes. Five of the areas were in St. Louis and were designated so that the population in each was approximately equal and the level of living of the inhabitants was as homogeneous as possible. One of the other areas was Joplin and the other Moberly. Stores were selected by use of a table of random numbers from each of these areas and customers in these stores were interviewed. In an attempt to remove, insofar as possible, the effect of the judgement of the interviewer, he was instructed to select the third customer who approached his station at the start and thereafter every third person who approached his station after the completion of an interview. There were few non-respondents. In some cases, near 12:00 o'clock and 5:00 o'clock, the percentage of non-respondents increased due to their hurry to get home for the usual meal time. There does not seem to be any reason to believe that these non-respondents would materially influence the results of this study. In case of a non-respondent the next person approaching the station was selected for interview. A total of 329 respondents were selected and interviewed in this manner.

**Frozen Desserts.** A little more than half of the 329 respondents had purchased and used vegetable fat frozen dessert at one time or another. Only two of the areas deviated very far from the average figure of 55 percent. Sixty-six percent of the respondents in a low income area in St. Louis and 63 percent of the respondents in Moberly had used frozen dessert.

When the responses were tabulated according to income groups, the percent of the respondents who indicated that they had used frozen dessert varied only about 4 percent on each side of the average. The only exception to this was in the case of the highest income group composed of those who received more than \$150 a week. In the case of this group, only 37 percent indicated that they had ever used frozen dessert. Since there were but 11 respondents in this group it is doubtful that this variation has any particular significance.

When the responses were tabulated according to the educational level of the respondent, the lack of difference between the groups was even more noticeable since only one of them varied from the average by more than 2 percent. The group which had more than 16 years of education showed a considerable deviation from the rest in that only about 44 percent of them had used vegetable fat frozen dessert.

More than two-thirds of the 180 respondents who

had used vegetable fat frozen dessert considered it a satisfactory† substitute for ice cream. Again, the proportion of the respondents replying in the affirmative was greater in the low income area in St. Louis and in Moberly than the average of 71 percent for the entire survey. Eighty-three percent of the respondents who had used vegetable fat frozen dessert in the St. Louis area and 79 percent of those in Moberly indicated that they considered it a satisfactory substitute for ice cream.

When the responses were tabulated according to income of the respondents, considerable variation was found but it did not bear a close relationship to increases in income. An interesting variation revealed here was the fact that only about 45 percent of those individuals receiving incomes of between \$100 and \$150 per week who had used the vegetable fat frozen dessert considered it a satisfactory substitute for ice cream, compared to the average of 71 percent for the entire survey. This variation is difficult to explain in light of the fact that 75 percent of those receiving incomes in excess of \$150 per week considered it a satisfactory substitute. It is possible that those in the income group between \$100 and \$150 per week felt obliged to maintain their social position by consuming ice cream instead of a substitute whereas those receiving over \$150 per week did not consider it necessary.

When the responses were tabulated according to educational level, a more noticeable relationship was revealed. As the level of education increased, the percent of the respondents who considered vegetable fat frozen dessert a satisfactory substitute for ice cream decreased. (See Table 4) Eighty-six percent of those

TABLE 4 -- NUMBER AND PERCENT OF RESPONDENTS BY EDUCATIONAL LEVEL WHO HAD USED FROZEN DESSERT AND CONSIDERED IT A SATISFACTORY SUBSTITUTE FOR ICE CREAM

Educational Level	Was it a satisfactory substitute for ice cream? <sup>a</sup>	
	Number Respondents	Percent Yes
Under 8 years	7	85.7
8 years but under 12 years	55	80.0
12 years	72	70.8
Over 12 years but under 16 years	35	57.1
16 years and over	11	54.5
Total	180	70.6

<sup>a</sup> This question was asked of those who had used the vegetable fat frozen dessert. The term satisfactory was not defined and could have included a certain sense of satisfaction due to the saving of a few cents as well as to the appeasement of the desire for this food. Since this is a value judgment, it would be very difficult to separate these two influences.

†The term satisfactory was not defined and could have included a certain sense of satisfaction due to the saving of a few cents as well as to the appeasement of the desire for this food. Since this is a value judgement, it would be very difficult to separate these two influences.

with less than an eighth grade education considered the frozen dessert a satisfactory substitute. This percentage declined consistently with increasing educational level until only 55 percent of those with a college degree considered the frozen dessert satisfactory.

Many of the respondents failed to answer the question about how much more they would pay for a quart of ice cream than for a quart of vegetable fat frozen dessert. Evidently many of them did not have a certain amount fixed in their minds but decided between the two desserts each time a purchase was made on the basis of their attitude at that particular moment.

The 104 respondents who cooperated in this part of the study stated that they were willing to pay an average of 11.2 cents per quart more for ice cream than for the vegetable fat frozen dessert. (See Table 5.)

TABLE 5 -- AMOUNT ABOVE PRICE OF VEGETABLE FAT FROZEN DESSERTS RESPONDENTS WILLING TO PAY FOR ICE CREAM

Amount above price of vegetable fat frozen dessert respondents willing to pay for ice cream (Cents)	Number of Respondents	Percent of Respondents
0	5	4.8
1 - 10	61	58.6
11 - 20	27	26.0
21 - 30	11	10.6
Total	104	100
Average Differential (cents)		11.2

About 5 percent of the respondents who answered this question would not pay any more for ice cream than for the vegetable fat frozen dessert. In fact, two not included in this tabulation stated that they actually preferred the vegetable fat frozen dessert. Sixty-three percent of them stated that they would not pay in excess of 10 cents more per quart for ice cream. In other words, only 37 percent of the individuals who replied to this question were willing to pay in excess of 10 cents more for a quart of ice cream. This is particularly significant when it is recalled that the fat in a quart of ice cream at present prices costs about 8.5 cents more than in a quart of vegetable fat frozen dessert.

When the respondents were grouped according to income, there were no material deviations from the average. In fact, 39 percent of the lower income group were willing to give in excess of 10 cents per quart more for the ice cream, while only 33 percent of the highest income group was willing to give this much more. When the respondents were grouped according to education the results were similar. Thirty-five percent of those with less than a high school education were willing to give in excess of 10 cents more per quart while only 31 percent of those with a high school education were willing to give in excess of 10

cents more for the ice cream.

When respondents were asked to rank a number of possible reasons why they preferred ice cream, a great majority of them indicated that they preferred the ice cream because it tasted better. (See Table 6.)

TABLE 6 -- RANKING OF REASONS RESPONDENTS PREFERRED ICE CREAM

Reason	Ranking			Total Number Choices
	1st	2nd	3rd	
	(Number of Respondents)			
Tastes better	144	25	22	191
Family prefers it	30	71	41	142
More nutritious than others	27	46	49	122
Totals	201	142	112	455

This reason received nearly five times as many first choices as the next most popular one. Many of the respondents chose "family prefers it" for the second choice. This reason is related closely to the first choice and the two probably could have been tabulated together without destroying the validity of conclusions from them.

Several of the respondents indicated that they preferred ice cream because they believed it to be more nutritious. A tabulation according to the educational level of the respondent did not disclose a meaningful relationship. Nineteen percent of those with less than a high school education selected this reason while 17 percent of those with a high school education or higher selected it. A tabulation according to the income of the respondent also failed to reveal differences. There were other reasons available for choice, but the next most popular one was chosen by only six individuals.

The list of reasons from which the respondent made his selection was randomly arranged. Six different random arrangements were made. These six lists were handed out in rotation for the consideration of successive respondents in order to minimize the possibility of securing biased results due to the arrangement of the list. The respondents were not forced to select reasons contained in the list but were permitted to name additional reasons which they considered relevant. In the case of some of the other products studied it will be noted that a significant portion of the respondents availed themselves of this opportunity and designated reasons not contained in the list.

When they were asked to choose the reason they preferred vegetable fat frozen dessert, most of the respondents indicated that they preferred it because it was cheaper. (See Table 7.) In fact nearly six times as many of them chose this reason as any other. The tabulation according to income of the respondents revealed that this was just as popular a reason for those

TABLE 7 -- RANKING OF REASONS RESPONDENTS PREFERRED VEGETABLE FAT FROZEN DESSERT

Reason	Ranking			Total Choices
	1st (Number of respondents choosing)	2nd	3rd	
Cheaper	86	19	2	107
Just as good as others	3	20	12	35
Keeps better than others	2	13	15	30
Family prefers it	0	16	11	27
Tastes better	15	9	1	25
Total	106	77	41	224

in the highest income bracket as for those in the lowest. In fact, 43 percent of the respondents in the highest income bracket chose this reason, compared to 35 percent of those in the lowest income bracket. The next most popular reason was that the vegetable fat frozen dessert was just as good as others. This reason was ranked second place more often than any other and was probably often coupled with the first choice reason "cheaper." The relative cheapness and the relative desirability are probably considered simultaneously when the purchase is made.

The leading choice for third place was "keeps better than other" but no logical reason for this choice is known. The tabulation according to educational level of the respondent revealed that just as high a percentage of those with a high educational level chose this reason as those with less than a high school education. Fifteen respondents chose "tastes better" for first place.

Respondents were also asked to rank reasons why they preferred sherbet. The three most popular selec-

TABLE 8 -- RANKING OF REASONS RESPONDENTS PREFERRED SHERBET

Reasons	Ranking			Total Number of Choices
	1st (Number of respondents choosing)	2nd	3rd	
Tastes better	21	10	3	34
Less fattening <sup>a</sup>	18	6	2	26
Provides variety <sup>a</sup>	18	5	1	24
Family prefers it	8	18	9	35

<sup>a</sup> These reasons were not on the list but were volunteered by the respondents.

TABLE 9 -- PERCENT OF VOLUME OF PURCHASES OF ICE CREAM TYPE DESSERT WHICH ARE VEGETABLE FAT SUBSTITUTE

Percent of Purchases	Income Groups <sup>a</sup>					Total
	1	2	3	4	5	
No purchases of either ice cream or vegetable fat substitute	14.5	8.3	5.9	1.6	8.8	7.6
0 - 50	58.2	67.8	61.7	88.6	82.4	70.4
51 - 100	27.3	23.9	32.4	9.8	8.8	22.0

<sup>a</sup> Income group 1 Less than \$50 per week  
2 \$50 - \$74.99 per week  
3 \$75 - \$99.99 per week  
4 \$100 - \$124.99 per week  
5 Over \$125.00 per week

tions are, in the order of their preference, "tastes better," "less fattening," and "provides variety." None of these three was overwhelmingly popular. (Table 8.) Another point of interest is the fact that the two reasons, "provides variety" and "less fattening," were not included in the original list presented to the respondents but were written in by them. The tabulation according to income and education level revealed no significant relationships in this case.

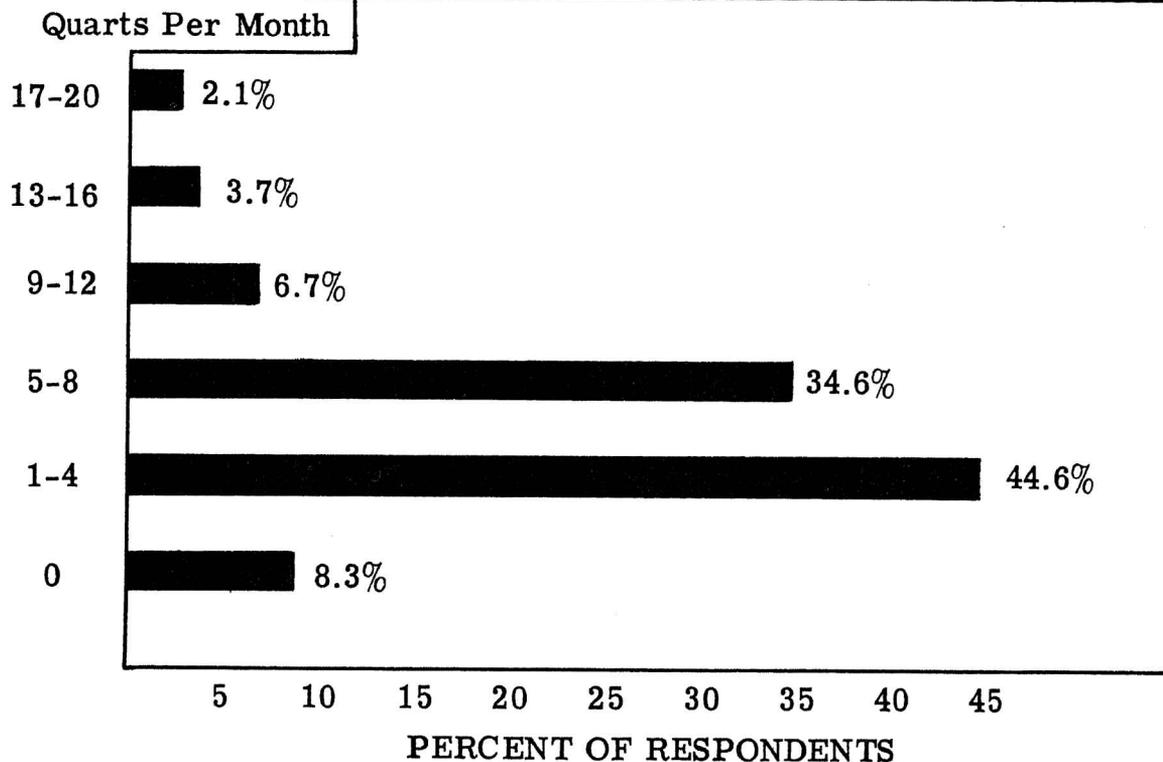
The respondents were asked what portion of their purchases of ice cream type dessert were vegetable fat substitute. About 8 percent of them indicated that they made no purchases of either ice cream or of the vegetable fat substitute. (Table 9.) Over 70 percent indicated that less than one-half of their purchases were of the vegetable fat substitute and 22 percent indicated that more than half of their purchases were vegetable fat frozen dessert.

When the responses were tabulated according to income of the respondent some significant relationships were revealed. More than 14 percent of the respondents in the lowest income group indicated that they made no purchase of either ice cream or of the vegetable fat substitute. The percentage of the respondents indicating no purchases of this type of dessert decreased as the income increased.

There was an inverse relationship between the income of the individual and the proportion of his purchases which were vegetable fat frozen dessert. Eighty-two percent of those in the highest income group indicated that less than half of their purchases were vegetable fat substitute while only 9 percent said that more than half of their purchases were of this product. This finding bears out that of a previous section which pointed out that individuals who purchased vegetable fat frozen dessert did so because it was cheaper.

Table 9 indicates that the vegetable fat substitute makes up a smaller part of the total purchases of those in the higher income groups. It also points out another fact which might be of value to the industry. A higher proportion of the people in the lower income

**GRAPH 4 -- PERCENTAGE OF RESPONDENTS PURCHASING VARIOUS QUANTITIES OF ICE CREAM TYPE DESSERT\***



\*Includes both ice cream and frozen dessert

groups make no purchases of this type dessert. This would seem to indicate the possibility of increasing sales by making price concessions so that these individuals would be encouraged to buy. It should also be noted that nearly three-fourths of the persons interviewed indicated that less than half their purchases of this type of frozen dessert were of the vegetable fat variety.

The respondents were asked to indicate the volume of their purchases of this type of dessert (both vegetable fat and ice cream). Only about 8 percent of them indicated that they made no purchases of this type dessert. (Graph 4.) Nearly one-half of them indicated that they purchased between 1 and 4 quarts a month and more than one-third indicated that they purchased between 5 and 8 quarts per month. A little more than 2 percent indicated that they purchased between 17 and 20 quarts of this type dessert each month.

When the responses were tabulated according to income groups some meaningful relationships were

revealed. A much larger proportion of the respondents in the low income group indicated that they made no purchases of this dessert. The effect of income is shown most clearly by the group which purchased between 13 and 16 quarts per month. Only 2.4 percent of the low income group indicated that they purchased this amount, compared to 5.3 percent of the high income group. Both this section and the one preceding it would seem to indicate that some people still consider ice cream a luxury item.

**Evaporated Milk.** Fifty-nine percent of the individuals had used filled evaporated milk at one time or another, and nearly 80 percent of those who had used it considered it a satisfactory substitute for evaporated milk. The tabulation according to educational level indicated that a smaller proportion of those with a higher education had tried the filled product and that a smaller percentage of those who had tried it considered it a satisfactory substitute for evaporated milk. Nearly 80 percent of those with less than eight years of education considered filled evaporated milk a satis-

factory substitute while only 69 percent of those with a college degree indicated that it was a satisfactory substitute.

Only 43 of the respondents disclosed the amount above the price for filled evaporated milk which they were willing to pay for evaporated milk. Even though the number of responses is limited in this instance the results appear to be worth reporting. In a previous section it was pointed out that there was 4.1 cents actual difference in the cost of the fat contained in a tall can of evaporated milk and in a can of filled evaporated milk. Only 14 percent of the respondents indicated that they were willing to pay 4 cents more for a tall can of evaporated milk than for a tall can of the filled product. Fifty-six percent of the respondents indicated that they were willing to give 2 or less cents difference between the two products. As long as the price differential between these fats remains as wide as it is at present it would seem that unless processors are willing to take a smaller profit margin on the evaporated milk, it is in a weak competitive position.

A majority of the respondents who preferred evaporated milk indicated that they did so because it tasted better and because their family preferred it. Nearly a third of them indicated that they preferred evaporated milk for cooking and for infant feeding whereas none indicated that they preferred the filled product for infant feeding and only 2 percent indicated that they preferred it for cooking.

The majority of the respondents who indicated that they preferred filled evaporated milk indicated that they did so because it was cheaper. A good many of them, however, indicated that they thought it tasted better. In this connection it is interesting to note that 21 percent of them indicated that they preferred the filled product because it whips while none of the respondents gave this reason for preferring evaporated milk. This would seem to give some indication of the effectiveness of an intensive advertising campaign.

A total of 322 of the respondents gave information on the volume of their purchases of evaporated milk, both filled and whole. Forty-two percent of them indicated that they made no purchases of these products. Nearly half of them indicated that they purchased more than five tall cans a month and one-fourth of them indicated that they purchased more than 10 tall cans per month.

The respondents who indicated that they used evaporated milk were asked what percent of their purchases of this product were filled. Three-fourths of them indicated that over 40 percent of their purchases of evaporated milk were of the filled variety. Nearly half of them (48 percent) indicated that more than 80 percent of their purchases were of the filled product.

**Aerated Cream.** Two-hundred-thirty of the 329 respondents or 70 percent indicated that they had used

aerated cream at one time or another. (Aerated cream is a whipped cream product which is placed in small cans under pressure. The consumer merely presses a button to secure a substance resembling whipped cream.) The tabulation according to educational level of the respondent did not reveal relationships of particular significance but the tabulation according to pay group of the respondent revealed a close positive relationship between the income of the individual and the percent who had tried aerated cream. Only 33 percent of those in the lowest income bracket had tried aerated cream. A larger percentage of each successively higher paid group had used this product and 82 percent of the highest income group had used it at one time or another. Seventy percent of those who had tried aerated cream considered it a satisfactory substitute for whipping cream.

When asked why they preferred aerated cream, most of the respondents indicated that they thought the aerated cream was more convenient. Several of them, however, indicated that they preferred aerated cream because it kept better and a considerable number of them believed that it was cheaper. Their belief that aerated cream was cheaper was probably due to the fact it could be used in small quantities when desired and there was less possibility of waste. When the respondents who preferred whipping cream were asked their reason for this preference, an overwhelming majority indicated that it was because the whipping cream tasted better. Several also indicated that it was because their family preferred it. Several of the respondents indicated that they preferred the whipping cream because they believed that it was more nutritious.

Only one-fourth of the respondents who used either whipping cream or aerated cream indicated that a substantial part of their purchases were aerated cream.

**Impulse Purchases.** The respondents were asked whether they had planned their last purchase of these products or whether they decided when they saw the display at the store. One-third of them indicated that they decided to purchase ice cream after they saw the display at the store. In the case of whipping cream and evaporated milk only one-fourth of them decided to make the purchase after their observation of the display at the store. Since whipping cream and evaporated milk are more of an integral part of a planned menu it seems reasonable that fewer impulse purchases of these type products would be made. Ice cream can be used more readily without previous planning and so would, therefore, be more likely to be subject to impulse purchasing. This might indicate the possibility of more attractive ice cream displays as a means of increasing sales.

## SUMMARY

In 1953, the issue of filled dairy products received widespread publicity. Only four states permitted the manufacture and sale of vegetable fat frozen dessert in 1952 but this increased to 9 in 1953. Most of the states which legalize the sale of these products require full disclosure of their character, and stipulate that the amount and type of other fats or oils contained must be indicated on the label.

Most dairy substitutes have the milk fat replaced with vegetable fats. This is particularly serious since it reduces the demand for butterfat, the component which largely determines the price of milk at present. This has come about because vegetable fats cost less to produce than butterfat. At present prices the manufacturer can separate the butterfat from the milk, replace it with vegetable fat and make a profit from the operation while providing the consumer with a cheaper product which he evidently accepts as a suitable substitute. Anything which tends to widen the spread between the prices of vegetable fat and butterfat will tend to encourage the growth of this practice.

Milk has come to be priced on the basis of its fat content because, historically, this has been the scarce component. We have used nearly all of the milk fat for human consumption for a great many years but as late as 1923 only a little over half of the non-fat solids portion was used for this purpose. Even in 1952 only about three-fourths of the non-fat solids was consumed by human beings. The other one-fourth was either used for animal feed or wasted. This means that the dairy industry has been geared to produce the amount of fat required for human needs and the excess of non-fat solids has been treated as a low value by-product.

There has been a great deal of discussion of the feasibility of pricing milk on the basis of the non-fat solids. As long as only three-fourths of the total production will move into human consumption channels at today's low prices, this is not a very likely development. It would not be an economically sound practice to base the price of a product on a component which existed in surplus amounts.

A new technique which makes it possible to combine a vegetable fat, which can be cheaply produced, with non-fat solids previously used for animal feed to produce a palatable and nutritious human food will increase the total supply of dairy type food on the market. This is detrimental to the dairyman since it tends to reduce the demand for his butterfat. It is beneficial to the economy as a whole since it makes possible an increased output of this type of food without a proportional increase in factors devoted to its production. The productive factors which would have been required to increase the output of milk can be released for some other use. Until demand comes more into

balance with this increased production potential, there will be a continued tendency toward surplus production. If the dairy industry were so organized that production could be easily and quickly adjusted, this would not present a serious problem but due to its structure, changes in output are slow. After these adjustments between demand and supply are completed, this technique will make it possible for a high percentage of the non-fat solids to be used for human nutrition. This should lead to improved stability and higher prices in the industry.

Carefully conducted experiments have failed to prove that butterfat is nutritionally superior to a carefully processed and vitamin fortified vegetable fat. On the basis of present evidence, then, the practice of combining vegetable fats with milk solids cannot be condemned from a nutritional standpoint.

A total of 329 persons were interviewed in various parts of the state in an attempt to ascertain their attitude toward certain filled dairy products. Over half of these people had purchased and used vegetable fat frozen dessert. More than two-thirds of those who had used this product considered it a satisfactory substitute for ice cream. Most of the individuals who continued to use the vegetable fat frozen dessert indicated that they did so because it was cheaper than regular ice cream. A majority of the respondents who gave information on this subject indicated that they would not pay in excess of 10 cents more for a quart of ice cream than for a quart of vegetable fat frozen dessert.

Nearly 60 percent of the respondents had used filled evaporated milk at one time or another and more than three-fourths of those who had used it considered it a satisfactory substitute. Only 14 percent of the respondents who cooperated in this part of the study indicated that they would give 4 cents more for a tall can of evaporated milk than for a can of the filled substitute. This is particularly pertinent since the fat in a can of evaporated milk costs about 4 cents more than the fat in a can of the filled product. Most of the respondents who indicated that they preferred filled evaporated milk said that they did so because it was cheaper. More than a fifth of them indicated that they preferred the filled product because "it whips," while none of them gave this as their reason for preferring evaporated milk. This would seem to show the effectiveness of an intensive advertising campaign.

One-third of the respondents said that they made their last purchase of ice cream on impulse. This was a larger proportion than made the same statement for either of the other products and would seem to indicate the possibility of using more attractive ice cream displays as a means of increasing sales.

## LITERATURE CITED

1. Hillman, J. S., Rowell, J. D., Israelsen, V. L., *Barriers to the Interstate Movement of Milk and Dairy Products in the Eleven Western States*, Bulletin 255, University of Arizona Agricultural Experiment Station, April, 1954, p. 61.
2. Pirtle, T. R., *History of the Dairy Industry*, Mojonner Bros., Chicago, Illinois, 1926, p. 105.
3. *Production of Manufactured Dairy Products*, 1952 U.S.D.A., Agricultural Marketing Service, Washington, D. C., p. 5.
4. *The Dairy Situation*, U.S.D.A., Bureau of Agricultural Economics, Washington, D. C., September-October 1953, p. 1.
5. Bourwell, R. K., et al., *Journal of Dairy Science*, Vol. 26, 1943, p. 429.
6. Deuel, et al., *Journal of Nutrition* 42, 1950, p. 239.
7. Schantz, E. J. and others, comparative nutritive value of butterfat and certain vegetable fats, *Journal of Dairy Science*, XXIII, 1940, p. 181-189.
8. *Journal of Dairy Science*, June 1953, pp. 93, 94 and 599.
9. Jacobson, Cannon, and Thomas, *Journal of Dairy Science*, 32, 1949, p. 429.
10. *Ibid.*
11. Keys, Ancel, "Kinds and Amounts of Butterfat and Other Fats in Human Diets," Proposal to American Dairy Association Research Council, July 9, 1953.
12. Mangel, Margaret, Professor of Home Economics, University of Missouri, April 2, 1953.

APPENDIX -- TABLE I -- PRODUCTION OF ICE CREAM AND MELLORINE-TYPE FROZEN DESSERT<sup>a</sup>

	Production of Ice Cream			Production of Ice Cream and Frozen Dessert	
	1951	1952	1953	1952	1953
			(Thousand Gallons)		
Illinois	32,814	32,394	29,802	34,851	35,102
Missouri	16,495	16,348	15,800	18,128	18,277
Oklahoma	6,193	6,280	5,225	6,822	7,440
Texas	24,466	22,155	20,074	28,504	30,944
Total of Four	79,968	77,177	70,091	88,305	91,763
Alabama	6,763	7,155	7,264	-----	7,320
Arkansas	2,371	2,458	2,370	-----	2,476
California	40,965	45,370	45,722	-----	46,852
Montana	2,765	3,020	2,699	-----	2,778
Oregon	6,583	6,513	6,116	-----	6,377
Total of Five	59,447	64,516	64,171		65,803
Total of All	139,415	141,693	135,072	152,821	157,566
U.S. Total	568,849	591,576	602,724	602,704	625,218

<sup>a</sup> Production of Manufactured Dairy Products, 1952, U.S.D.A., Agricultural Marketing Service, Washington, D. C., p. 13.  
 1953 Preliminary Report of Manufactured Dairy Products, September 24, 1954, U.S.D.A., Agricultural Marketing Service, Washington, D. C.  
 Production of "Mellorine-Type" Frozen Desserts, 1953, July 23, 1954, U.S.D.A., Agricultural Marketing Service, Washington, D. C.