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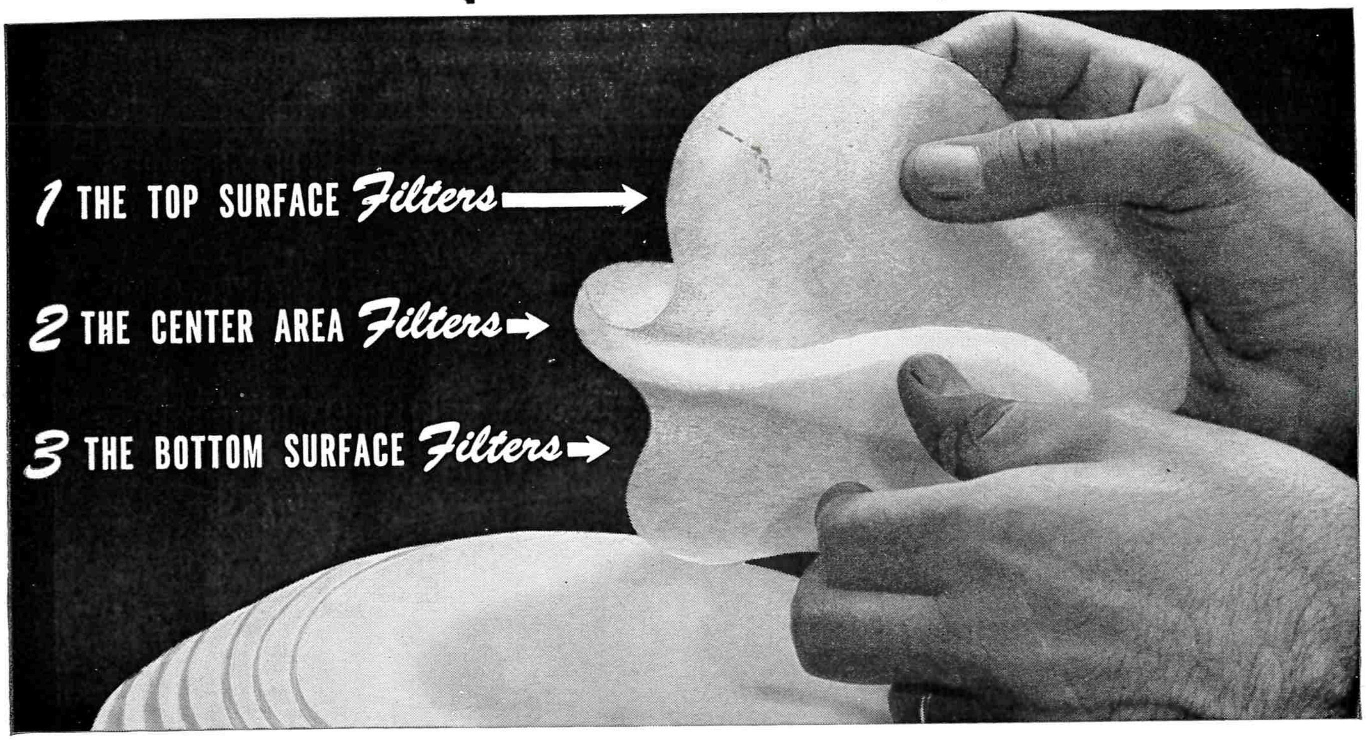

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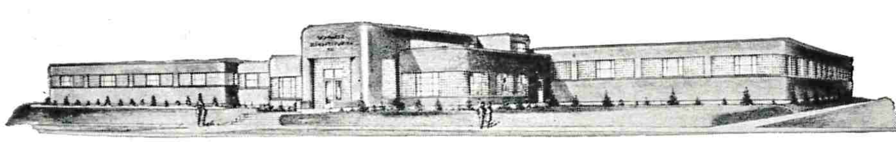

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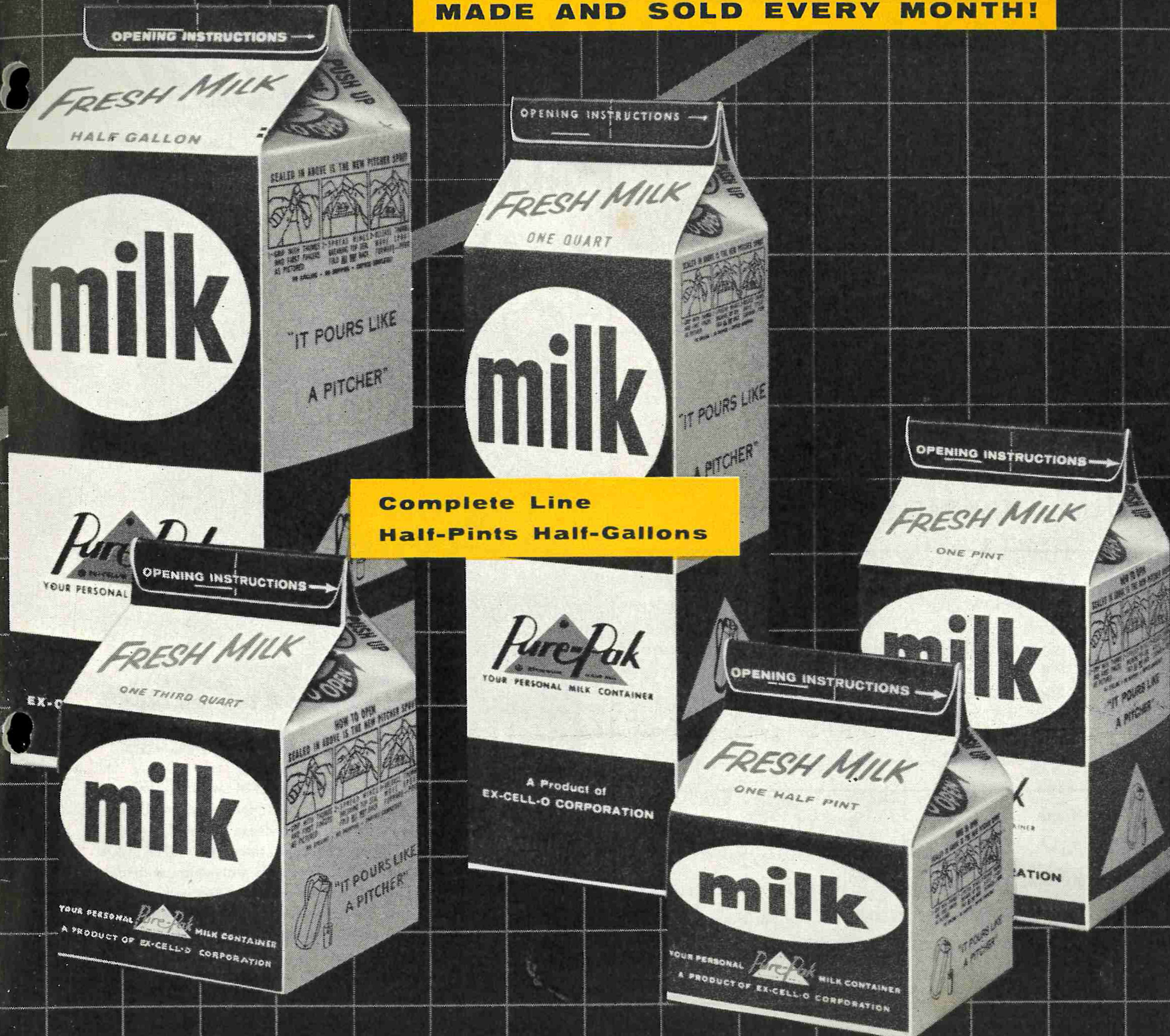

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FACTORS INVOLVED IN THE CONTROL OF GELATINOUS CURD DEFECTS OF COTTAGE CHEESE

II. INFLUENCE OF pH AND TEMPERATURE UPON THE BACTERICIDAL EFFICIENCY OF CHLORINE

E. B. Collins
Department of Dairy Industry, University of California, Davis

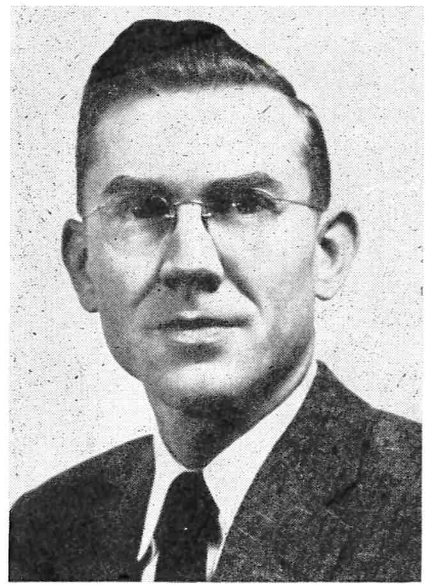
(Received for publication March 10, 1955)

The influence of temperature and pH upon the bactericidal efficiency of free chlorine was determined for cultures of *Pseudomonas fragi, Pseudomonas viscosa, Alcaligenes metalcaligenes, Escherichia coli,* **and** *Aerobacter aerogenes.* **Low temperature and high pH markedly decreased the effectiveness of chlorine.** *P. fragi* **was the most resistant species studied.**

Since the species of bacteria associated with gelatinous curd in cottage cheese are of no concern to public health authorities, chlorination at the plant may be necessary as a safeguard against such contamination from the water supply. Prior to chlorination, the water used to wash and chill cottage cheese curd is often refrigerated. Certain areas have very alkaline water, at pH 8.0 and above.

Butterfield *et al.* (2), in studying coliforms and certain enteric pathogens, found that increased pH and decreased water temperature markedly decreased the bactericidal efficiency of free chlorine. Weber and Levine (6) reported that the time required for chlorine to kill *Bacillus metiens* spores increased greatly at pH values above 8.0, and that the period of exposure had to be increased 2.1 to 2.3 fold for equal kill when the temperature was decreased 10°C. Parker *et al.* (5) studied the destruction of certain species (including the three tested in the present study) at pH 9.5 with the Weber and Black technique which employs a reaction temperature of 25°C. They found that 10 p.p.m. of chlorine effectively destroyed all of the cultures studied within 15 seconds. In a study of unidentified species of five genera that caused surface spoilage of cottage cheese, Davis and Babel (3) found in 60-second exposures to chlorine of 15 cultures that seven survived a concentration of 5 p.p.m., three survived 25 p.p.m., and two survived 50 p.p.m. These two most resistant cultures were species of *Pseudomonas* and *Alcaligenes.*

The present study was conducted to determine the influence of pH and temperature upon the bactericidal efficiency of chlorine for cultures of *Pseudomonas fragi, Pseudomonas viscosa, and Alcaligenes metalcaligenes.*



Dr. Edwin B. Collins was graduated in 1943 from Clemson College of South Carolina with a B.S. in Dairying. Upon return from service in the U.S. Army, he completed his M. S. and Ph.D. degrees in Dairy Bacteriology at Iowa State College in 1948 and 1949, respectively. He is now Assistant Professor of Dairy Industry and Assistant Dairy Bacteriologist in the Experiment Station, University of California, Davis.

Methods

The cultures of *P. fragi, P. viscosa,* and *A. metalcaligenes* were isolated from cottage cheese that exhibited surface spoilage. They were propagated on tryptone glucose extract agar slants at 25°C., with an incubation period of 40 hours. (Cultures of *Escherichia coli* and *Aerobacter aerogenes,* included in the study for comparison, were incubated for 24 hours at 35°C.) Bacterial cells were removed from agar slants, washed twice in physiological saline (0.9% NaCl), and adjusted with a Klett-Summerson photoelectric colorimeter to a turbidity reading that previously had been determined to give about 10^8 bacteria per milliliter. The suspensions were refrigerated for 2 to 16 days prior to use; fresh 1:10 dilutions in saline served as inocula.

Buffered distilled water contained 0.001 M dipotassium phosphate and 0.001 M sodium tetraborate. Quantities of the buffered water were adjusted to the desired pH, sterilized in an autoclave, and readjusted, when necessary, just prior to use. A Beckman model K potentiometer was used for determining pH. Sufficient calcium hypochlorite solution was added to give the desired concentration of residual chlorine, which was adjusted and checked colorimetrically, using the ortho-tolidine method (1). A standard concentration curve was determined from permanent chlorine standards, using a Klett-Summerson photoelectric colorimeter equipped with filter no. 54. The colorimeter subsequently replaced visual comparison in determinations of residual chlorine. Concentrations, checked after the addition of bacteria and after the completion of experiments, were found not to have changed detectibly.

After 100 ml. of chlorinated buffered water had been adjusted to the desired temperature in a water bath, 1 ml. of the bacterial inoculum was added and the bottle was agitated. Use of this procedure gave about 10^5 bacteria per milliliter. Quantities of 1 ml. were removed at intervals and placed in bottles containing 9 ml. of sterile 0.002 M sodium thiosulfate.

Bacto-brilliant green bile 2 percent was found suitable for detecting the surviving bacteria. Each of three tubes received 1 ml. of the bacteria-sodium thiosulfate mixture, and the presence or absence of turbidity was recorded after the tubes had been incubated for 48 hours at 25°C. With this procedure the end point of destruction was no growth in a total of 0.3 ml. of organism-chlorinated water mixture—a destruction of about 99.99 percent.

RESULTS AND DISCUSSIONS

Experiments were conducted at 4.4°C. to determine the effectiveness of chlorine at pH values of 6.0, 8.0, and 10.0. With each set of conditions three trials were made for each of the cultures, using exposure periods of 0.5, 1, 2, 4, 8, 12, and 16 minutes. The shortest periods giving no growth (about 99.99 percent destruction) in the three trials were averaged, with the resulting values given in Table 1. The data show that all of the cultures were destroyed rapidly at pH 6.0 by either 3 or 5 p.p.m. of residual chlorine. Normally the cultures did not survive the shortest exposure period. However, chlorine resistance increased with increasing pH. Exposure to 3 p.p.m. for 2 minutes was sufficient for destruction of cultures at pH 8.0, but at pH 10.0, two cultures of *P. fragi*—the most resistant species studied—required exposure for 12 minutes. *A. metalcaligenes* and *E. coli* were the most sensitive species studied.

TABLE 1—INFLUENCE OF pH ON THE BACTERICIDAL EFFICIENCY OF CHLORINE AT 4.4°C.

Culture	Av. no. of minutes required for destruction (about 99.99 per cent destruction) 3 p.p.m. pH 6.0	3 p.p.m. pH 8.0	3 p.p.m. pH 10.0	5 p.p.m. pH 6.0	5 p.p.m. pH 8.0	5 p.p.m. pH 10.0
P. fragi B	0.8	2	12	0.5	0.7	4
P. fragi C	0.5	1.7	8.7	0.5	0.5	3
P. fragi D	0.5	2	12	0.7	0.7	5.3
P. viscosa	0.5	2.2	6.7	0.5	0.7	2
A. metalcaligenes	0.5	0.5	1.5	0.5	0.7	1.2
E. coli	0.5	0.5	2.3	0.5	0.5	1.2
A. aerogenes	0.5	1.8	6	0.5	0.7	0.7

Two cultures of *P. fragi* were used to compare the bactericidal efficiency of residual chlorine at 4.4° and 21° C. Results at pH 10.0 are given in Table 2. They show that the bactericidal efficiency of chlorine was greater at 21°C. However, the differences were not as great as those reported by Weber and Levine (6) for *B. metiens* spores. In the present study about twice as much time was required for destruction of cultures when the refrigerated water was used.

TABLE 2 — INFLUENCE OF TEMPERATURE ON THE BACTERICIDAL EFFICIENCY OF CHLORINE AT pH 10.0

Culture	Av. no. of minutes required for destruction (about 99.99 per cent destruction) 3 p.p.m. 4.4°C.	3 p.p.m. 21°C.	5 p.p.m. 4.4°C.	5 p.p.m. 21°C.
P. fragi B	10	4	....	....
P. fragi D	14	8	6	4

For all trials at 4.4°C. and pH 10.0 reported for cultures of *P. fragi*, the average time required for destruction was 12 minutes with 3 p.p.m. as compared to slightly less than 5 minutes with 5 p.p.m. of residual chlorine. These results are similar to those reported for higher concentrations of chlorine by Weber and Levine (6). They found that doubling the concentration of available chlorine reduced the killing time of *B. metiens* spores by approximately 50 percent.

Although a no-growth end point of destruction (about 99.99 percent destruction) was used in these experiments, the influence of initial numbers of bacteria upon the time necessary for "destruction" with chlorine (where no-growth end points are used) should not be overlooked. Long and Hammer (4) reported data showing that chlorine destroys low initial numbers of *P. putrefaciens* more rapidly than greater numbers. Had a smaller number of bacteria been used in the present experiments, the absence of viable bacteria in 0.3 ml. of organism-chlorinated water mixture would have been accomplished at a smaller percentage destruction of the initial population and the periods of exposure necessary for "destruction" undoubtedly would have been shorter. Davis and Babel (3) used about 10^6 bacteria, and Parker *et al.* (5) used about 10^4 bacteria per milliliter. In addition to differences in pH, temperature, chlorine concentration, method of preparing cultures for study, and chlorine resistance of the cultures used, differences in initial numbers of bacteria undoubtedly have contributed to the differences in time required for "destruction."

Among the factors considered in establishing a satisfactory reaction time in the chlorination of waters naturally contaminated with bacteria capable of causing surface spoilage of cottage cheese, the additive effects of high pH and low temperature should receive due consideration. Instances may be encountered in which it is necessary to acidify the water, increase the chlorine concentration, or permit a longer reaction time.

SUMMARY

Either 3 or 5 p.p.m. of residual chlorine destroyed cultures of *Pseudomonas fragi*, *Pseudomonas viscosa*, *Alcaligenes metalcaligenes*, *Escherichia coli*, and *Aerobacter aerogenes* very rapidly at pH 6.0. The bactericidal efficiency of chlorine was somewhat less at pH 8.0 and greatly reduced at pH 10.0. *P. fragi* was the most resistant species studies.

The effectiveness of chlorine was decreased by low temperature. For equal destruction of *P. fragi* at 4.4° and 21° C., approximately twice as much time was required at 4.4° C.

With the experimental conditions used, doubling the concentration of residual chlorine decreased the time required for destruction of *P. fragi* by approximately 50 percent.

ACKNOWLEDGMENT

This study was supported in part by funds from the California Dairy Industry Advisory Board. The author wishes to acknowledge the assistance of Dr. P. R. Elliker, Oregon State College, who kindly furnished certain cultures of bacteria.

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FARM WATER SUPPLIES[1]

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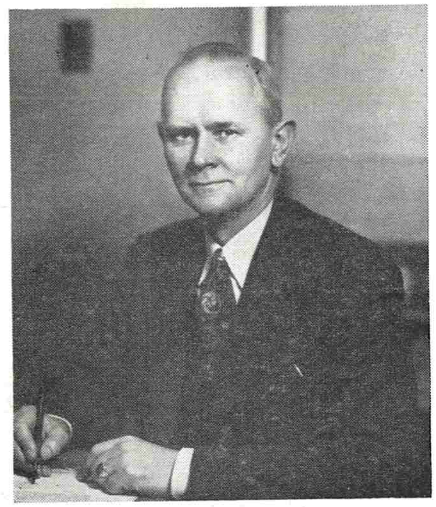
The most misunderstood and inadequately supervised item of sanitation on the dairy farm is the water supply. Even in some areas supervised by well organized milk inspection programs, water supplies frequently are found to be improperly located, constructed and protected. It is only necessary to review the facts presented in the Sanitary Milk Control Study (1) made by the National Research Council several years ago to see that this statement has a basis in fact. In four of the eight cities studied, the percentage of *improperly* constructed and protected water supplies varied from 36 to 66 per cent of the farms inspected. No other item received such low scores.

This failure on the part of sanitation workers to insist on properly located and constructed water supplies may be due to several things. In the first place it is possible that some sanitarians do not consider the water supply important in preventing disease transmission. After all, they may reason, any disease organisms getting into a milk supply through this source will be eliminated in the pasteurization process. This viewpoint, of course, overlooks the generally accepted concept that control should not be based on one line of defense but on many. One of our leading text books (4), however, appears to take the former position: "The water supply on a dairy farm should be potable. Extensive tests have shown that often this is not the case. Inasmuch as little can be done to remedy such a condition, food officials insist that all water for washing purposes be boiled, and they are increasingly requiring that chlorine be used in a final rinse as a factor of safety."

A sound philosopy of health protection in the field of milk control would be that one should strive for a solid foundation of protection at several points from the source whether it is a cow or a well, through the steps of pumping, handling and storing to the final processing of the product. If the total effort depends on one thin protective crust such as cooking, pasteurization, or chlorination then any sudden or temporary breakdowns at any one step would not be covered by a supplementary protective measure.



Alfred Fletcher received his B. S. degree from the Massachussetts Institute of Technology and M. S. degree from Harvard. He has spent 18 years in municipal sanitary engineering. During that time he has been very active in national sanitary engineering societies and currently is Secretary-Treasurer, Conference of State Sanitary Engineers. Mr. Fletcher served on the U. S. Public Health Service Milk Sanitation Advisory Board from 1938-42 and is presently a member of the Board of Consultants of the National Sanitation Foundation.

A second possible reason for neglect of the water supply item in dairy farm inspection might be hesitancy, on the part of sanitarians who have not had much contact or experience in water supply sanitation, to give advice and to criticise the farm water supply. If this is a reason for carelessness on the part of sanitarians in stressing the importance of a protected water supply, then special emphasis should be directed to the training of personnel in this important item of sanitation.

Water Supply Important to the Dairy Farm

A three year study (2) of nine dairy farms in the St. Louis milkshed by the Agricultural Research Service of the U. S. Department of Agriculture and published in May of 1954 concluded that good practice in dairy farming was hampered when the water supply was inadequate or when conditions were not conducive to habits of cleanliness. This study emphasized the importance of good sanitation practice as a require-

[1]Presented at the 41st Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., Atlantic City, New Jersey, October 21-23, 1954.

ment for the most economical method of producing high quality milk. Water supply is an important consideration in any attempt to develop the most economical investment in building, equipment and labor consistent with the production of quality milk. Economy in the production and processing of milk is tremendously important in this time of high costs.

WATER SUPPLY NECESSARY FOR REASONS OTHER THAN JUST MILK PRODUCTION

The water supply is important not only because of the danger of contaminating the milk supply through an unsafe water supply but because of the importance of an adequate supply conveniently available, for the proper cleaning of dairy plant facilities, equipment and personal cleanliness.

Just as an adequate and safe water supply for municipal, industrial and business use is recognized as being of fundamental importance in the development of our national economy, so it is recognized as equally important on our farms for the many household tasks, for fire protection, for personal cleanliness, for stock to drink, and for the cleaning of facilities and equipment used in the production of quality milk. Not only is it important to have a source of water available but it is important to have it under pressure and conveniently available for the washing and sterilizing of utensils and other clean-up uses if the operation of the dairy is to be efficient and economical.

Although assistance in the development of a water supply is frequently given by agricultural departments, in bulletins and through Extension Agents, progressive and up-to-date milk sanitarians should know some of the fundamental factors that are important. Such factors include location in relation to sources of pollution, capacity of available sources of supply including short time and total daily pumping capacity of the source of supply, and the desirable storage capacity to meet peak as well as total demands.

TECHNICAL INFORMATION AVAILABLE

Technical information as to the proper location, design and construction of water supplies is available in a number of publications. Several such publications are listed and commented on in order to assist inspectors in dealing properly with this problem of water supply on a dairy farm. The U. S. Public Health Service issues a pamphlet entitled "Individual Water Supply Systems" (5), which outlines recommendations of a Joint Committee appointed to study the problems involved and to develop a set of uniform recommendations for the use of agencies responsible for the supervision of individual water supply systems. This publication not only outlines basic requirements but gives details regarding location, protection, treatment, distribution and storage. Procedures are recommended for the disinfection of water supplies and a very excellent bibliography on the subject is included. Another publication which gives considerable detail on the same problem is the 1953 Milk Ordinance and Code (6) recommended by the U. S. Public Health Service. As an appendix to the Ordinance and Code there is a complete outline of minimum standards for location, construction and protection of water supplies for dairies. This appendix is liberally illustrated with construction details for the various types of wells and springs together with typical pump mountings, man-hole covers and piping installations. A third publication entitled "Safe Water for the Farm" is issued by the U.S. Department of Agriculture (3). This publication includes a number of tables regarding farm uses of water, friction losses in various sizes of pipes, data on wind-mills, capacity of tanks and cisterns, and characteristics of various types of pumps.

TWO MISCONCEPTIONS WHICH SEEM TO HAVE QUITE WIDE ACCEPTANCE

It is not possible to present in this paper a treatise on the design, construction and maintenance of the various types of water supplies which would be found on dairy farms throughout the country. Nor would it be possible or wise to outline in detail all of the hydrological, geological and bacteriological factors which affect the quantity and quality of water supplies. This information as indicated above is available elsewhere; however, two apparent misconceptions as to the proper construction of wells deserve comment.

The following statement often is heard: "This well is OK because it is a drilled well". Regardless of how a hole is opened from the ground surface to the water bearing strata, the same two general ways of contaminating the well exist. It may be constructed so as to permit water to enter from the ground surface and run into the well or it may be so located as to permit seepage or a contaminated underground source to enter the hole below the ground surface and run down the hole to contaminate the supply. Unless the well is located away from sources of pollution such as cesspools or sewers, contamination may reach the water. Such contamination can be prevented by proper location and by proper filling between the casing and well hole and by sealing the bottom of the casing into an impervious strata. Surface water, in so far as possible, should be prevented from flooding over the top of the well. This is difficult to do if well pits and sumps are used and for this reason some health departments prohibit such pits. These simple principles of protection apply to bored wells, drilled wells, and to dug wells.

Another misconception often expressed is — "This well is protected at the surface because it has a concrete top". Here again there is no magic in the concrete *per se*. The top must be sealed to prevent surface water from running into the well through any opening at the top of the well. First the hole is opened from the ground surface to the water strata; then a casing is installed to support the wall of the hole. A strainer is attached at the bottom to keep the sand strata back and permit the water to enter the well hole. Inside the casing a flow line is installed to house the pump impellers. Factors which are important in properly covering the top of the well include sealing the flow line to the pump base, sealing the annular space between the casing and flow line, filling the annular space between the casing and well hole at least to a depth of ten feet, and providing a top to shed surface water and support the motor and pump. The casing usually is brought up several inches above the ground surface and recessed into the pump base. The basic principles outlined above apply in protecting the top of dug as well as drilled wells. Milk control officials should reappraise their efforts relative to this item of sanitation as there is ample evidence to indicate that proper well construction often is neglected.

SUMMARY

The most misunderstood and inadequately supervised item of sanitation on the dairy farm is the water supply. It is, however, important from an economy standpoint as well as a secondary line of defense against contamination of a milk supply. Technical information on the location, design and construction of farm water supplies is readily available. Several misconceptions which seem to be quite prevalent in the minds of the general public and some milk control sanitarians are described.

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OBSERVATIONS ON TEMPERATURE CHANGES IN PASTEURIZED MILK DURING BOTTLING, STORAGE AND DISTRIBUTION

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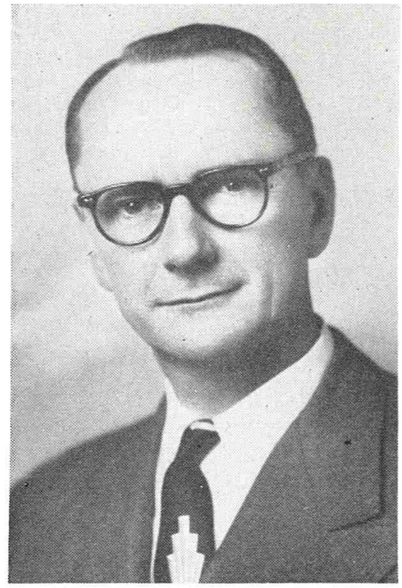
Studies indicate that temperatures to which milk is cooled after pasteurization and before packaging are vitally important since storage room temperatures reduce the temperature of packaged milk very slowly. These studies also indicate that milk, when subjected to warm temperatures, increased in temperature to a point which might be considered harmful in a comparatively short time. A limited survey of open display cabinets indicated that temperatures varied at different points within the cabinets to a degree which could be harmful to the keeping quality of milk, especially if the cabinets are over-loaded.

Current trends in the market industry demand extremely efficient plant operation and proper distribution methods if dairy products are to be of high quality at the time of consumption. Factors which are important in the development and maintenance of high quality are; (a) good raw materials, (b) sanitation on the farms and in the plants, (c) efficiently operated modern production equipment, and (d) good transportation and merchandising facilities. A few years ago most of the bottled pasteurized milk was consumed within forty-eight hours after production. Today a considerable amount of milk is a week old, or older, when consumed. This greater age is due to such trends as every-other-day collection from bulk tanks on farms, five or six day plant operating schedules, paper cartoned milk which is transported over considerable distances, and the increasing amount of milk being handled through stores. This greater age of milk before consumption makes the factors effecting quality vitally important to the plant operator and producer as well as the consumer. One of these factors is the storage temperature to which milk may be subjected during the time it is in the plant after pasteurization, and during its transportation to retail and wholesale outlets and its storage at such locations.

The objective of the studies herein reported were to acquire information on temperature conditions of storage of pasteurized bottled milk which could be used in training in-plant personnel, as well as personnel involved in transportation and sales of dairy products.

These studies involved the recording of over 2,400 temperature readings and other operations.



Mr. Ratzlaff's early youth was spent on a farm in South Dakota. He was graduated from the University of Minnesota in 1935 with a major in Dairy Industry. Since that time he has had extensive experience in milk processing and quality control work. For several years he served as a member of the staff of the Minneapolis and St. Paul Quality Control Laboratory. On his return from military service during World War II he was employed by Marigold Dairies, Inc., Rochester, Minnesota, where he is now Director of Laboratories and Quality Control. Currently, Mr. Ratzlaff is President of the Minnesota Milk Sanitarians Association.

Changes in Temperature of (a) Cold Milk Placed at an Elevated Ambient Temperature, and (b) Warm Milk Placed at Low Ambient Temperatures

One set of samples of homogenized milk and buttermilk in glass and paper cartons at 40°F. was placed in a room maintained at a temperature of 82°F.±1°F. Another set was warmed to 64°F. and placed in a room maintained at 38°±1°F. and a third set was warmed to 64°F. and was placed in a domestic refrigerator at 40° F. A mercury thermometer was submerged two inches into the milk in each sample. The samples were placed four inches apart so that the surrounding air could contact freely all sides of each bottle. Temperature readings were taken each ten

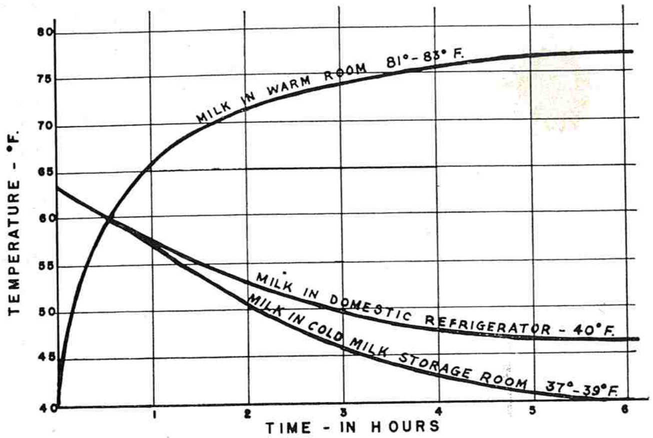


FIG. 1. Changes in temperature of (a) cooled milk placed in warm room, and (b) warmed milk placed in cold room and in a domestic refrigerator.

minutes. Figure 1 illustrates the temperature changes which occured in homogenized milk in glass bottles. Similar curves were obtained from samples of buttermilk in glass containers and homogenized milk and buttermilk in paper containers; although, the changes occuring in the products contained in paper containers were somewhat slower.

It may be observed that the temperature of the samples in the warm room increased 19°F. in the first thirty five minutes while the temperature of the samples in the cold room and the domestic refrigerator decreased only 4°F. Also, it was noted that whereas only thirty five minutes were required for the temperature to rise 19° F., nearly five hours were required for the temperature to drop 19°F. under the good conditions of the cold storage room (air blast at 38° ± 1°F.). This is about eight times longer than was required for the rise of 19°F. in the warm room. An even greater length of time was required for the samples to decrease 19°F. in the still air of a domestic refrigerator.

Numerous applications of this information can be made in the dairy industry. The receiving room operator or the technician taking raw milk samples, either in the receiving room or on the farm (as is the case of the bulk tank system), may not realize the rapidity with which the temperature of samples for bacterial analyses may rise. When one is busy, a "few minutes" delay in properly icing samples can stretch to a half hour or more very easily. If this occurs the sample is no longer reliable.

The information showing the rapid rise in temperature of milk when not properly protected has other applications such as: (a) in the plant processing room where the operator may, under certain conditions, allow milk to stand for varying periods of time in cans, in the filler bowl, in bottles in partially filled cases on the conveyor track, or on dollies before movement to the cold storage room; (b) to the route delivery man who must properly care for the milk while he is loading, hauling, or delivering the milk; and (c) to the housewife and restaurant operator who may allow the milk and cream to remain on the table or counter for extended periods of time and then feel dissatisfied with the keeping quality of the products. It is important that such individuals realize the slowness of cooling in the quiet air of refrigerators.

EFFECTS OF STORAGE IN WOOD AND WIRE CASES

Temperatures at the various points in the cases were determined by use of a potentiometer with 20 thermocouples. Figures 2, 3, 4, and 5 indicate temperatures which were found in one of the center quarts of milk contained in the case second from the floor in a stack of six milk cases. It was thought this particular quart would be the last to react to the effects of the ambient temperature.

In an attempt to determine the cooling effect of the ambient temperature on all of the milk in the entire stack, one of the corner bottles, one of the side bottles, and one of the center bottles in the top case, as well as bottles in the same location in the case second from the bottom, were wired with thermocouples. While the information derived as to the temperatures of each of these six bottles is not presented, it was noted that none of the temperatures varied appreciably from the temperatures which were charted. The maximum difference between these temperatures was 5°F.

The wooden cases in which the paper cartoned milk was stored were solid on all sides except for the small hand opening on each end. The wooden cases used for the glass bottled milk contained the same hand openings on the ends and also contained an opening on each side 2¾x12 inches. The wire cases were of the usual wire construction which permitted air movement around and over the top and bottom of the cartons or bottles.

Temperature readings were taken at fifteen minute intervals for the first few hours of each of these studies and then less frequently as the changes in temperature became less rapid.

Milk in glass bottles—warm milk placed at low ambient temperatures. Figure 2 shows the comparison of the cooling effects on glass bottled milk in wood and wire cases. The samples of milk used in this test were first warmed to 60°F. and then placed in the milk storage room at a temperature of 41.3°±3°F. During cooling, the temperatures of these samples of milk were above 40° to 45°F. for a considerable number of hours.

Psychrophilic organisms have come to be very important to the dairy industry today because the modern trends promote greater age of the milk at the time of consumption than was the case some years ago. For this reason a number of factors involved in the handling of milk are very important. Temperature at which the milk is held is one of these important factors. Psychrophilic organisms can grow well at 45° F. and can grow much more rapidly at temperatures of 50° and 55° F. During the hours above 40° to 45°F., as illustrated in Figure 2, the spoilage bacteria which can produce fruity or other undesirable flavors and odors may develop rapidly.

From Figure 2 it may be observed that nearly eleven

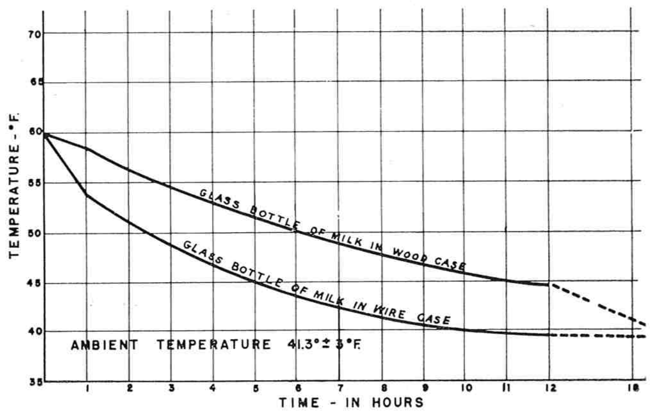


Fig. 2. Comparison of cooling rates of milk in glass bottles stored in wood and in wire cases.

hours were required to bring milk at 60°F. in glass bottles packed in wooden cases down to 45° F. In slightly more than eighteen hours the temperature in this milk reached 40° F. The same milk in wire cases required five hours to reach 45° F. and ten hours to reach 40° F.

Although, milk may be stored later at a somewhat lower temperature, psychrophilic bacteria which may have increased during holding at the elevated temperatures may produce spoilage in a much shorter time than would have been the case if the milk had been initially placed in the cold milk storage room at the proper temperature. It should be emphasized that the cold milk storage room should be considered only as "storage" room, and should never be considered as a cooling room in which improperly cooled products are placed to cool. The cooling effect is so slow that deterioration of the product is apt to result before the product has cooled to good storage temperature.

The temperature of 60°F. at which these cooling tests were begun may seem high. However, in processing and transporting dairy products numerous factors may contribute to high temperatures. In the case of glass bottled milk a rise of seven degrees was found between the time the milk came from the cooling section of the pasteurizer and the time the bottles of milk reached the milk storage room. This temperature rise occurred due to the heat picked up while passing through the surge tank, the sanitary lines, the filler bowl, and perhaps most of all from the heat contained in the glass bottles. At the time these tests were made the milk was coming from the cooling section at 37° F. By the time the milk reached the cold storage room the temperature was 44°F. This constitutes a rise of seven degrees. During these tests the bottle washer was considered to be in normal operating condition. The bottles were being cooled before being discharged from the washer by the cold water rinse. This is standard operation in most washers. In case the bottles are not cooled by this cold water rinse they will cause an even greater increase in the temperature of the milk being bottled. Instances have been noted, after a shut down, in which operators neglected to turn on the cold water rinse. In these cases a considerable amount of heat is added to the milk as the bottle is being filled.

Poor refrigeration in the final section of the plate or other cooler may allow the milk to reach the filler at too high a temperature. If this milk is bottled, cased, and placed in the milk storage room, many hours are required to bring this milk down to the desired temperature. Poor handling while loading trucks can easily allow an appreciable rise in the temperature of the milk being handled on a warm day. Poor refrigeration and insulation in the trucks while the milk is being delivered or transported over the road may contribute greatly to excessive temperatures.

Milk in paper cartons—warm milk placed at low ambient temperatures. As might be expected, milk in paper cartons cooled more slowly than milk in glass bottles. This is illustrated by the curves shown in Figure 3.

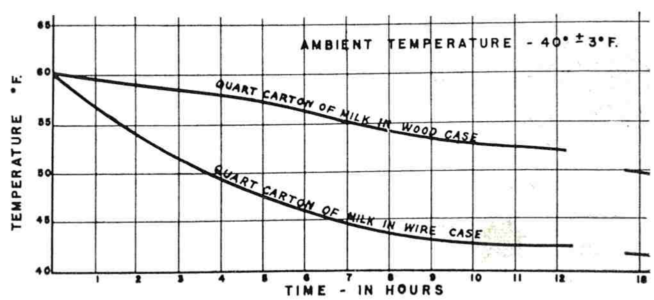


Fig. 3. Comparison of cooling rates of milk in paper cartons stored in wood and in wire cases.

Glass bottles do not pack as solidly in the cases as do paper cartons. This allows space for a small amount of air movement around the bottles while no chance exists for such air movement around the paper cartons which pack solidly in the cases. When wire cases are used a chance exists for air to move across the tops of the bottles or cartons even though the day's production may be stacked closely together in the cold milk storage room. The wooden cases which were used in these tests did not allow for this air passage, therefore, cooling was very slow in these cases. A drop of only 10° F. was noted after eighteen hours which brought the temperature of the milk down to 50°F. On the other hand, paper cartoned milk in wire cases dropped to 50°F. in about three and one-half hours.

A reduction in the quality of this milk might be expected since it would be held for an extended period of time at a temperature which may allow rapid reproduction of psychrophilic organisms. This very slow reduction in temperature is further evidence that the milk storage room should be considered only as cold storage space and not as a space for cooling a product which was improperly handled in the processing room or on the trucks.

Milk in glass bottles—cold milk placed at an elevated ambient temperature. In determining the rate of warm up occurring in cold milk, thermocouples were placed in the cold samples while still in the cold storage room. The stacks then were moved out into the processing room which was maintained at a temperature of 77°±3°F. and were placed so that the warm air could contact each side of the case. This was done in an attempt to simulate conditions under which milk may be handled after it is removed from the cold room, i.e. moving milk by conveyor over loading docks to trucks, movement of cases of milk into wholesale stops, transportation in small loads carried by uninsulated delivery trucks, unloading trucks, etc. The results are illustrated in Figure 4.

It was found that glass bottled milk warmed 10° F. in one hour. Previous observations (see Figure 2) showed that about seven and one-half hours were required to reduce the temperature of glass bottled milk from 50° to 40° F. when stored in wire cases and longer when stored in wooden cases.

It was noted that whereas a considerable difference existed in the rate of cooling glass bottled milk in wood and wire cases there was very little difference in temperatures of the milk being warmed in the two types of cases. At no time during the tests made in

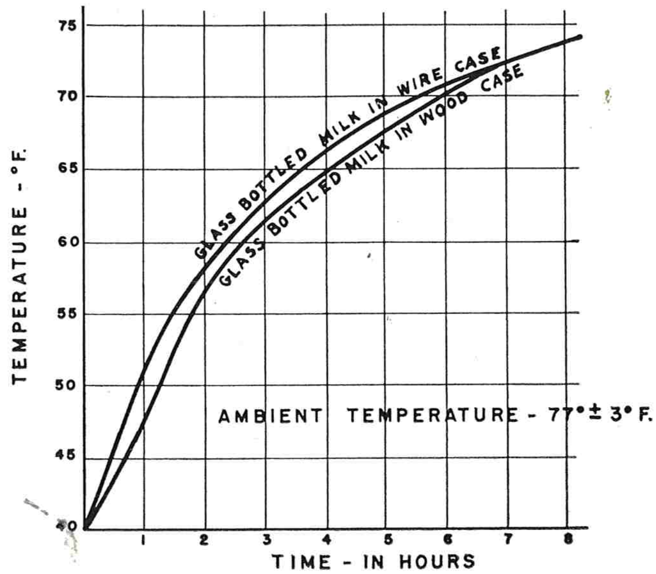


FIG. 4. Comparison of warming rates of milk in glass bottles stored in wood and in wire cases.

warming glass bottled milk was there more than a 3° F. difference in the two types of cases.

Milk in paper cartons—cold milk placed at elevated ambient temperatures. Milk in paper cartons warmed more slowly than milk in glass bottles. This may be observed from a comparison of the curves presented in Figures 4 and 5. Furthermore, the difference in temperature of the milk in paper cartons packaged in the two types of cases was greater than was the temperature difference in glass bottled milk packaged in the same types of cases.

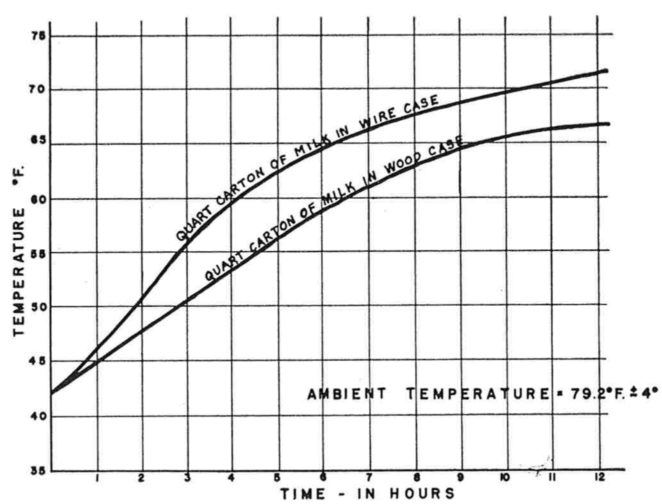


FIG. 5. Comparison of warming rates of milk in paper cartons stored in wood and in wire cases.

TEMPERATURE DIFFERENCES IN DISPLAY CASES

A limited study of open display cases was carried out. Seven display cases were included in the study. Six of these cases were located in supermarkets and one in a dairy store. The ages of these cases ranged from six months to over ten years. One case was checked twice; once in summer with a room temperature of 86° F. and again in winter when the room temperature was 75° F. Temperature readings were taken at three or more levels in the cabinets. The room temperatures were taken each time the cabinet temperatures were taken. Thermometers were placed on cards at various levels in the cases and were read three or more times at hourly intervals.

From each display case one set of readings was obtained at a point four inches above the bottom of the case, which is about the height of the center of a quart of milk resting on the bottom of the case. Another set of readings was taken at a point eight inches from the bottom and still another set was taken one and one-half inches below the top of the cabinet.

The temperatures of the air at various points in the cabinets which were surveyed are given in Table 1.

TABLE 1 – TEMPERATURE RECORDINGS IN MILK DISPLAY CASES

Display case	Ht. of front (in.)	Temperatures recorded at locations indicated: 1½″ below top (°F.)	12″ above base (°F.)	8″ above base (°F.)	4″ above base (°F.)	Temp. of room
A	15	54	....	44	41	67
B	15	44	....	38	36	72
C	15	56	....	43	39	71
D	13	51	....	40	38	72
E	13	48	....	39	37	72
F	13	50	....	49	48	72
G-1	18.5	63	49	42	41	75
G-2	18.5	78	56	42	42	86
Average temperature—		55.5	52.5	42.1	40.2	

It was found that as long as the cartoned or bottled dairy products were stored in these cabinets in only one tier the temperatures usually were satisfactory.

At a point four inches above the floor of the cabinets an average temperature of 40.2° F. was found, while at a point eight inches above the floor an average temperature of 42.1° F. existed. At a point one and one-half inches below the top of the front side an average temperature of 55.5° F. occurred. Cabinets G-1 and G-2 with apparently normal air movement and refrigeration showed temperatures which were satisfactory at four and eight inches above the floor, while the temperatures one and one-half inches below the top were very poor. For example, when the room temperature was 75° F. the cabinet temperature at that point was 63° F.; when the room temperature was 86° F. the temperature at that point was 78° F. One can well understand the unsatisfactory condition of dairy products likely to be encountered in such cabinets, or other cabinets when they are overloaded.

In certain supermarkets where the sale of dairy products is large in porportion to the cabinet facilities available, a great tendency exists to overload the display cabinets. In such instances some of the products are subjected to unsatisfactory refrigeration.

SUMMARY

A knowledge of the rates at which bottled milk rises or drops in temperature under various conditions is important to plant personnel as well as to all others who are concerned with handling milk. It is essential that milk be properly cooled before being packaged and placed in the cold milk storage room since the temperature of the cold milk storage room may require several hours to affect the temperature of the packaged milk to any great extent. It was found that glass bottled milk reacts more rapidly to the cooling effects of the storage room temperatures than does paper cartoned milk. On the other hand the type of case, wood or wire, made little difference in the warming effects on glass bottled milk. In this series of tests the temperatures of the milk in the two types of cases was never over 3° F. apart during a seven hour warming period. There was, however, a slightly greater difference between the temperatures of paper cartoned milk when tested in these same types of cases.

A limited survey of open display cabinets showed that in some instances the milk was subjected to excessively high temperatures while being merchandised. This was especially true if the cases were overloaded.

ACKNOWLEDGEMENT

Grateful acknowledgement is hereby given to Mr. Joe R. Lourey, Refrigeration Engineer, and his assistant, Mr. Walter M. Schacht, of Marigold Dairies, Inc., Rochester, Minnesota, for their help in carrying out these temperature studies; also, to the King Ventilating Company, of Owatonna, Minnesota who furnished the potentiometer and thermocouple equipment which was used. Their interest and co-operation was much appreciated. The plant studies herein reported were carried out in the plant of Marigold Dairies, Inc., Rochester, Minnesota. This company furnished the plant facilities and paid the expenses involved in these studies.

THE NATURE, SIGNIFICANCE AND CONTROL OF PSYCHROPHILIC BACTERIA IN DAIRY PRODUCTS[1]

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Introduction

Excellent keeping quality of perishable dairy products has always been the goal of the dairy industry. However, due to certain technological and economic factors, the need for maximum attainment of this property has become of increasing importance in recent years. Storage at low temperatures is a customary means of preserving milk products from deterioration by bacterial action; consequently, the existence of certain bacterial types known as psychrophiles which are able to grow rather quickly at low temperatures is a matter of concern relative to the transportation, processing, and storage of raw and pasteurized products. The objective of this report is to present a brief discussion of the nature, significance, and control of this group of bacteria. No attempt has been made to cite all literature bearing on this subject. However, pertinent references have been included which will serve as a guide to more detailed information on specific points and to other reports of research.

The term psychrophile[2], as commonly used in the dairy industry, refers to those bacterial species which are capable of relatively rapid growth at low temperatures, generally within the range of 35° F. (1.7°C) to 45°F. (7.2°C). These are the organisms which are of major importance in affecting the keeping quality of dairy products stored at low temperatures.

Types of Organisms

The organisms belonging to this group are largely Gram-negative non-spore-forming rods. Members of the genera *Pseudomonas, Flavobacterium, Proteus, Alkaligenes, Achromobacter,* and certain coliforms are most commonly encountered (2) (4) (7) (13) (18).

[1]Presented in part at the Annual Meeting of the International Association of Milk and Food Sanitarians, Inc., at Atlantic City, New Jersey, October 21-23, 1954 as a portion of the report of the Committee on Applied Laboratory Methods.

[2]Psychrophile means cold loving. The term cryophile, now largely discarded, has often been used with identical meaning. However, the prefix "cryo" refers to a more intense cold such as icy or freezing and therefore is a less desirable term.

Psychrophiles in Raw Milk

Generally, little difficulty is experienced due to the growth of psychrophiles in raw milk supplies for plants located close to their source of supply. Here the milk is processed before appreciable growth takes place.

Psychrophiles in Pasteurized Milk

The importance of psychrophiles in pasteurized fluid milk products is related primarily to keeping quality. A large variety of flavor defects may be attributed to their activity. Some of the more common of these are unclean, putrid, fruity, and an unclean sour odor and taste. Changes in body or appearance often may be observed as a result of their growth, i.e, a thickening often associated with ropy or stringy conditions, or a greenish yellow coloration noticeable usually at the surface. These body and color defects occur almost invariably after flavor defects have become pronounced; they may go unnoticed, however, in products that are frequently agitated as during delivery and transportation.

In recent years increasing amounts of raw milk and cream are being shipped long distances (10). This serves to extend considerably the time that such products are held before processing; thus, sufficient time may be provided during receiving, handling, and transportation of milk to allow very small numbers of psychrophiles initially present to increase until their numbers become objectionable.

Psychrophiles are invariably present to a greater or less extent in all raw milk supplies (3). The extent of their numbers depends upon the sanitary conditions under which milk may be produced and the time which elapses before processing. Since growth of psychrophiles increases as temperature increases, at least to 25°C. (77°F.) the temperature of holding will influence their numbers appreciably. Like the coliforms, thermodurics, and thermophiles, they are a part of the normal flora of raw milk, and, like the others, constitute a problem whenever milk is subjected to conditions which favor their eventual appearance in objectionable numbers. Initial contamination may be minimized by good sanitary methods. Where milk is to be transported long distances, careful attention should be given to the sanitary condition of tank trucks or cans. These must be thoroughly cleaned and sanitized. In this connection it should be emphasized that water supplies, otherwise satisfactory, may be a major source of psychrophiles (7); thus, rinsing of tanks and cans prior to their filling may contribute sufficient of these types so that subsequent growth may become extensive. While the nature of psychrophiles permits their development at low temperatures, these types are retarded markedly (although not as much so as other types) as the temperature approaches the freezing point (5). Consequently, close attention to the maintenance of low temperatures (40° F., preferrably lower) during storage and transportation will greatly retard their growth.

EFFECT OF PASTEURIZATION

Most of the available information (1, 12, 16, 20) indicates quite conclusively that proper pasteurization will destroy the psychrophilic bacteria present in raw milk, at least to the extent that the few which may survive would not be a factor in flavor deterioration of properly pasteurized products over an extended storage period.

The influence of psychrophiles on the flavor of milk kept under proper refrigeration does not manifest itself usually until after three or four days of storage and often not until a considerably longer period has elapsed. At a constant temperature of storage, the rapidity with which deterioration takes place will depend largely upon two factors, (a) the initial number of psychrophiles present and (b) the type of organism. The latter factor is of greater importance and accounts for the observation that the total psychrophilic populations found at the time that off flavors of microbic origin occur may be quite variable.

PSYCHROPHILES IN OTHER PASTEURIZED PRODUCTS

Several defects of notable economic importance in non-fluid dairy products may be attributed to activities of psychrophilic bacteria. Of primary significance are flavor and physical defects in butter, cottage cheese and solid cheeses. A defect peculiar to butter made from pasteurized cream is commonly identified as "surface taint". A number of different species have been reported to produce the typical condition but it is generally accepted that *Pseudomonas putrefaciens* is the causative agent (19). Primary stages of "surface taint" are fairly non-specific, varying from loss of typical aroma to an oxidized, "cardboardy" or cooked milk flavor. The more pronounced stages of spoilage will commonly appear within 10 days at storage temperatures of 5° C. (41° F.). As *P. putrefaciens* is aerobic, spoilage appears initially on surfaces which have free access to air, but the "surface taint" flavor and aroma usually permeate the entire butter mass. Other species of *Pseudomonas* and *Achromobacter* as well as members of other psychrophilic genera may be encountered in rancid or cheesey butter (6, 21).

Psychrophilic types also are responsible for widespread losses of cottage cheese. The most common manifestation of psychrophilic activity is a gelatinous, slimy or tapioca curd. Members of several gram-negative genera including *Pseudomonas, Proteus, Alcaligenes, Aerobacter* and *Achromobacter* have been associated with the defect (2, 13). Reports have indicated that the predominant organisms may vary with the geographical area involved. Holding temperatures and pH have a decided influence on development of the spoilage. Activities of these species in cottage cheese can be severely limited at pH 4.8 providing the holding temperature is near 5°C. (41°F.). However, at higher temperatures spoilage may take place at pH 4.7 or below. As in the case of butter the loss of typical aroma may precede the more apparent stages of spoilage (14). Bitter, fruity, or unclean flavors also are observed to precede any apparent physical decomposition of the curd particles.

Cheddar and other firm curd cheeses are also affected by psychrophiles. This is especially true in instances where ripening acidities are relatively low. Activity of coliforms in stored cheese frequently results in gas or open curd defects and off flavors. According to at least one report they also act in a synergistic manner, promoting growth of anaerobic butyric acid bacteria in cheese (8). Such stimulation could conceivably result from lowered oxygen tension or increased CO_2 tension as a result of respiration of the aerobic species. Growth of coliforms in cheese usually reaches a peak during the first week of ripening and viable organisms may persist into the second or third month. Open curd defects have also been ascribed to anaerobic sporeformers growing in ripening cheese held at 10° to 12° C. (50° to 53.6° F.) (15). Salt concentrations of 1.7 percent and sufficient acid development may assist in controlling these organisms.

The keeping quality of concentrated milks (3:1 and 4:1) also may be influenced greatly by psychrophiles. Recent studies (11) have shown that psychrophilic growth takes place at an appreciably greater rate in recombined milk than in the concentrate from which it was prepared. Considerable variation in the keeping quality of commercially processed concentrate was observed. This variation was influenced greatly by the amount and type of post-pasteurization contamination which occurred during manufacture. The psychrophile problem and its control as related to these products is much the same as for fresh milk products.

METHODS FOR DETECTION

Agar plate method. For selective culture of psychrophiles in freshly pasteurized milk and other products, low temperature incubation is necessary. Recent studies (1, 12) have emphasized this important fact which has been frequently overlooked in the past. Available evidence indicates that organisms which survive pasteurization do not reproduce significantly in milk during storage at 40° to 45° F. (4.4° to 7.2°C.) over a period of one or two weeks; however, growth may be extensive when milk is held at 50°F. (10°C). Likewise, plate counts of fresh pasteurized milk known to be free from post-pasteurization contamination with psychrophiles are almost invariably negative after incubation at 40° or 45°F. for 7 to 10 days. On the other hand, colonies on plates incubated at 50°F. for 7 to 10 days often may be numerous indicating that this temperature allows growth of thermodurics which are not important in the keeping quality of properly refrigerated milk. Consequently, 50°F. is too high an incubation temperature for use in the selective detection of psychrophiles in freshly pasteurized products. In this connection, it has been observed that occasionally no colonies may be found after incubation at 50°F. when milk was examined immediately after pasteurization, but after storage of the milk at 50°F. for three days the counts approached those obtained from plates incubated at 77° and 95°F. (25° and 35° C.) Such observations have been taken to indicate that maximum counts of thermodurics as obtained from plates incubated at 50°F. can only be obtained after the organisms have been allowed a period of adjustment to their environment after being subjected to the heat treatment of pasteurization.

The above shows that the five degrees difference between 45° and 50°F. is critical in the incubation of plates for obtaining psychrophile counts, and that counts obtained using an incubation at 50°F. should be interpreted carefully, realizing that such counts may include a significant portion of the thermoduric flora and therefore not give any indication of post-pasteurization contamination with psychrophiles.

Since the presence of psychrophiles is directly related to keeping quality during low temperature storage, the following, based upon available evidence, may be helpful in avoiding misunderstanding and false conclusions:

A. Psychrophile counts (incubation of plates at 40° to 45°F. (4.4° to 7.2°C.) for 7 to 10 days) on freshly pasteurized milk usually are very low. Counts obtained at 10°, 25°, 32°, and 35° C. incubation are much higher, as would be expected, due to the growth of non-psychrophilic types.

B. As storage progresses, psychrophile, 10° C. and 25° C. counts all increase rapidly, the first gradually approaching the other two, while generally the counts at 32° and especially at 35°C. increase more slowly but do not reach the levels attained at lower incubation temperatures. This is due to the fact that 25° C. is still within the growth temperature range for essentially all psychrophilic types of importance in milk supplies. Some may grow at higher temperatures but a large proportion of them either may not grow or may not form countable colonies; also, 25° C. will allow growth of most non-psychrophilic types; hence, the close relationship between 25°, 32° and 35° C. counts on fresh milk.

C. Bacterial counts of products stored for several days at low temperatures as obtained from plates incubated at 25°C. for 3 days can be expected to include all psychrophiles as well as most other types which may happen to have been present.

D. Mere absence of psychrophiles from one or two milliliters of product (the amount usually examined) is not necessarily a reliable indicator of good keeping quality; however, if detected at all in such amounts of milk, poor keeping quality is almost inevitable (1, 12, 20).

E. When pasteurized milk products are held under refrigerated storage, the longer the storage period the less reliance which can be placed on counts obtained from plates incubated above 25°C.

Other procedures. Recently several other laboratory procedures were studied as possible methods for the detection of psychrophile deterioration of pasteurized milk prior to the development of off flavours (1). The following is a summary of the results of these studies on milk stored at 4.4°C. for a period of 15 days.

A. The resazurin reduction time of refrigerated pasteurized milk at either 20° or 37°C. was found to be so great that this method was of little help in rapidly obtaining information concerning the activity of psychrophiles.

B. Phosphatase tests were negative throughout the 15 days of storage. In view of this and the diversity of the samples, the possibility of false phosphatase tests occuring as a result of phosphatase production by psychrophiles during storage of properly pasteurized milk was considered extremely remote.

C. The titratable acidity and pH of milk during storage did not change significantly, consequently these procedures were of no value in following bacterial increases and deterioration of flavor.

D. A marked decrease in protein stability as measured by a protein stability test (17) was closely associated with the development of off-flavour. This test was more valuable in predicting keeping quality than total bacterial counts. This was thought to be due to the fact that population levels associated with flavour changes vary with different organisms.

CONTROL OF PSYCHROPHILES

Since proper pasteurization effectively destroys most psychrophiles, their presence in a freshly pasteurized product indicates rather conclusively post-pasteurization contamination of the product. Other faulty practices may be involved but this is the major factor contributing to the presence of psychrophiles in pasteurized products. The effectiveness with which the cleaning and sanitizing procedures are carried out directly influences the number of psychrophiles in finished products. Water supplies used for rinsing purposes may play an important role in such contamination, especially in such products as butter and cottage cheese. However, in the case of pasteurized fluid milk products the available evidence points more directly to the lack of effective cleaning and bactericidal treatment of all equipment surfaces involved beyond the pasteurizer. Since most psychrophiles are markedly sensitive to chlorine, the chlorination of water used in the manufacture of products such as butter and cottage cheese is an effective control measure. In most instances 5-10 ppm available chlorine is considered adequate (9, 13).

The control of the psychrophile problem, therefore involves:

A. Proper pasteurization.

B. Proper cleaning and sanitizing of all equipment, particularly that used following pasteurization.

C. Protection of properly cleaned and sanitized equipment prior to its use.

D. Chlorination, if necessary, of water supplies, especially those used in the manufacture of butter and cottage cheese.

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PROGRAM

FORTY-SECOND ANNUAL MEETING OF THE INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC.

OFFICERS

President: Ivan E. Parkin, University Park, Pennsylvania

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JOURNAL OF MILK AND FOOD TECHNOLOGY

Associate Editor, Dr. J. C. Olson, Jr., St. Paul, Minnesota

Managing Editor, H. L. Thomasson, Shelbyville, Indiana

SPECIAL ACTIVITIES PROGRAM

Auspices Georgia Chapter – To be announced by general chairman

Ladies Program – Hostesses, Ladies of Georgia Chapter – Headquarters for Ladies – Sky Room.

SUNDAY, OCTOBER 2, 1955

9:00 *A.M.*– 1:00 *P.M.*–Meeting of Executive Board

2:00 *P.M.*– 6:00 *P.M.*–Meeting of Executive Board

MONDAY, OCTOBER 3, 1955

2:00 *P. M.* – Registration Desk Opens – Lobby

9:00 *A.M.*–12:00 *Noon–Meeting of Executive Board*

1:00 *P.M.*– 2:00 *P.M.*–Meeting of Local Arrangements Committee and Executive Board

2:00 *P.M.*– 3:15 *P.M.*–Meeting of Journal Editors and Executive Board

3:30 *P.M.*– 6:00 *P.M.*–Meeting of Council and Executive Board – Rose Room

1:30 *P.M.*– 5:00 *P.M.*–Individual Committee Meetings

7:00 *P.M.*– 9:00 *P.M.*–Informal Reception

TUESDAY MORNING, OCTOBER 4, 1955

Ballroom

Harold S. Adams, *President-Elect*, Presiding

8:00 *A.M.*–Registration–Lobby

8:30 *A.M.*–Motion Picture: "Partners in Progress" Courtesy, National Dairy Council

9:00 *A.M.*–Door prizes presented by various affiliates

9:10 *A.M.*–Invocation

9:15 *A.M.*–Introduction of Dr. O. C. Aderhold, *President*, University of Georgia, by Dr. John J. Sheuring
Address of Welcome–President Aderhold

9:30 *A.M.*–Introduction of Ivan E. Parkin, *President* IAMFS
Presidential address – President Parkin

9:45 *A.M.*–Appointment and charge to nominating committee by President Parkin

10:00 *A.M*–"Antibiotics in Milk", Professor W. A. Krienke, Dept. Dairy Science, University of Florida, Gainesville

10:30 *A.M.*–Report of Committee on Sanitary Procedures, C. A. Abele, *Chairman*
RECESS – 10 MINUTES

11:10 *A.M.*–"Recent Developments in Food Uses for Antibiotics", Dr. C. L. Wrenshall, Chas. Pfizer and Company, Inc. Brooklyn, N.Y.

11:40 *A.M.*–Report of Committee on Food Equipment – William V. Hickey, *Chairman*

TUESDAY AFTERNOON, OCTOBER 4, 1955

Garnett DeHart, *Vice-President*, Georgia Chapter, Presiding

2:00 *P.M.*–Door prizes presented by various affiliates

2:15 P.M.—"Rancidity — A problem in farm milk supplies", DR. J. C. OLSON, JR., Department of Dairy Husbandry, University of Minnesota

2:45 *P.M.*—Report of Committee on Dairy Farm Methods, CHESTER BLETCH, *Chairman*

3:15 *P.M.*—"Industry's Program on Crabmeat Plant Sanitation", CHARLES E. JACKSON, National Fisheries Institute, Washington, D.C.

3:45 *P.M.*—Report of Committee on Applied Laboratory Methods, C. K. JOHNS, *Chairman*

4:00 *P.M.*—"The Place of Sanitarians in the Development of Foreign Markets for Dairy Products", DR. C. J. BABCOCK, Dairy and Poultry Division, Foreign Agricultural Service U.S.D.A.

4:15 *P.M.*—Announcement by EMORY COOK, *Chairman* Entertainment Committee, Georgia Chapter
Barbecue and Dance — JULIA SMITH Park and Casino

WEDNESDAY MORNING, OCTOBER 5, 1955

DR. H. H. ROTHE, *President*, Florida Association of Milk and Food Sanitarians, Presiding

8:30 *A.M.*—Motion Picture: "Information at Work", Courtesy, Taylor Instrument Companies

9:00 *A.M.*—Door prizes presented by various affiliates

9:15 *A.M.*—Report of nominating committee

9:25 *A.M.*—Panel Discussion: "New High Temperature Pasteurization Processes"
Moderator: C. W. WEBER, State Department of Health, Albany, New York
Microbiological Criteria for Establishing Adequacy of Process, DR. WARREN LITSKY, University of Massachusetts, Amherst
Bacteriological Evaluation of Pasteurization Treatments, DR. FRANKLIN BARBER, National Dairy Products Company, Oakdale, New York
Instrumentation and Control Devices, HAROLD B. ROBINSON, U.S. Public Health Service, Washington, D.C.

RECESS — 10 MINUTES

10:55 *A.M.*—"Career Opportunities in the Food Industry", MR. FRANK K. LAWLER, Editor, Food Engineering, New York City

11:30 *A.M.*—"The use of Silicones in the Dairy Industry and in the Food Processing Industry", MR. CHARLES W. TODD, Dow Corning Corporation, Midland, Michigan

12:00 Noon—Report of the Committee on Communicable Disease Effecting Man. DR. R. J. HELVIG, *Chairman*

WEDNESDAY AFTERNOON, OCTOBER 5, 1955

IVAN E. PARKIN, *President*, IAMFS, Presiding

2:00 *P.M.*—Motion Picture: "Working for Better Public Health Through Recognition of Feelings", Courtesy, U. S. Public Health Service

2:15 *P.M.*—Door prizes presented by various affiliates

2:30 *P.M.*—"Efficacy of Disinfectants for Decontamination of Teat Cups", DR. G. R. SPENCER, Department of Veterinary Medicine, State College of Washington, Pullman

3:00 *P.M.*—Report by *Executive Secretary*, H. L. THOMASSON, "Status of the International Association of Milk and Food Sanitarians"

3:15 *P.M.*—Report by *Secretary-Treasurer*, HOWARD H. WILKOWSKE on Financial Condition

3:30 *P.M.*—Report of Committee on Education and Professional Development, H. S. ADAMS, *Chairman*

3:45 *P.M.*—Report of Committee on Frozen Foods FRANK FISHER, *Chairman*

4:15 *P.M.*—Joint Meeting, Executive Board, Committee Chairmen and members

7:00 *P.M.*—Annual Banquet and entertainment — Crystal Room
Toastmaster, JOHN CULP, Atlanta
Presentation of Past-President's Certificate by IVAN E. PARKIN, *President.*
Presentation of Citation Awards and of Sanitarians Award* by JOHN D. FAULKNER, Chairman of the Committee on Recognition and Awards.
*The Sanitarians Award is supported jointly by the Diversey Corporation, Klenzade Products, Inc., Oakite Products, Inc., Olin Mathieson Chemical Corporation, and the Pennsylvania Salt Manufacturing Company, and is administered by the International Association of Milk and Food Sanitarians, Inc.

Introduction, Professor H. B. HENDERSON
Guest Speaker, DR. HUGH MASTERS, Director University Center for Continuing Education, University of Georgia
"Education for the Changing World"

THURSDAY MORNING, OCTOBER 6, 1955

HOWARD WILKOWSKE, *Secretary-Treasurer,* Presiding

8:30 *A.M.*—Motion Picture: "A Nation's Meat" Courtesy, of Swift and Company

9:00 *A.M.*—Door prizes presented by various affiliates

9:15 *A.M.*—Report of Committee on Recognition and Awards, JOHN D. FAULKNER, *Chairman*

9:30 *A.M.*—Report of Resolutions Committee Harold J. Barnum, Chairman

9:45 *A.M.*—Report of Membership Committee HUGH TEMPLETON, *Chairman*

10:00 *A.M.*—"Wildlife Rabies at Home and Abroad", DR. ERNEST TIERKEL, Veterinary Public Health Section, CDC, Atlanta, Georgia

10:30 *A.M.*—"Public Relations in Government" The Honorable ERNEST VANDIVER, Lieutenant Governor of Georgia

RECESS (10 MINUTES)

11:10 *A.M.*—"Some Proposed Changes in the USPHS Recommended Food Ordinance" JOHN D. FAULKNER, Chief, Milk and Food Program, USPHS, Washington, D.C.

11:45 *A.M.*—Report of Committee on Baking Industry Equipment VINCENT T. FOLEY, *Chairman*

12:10 *P.M.*—Report of Committee on Ordinance and Regulations, WILLIAM A. HOSKISSON, *Chairman*

THURSDAY AFTERNOON, OCTOBER 6, 1955

PAUL CORASH, *First Vice-President,* Presiding

2:00 P.M.—Door prizes presented by various affiliates

2:15 *P.M.*—"Our most Demanding Critics can be Our Best Friends" MR. A. J. CLAXTON, President, Meadowgold Dairies, Inc., Pittsburg, Pennsylvania

2:45 *P.M.*—"Milk Plant Waste Disposal" DR. NANDOR PORGES, Bureau of Agricultural and Industrial Chemistry, USDA, Philadelphia

3:15 *P.M.*—Business Meeting
IVAN E. PARKIN, *President* Presiding
Election of Officers
Installation of Officers
Adjournment

4:00 *P.M.*—Meeting of Executive Board

COMMITTEES ON LOCAL ARRANGEMENTS GEORGIA CHAPTER

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1. MR. J. P. GIBBS, *Chairman*
2. MR. GARNETT DEHART
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4. MR. SILAS MAJOR
5. MISS MILDRED CRAIG
6. MRS. LOUISE STEPHENS.
7. MR. CARL WILLIAMS

The officers of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., wish to express their sincere appreciation to the Committees of the Georgia Chapter for the fine planning and work they have done. We are truly grateful to you.

NEWS AND EVENTS

HELPFUL INFORMATION

Editorial Note: Listed below are sources of information on a variety of subjects. Requests for any of the material listed should be sent by letter or postcard to the source indicated. Please mention the Journal of Milk and Food Technology when corresponding about items mentioned in this column.

Bovine Mastitis: A study of the underlying causes of mastitius and evaluation of various measures that may be taken to effect control. Bulletins 581 and 581P. Available from College of Agriculture, The Pennsylvania State University, State College, Pa.

Conference Report on Incineration, Rubbish Disposal and Air Pollution. Report No. 3. Available from Air Pollution Foundation, 704 South Spring Street, Los Angeles, Calif. 1955. 52 pages. Price $3.00.

Acid Compositions of Oils and Fats. Chart. Available from E. F. Drew and Company, Technical Products Division, 15 East 26th Street, New York 10, N.Y.

Principles of Emulsion Technology. Book. Published by Reinhold Publishing Company, 430 Park Avenue, New York, N. Y. 149 pages. Price $2.95.

Plant Maintenance Cleaning Guide. Circular. Available from Oakite Products, Inc., Dept. JMFT, 19 Rector Street, New York, N. Y.

General Background of Sanitation Problems. Booklet. Available from Klenzade Products Company, Dept. JMFT, Beloit, Wisc.

Questions and Answers—Dairy Sanitation Quality Quiz. Circular. Available from Klenzade Products Company, Dept. JMFT, Beloit, Wisc.

Guide for Cleaning in Food Canning and Preserving Plants. Handy Guide. Available from Oakite Products Company, 27 Rector Street, New York 6, N. Y.

Experimental Cookery (4th ed.). Book by Belle Lowe. Published by John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 1955. 573 pages. Price $7.50.

Applications Unlimited. Booklet. A review of 40 applications of CO_2 in food processing. Available from Liquid Carbonic Corporation, Dept. JMFT, 3100 South Kedzie Avenue, Chicago 23, Ill.

Poultry Processing Practices. Booklet. Useful in training foremen and in instructing workers. Available from Gordon Johnson Company, Dept. JMFT, 2519 Madison Street, Kansas City 8, Missouri.

Control of Communicable Diseases in Man (8th ed.). Booklet. Available from American Public Health Association, 1790 Broadway, New York, N. Y. 219

pages. Price 60 cents.

Food Service in Institutions (3rd ed.). Book by Bessie Brooks West and LeVelle Wood. Published by John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N.Y. 1955. 682 pages. Price $7.50.

Introductory Foods (3rd ed.). Book by Osee Hughes. Published by MacMillan and Sons, New York, N.Y. 1955. 551 pages. Price $4.75.

Water Supply Engineering. Book by H. E. Babbitt and J. J. Doland. (5th ed.). Published by McGraw Hill, New York, N. Y. 1955. 608 pages. Price $8.50.

Handbook of Food and Agriculture. Book edited by F. C. Blanck; 26 cooperative writers, 1000+ pages. Published by Reinbold Publishing Company, 430 Park Avenue, New York 22, N. Y. 1955. Price $12.50.

Enzyme Regeneration in High Temperature—Short Time Sterilized Canned Foods. Booklet available from Metal Division Research and Development Dept., Continental Can Company, 100 East 42nd Street, New York 17, N.Y.

Basic Bakery Sanitation Principles. Pamphlet available from American Institute of Baking, 400 East Ontario Street, Chicago 11, Ill.

Tempest in the Coffee Pot. By F. A. Pearson. Bulletin AE 960, January 1955. Available from Dept. of Agric. Economics, Cornell University, Agric. Experiment Station, Ithaca, New York.

Use of Sugars and Other Carbohydrates in the Food Industry. Advances in Chemistry Series 12. Book. Special Publications Department, American Chemical Society, 1155 16th Street, N. W., Washington, D. C. 1952. 142 pages. Price $3.00.

Cleaning and Sanitizing Farm Milk Utensils. Bulletin available from Supt. of Documents, Washington, D. C. Catalogue No. A 1.9:2078. Price 10 cents.

Farm Methods of Cooling Milk. Bulletin available from Supt. of Documents, Washington, D. C. Catalogue No. A 1.9:2079. Price 10 cents.

History of Plague in the United States. Bulletin available from Supt. of Documents, Washington, D.C. Catalogue No. FS 2.62:26. Price 60 cents.

Sanitation in the Cottage Cheese Industry. Booklet available from Klenzade Products, Inc., Beloit, Wisc.

Testing of Hydrometers. By J. C. Hughes, National Bureau of Standards Circular No. 555. Available from Government Printing Office, Washington, D. C. 10 pages. Price 10 cents.

Principles of Emulsion Technology. Book by Paul Becher. Published by Reinhold Publishing Company, 430 Park Avenue, New York 22, N.Y. 1955. 149 pages. Price $2.95.

Sanitation in the Poultry Industry. Booklet available from Klenzade Products, Inc., Beloit, Wisc.

18th Annual Series on Production and Utilization of Dairy Products in 1953. Booklet available from Olsen Publishing Company, 1445 North Fifth Street, Milwaukee 12, Wisc.

Chemical Problems of Farm Water Supplies. Circular No. 111, November 1954. Available from Agric. Experiment Station, South Dakota State College, Brookings, South Dakota.

Vinegars and Salad Dressings. Bulletin available from Missouri Agric. Experiment Station. No. 631, September 1954. College of Agriculture, Columbia, Mo.

Recommendations and Requirements for Slaughtering Plants. Bulletin No. 633, September 1954. Available from Missouri Agric. Experiment Station, College of Agriculture, Columbia, Mo.

Methods in Enzymology. Book by S. O. Colwick and N. O. Kaplan. Published by Academic Press, Inc., 125 East 23rd Street, New York 10, N. Y. 1955. Price $18.00.

Margarine. Book by A. J. C. Anderson. Published by Pergamon Press, 122 East 55th Street, New York 22, N. Y. 1954. 327 pages. Price $9.80.

Quality Control Program for Milk Producers. Booklet available from Klenzade Products Company, Inc., Beloit, Wis.

Weights of foods eaten per meal by 242 women 30 to 92 years of age. Available from Michigan Agr. Experiment Station, College of Agriculture, E. Lansing, Michigan. Bulletin No. 244, January 1955.

Rules for Money Making Milking. Circular available from Babson Bros. Company, 2843 W. 19th Street, Chicago, Ill.

Food Consumption of Urban Families in the United States. Bulletin by Faith Clark, Janet Murray, Gertrude Weiss and Evelyn Grossman. Available from Agriculture Research Service, Supt. of Documents, Washington, D. C. 203 pages. Price $1.00.

Water Treatment Handbook. Book by Emile Degremont. Published by H. K. Elliot, 20 Harrington Court, London, S. W. 7, England. 1955. 468 pages. Price $7.50.

The Analysis of Drugs and Chemicals. Book by Norman Evers and Wilfred Smith. Published by Charles Griffin Company, 43 Drurylane, London W. C. 2, England. 1955. 546 pages.

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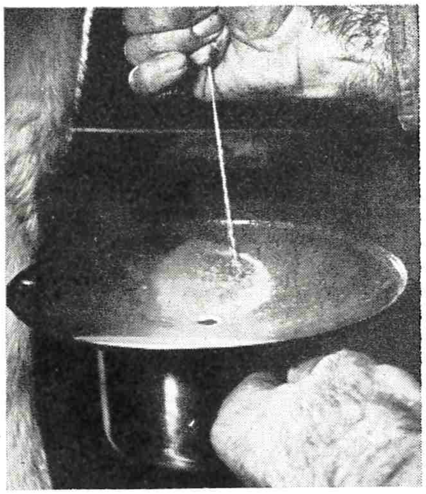


NEW PLATE-TYPE STRIP CUP DETECTS MASTITIS EARLY

One of the handiest, most important and yet most overlooked dairy tools is the strip-cup. Perhaps more than any item except the scrub brush, it can safeguard the health of the herd and quality of milk by detecting mastitis *in time.*

Veterinarians and dairy health authorities believe too many dairymen are merely talking about strip-cups . . . not enough are using them. The late Dr. Claude Bryan of Michigan, a recognized expert on mastitis, said that steady use of a strip cup would catch 75 per cent of udder infections at the early stage detectable only by a laboratory test.

The new plate-type strip cup pictured here has a wide, flat, dark-colored surface, with concentric rings like a phonograph record, which show up small flakes of mastitis immediately . . . before the usual "ropiness" appears.

The new plate-cup design is being introduced by Babson Bros. Co. of Chicago. Dairymen find that the new plate-cup is also easier to clean than wire screen types. The new strip-cup makes it possible to detect mastitis promptly, while there's still time to cure a valuable cow and save her from the butcher's block. Using the strip-cup also disposes of the high bacteria "first milk" and stimulates let-down.

If small flakes of clotted milk are detected, they are advance danger signs of a bacteria count as high as two million. Milk from that cow should immediately be discarded and the udder treated according to your veterinarian's recommendations.

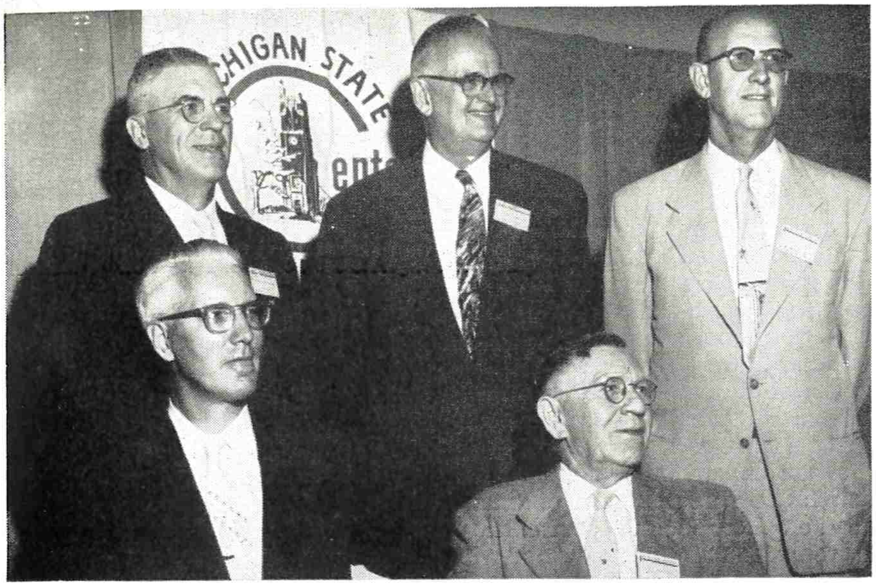
NEW SPARTA ILLUSTRATED BRUSH FOLDER

Sparta Brush Co., Inc., Sparta, Wisconsin, has just released a new convenient pocket-size illustrated folder, "Modern Sanitation Aids", for its line of job-fitted dairy farm brushes. The folder is part of a program for helping dairy plants improve milk quality and is designed so that it can readily be included in outgoing mail to producers, sent out under its own cover as a mailing piece, or handed out by haulers and fieldmen.

Wherever used, the folder has demonstrated that it is highly effective in encouraging dairy farmers to use better designed and more effective brushes for cleaning milking equipment as well as for environmental sanitation. The folder features many completely new brushes in combinations of new designs and materials which greatly help producers to do a better cleaning job.

These folders are furnished free either to jobbers for distribution to dairy plants or direct, in quantities, to dairy plants who will use them for producer distribution.

Sample copies of this new folder, "Modern Sanitation Aids", can be had without obligation by writing to Sparta Brush Co., Inc., Sparta, Wisconsin.



Here are the new officers of the American Dairy Science association who were installed at the June 20-23 annual meeting of the organization at Michigan State College, East Lansing. Seated, from left: Dr. I. R. Gould, Ohio State University, president, and Dr. Carl F. Huffman, Michigan State College. Standing, from left: Dr. I. W. Rupel, Texas A & M, director; H. F. Judkins, New York, retired president of Sealtest, Inc., first full-time association secretary; and Dr. E. L. Fouts, University of Florida, Gainsville, director. (M.S.C. Photo)

These men are the 1955 winners of the coveted awards presented during the annual meeting of the American Dairy Science association at Michigan State College, June 20 - 23. Seated, from left, Professor C. W. Duncan, Michigan State College, the Borden Company award for dairy production research; Dr. Frederick E. Herzer, Mississippi State College, Milk Industry Foundation & Dairy Science Teaching Award; and Professor Floyd J. Arnold, Iowa State College, De Laval Extension Dairyman Award. Standing, from left: Walter A. Wentworth, retired vice president of the Borden Company in New York, honorary membership in the ADSA; Drs. Norman L. Jacobsen and Robert S. Allen, Iowa State College, co-winners of the Nutrition Council Award of the American Feed Manufacturers association. Not present is another Borden Award Winner, Dr. Frank V. Kosikowsky of Cornell University, who is in Europe on a Fulbright fellowship. (M.S.C. Photo)

DR. ROBERT F. HOLLAND APPOINTED

Effective July 1, Dr. Robert F. Holland will become head of the dairy industry department at Cornell University, succeeding Dr. James M. Sherman who has been head for the past 32 years.

Dr. Sherman is relinquishing his administrative duties but will continue on the staff of the College of Agriculture as professor of bacteriology. He will devote full time to research and writing in that field, in which he is an authority.

He plans to continue his studies of important groups of bacteria, especially the streptococci; and to continue research on microorganisms of importance in milk, food products, and industrial fermentations These are areas in which he has already made notable contributions to science.

Professor Holland, a native of Holley, N. Y. received the B.S., M.S., and Ph.D degrees from Cornell, in 1936, 1938, and 1940, respectively. From 1935-39 he held the title of instructor in dairy chemistry, and previous to that was bacteriologist for Inlet Valley Farms, Inc., 1932-35.

Before joining the Cornell faculty as professor of dairy industry in 1945, Dr. Holland served as director of chemical research for G.L.F. for four years. He has also had experience as dairy sales engineer for the Cherry-Burrell Corp., and was associate in research for the State Agricultural Experiment Station, Geneva, from 1939-41.

At Cornell he has been in charge of the extension work in the dairy department and has taught specialized courses in dairy industry, dairy chemistry, and bacteriology. He has published many papers of an educational, extension, and research nature in dairy science. One of his technical bulletins published at Geneva concerned the effect of time and temperature of pasteurization on some of the properties and constituents of milk.

In addition to membership in Phi Kappa Phi, Sigma Xi, and Alpha Gamma Rho, Dr. Holland is affiliated with the American Dairy Science Association, the Society of American Bacteriologists, and the International Association of Milk and Food Sanitarians.

The new department head

resides in Trumansburg with his wife, two sons, and a daughter. Another son is a 2nd lieutenant at Fort Sill, Oklahoma.

He belongs to the Rotary Club and is a member of the Trumansburg School Board and the Board of Cooperative Services.

NATIONAL SANITARY ENGINEERS REGISTER

At the request of the Office of Defense Mobilization, the Public Health Service, U. S. Department of Health, Education, and Welfare, is developing a National Register of Sanitary Engineers. The activity has been integrated into the overall program of the National Science Foundation, which is working through many professional organizations to have available complete information on trained technical and scientific personnel who might be needed in case of an enemy attack or other major national disaster.

Engineering skills in basic sanitation, water supply, waste disposal, radiological monitoring, food and milk sanitation, and emergency housing are of great importance at any time; they can mean life and death to millions of Americans in a national emergency. This National Register of Sanitary Engineers will, therefore, be a vital factor in the Nation's mobilization program.

In 1949, the American Public Health Association prepared a National Roster of Sanitary Engineers for the National Security Resources Board. Maintenance of that roster was discontinued a few years ago. The Public Health Service used that list and drew on the Association's valuable experience as the basis for starting work on this Register.

All the professional organizations in the United States with which sanitary engineers are affiliated are cooperating. The American Public Health Association, the American Society of Civil Engineers, the American Water Works Association, the Federation of Sewage and Industrial Wastes Association, the Conference of Public Health Engineers, the Conference of State Sanitary Engineers, and the Registration Boards in each State have supplied their membership lists. A master mailing list of over 10,000 names of sanitary engineers has been developed from these and other sources.

A one-page information sheet which requires only a few minutes to fill in has been prepared in cooperation with the Engineers' Joint Council and the National Science Foundation, and will be sent during the next several months to each engineer whose name is on this list. A letter from Assistant Surgeon General Mark D. Hollis, Chief Engineer of the Public Health Service, will accompany the information sheet, asking each recipient to read the accompanying National Research Council's definition of a sanitary engineer before transmitting his reply, and a return envelope will be furnished. By this means, details on the engineer's education, his professional experience, and his sanitary engineering specialty will be recorded. When completed, the Register will be maintained by the Public Health Service.

EMIL HOWE RE-NAMED TO TOP NADEM POST AT 10TH ANNUAL MEET

Emil Howe, Waukesha Foundry Co., was re-elected Chairman of the Executive Committee of National Association of Dairy Equipment Manufacturers at NADEM's tenth Annual Meeting held in May at the Kenwood Country Club in Bethesda, Md.

D. H. Burrell III, Cherry-Burrell Corp., was re-elected Vice Chairman of the six-man Executive Committee. The other four members of the committee are: H. I. Edwards, The Pfaudler Co.; Paul K. Girton, Girton Manufacturing Co.; Ferd Hinrichs, Tri-Clover Division, Ladish Co.; H. L. Solie, General Dairy Equipment Corporation.

All of the above have served previously in these posts, with the exception of Mr. Girton, who comes newly to the committee, replacing Walter J. Wachowitz, Sr., of Alloy Products Corp., who did not seek re-election.

More than 60 representatives from 35 member firms attended the session, according to John Marshall, NADEM's Executive Secretary. Staff headquarters of the national group are located at 1014 14th Street, N.W., Washington 5, D. C.

AWARDS IN MEMORY OF SAMUEL J. CRUMBINE ESTABLISHED BY PAPER CUP INSTITUTE

Public health departments will be recipients of two annual national awards, just established by the Public Health Committee of the Paper Cup and Container Institute in honor of the late Dr. Samuel J. Crumbine. Dr. Crumbine, pioneer public health officer and campaigner against the common drinking cup, was a consultant to the Public Health Committee of the Paper Cup and Container Institute for several years before his death in July, 1954.

The awards, to be known as the Samuel J. Crumbine Awards, are intended to perpetuate the late doctor's life-long interest in health education and sanitation. They are offered to official city, county and local district health units for "outstanding achievement in the development of a comprehensive program of eating and drinking sanitation."

Winning programs will be selected by an Awards Jury of prominent public health authorities. Members of the jury are:

Dr. Mayhew Derryberry, Chief
Division of Public Health Education
U.S. Public Health Service

Dr. Granville Larimore
Deputy Commissioner of Health
New York State Health Department

Dr. Daniel Bergsma
Commissioner of Health
New Jersey State Health Department

Dwight Metzler, Chief Engineer
Kansas State Board of Health

Walter S. Mangold
Associate Professor of Public Health
University of California

Mrs. Lucy R. Milligan
Health Chairman
General Federation of Women's Clubs

Competition for the Awards is open to the nearly 1,150 local health units in the United States. Awards offered this year will cover programs or activities in progress or having been completed during

1955. Entries must be submitted on or before September 15, 1955.

Each award to a winning health unit will consist of a bronze medal and engraved plate mounted on a walnut plaque. In addition, the health officer and the person or persons most directly responsible for the winning program under him will each receive a duplicate of the bronze medal.

Presentations will be made at one of the annual professional meetings to be held in the fall of 1955.

Eligibility for a Samuel J. Crumbine Award is limited to official health city, county and local district health units of the U.S. and entries should be submitted by the administrative head of the competing health unit.

To enter the competition for either of the Samuel J. Crumbine Awards, which are of equal importance, the health unit should write for an application to: The Public Health Committee, Paper Cup and Container Institute, Inc., (Samuel J. Crumbine Awards Jury) 250 Park Avenue, New York 17, New York.

The Award for "Outstanding Achievement in the Development of a Comprehensive Program of Environmental Sanitation" is designed to provide recognition for complete programs which embrace all the aspects of modern environmental control. It is intended to stimulate and encourage local health units to broaden and diversify their activities.

All programs will be judged on the basis of relative emphasis placed on each aspect of sanitation in terms of local needs and expenditures of time and money and personnel.

In the tradition of Dr. Crumbine, special consideration will be given to newly developed activities of a pioneering nature which complement and support the total program. However, award selections will be made on the basis of the completeness and balance of the program, rather than on unique or dramatic achievements in any single area.

The Award for "Outstanding Achievement in the Development of a Program of Eating and Drinking Sanitation" is intended to honor health departments which have originated or developed programs arousing specific public action or participation leading to better food and beverage sanitation. Programs considered for this award should demonstrate progress or achievement based on team work in sanitation, administration and health education as exemplified by Dr. Samuel J. Crumbine.

Among the characteristics of an outstanding program in this area might be the degree of public support aroused by the program . . . the use of community resources other than the health department . . . the involvement of community organizations.

Judgment will be based on evidence of specific action directed towards better sanitation in eating and drinking situations, whether or not results have yet been achieved.

Dr. Samuel J. Crumbine, in whose memory these Awards are offered by the Public Health Committee of the Paper Cup and Container Institute, was the originator of many famous health crusades, including campaigns against the common drinking cup, the housefly, and the roller towel. He popularized and made effective slogans such as "Swat the Fly," "Bat the Rat," "Don't spit on the Sidewalk," and "Sleep with your Windows Open." The programs, represented by these slogans, marked the beginning of some of the most important advances in the history of public health.

NEW SPRAY ARM SYSTEM FOR CLEANING VACUUM PANS

A completely new approach to cleaning vacuum pans and evaporators has been perfected by Klenzade Products, Inc., Beloit, Wisconsin after more than several years of field testing.

The new system embraces the use of specially designed spray arms which reach all sections of the pan with the cleaning solution, especially the entrainment section of coil pans.

The Klenzade Spray Arm System affects a considerable saving in boiler horsepower due to lower steam consumption during the cleaning cycle. Only about 1/10 as much water is used as in former cleaning systems. Substantial savings in man-hour cleaning time are also made because hand cleaning is reduced to a very low minimum.

The system is particularly notable because of its efficient cleaning of coils or tubes and other heated surfaces where heaviest residues of product usually collect.

The Klenzade Spray Arm Cleaning System is available for all types of vacuum pans and single, double, and triple effect evaporators with a minimum of mechanical changes to the equipment. Installation is supervised by Klenzade technicians. For complete information write to Klenzade Products, Inc., Beloit, Wisconsin, mentioning your type of equipment.

DR. CHESTER D. DAHLE RETIRES

One of the nation's leading authorities in the field of dairy manufacturing will retire with emeritus rank on August 1, after 31 years of service.

He is Dr. Chester D. Dahle, professor of dairy manufacturing at the Pennsylvania State University since 1924.

Dr. Dahle in 1947 received the coveted Borden Award in Dairy Manufacturing for outstanding research work in the manufacture of ice cream, cheese, and other dairy products.

The first work done in the field of high-temperature short-time pasteurization of ice cream mixes was done by Dr. Dahle in 1931. Within the last five years, this system has been adopted by many of the large ice cream plants in this country. His research has also been concerned with flavor and texture of ice cream and he was the first to discover the air cells in milk powder globules.

Dr. Dahle invented the Duo-Visco Homogenizer Valve which has been widely used in the homogenization of ice cream mixes, and with Dr. George H. Watrous, Jr. of the Penn State faculty, discovered a new method for making a grating type cheese.

Born in Cheyney, Washington, Dr. Dahle received his bachelor's, master's and doctor's degrees at the University of Minnesota and also served on the faculty there prior to coming to Penn State in 1924.

Dr. Dahle has been especially active in teaching short courses in ice cream manufacturing. The Penn State Ice Cream Short Courses have attracted people from all over the world and the attendance in these courses has been unusually heavy.

He has assisted in ice cream short course conferences in 25 other universities in this country and Canada and has appeared on numerous State and International Association Ice Cream programs.

Dr. Dahle served as chairman of the Statistical Research Committee of the International Association of Ice Cream Manufacturers for the past ten years — and is now Vice-Chairman of the Production and Laboratory Council of the same association and in addition has served the International Association as witness in the Food and Drug hearings. In 1949 he made a survey of the "acidity problem" all over the U. S. for the Association.

Dr. Dahle has served as chairman and secretary of the Manufacturing section of the American Dairy Science Association and for years was abstractor of Ice Cream articles for the Journal of Dairy Science and later was Ice Cream Abstract Editor.

Since 1927 Dr. Dahle has been technical editor of the "Ice Cream Field" and has contributed technical articles to other trade papers. He is author of 115 technical articles, papers and bulletins pertaining to the dairy industry.

While Dr. Dahle has not reached retirement age at the University, the retirement plan permits one to retire after 25 years of service. Thus several years short of retirement age he plans to continue in the ice cream consulting field. He will maintain an office in his home.

B. F. BEACH, AS DISI REPRESENTATIVE, ADVISING PUERTO RICO DAIRY INDUSTRY, GOVERNMENT OFFICIALS ON NEW SYSTEMS

An executive of an American dairy industry enterprise has gone to Puerto Rico to counsel local groups on the Island on the establishment of a milk code and on the formulation of a pricing system for milk.

He is B. F. Beach, Michigan Producers Dairy Company, Adrian, Michigan, who expects to complete a Puerto Rican "tour of duty" in early or mid August.

He is there as a special representative of Dairy Industries Society, International, the educational and enterprise-promoting membership organization which among other current activities is adviser to the Economic Development Administration of Puerto Rico on various dairy economic, technical and marketing matters.

The Society began to serve Puerto Rico systematically in this manner in 1953 by consulting with processors and producers of milk there regarding disposition of an annually mounting milk surplus. Robert Rosenbaum, Chairman of DISI's Board of Directors, still earlier as a personal contribution to Island welfare had given extended dairy development counsel both to public officials and private interests . Then following a Society survey of the Island made by Irving C. Reynolds, a DISI past President and Chairman of the Board of Franklin Ice Cream Co., Toledo, Ohio, DISI recommended that a by-products plant be built to turn surplus milk into cheeses, evaporated milk, ice cream mix, flavored milk drinks and buttermilk. Processors on the Island then formed a joint stock company — Industria Lechera de Puerto Rico, Inc. —and its plant will be ready to operate this Fall.

Later the Society sent Dr. John L. Barnhart, who had obtained leave from his work as Technical Director of Dairy Industries Supply Association, to Puerto Rico, to advise on-the-spot on problems of plant building and lay-out.

Mr. Beach is accustomed to a broad-scope special industry service. He is Chairman of Dairy Industry Committee; he was a member of a Presidential Trade Mission to Europe in 1953; he has been long active as director or officer of several of the major dairy processors' associations and he presently serves on the Dairy Export Advisory Committee of USNA's Foreign Agricultural Service.

In Puerto Rico he is conferring with officals of the Economic Stabilization office and of the Departments of Health and of Agriculture and Commerce. One of the officials of the last named government department is Carlos Rivera Gonzalez, a DISI Area Director. Mr. Beach also is meeting with the directors of Industria Lechera de Puerto Rico, many of whom are DISI members.

Mr. Beach's assignment is identified by the Secretary as one of "agicultural, industrial and political statesmanship." So far milk producers in Puerto Rico have received and dairy processors have paid, a single price for milk. With a first Island dairy by-products plant coming into production new economic and marketing analyses of complex Island-wide factors as a basis for devising appropriate definitions of grades and an equitably adjusted pricing method are required.

STUDENTS RUN FACTORIES IN UNIQUE PLAN

A growing number of high school students will gain on-the-spot experience in running a factory during the coming school year.

The students will be participants in a project known as the Students-in-Industry program, developed by the American Can Company and tested on a "pilot" basis during the last school year in St. Louis, Portland, Me. and Hoopeston, Ill.

Basically, the program consists of using Canco plants and sales offices as "laboratories" for case studies of industry in operation and then giving the students a chance to actually run the factories in collaboration with the regular supervisors, explained L. W. Graaskamp, company vice president. A major purpose of the program, he added, is to help the student bridge the gap between classroom studies and the realities of an industry working within the community.

Canco is planning to offer its cooperation in expanding the program this fall to high schools in New York City and Indianapolis and later to other selected cities where the firm operates factories.

Last winter's tryouts of the program were widely acclaimed by school officials. Philip J. Hickey, superintendent of instruction for St. Louis, said: "The Students-in-Industry program looks to us like the answer to meaningful education of high school students in the whys and wherefores of the free enterprise system. We think the pattern we are establishing in this project will prove useful in many communities, and it would not surprise us to see it spread throughout the country."

A typical Student-in-Industry program works this way:

The manager of the local Canco plant works with a high school in his community to develop a project that meets the school's specific requirements and to set up a class — usually of seniors — to participate in the program. (The student groups have ranged in size from 30 to just under 100. Both boys and girls participate.)

Then for a period ranging from three to six weeks, management personnel from the Canco factory meet daily with the class, discussing with the students various aspects of the company's national and local operations, as well as the economics and operation of the container and container-using industries in general. Using Canco as a case study, a broad background of American business functioning is given. Field trips are made to the can factory and to industrial plants where Canco-made containers are used.

The school room phase of the course concludes with the students being assigned to managerial positions in the local plant for a full day, where they work side by side with regular company managers and supervisors. On this occasion, known as S-Day, the posts filled by the students range from plant and district sales managers to assistant foreman, plant nurse and, at times, key secretarial jobs.

The Students sit in on all meetings, handle daily correspondence, prepare and sign daily reports, take telephone calls, order raw materials, call on customers and so forth. Every effort is made to give the students a full, active day in which they make management decisions and perform normal managerial duties.

"We believe," said Mr. Graaskamp, "that the Students-in-Industry program in many instances can be repeated year after year as a regular part of the high school curriculum. In some cases it has been made part of existing social studies courses, and in others special classes have been created for the project."

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INSTRUCTIONS TO CONTRIBUTORS

Manuscripts.—Manuscripts should be submitted on suitable 8½" x 11" paper. The original typewritten copy double or triple spaced with wide margins not less than 1" on all four sides should be submitted. Tabular material and illustrations should accompany the manuscript; also, each manuscript should be accompanied by (a) a glossy personal photograph of the author, (b) a brief biographical sketch of the author not more than 50 - 75 words, and (c) an abstract of the paper not to exceed 75 words. These will be used at time of publication of the paper. All material should be sent by first class mail in flat form to the Managing Editor, H. L. Thomasson, P. O. Box 437, Shelbyville, Indiana.

Authors should make every effort to present their material accurately and in a clear and concise form. In preparing manuscripts, use of the first person should be avoided. Manuscripts should be proofread carefully before they are submitted. Each manuscript will be reviewed by one or more Associate Editors. Anonymity of reviewers will be preserved.

Manuscripts reporting the results of experimental work, generally, should be divided into sections, for example: Introduction; Experimental; Results; Discussion; Summary and Conclusions; References.

Figures, Tables and Photographs. — Tables should be clear and concise. Excessively large tables, as well as those consisting of only one or two lines, should be avoided if possible. Headings should be brief but fully descriptive. Avoid presenting the same data in a table and again in a figure. Place each table or figure on a separate sheet—not in the body of the manuscript.

Figures consisting of drawings, diagrams, charts and similar material should be done in India ink on 8½" x 11" tracing paper or cloth. A lettering guide should be used for all written material on figures. Submit original figures rather than photographs of such figures.

Photographs should be glossy prints free of imperfections.

Legends. — Legends for figures and photographs should be typed on a separate sheet. The legends should be brief but fully descriptive.

References. — References should be double spaced and arranged alphabetically as to authors. References to papers by a single author should preceed references to papers by the same author and associates. References to papers by multiple authors should be listed in the alphabetical order of the several authors. Initials rather than the full first names of male authors should be given. Reference citations in the text should be made by a number in parentheses, corresponding to that number in the reference list.

Sample of journal citation: (1) Mallmann, W. L. Sanitation in Bulk Food Vending. J. Milk and Food Technol., *16*: 267-269. 1953.

Sample of Book citation: Adams, H. S. *Milk and Food Sanitation Practice.* The Commonwealth Fund. New York, New York. 1947.

Sample of Experiment Station publication citation: Watrous, G. H., Doan, F. J. and Josephson, D. V. Some Bacteriological Studies on Refrigerated Milk and Cream. Penn. Agr. Exp. Sta. Bull. 551. 1952.

Publications should be abbreviated according to the form given in CHEMICAL ABSTRACTS, vol. 45. no. 24, part 2. 1951.

Abbreviations.—Common abbreviations to be used in the text are: cm., centimeter(s); cc., cubic centimeter(s); C., Centigrade; F., Fahrenheit; g., gram(s); log., logarithm; lb., pound(s); μ, micron(s); μg., microgram(s); mg., milligram(s); ml., milliliter(s); oz., ounce(s); sp. gr., specific gravity.

News items and announcements. — Items of general interest should be submitted in the same manner as indicated for manuscripts. An informal writing style is preferred. News of the activities of affiliate associations, members and events is particularly desirable.

Letters to the Editor.—Letters to the editor are encouraged. Letters should be addressed to the Managing Editor and must be signed by the writer. Excessively long letters should be avoided due to Journal space limitations.

INDEX TO ADVERTISERS

QUESTIONNAIRE FOR INFORMATION ON VOCATIONAL DATA OF MEMBERSHIP

Dear IAMFS Member:

Your association and the Journal of Milk and Food Technology has steadily grown in stature over the years. Beginning with January 1954, the Journal was issued monthly. In order to continue this and to increase the size and scope, it is necessary to increase our advertising volume. Prospective advertisers have informed us that they need additional information relative to the professional activities, employment and other general data of our membership. We would therefore appreciate it if you would fill out the following questionnaire to the best of your ability and send it to H. L. Templeton, Chairman, Membership Committee, 6125 Florence Blvd., Omaha 11, Nebraska. The material you submit will be held completely confidential. In addition, we would appreciate having any comments you wish to make.

Very truly yours,
H. L. Templeton, Chairman
Membership Committee

1. *Which of the following occupational groups would you say you would fit? (You may answer more than one category.)*
   - Attorney ☐
   - Bacteriologist ☐
   - Chemist ☐
   - Consultant ☐
   - Educator ☐
   - Engineer (general) ☐
   - Farmer ☐
   - Food Processor ☐
   - Laboratory Technician ☐
   - Librarian ☐
   - Manufacturer of Food Equipment ☐
   - Manufacturer of Milk Equipment ☐
   - Milk Processor ☐
   - Physician ☐
   - Publisher ☐
   - Sanitarian ☐
   - Sanitary Engineer ☐
   - Student ☐
   - Veterinarian ☐
   - Other ☐
2. *How many of the following do you visit each year?*
   - Barber Shops ______
   - Butcher Shops ______
   - Dairy Farms ______
   - Food Plants (excl. milk) ______
   - Groceries ______
   - Hotels ______
   - Lodging Houses ______
   - Milk Plants ______
   - Nurseries ______
   - Restaurants ______
     - Drug Stores ______
     - Soda Fountains ______
   - Schools ______
   - Sewage Disposal Plants ______
   - Tourist Homes ______
   - Trailer Camps ______
   - Water Works ______
   - Other ______
3. *Milk Sanitation*
   a. Approximately how many cows are there on the farms under your supervision? ______
   b. Approximately how many milking machines are there on these farms? ______
   c. How many farms are now under the bulk milk pickup system? ______
   d. What is the total production of the farms? ______ plants? ______ under your supervision?
   e. Are the plants filling bulk milk dispensers? ______
   How many? ______
4. *By which of the following agencies are you employed?*
   a. Government Agencies –
   - Federal ☐ State ☐
   - Civilian ☐ City ☐
   - Military ☐ County ☐

   b. Educational Institutions –
   - University or College ☐
   - High School ☐
   - Federal, State, or City ☐
   - Industrial ☐

   c. Laboratories –
   - Official agency ☐
   - Commercial or industrial ☐
   - Institutional ☐

   d. Industry –
   Milk and milk processing plants:
   - Receiving stations ☐
   - Evaporating plants ☐
   - Dry milk plants ☐
   - Ice cream plants ☐
   - Fluid milk plants ☐
   - Cheese plants ☐
   - Butter plants ☐
   - Butter ☐

   e. Other ☐
5. *Automatic Vending Machines – How many of the following are under your jurisdiction?*
   - Carbonated and non-carbonated beverage ______
   - Coffee ______ Sandwich ______
   - Milk ______ Other Foods ______
   - Soup ______ Other ______
6. *For statistical information, please indicate size of the city or place in which you have your residence. (If a suburb, check size of city of which it is a suburb.)*
   - Over 1,000,000 (in the United States, *only* New York, Chicago, Philadelphia, Los Angeles, Detroit) ______
   - 100,000 to 1,000,000 ______
   - 25,000 to 100,000 ______
   - 2,500 to 25,000 ______
   - Under 2,500 (non-farm) ______
   - Farm ______
7. *Please write in the state in which you have your permanent residence* ______
8. *Please furnish the following information relative to the car you drive.*
   Make ______ Year ______
   Miles driven per year ______
9. *Do the advertisements in the Journal of Milk and Food Technology help you in your work?* Yes ☐ No ☐
10. Comments:
    ______
    ______

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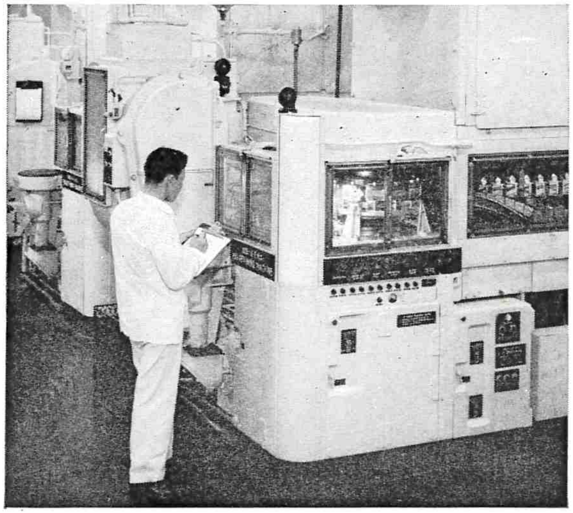
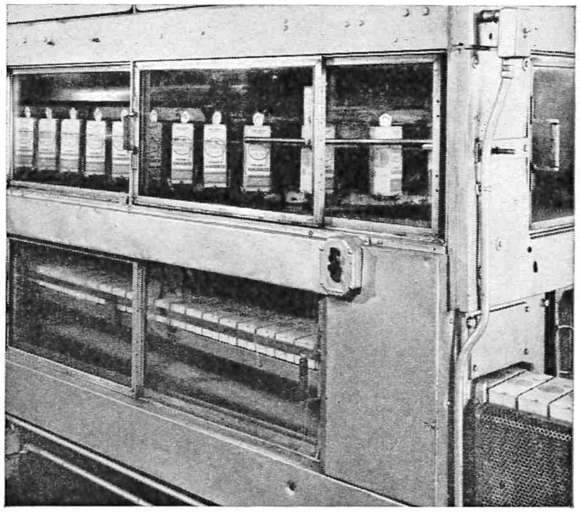


The assembled Canco containers are preheated and then immersed in molten paraffin in this enclosed machine. As an added sanitary precaution, the air required in this paraffining process is filtered as it flows into the apparatus.



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