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MILK and FOOD TECHNOLOGY

Official Publication

International Association of Milk and Food Sanitarians, Inc.

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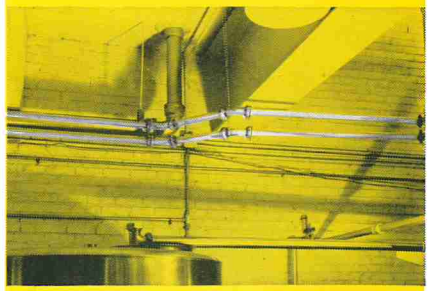

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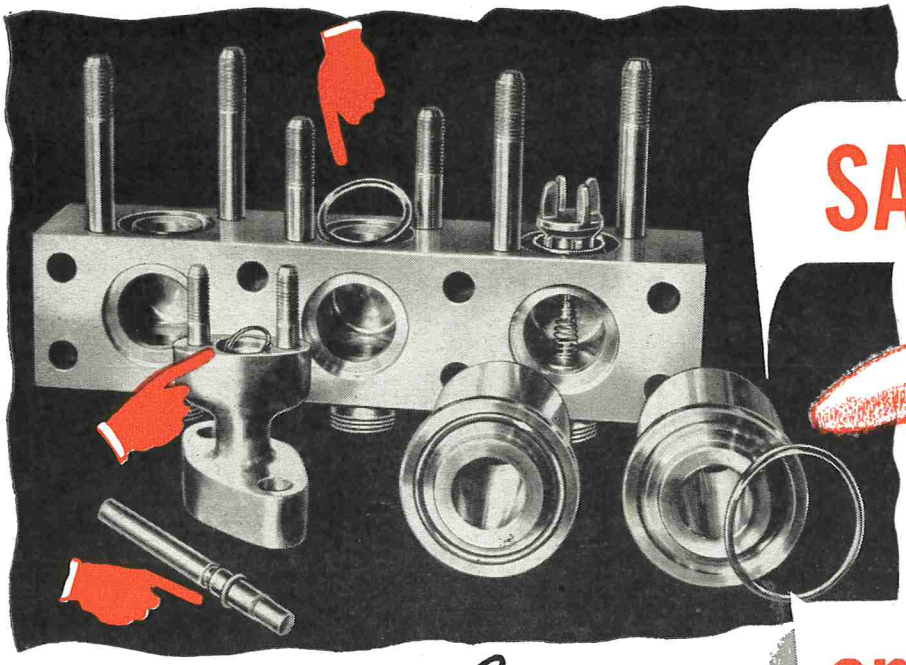

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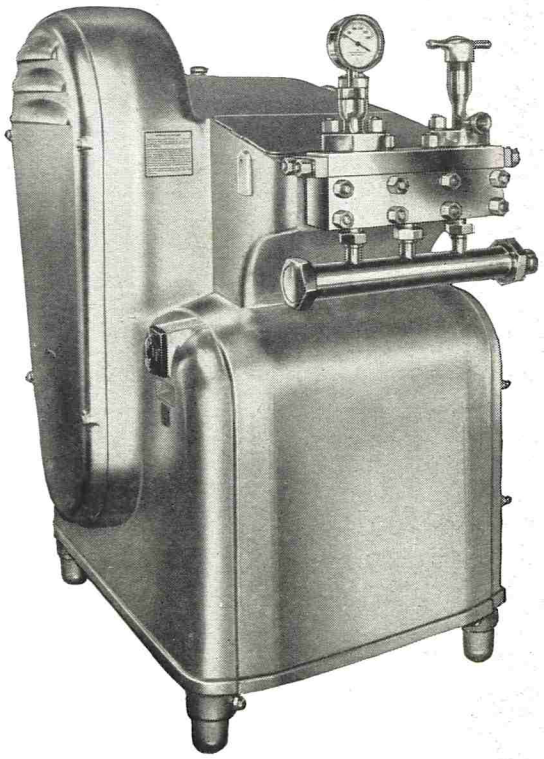

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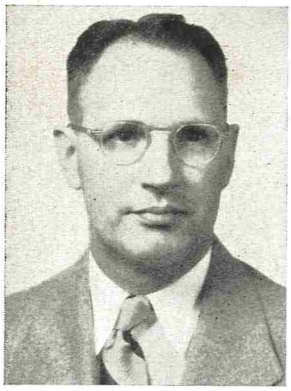
EDITORIAL NOTES

TUMBLEWEEDS *



IT IS a pleasure to discuss with the members and guests of the Association here meeting certain aspects of the services and activities that can be performed by the professional sanitarian in his chosen vocation. The tumbleweed, wherever it may be, grows under whatever conditions may give it succor. Whether it be on rich or poor soil, with stunting dryness, or with the created lushness of the watered valley, it takes what it can and grows as it might, only shortly to break off from its nursing roots when the seasons change, to tumble, driven before the wind, helpless and without direction of its choosing.

The tumbleweed has often represented to me a process of living wherein the philosophy is to sap from the environment without restoring in equal measure, and to the bounty of others that follow. It represents too a mode of living where, in the fullness of maturity, it loses control of its own destiny and drifts before the forces of its environment. The potential service of the sanitarian in the course of his chosen career is great, and should not wither to blow before adverse elements.

The profession of the sanitarian is an honorable one. The population status of this country is evidence of contribution by this endeavor. The population of the United States is increasing at a very significant rate. In the depression period from 1930 to 1940 it increased eight million, and in the prosperous 40's it increased twenty million to a total of 150 million. At current rates of increase it can be 175 million by 1960 and 200 million by 1970. Very significantly, many of our people are older. In the time of the Roman legionnaire, about 500 B.C., average life expectancy was about 23 years. By 1850, in this country, it was 40; by 1940, 63; and in 1950 about 67. By virtue of habits and practices in sanitation, advances in medical science, and in food utilization knowledge and habits, the life span in the United States has increased as much in the last 50 years as in the preceding 2000. In 1900 some 17 percent of the population was over 45 years of age; by 1950 this has increased to about 30. In 1945, 11 percent of the population was over 60, and by 1960 it is estimated 15 percent or one of every 7 will be 60 or over. The benefits of the services of the sanitarian to his fellowmen can be realized in the backward glance of statistics, and in comparisons with peoples elsewhere.

It is not enough, however, to take pride only in part of the scene, for these changes in statistics bring to us problems before which we must not drift. Up until the current period it has been possible for this nation to produce food in bountiful quantities, not only for the increasing millions of its own, but also to give in the burden of recurring wars and to share with others in their famines. On the basis of present figures, this nation has now reached the point where it produces only as itself consumes. There is little available to share. The surplus is gone.[4] Science in agriculture must provide the additional quantities we need to maintain our food intake status, and for increasing numbers. Fortunately, agriculture can be as subject to stimulus as it is to intentional curtailment.

The changes that are taking place, and will take place in practices in agriculture, must be reckoned with by all sanitarians. The increase in population is decreasing the area of tilled land. In the past ten years some 10,000,000 acres of tilled land, equalling 3 percent of the total, have been transferred to other, such as housing, uses. Significantly, to dairy sanitarians, this land has been taken from areas immediately adjacent to urban centers, and invariably used in dairy farming. There is a decreasing number of farms and farmers, though larger farms. The number of dairy farms has decreased by 50,000 in a 5-year period. The total quantity of milk produced has not kept pace with the potentially increasing numbers of people, averaging 111 billion pounds in the period 1938–1947, and being 117 billion pounds in 1950.[1] There can be anticipated increasing pressures for allocation of the available milk supply. There necessarily will come very definite if not radical changes in the concepts of production, handling and distribution of milk. A recent report indicates that in 1950, cornbelt hogs and beef-fattening farms showed a labor return of $2.16 per hour; cash grain farms showed a labor return of $1.97; wheat farms in the southern plains $2.06; mountain cattle ranches $1.35; and in contrast, dairy farms in southern Wisconsin only $0.98 per hour of labor.[2] Evidently greater progress has been made in the mechanics of producing other farm products than in simplifying the hard labor and long hours of dairying. These

* Presidential Address presented before the 38th Annual Meeting of the Association, Glenwood Springs, Colorado, September 26, 1951.

points must be recognized by sanitarians in their prescribing of concepts by which milk and other foods are handled. It is important that the intent in the development of the 3A Sanitary Standards program "to allow and encourage full freedom for inventive genius or new developments" be carried to its literal extreme if the production of adequate as well as increasing amounts of low cost milk is to be realized. All too often there is the tendency to delimit the potential exercise of developments in food handling by precise use of words of text which previously may have been comprised. In this respect I am often reminded of useless nails that clutter a barn, and must be removed when it is whitewashed or painted.

The profession of the sanitarian is honorable, and the service rendered is worthy. Unfortunately, the status and role of the sanitarian as such is not recognized by the classification of government departments, such as the Department of Labor. It is important to the professional welfare of the sanitarian that the service be recognized for what it is, and what it does, and in this certain things must needs be done. It has been the historic experience of professional recognized vocations that enduring public acceptance of qualified personnel must come through the establishment of qualifications from within and by the profession. The creation of a classification, or the segregation of a profession by legislative fiat is insufficient to attain the level of qualifications necessary by which better service to man may be achieved. Legislative classifications tend to fix, while competitive qualifications tend to improve, the abilities of personnel.

There is a tremendous need for the establishment of curricula in colleges and universities for the training of sanitarians. A current practice in collegiate levels is to train personnel in dairy or food technology, chemistry or bacteriology, and to supplement the training with limited background in public health regulations and procedures and sanitation techniques. There should be a major emphasis on the latter, augmented by the former.

Sanitarians are inherently a conservative lot; their lights are buried under bushels. Achievements in annual reports frequently are prescribed in negative values, as low incidence, low count, negative coli, and the like. Sanitarians seldom use or procure front page news space, nor occupy the rostrums of community service groups, women's clubs and parent-teachers groups and so on that the world may know what share of burdens and service is done. My own experience in this "teaching" role, done extra-curricularly, has been most gratifying, and I should encourage you to use every opportunity to do likewise. Sanitarians should take a positive approach in the public evaluation and explanation of their activities. The profession of the sanitarian should have the acclaim of the fellow citizen.

The accomplishments in the eradication and control of animal diseases in this country have been tremendous. The skills and experiences, trials and heartbreaks, in some of the major projects in this field of work have been borne by sanitarians before us. It is essential to the younger generation of sanitarians to recognize that elimination and control is not an accomplished fact. It is estimated that currently over 1,300,000 dairy and 800,000 beef cattle in this country have brucellosis and that some 9,000 new cases of human brucellosis appear annually.[3] There cannot be relaxation on the transfer and the updating of information by sanitarians on the basic concepts and techniques of control of animal diseases. There are larger herds, greater movements of livestock, and new personnel engaged in both dairy and livestock work. The basic tenets by which major afflictions have been kept under control in the past must be recognized by the newer personnel.

Modern mechanical war between nations is devastating. Its strategy provides for inclusion, manipulation, and disruption of civilians in distant as well as assigned battle areas. The occasion is unpredictable. This nation is in a preparedness mobilization program, and engaged in a full scale war. It is the responsibility of all sanitarians to recognize the war mobility status and its potentialities. There must be advance planning and consideration for possible involvement of atomic, biological, or chemical warfare. Devastation of increasingly large urban centers will involve mass movements of people and the necessity of provision of food and water supplies. It is a service duty of all sanitarians to pre-draft the potential moves to be made in such occasions. It involves location of the stored cased goods supplies, the location and provision of equipment and means by which water may be made potable, of the transfer of unprocessed foods from one damaged area to another for utilization, and of the establishment of joint facilities used by sanitarians in adjacent areas. The urgency of identifying individual cases of infection in biological warfare cannot be overstressed.

The INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS does not run by itself. Its service is rendered by the joint action of its members, by the sweat and mental pains, if you please, of those willing to give of themselves to others. It is important to this Association that its members work together on those things upon which there is agree-

(Continued on page 183)

BACTERIOLOGICAL ASPECTS OF THE EVALUATION OF ADEQUACY OF PASTEURIZATION

FRANKLIN W. BARBER

National Dairy Research Laboratories, Inc.
Oakdale, New York

Increased interest in high-temperature, short-time pasteurization of various dairy products has emphasized the need for methods to determine the adequacy of pasteurization. One such method is described, but there is need for additional information. The thermal death time curves of various pathogens should be determined in different dairy products. A suitable heat resistant test organism such as *Micrococcus MS-102* should be selected, approved by health officials and made available to others for controlled studies. Data should be accumulated so that curves could be prepared to show any combination of time and temperature which would result in adequate pasteurization.

SINCE the early 1900's it has been recognized that a heat treatment sufficiently severe to destroy all pathogenic microorganisms is needed to make dairy products safe for human consumption. This process has long been known as pasteurization. The long-hold method of pasteurization of dairy products is recognized as a safe and satisfactory method of heat treatment. The accepted standards for these methods are known to be more than adequate for making dairy products safe because not only is the holding time at 143° F in itself more than enough to insure destruction of pathogens in milk but also there is additional safety in the process provided by the long heating and cooling periods used.

When new combinations of time and temperature of pasteurization are considered for various dairy products, methods are needed to determine the adequacy or efficiency of the new process to make certain that the bacterial destruction is comparable to or better than that obtained by standard long-hold pasteurization treatments. It is the problem of this evaluation of high-temperature short-time (HTST) pasteurization and the determination of *new* standards for HTST pasteurization that are to be discussed in this paper.

* Presented before the Thirty-seventh Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., at Atlantic City, N. J., October 13–16, 1950.

PASTEURIZATION TEMPERATURES FOR MILK

The process of pasteurization was first applied to milk. Hence the early investigators were interested in the determination of the time and temperature necessary to destroy the disease-producing organisms which might be present in raw milk. Perhaps it was the equipment and controls available in the babyhood days of pasteurization which necessitated the use of low-temperature long-time pasteurization methods. In any case the emphasis of bacteriological research was placed on the time required to kill pathogenic bacteria at temperatures in the range of 140° to 150° F. The voluminous results reported show that the pasteurization treatment of milk at 143° F for 30 minutes gives satisfactory destruction of the pathogens which might possibly be found in the raw milk.

It was always believed that rapid heating to high temperatures (above 160° F) might be a more satisfactory pasteurizing method from an economic point of view as well as resulting in a better final product. Flash pasteurization, as the early HTST methods were called, has been practiced at intervals ever since the early 1900's. However, since the late 30's, improvements in the design of equipment and controls have been such that this HTST pasteurization method is now feasible and accepted as satisfactory by the dairy industry and health department officials for the pasteurization of milk.

In the meantime products other than milk were being subjected to pasteurization treatments. Fluid cream, skim milk, chocolate milk, ice cream mix, cream for butter making, milk for cheese making, all required pasteurization treatment. The long-hold pasteurization of these products produces satisfactory results but what HTST combinations of time and temperature are necessary for comparable bacterial destruction.

Dr. Franklin W. Barber has been connected with the Research Laboratories of National Dairy Products Corporation since 1945 and is now Senior Microbiologist in charge of the Division of Microbiology at the company's research headquarters, Oakdale, Long Island, New York. He is a graduate of Aurora College, Aurora, Illinois, and received his M.S. and Ph.D. degrees from the University of Wisconsin. He has been active in the field of dairy bacteriology since 1937, and has numerous publications in this field.

PROBLEM FOR OTHER MILK PRODUCTS

The processing of these products and application of HTST pasteurization to dairy products added to the problem of evaluation of the adequacy or efficiency of pasteurization treatments. Of course once a standard combination of time and temperature of heat treatment was decided upon, control of pasteurization was a fairly simple matter of checking thermometers, charts, and timing devices, aided by chemical tests for the destruction of phosphatase. It is the determination of new standards of time and temperature of the various heat treatments for these different dairy products which poses a problem for dairy bacteriologists, sanitarians, and health officials.

The problem of evaluation of adequacy of pasteurization is primarily bacteriological. At first glance it appears to be a relatively simple problem, but further investigation discloses many troublesome aspects. Many bacteriological aspects of the problem require investigation and most of the research must be proven in the laboratory before new pasteurization processes are used in the industry.

Such questions as the following must be answered:

1. Is *Microbacterium tuberculosis* the most heat resistant of the pathogens which must be destroyed by pasteurization treatments?

2. How much more time or heat is required to overcome the protective action of fat, sugar, or increased viscosity of the product?

3. How does the thermal death time curve of possible heat-resistant non-pathogenic test cultures compare with that of pathogenic bacteria?

4. What are the best methods for determining heat treatments which are comparable to longhold pasteurization?

5. Should not the thermal death time curves of pathogens inoculated into milk, cream, chocolate milk, and ice cream mix be determined?

6. Should not a satisfactory heat-resistant non-pathogenic test organism be selected, studied, approved by health officials, and made available for bacteriological evaluation of adequacy or efficiency of pasteurization processes?

These questions can be answered but it will require cooperation of universities, experiment stations, commercial research laboratories, dairy companies, dairy equipment companies, and health departments and officials to obtain data that can be accepted by all concerned. An organization such as the *International Association of Milk and Food Sanitarians* might well set up and sponsor a program for the unification of a plan of action. There is little doubt in the minds of many that there is need for such a program.

Needed Studies in HTST Pasteurization

It is felt that there are certain questions which must be answered sooner than others. For example the increased interest in the HTST pasteurization for dairy products other than fluid milk necessitates the determination of standards of HTST pasteurization for these products. At present such standards for ice cream mix are of paramount importance if the advantages of this method of pasteurization are to be realized. Later the time and temperature combinations used with cream and chocolate milk should be evaluated.

Standards are in effect for the pasteurization of milk, and everyone accepts the HTST treatment of 161° F for 16 seconds as being comparable to 143° F for 30 minutes. The HTST pasteurization of ice cream mix is assuming more and more importance to the dairy industry. Presently accepted standards require a pasteurization treatment of 155° F for 30 minutes but no standards have been approved for HTST pasteurization, although tentative approval has been granted for a treatment of 175° F for 25 seconds.

Let us consider for a moment a few of the bacteriological problems which are involved in the determination of a HTST pasteurization standard for ice cream mix. The first problem facing the research investigator is, of course, the determination of HTST temperature and time combinations which result in satisfactory bacterial destruction.

A search of the literature shows that much of the early work on the heat resistance of pathogens was concerned with the destruction of *M. tuberculosis* in milk.[10] There are almost as many thermal death times reported for this organism in milk as there are investigators reporting. However, North and Park[7] reported that 138.2° F for 30 minutes destroyed the tubercle bacillus and stated that probably the variance in thermal death times reported by others was due to methods of study and not to resistance of strains. A few studies have been reported using cream as the heating medium and even fewer using ice cream mix.

Oldenbusch, Frobisher, and Shrader[8] reported on studies using cream and ice cream mix. They showed the tubercle bacillus to be the most resistant of the pathogens studied and that it was killed within 6 minutes at 145° F and within 3 minutes at 150° F. Using this data, Ball[2] has determined the thermal death time curve for *M. tuberculosis* in cream and shown the slope of this curve to be 12.6° F.

These studies show that satisfactory destruction of pathogens is obtained by long-hold pasteurization of 155° F for 30 minutes but what about temperatures of 160°, 170°, 180° F, or even higher, for seconds of holding time. Studies should be undertaken to determine if possible the destruction of these organisms at high temperatures or at least to determine the thermal death time curves in various dairy products.

In seeking approval of HTST pasteurization of ice cream mix, it is necessary to show that the time and temperature of treatment results in bacterial destruction comparable to that obtained by the presently accepted pasteurization treatment of 155° F for 30 minutes.

Three approaches can be taken to this problem. (1) The determination of the destruction of the normal bacterial flora at these temperatures as compared to the destruction obtained at 155° F for 30 minutes. (2) Actual studies at these temperatures using the tubercle bacillus as a test organism; or (3) studies at these temperatures using a heat-resistant non-pathogenic test organism.

The destruction of the normal bacterial flora is probably the most simple approach to the problem. It requires that standard plate counts be made on samples of the raw mix, of the mix pasteurized in the laboratory at 155° F for 30 minutes and of the mix pasteurized by whatever HTST combinations are being studied. The percent destruction of the normal flora by each treatment is then calculated. As long as a laboratory pasteurized control is used, the comparable destructiveness of various combinations of time and temperature can be determined. However, the normal flora is variable and, therefore, there is nothing known about the organisms present in mix or their thermal death rates. It is this fact which has prompted health officials to request studies using test cultures of known heat resistance with a known thermal death time curve.

HTST as Compared with Long-hold Pasteurization

The ideal method of evaluating HTST pasteurization methods would be the inoculation of the most heat resistant pathogen into the product, pasteurization of the product using various combinations of time and temperature and finally the determination that the organism was killed by these treatments. It is understood that there are such studies being conducted with HTST pasteurization of ice cream mix and it is hoped that the results will be made known to the dairy industry.

However, there is understandable reluctance toward the use of pathogenic bacteria in a dairy plant. Therefore, the third approach of using a heat-resistant non-pathogenic test organism may provide the necessary information for the evaluation of the adequacy of a pasteurization process. Several heat-resistant cultures have been used for this purpose. Some of the early milk work

made use of *Escherichia coli* strain 3U. Speck[9] has reported on the use of *Micrococcus freudenreichii.* Tracey *et al.*[11] have studied *M. freudenreichii, Streptococcus faecalis,* and an unidentified spore-forming bacillus. Barber and Hodes[3, 4] reported using an unidentified *Micrococcus MS-102.*

The selection of a satisfactory heat-resistant test culture is important. To be of value in the evaluation of HTST treatments the culture should survive heating at high temperatures (above 175° or 180° F); it should be easily recognized by distinctive colony formation on agar plates; it should grow profusely so that large numbers of cells can be harvested for inoculum; it should have uniform heat resistance; it should be more resistant to heat than the most resistant pathogen and yet have a thermal death time curve slope as close as possible to that of the pathogen. The *Micrococcus MS-102* meets all of these requirements. It survives a heat treatment of 180° F for 15 seconds, produces a typical golden yellow colony on yeast extract "N-Z-Amine" agar, grows profusely on this medium at 35° C, has uniform heat resistance when transferred properly, is more resistant to heat than *M. tuberculosis,* and has a thermal death time curve slope in milk of 11.4° F as compared with the *M. tuberculosis* thermal death time curve slope of 12.6° F.

Two of the foregoing methods for the evaluation of adequacy of pasteurization were used in recent studies on the HTST pasteurization of ice cream mix at National Dairy Research Laboratories. Preliminary studies were made in which the destruction of the normal bacterial flora of the mix was determined for temperatures of 165°, 170°, 175°, and 180° F with holding times of 37½, 32½, 29½, and 25 seconds at each temperature. Laboratory long-hold pasteurization for these studies was 160° F for 30 minutes. The results indicated that destruction of the normal flora obtained at 175° to 180° F for 25 seconds was comparable to that obtained at 160° F for 30 minutes.

Further studies with a different HTST unit were made using temperatures of 160°, 165°, 170°, 175°, and 180° F for 25 seconds and 180°, 190°, 200°, 220°, 240°, and 260° F with no holding tube in the equipment. Normal flora destruction at 175° F for 25 seconds and temperatures above 190° F with no holding tube was comparable to laboratory long-hold pasteurization destruction at 155° F for 30 minutes.

Health officials requested further studies using a heat-resistant test culture. The experimental HTST unit was installed at the National Dairy Research Laboratories and studies were made using the heat-resistant culture *Micrococcus MS-102.* The mix was inoculated so that there were between 500,000 and 1,000,000 cells of the test organism per ml of mix. Laboratory pasteurization of the inoculated mix was at 155° F for 30 minutes. The mix was pasteurized in the experimental unit at 165°, 175°, and 185° F for 25 seconds and at 190°, 210°, 240°, and 260° F for 1.4 seconds. The bacteriological results indicated that destruction of the heat-resistant test culture at 175° F and above for 25 seconds and at 190° F and above for 1.4 seconds was comparable to that obtained at 155° F for 30 minutes.

From the results just described it would appear that the HTST standard for ice cream mix might be 175° for 25 seconds. Other investigators have reported numerous other time and temperature combinations (table 1).

TABLE 1

REPORTED TIME AND TEMPERATURE COMBINATIONS GIVING SATISFACTORY HIGH-TEMPERATURE SHORT-TIME PASTEURIZATION OF ICE CREAM MIX

Temperature (° F)	*Time (Sec.)*	*Investigator*
175	23	Minthorn[6]
175	25	Barber-Hodes[3, 4]
175–180	25	Speck[9]
180	16	Armstrong[1]
180	19	Dowd-Anderson[5]
185	6.1	Tracy *et al.*[11]
190	1.4	Barber-Hodes[3, 4]
194	0.75	Tracy *et al.*[11]

A chart (figure 1) has been prepared which shows graphically the information obtained in these studies on HTST pasteurization of ice cream mix. Curve 1 is the thermal death time curve of MS-102 in ice cream mix (Data for this curve is shown in table 2). Curve 2 is a curve drawn through the points 155° F and 30 minutes (1800 seconds) parallel to curve 1. Curve 3 is the reported thermal death time curve for *M. tuberculosis.* Also shown on the chart are time and temperature combinations reported for HTST pasteurization of ice cream mix. It can be seen that these points all fall well above curve 2 which represents time and temperature combinations comparable to 155° F for 30 minutes.

TABLE 2

TIME REQUIRED TO OBTAIN 99.9% DESTRUCTION OF MS-102 IN LABORATORY PASTEURIZED ICE CREAM MIX AT VARIOUS TEMPERATURES

Data for Curve 1—Fig. 1

Temperature ° F	*Time to obtain 99.9% destruction seconds*	*Number of trials*
155	3780	10
160	1650	7
165	642	8
170	210	7
175	48	5
180	9.6 to 15	5

It is felt that this method of obtaining and presenting data can be applied to dairy products such as milk, skim milk, cream, and chocolate milk. The foregoing data are presented as a suggestion for the evaluation of adequacy of pasteurization and the determination of HTST pasteurization standards.

PROBLEMS NEEDING STUDY

To return to the questions which were raised earlier in this paper, what should be done to improve the evaluation of new pasteurization processes? It would seem that there are definite points which require investigation, the result of which may do much in providing a firm, well established foundation for the determination of HTST pasteurization standards for various dairy products.

First, the thermal death time curves of various pathogenic micro-

(Continued on page IX)

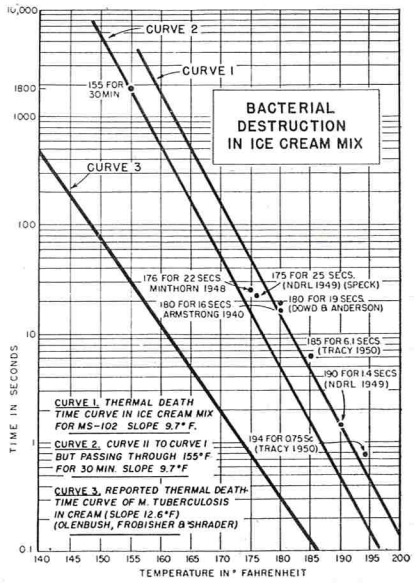


FIGURE 1

THERMAL RESISTANCE OF A FACULATIVE AEROBIC SPORE-FORMING BACTERIUM IN EVAPORATED MILK

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Spores of a faculative aerobic spore-forming rod tentatively identified as *Bacillus subtilis* and responsible for sweet coagulation of evaporated milk has been found to show unusual heat resistance above regular evaporated milk sterilization processes. The organism does not produce acid or gas and the spoilage is manifest only by coagulation of the product. It is assumed that the organism entered through the raw milk and multiplied in the product and equipment as a result of faulty clean-up procedures.

FOR two consecutive years, this laboratory was requested to investigate the occurrence of sweet coagulation of evaporated milk in normal-appearing, 14½ oz. vent-hole cans. This spoilage was characterized by milk of normal pH value but which was gelled usually into a smooth-appearing, custard-like mass. The extent of this spoilage would have been of little concern if the cans containing coagulated milk could have been separated readily. However, the organisms involved did not produce gas which would have bulged the can ends as external evidence of spoilage. Consequently, it was necessary to shake each can by hand to determine audibly whether or not the milk was fluid in any block of goods under suspicion. Thus, the spoilage was not only troublesome but costly even when the spoilage involved only three to five cans per 1,000 packed.

Pure cultures of an aerobic spore-forming rod were isolated from the cans examined bacteriologically; and one typical culture, 15u, included in a study by Curran and Evans * on the germination of spores after sublethal heating, was provisionally identified as *Bacillus subtilis*. The fact that certain species of aerobic spore-forming bacteria have the ability to cause sweet curdling of milk is not new, the coagulation of evaporated milk by *Bacillus subtilis* having been reported as early as 1912 by the Vermont Agricultural Experiment Station (Bulletin 170). However, the possibility that organisms of this type might survive regular evaporated milk sterilization processes had not previously been encountered. Consequently, in the absence of container defects which might have allowed organisms to enter the milk subsequent to sterilization, an extensive program of thermal resistance studies on the spoilage organism was undertaken. This work showed unusual heat resistance of spores of the organism in evaporated milk and in neutral phosphate.

HEAT RESISTANCE STUDIES

To determine the heat resistance of the organism, suspensions of spores from 8- to 11-day old nutrient agar slants were prepared in neutral phosphate and in evaporated milk. One ml portions of the suspensions were then sealed in small glass thermal death time tubes and heated for varying times at 230° F, 240° F, 250° F, and 260° F in special thermal death time (T.D.T.) equipment permitting almost instantaneous heating and rapid cooling. Following the test, the tubes were opened aseptically and the contents plated and incubated to check survival. The results obtained on several tests with three concentrations of spores are given in Table 1.

When plotting the resistance data of this test organism having an approximate count of 1,500,000 spores per ml on semi-log paper, z values of 15 and 14.3 are obtained respectively for the thermal death time curves of the test organisms in evaporated milk and neutral phosphate, and F values of 3.7 and 3.9 respectively (see "Thermal Death Time Curves").

Using the values from the T.D.T. curve obtained for evaporated milk, assuming an initial temperature of 210° F, the following processes were calculated as necessary to eliminate spoilage under the conditions of this test:

Process temp. °F.	Minimum process time in minutes
240	22.2
241	19.8
243	16.4

A process of 15 minutes at 241° F was used at one of the plants included in this investigation at the time that the sweet coagulation spoilage occurred. Since the spoilage was quite low, indicating that this commercial process was nearly adequate, the process was elevated arbitrarily to 14.5 minutes at 243° F. No spoilage was reported after the process was increased. Apparently the resistance and/or concentration of the organism was not as high in the commercial packs as for the spores used in the T.D.T. test.

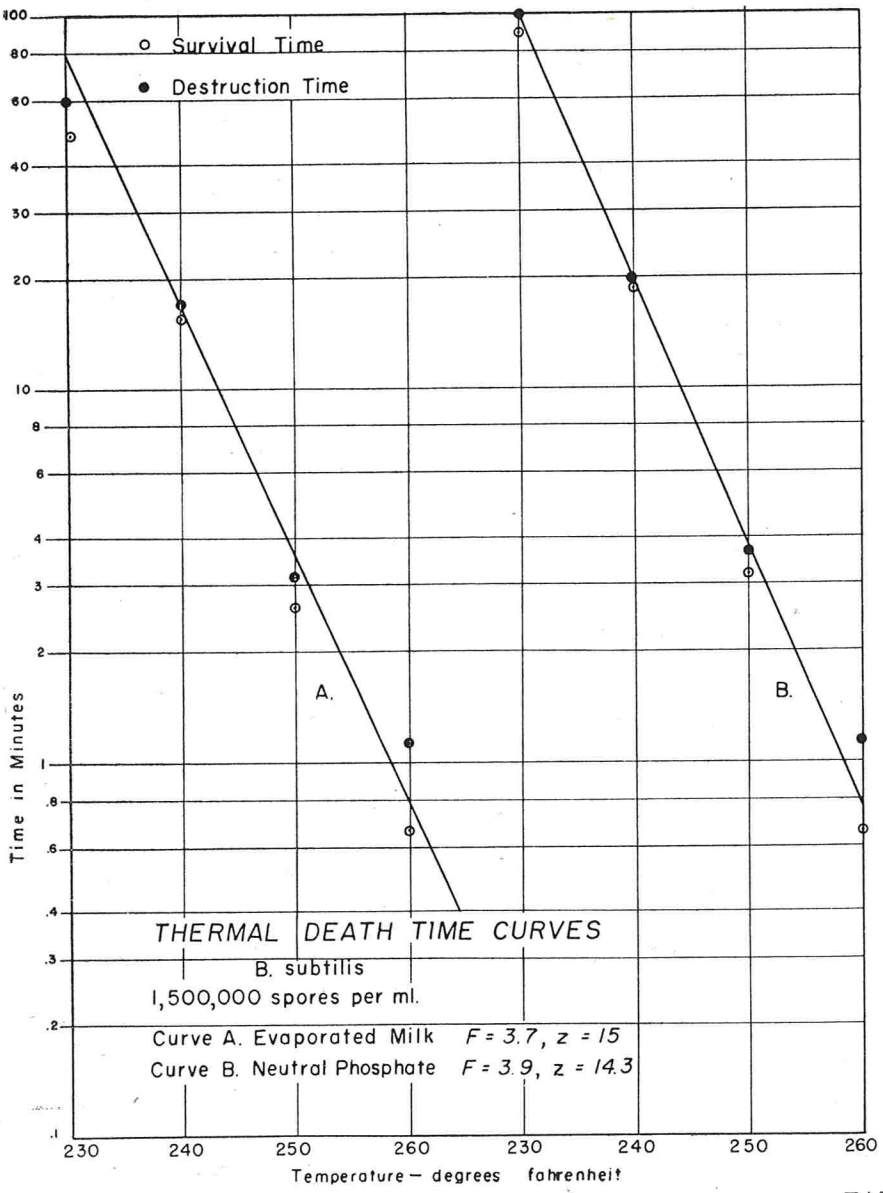
TABLE 1

RESISTANCE OF *B. subtilis* IN EVAPORATED MILK AND NEUTRAL PHOSPHATE

Temperature °F.	Approximate spores per T.D.T. tube	Evaporated milk suspension corrected times *		Neutral phosphate suspension corrected times *	
		Survival min.	Destruction min.	Survival min.	Destruction min.
230	900,000	....	....	79.15	89.15
"	1,500,000	49.15	59.15	89.15	99.15
240	900,000	....	....	15.15	16.15
"	1,500,000	16.15	17.15	18.15	19.15
250	900,000	....	....	2.65	3.15
"	1,000,000	2.15	3.15	2.15	3.15
"	1,500,000	2.65	3.15	3.15	3.65
260	900,000	....	....	0.65	1.15
"	1,000,000	0.65	1.15	0.65	1.15
"	1,500,000	0.65	1.15	0.65	1.15

* Corrections for experimental heating times to compensate for heating lag in T.D.T. tubes were obtained from work by Sognefest and Benjamin [*Food Research* 9:234–243 (1944)], 0.85 minute being subtracted from the experimental times to give the corrected times.

* Curran, Harold R., and Evans, Fred R. Heat Activation Inducing Germination in the Spores of Thermotolerant and Thermophilic Aerobic Bacteria, *J. Bact.* 49:335–346 (1945).



That the resistance of this organism depends upon the concentration or the number of spores per unit volume, is shown in the T.D.T. data given in Table 2. Experimental packs were also made in regular 14½ oz. vent-filler cans. The cans were inoculated with different concentrations of the aerobic test organism and given the two processes which were used in the plant during this investigation. The results as given in Table 3 indicate that the spores of one test organism used survived the two commercial processes including the 14½-minute cook at 243° F with a concentration as low as 950 spores per ml. of milk.

The processing of the milk in 14½ oz. vent-filler cans was carried out in a Fort Wayne Pilot Sterilizer with the following come-up schedule:

Time in minutes	Temperature reached °F.
3	140
6	165
9	190
12	210

Come-up time to 210° F was 12 minutes. Held at 210° F for 3 minutes and allowed 1 minute come-up from 210° F to process temperature.

Fresh, stabilized * evaporated milk as used for this test had a pH value of 6.4 before processing and from 6.1 to 6.2 after processing. Following incubation, aerobic spore-forming rods were recovered from the flat but coagulated product and the milk had set up to a custard-like consistency. The spoiled product as usual was sweet in odor and there was no appreciable change in pH. The majority of the spoiled and normal samples had a pH from 6.0 to 6.1. The milk set up in the spoiled cans in from 5 to 8 days at 98° F.

PROBABLE SOURCE OF SPOILAGE ORGANISM

The exact source of the spore-forming facultative aerobe responsible for the spoilage was not determined in this study. A bacteriological survey was made over a period of several days at one plant which had had trouble with sweet

* This means the small amount of disodium phosphate which was added to the milk to adjust its properties to take an ordinary conventional milk process without coagulating.

TABLE 2

RESISTANCE OF *B. subtilis* IN EVAPORATED MILK AND STANDARD PHOSPHATE BUFFER AT 240° F.

Culture No.	Source	Suspending medium	Approximate spores per T.D.T. tube	Corrected times *	
				Survival min.	Destruction min.
71Q	Plant 1	Evaporated milk	5,200	11.15	12.15
"	"	" "	54,000	12.15	13.15
"	"	" "	480,000	13.15	14.15
"	"	" "	4,500,000	15.15	16.15
"	"	Neutral phosphate	1,300	10.15	11.15
"	"	" "	22,000	13.15	14.15
"	"	" "	220,000	17.15	18.15
"	"	" "	2,100,000	19.15	20.15
61A	Plant 2	Evaporated milk	5,000	11.15	12.15
"	"	" "	47,000	15.15	16.15
"	"	" "	414,000	16.15	17.15
"	"	" "	4,680,000	17.15	18.15
"	"	Neutral phosphate	2,500	15.15	16.15
"	"	" "	24,000	18.15	19.15
"	"	" "	290,000	23.15	24.15
"	"	" "	2,700,000	23.15	24.15

* 0.85 minute was subtracted from the experimental times to give the corrected times.

TABLE 3

SPOILAGE DATA FOR INOCULATED EVAPORATED MILK PACKED IN 14½ OZ. VENT FILLER CANS AFTER 30 DAYS STORAGE AT 98° F.

Lab. Code*	Approximate spore count of diluted suspension		Process		Total Number cans incubated	Number cans spoiled	% spoilage
	Per ml. milk	Per can	Time min.	Temp. ° F.			
1AA	0	0	15	241	5	0	0
1AB	0	0	14½	243	5	0	0
3AA	950	399,000	15	241	5	3	60
3AB	950	399,000	14½	243	5	1	20
4AA	8,400	3,528,000	15	241	5	5	100
4AB	8,400	3,528,000	14½	243	5	1	20
5AA	75,000	31,500,000	15	241	5	5	100
5AB	75,000	31,500,000	14½	243	5	4	80
1BA	0	0	15	241	5	0	0
1BB	0	0	14½	243	5	0	0
3BA	350	147,000	15	241	5	1	20
3BB	350	147,000	14½	243	5	0	0
4BA	4,950	2,079,000	15	241	5	2	40
4BB	4,950	2,079,000	14½	243	5	0	0
5BA	70,000	29,400,000	15	241	5	5	100
5BB	70,000	29,400,000	14½	243	5	1	20

* Second character of code indicates culture used. Both were similar but isolated from different cans.

coagulation, but the organism was not isolated from either the incoming raw milk or the plant equipment. Also the milk packed during the period of the survey was sorted and no flat cans containing coagulated product found, indicating the absence of any foci of infection at the time. However, prior to the survey, the collecting stations had been requested to exercise greater care in cleaning equipment and cooling the milk, and stricter supervision of plant equipment and tank car clean-up was also being exercised. In addition, it is known that the outbreak was encountered during a time of heavy milk receipts, and occurred at another plant in milk received from this same area. Hence, the organism appears to have entered through the raw milk and very likely multiplied in the product and equipment as a result of faulty clean-up procedures either at the collecting stations and/or at the condensery.

CONCLUSIONS

Growth of a facultative aerobic spore-forming rod identified as *Bacillus subtilis* in commercially canned evaporated milk is characterized by a change in product to a gel or custard-like consistency with little or no change in pH. Also since the organism produces no gas, the cans remain flat with no external evidence of spoilage. Consequently, to segregate such spoilage from a block of goods under suspicion necessitates shaking each can by hand to determine audibly whether the milk is fluid.

Spores of the organism show unusual heat resistance even in comparatively small numbers and spoilage has been encountered in commercially canned 14½ ounce cans processed for 15 minutes at 241° F. The resistance of the organism depends upon the concentration or number of spores per unit volume and calculations based on death time data indicate that a minimum of 16.4 minutes at 243° F is necessary to eliminate spoilage.

Control of contamination depends largely upon adequate cleaning and sterilization of all equipment at collecting stations, tank trucks and in the canning plant. To check for the adequacy of plant clean-up, rigid inspection is recommended including a periodic bacterial examination of the raw milk supply.

Federal Food, Drug, and Cosmetic Law Administrative Reports 1907–1949. Published by the Commerce Clearing House, Inc., Chicago, New York, and Washington, D. C. 1951. 1446 pages.

The Foreword described briefly the Food Law Institute, Inc., as being a public organization that is supported by leading food manufacturers with two major objectives: one is to promote basic instruction, train legal experts, conduct research, and disseminate food law knowledge; the second is to compile and publish authoritative books on food law, to be known as the "Food Law Institute Series." This is the first book published in that series. It is a compilation of all the reports of the administrative officers under the original Federal Food and Drugs Act of 1906, from 1907 through 1938, and then under the new Federal Food, Drug, and Cosmetic Act of 1938, with reports from 1939 through 1949 inclusive. The index of 17 pages includes an estimated eighteen thousand references. An introduction by Dr. Paul B. Dunbar, the retiring (see page ..., this JOURNAL) United States Commissioner of Food and Drugs, recites the development of the food regulatory and control practices over 43 years of operations.

Brucellosis—A Symposium Under the Joint Auspices of National Institutes of Health of the United States Public Health Service, the United States Department of Agriculture, and the National Research Council. Published by the American Association for the Advancement of Science, Washington 5, D. C. 1950. 271 pages. $4.00.

The 24 papers included in this monograph were presented by 30 experts in the field of the study of brucellosis, at a symposium held at Bethesda, Maryland, in September 1949. It deals with the etiology, bacteriology, immunology, prevention, diagnosis, and treatment of the disease, in language that is readily understood by the average intelligent reader. The whole field is excellently covered by bringing together the information that is scattered throughout forty thousand references to the literature. Its great value to the health worker lies in its authoritative presentation of the latest knowledge on the whole subject.

MILK and FOOD SANITATION

AVERAGE PLATE COUNT RATIOS OF DAIRY PRODUCTS CALCULATED FOR PERIODS OF SIX MONTHS

BASED ON U.S.P.H.S. RECOMMENDATION THAT AVERAGE RATIOS SHOULD NOT BE OVER 2.0 FOR THOSE SAMPLES FOR WHICH TWO DILUTIONS SHOW BETWEEN 30 AND 300 COLONIES

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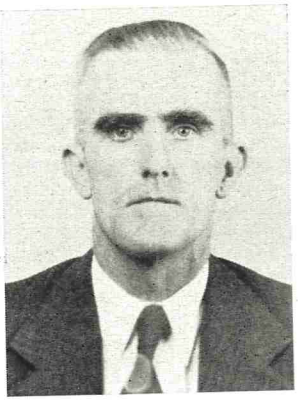

J. L. Courtney grew up on a farm in Tennessee. He received a B.S. degree from East Tennessee State College in 1939. He was employed for five years with the Division of Laboratories of the Tennessee State Health Department after which he served in the Army Veterinary Corps. In 1948 he received an M.S. degree from Texas A. and M. College. He has been director of the Oak Ridge Public Health Laboratory since organizing it in 1943.

Average standard plate count ratios occurring during 6 six-month grading periods were 1.9, 1.9, 2.0, 1.8, 1.6, and 1.5. A total of 12,109 samples were examined during the three years with an over-all average of 1.8. It is suggested that state and local administrators may find the average ratio helpful in maintaining satisfactory technique among laboratory workers and in securing reasonably comparable results among different laboratories.

THIS report presents standard plate count ratios in a manner which it is hoped will be directly comparable to those secured by most laboratories. All ratios have been derived from single platings of dilutions of 1:100 and 1:1,000 since general practice in making standard plate counts is to use these dilutions. Average ratios have been computed on the basis of six-month periods coinciding with the maximum grading periods recommended in the *1939 Milk Ordinance and Code.*

The count ratio is the ratio of the greater to the lesser computed plate count;[1] the plate count being computed by multiplying the colonies per plate by the dilution used.[2] The following excerpt is taken from the *1939 Milk Ordinance and Code:* "Average of the count ratios of those samples for which both dilutions show between 30 and 300 colonies. This should not be over 2.0." The average is described as being a measure "with which to judge the work of the laboratory." Although the following statement appears in the 9th Edition of Standard Methods[2] "Count ratio is the ratio of the greater to the lesser plate count, as applied to plates of consecutive dilutions having between 30 and 300 colonies," together with a table in which examples of ratios are given, no mention is made of the recommendation that *average* count ratios should not be over 2.0 or that this average is a measure of laboratory accuracy.

In a study[4] previously reported, it was shown that the figure 2.0, when applied to groups of the usual types of dairy products, is a reasonable requirement readily attainable, in most cases, with careful technique. The data were based on three dilutions and periods of fourteen months. The results showed that the elimination of the clinging drop on the tips of pipettes, along with the inseparable improvement of other phases of technique which occurs at the same time, gave lowered ratios. This agreed with observations of Black[5] that the clinging drop error is the most common cause of high ratios. Since in the survey conducted by Black[3] only 64 laboratories out of 357 (undetermined in 42 additional laboratories) were taking measures to eliminate clinging drops, it seems justifiable to present additional data based on dilutions and periods in most common use. The emphasis on clinging drops is not intended to minimize other errors of technique. For example, failure to touch pipettes to dry areas in petri dishes contributes to high ratios. Close adherence to all the requirements of Standard Methods is essential to maintaining a low average ratio.

In addition to the detailed procedure for making plate counts, Standard Methods provides a number of control procedures as aids in maintaining uniform practices and accurate results. These may be stated briefly as follows:

1. Preparation for plating.
   a. Determine pH of each batch of media used.
   b. When using oven or autoclave, preferable record period of time and minimum temperature used for each lot of materials sterilized.
   c. Discard dilution blanks when after sterilization they do not conform to tolerance of plus or minus 2 ml.
2. Sterility of media and dilution blanks.
   a. With each series of samples, plate a control on each container of medium and each batch of dilution blanks.
3. Plating procedure.
   None.
4. Incubation of plates.
   a. Preferably record daily the temperature of incubation.
   b. Agar should not lose more than 15 percent of its weight during the incubation period of 48 hours and show no apparent dryness in four days.
5. Counting plates.
   a. Laboratory workers should duplicate their own counts within 5 percent and those of others within 10 percent.

It will be noted that none of these controls apply to the actual manipulations involved in the plating of the samples, that is, from the time the samples are shaken and after the medium is poured from the container until the plates are ready to be incubated. The average plate count ratio bridges this gap by reflecting certain significant deviations in technique, especially, inaccurate volumetric measurements. Thus it controls, without duplicating other checks of Standard Methods, a part of the procedure in which many of

the gross errors of technique occur.[3]

The necessity of uniformity and accuracy in the comparatively simple procedure of making standard plate counts has been emphasized by Perry [6] as follows:

> The differences in counts made in official, unofficial, and uncontrolled laboratories vary to an amazing degree and are unpardonable. Plate counts (and the same thing is true to a large degree for microscopic counts) are dependable only if the methods are carried out meticulously. Plate counts represent only the number of bacteria and clumps of bacteria which can be expected to form colonies when a closely standardized technic is used.

The products examined consisted of raw milk as delivered for pasteurizing, pasteurized whole milk, pasteurized cream, frozen desserts, chocolate beverage, condensed skim milk, and pasteurized skim milk. Only small numbers of some of these products were examined but they have been included since ratios resulting on all products subjected to the standard plate count make up the average ratio. However, sufficient numbers of raw milk and pasteurized whole milk samples were examined to make the results worthy of separate consideration and comment.

Table 1 shows average ratios resulting on raw milk during each six-month period. The variation ranges from 1.5 to 2.0. During Periods II, III, and IV, a worker was employed who had little interest in dairy products. This worker, whose results in clinical bacteriology were very dependable, regarded as superfluous the precise care taken with plate counts in this laboratory and probably never took very seriously instructions regarding the elimination of clinging drops. During the last three or four months of Period II and during Period III, this worker shared quite regularly in the plating of raw milk but very seldom did so during Period IV. On days when pasteurized products were being examined this worker usually did tests on the products other than the plate count. It is of interest to note that the average ratio for raw milk during Periods II and III was 2.0 in each case as compared with 1.8, 1.7, 1.6, and 1.5 for Periods I, IV, V, and VI. Although the technique of the worker referred to may not have been the sole cause of this increase, it was undoubtedly a contributing factor.

TABLE 1
RATIOS OCCURRING ON RAW MILK

Grading period	Number of samples plated	Number of samples showing two plates of two different dilutions with counts between 30 and 300	Percent of total samples showing two plates of two different dilutions with counts between 30 and 300	Maximum ratio	Average ratio
I	1,377	33	2.4	6.3	1.8
II	1,837	90	4.9	8.9	2.0
III	1,480	110	7.4	10.7	2.0
IV	1,614	102	6.3	11.1	1.7
V	1,323	108	8.2	3.9	1.6
VI	1,800	86	4.8	2.7	1.5

Table 2 shows average ratios occurring on pasteurized whole milk during each six-month period. The results vary from 1.4 to 2.3. The percentage of samples producing ratios during Period IV, 12.6, was much higher than for any other period. The low percentage during Period I, 1.1, of samples producing ratios appears to be largely the result of a minimum number of counts falling close to the top of the 30–300 range on the 1:100 dilution and close to the bottom of the 30–300 range on the 1:1,000 dilution whereas during Period IV a maximum number of counts occurred in the manner indicated thus setting the stage for a greater number of ratios.

TABLE 2
RATIOS OCCURRING ON PASTEURIZED MILK

Grading period	Number of samples plated	Number of samples showing two plates of two different dilutions with counts between 30 and 300	Percent of total samples showing two plates of two different dilutions with counts between 30 and 300	Maximum ratio	Average ratio
I	264	3	1.1	3.0	2.3
II	308	10	3.2	2.3	1.7
III	281	20	7.1	4.2	1.8
IV	238	30	12.6	6.2	1.7
V	46	3	6.5	1.5	1.4
VI	36	1	2.8	1.6	1.6

Table 3 summarizes the ratios occurring on all products for each grading period. The average ratio for each grading period conforms to the requirement that the average be not greater than 2.0. The averages range from 1.5 to 2.0.

TABLE 3
SUMMARY OF RATIOS BY GRADING PERIODS

Grading period	Number of samples plated	Number of samples showing two plates of two different dilutions with counts between 30 and 300	Percent of total samples showing two plates of two different dilutions with counts between 30 and 300	Maximum ratio	Average ratio
I	2,011	42	2.1	6.3	1.9
II	2,470	108	4.4	8.9	1.9
III	2,130	151	7.1	10.7	2.0
IV	2,161	153	7.1	11.1	1.8
V	1,420	111	7.8	3.9	1.6
VI	1,917	91	4.7	2.7	1.5

Table 4 shows the products examined and summarizes all ratios occurring during the three year period. The total number of samples examined was 12,109 of which 5.4 percent produced ratios. The average of the 656 ratios produced was 1.8. The maximum ratio, 11.1, occurred on raw milk. The largest ratio occuring on a product other than raw milk was 6.2 on pasteurized milk.

TABLE 4

SUMMARY OF RATIOS BY TYPES OF PRODUCTS

Product	Number of samples plated	Number of samples showing two plates of two different dilutions with counts between 30 and 300	Percent of total samples showing two plates of two different dilutions with counts between 30 and 300	Maximum ratio	Average ratio
Raw Milk	9,431	629	5.6	11.1	1.8
Pasteurized Milk	1,173	67	5.7	6.2	1.8
Pasteurized Cream	176	5	2.8	3.8	2.1
Frozen Desserts	952	47	4.9	5.5	1.9
Chocolate Beverage	259	4	1.5	2.0	1.5
Condensed Skim Milk	81	2	2.5	2.7	2.1
Pasteurized Skim Milk	37	2	5.4	1.5	1.4
Total Group	12,109	656	5.4	11.1	1.8

Two products, cream and condensed skim milk, gave average ratios greater than 2.0 each being 2.1. However, only 5 cream ratios and 2 condensed skim milk ratios make up these averages. A tendency had previously been noted for pasteurized cream to produce ratios higher than other products.[4] Only 2.8 percent of pasteurized cream, 2.5 percent of condensed skim milk, and 1.5 percent of chocolate beverage samples produced ratios. These percentages are markedly lower than for the other products. Apparently the reason for the differences is that counts on cream and condensed skim milk usually were either very low or very high and counts on chocolate beverage were extremely low thus providing less opportunity for ratios to occur, but there are not enough samples involved to warrant definite conclusions.

SUMMARY

Average standard plate count ratios calculated from ratios occurring on all types of dairy product samples plated by the laboratory conformed, during each of 6 six-month periods, to the recommended requirement that such averages be not greater than 2.0. Averages, when calculated for a six-month period on each type of product, were occasionally greater than 2.0. This was true of cream; also true of condensed skim milk but few samples of this product were examined. High average ratios on raw milk during two periods seemed to be, at least partially, the result of poor technique on the part of one worker engaged in these examinations. This is in agreement with the basic idea that the average ratio increases as the accuracy of the technique decreases.

CONCLUSIONS

1. With accurate technique average standard plate count ratios, of the types of dairy products commonly examined in public health programs, can usually be maintained at a point not greater than 2.0 during six-month periods taken to coincide with grading periods.

2. If the recommended requirement is interpreted to mean that the average ratio for each type of product should not be over 2.0, the data reported indicate that this cannot always be achieved with some products, notably, cream.

3. It appears that the standard plate count ratio could be used to advantage by administrative officials in maintaining a satisfactory level of technique among laboratory workers and especially by state administrators to attain reasonably comparable results in different laboratories.

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Association News

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Resume of 38th Annual Convention of the International Association of Milk and Food Sanitarians, Held at Glenwood Springs, Colorado, September 26–29, 1951

The Thirty-eighth Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., at Glenwood Springs, Colorado, September 26–29, 1951, was successful in every respect. The registration was higher than expected and taxed the capacity of the meeting rooms. New features were the breakfast meetings, movies at the beginning of sessions, the breaking up of the sessions into food sections and milk sections, the organization of the Council, and an unusually enjoyable entertainment each evening. Attendance at the beginning sessions were stimulated by the offering of door prizes at each session.

The papers will be presented in forthcoming issues of this *Journal.*

At the business session the Association authorized a study and report "on the desirability of establishing qualifications and legislation for Professional Sanitarians and Registered Sanitarians either within itself or in collaboration with other national associations having similar objectives."

Appreciation of the work of the late William B. Palmer, former Managing Editor of the *Journal,* was expressed in the following citation:

Citation
William B. Palmer

for the unfaltering discharge of his duties, recognition of his responsibilities, and his conscientious and wise administration of public health laws in the community in which he lived; for his zealous interest in the work of the Association, as shown by his accomplishments as Committee member, as Officer, and as President; for having managed so well the "Journal of Milk and Food Technology"; for his

tireless devotion to the field of sanitation and advancement of the profession.

Given this day of September 27, 1951, at the 38th Annual Meeting Assembled Glenwood Springs, Colorado by the International Association of Milk and Food Sanitarians.

Geo. A. West, Secretary-Treasurer — K. G. Weckel, President

President Weckel presented to the Editor of the *Journal,* Dr. James Houston Shrader, an engrossed citation as follows:

Citation
presented to
James Houston Shrader

because he has served in the difficult role of community public health administrator when the development and application of the technology of sanitation was in its infancy; because he collated and prepared a leading text in food sanitation principles and practices; because he pioneered in the development of organized industrial sanitation practices and their means of administration; because he chose to disseminate knowledge of the Science of Sanitation by serving long, faithfully, and successfully as Editor of the "Journal of Milk and Food Technology"; because he is a versatile thought provoker in the problems and potentialities of the profession of sanitation; because of his sincere scholarly eloquence; because of his wise counsel to a long line of officers of the organization; and because of the sterling example he has set for all men as a teacher and a leader.

Given this 27th day of September, 1951 at the 38th Annual Meeting Assembled, Glenwood Springs, Colorado by the

INTERNATIONAL ASSOCIATION
of
MILK AND FOOD SANITARIANS

Geo. A. West, Secretary-Treasurer — K. G. Weckel, President

The new officers of the Association are:

President, H. L. Thomasson...Shelbyville, Ind.
President-Elect, H. J. Barnum....Denver, Colo.
First Vice-President, J. D. Faulkner, Washington, D.C.
Second Vice-President, I. E. Parkin, State College, Pa.
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Dr. W. H. Haskell.....Beloit, Wis.
J. M. Doughty.....Santa Fe, N. Mex.

Attendance prizes to the holder of the successful number on the membership badges were presented at the beginning of each session by representatives of the affiliates which donated the prizes:

The Iowa Association, represented by F. W. Kramer, Vice-President, announced to the winner, Russell Palmer of Detroit, three pheasants "after they were shot".

The Associated Illinois Milk Sanitarians gave six, choice, boned steaks, to be air-mailed to Doug Morton, from Moreland, Wyoming.

Indiana, through Tim Sullivan, gave two box seats for the 500-mile speed race to Ken Bowman, of Bowlder, Colorado.

The New York prize was given by Clarence Weber to Dr. W. A. Vernon of Hutchinson, Kansas. It was a "Manual on Milk Plant Operation".

Michigan gave a case of canned cherries, by Milo Wilson, the President, to R. D. Ritchie, sanitarian, from Laramie, Wyoming.

Minnesota gave an assortment of Minnesota cheeses, won by Dr. Harold Ritchie, Chief Sanitarian of Swift and Company, presented by C. H. Holcombe of St. Paul.

Washington gave a wooden serving tray, by Leslie E. Jenne, the President, to B. C. Booth, Weld County Health Department, Greeley, Colorado.

Clarence O. Widder of the State Board of Health of Wisconsin gave an assortment of cheeses to Dr. R. S. Johnson, La Junta, Colorado.

Jesse Barlow of Missouri presented an assortment of cheeses to John Brown of Colorado Springs, Colorado, and a pair of night driving glasses to Edward Chamberlain of Denver.

At an evening session to "Get Acquainted in the Corral", Bill Bryant showed a series of candid shots on the movie camera of a large number of familiar faces taken at the various conventions over the country. The series was entitled "See Ourselves as Others See Us", and was high-lighted by Bill's witticisms.

The next evening we had a chuck wagon dinner featuring a buffalo roast with all the trimmings; the entertainment provided hillbilly music, a plumber concert, and demonstration in square dancing (subsequently participated in by the guests).

On the third evening, at a "Miners' Dinner", Dr. Johns was given the prize of a tooth pick for giving the shortest speech at the convention and Mr. Tarbett was given the same prize for presenting the longest speech. One member was called upon to recite "Casey at the Bat" with gestures. A quartet was selected from the members. This quartet did an excellent job. Dr. George Grimm and C. B. Shogren had a five minute debate on "Beer vs. Milk". Then following was a gambling casino. One thousand dollars in paper money was given to each participant. Such games as Chuck-a-Luck, Horse Racing, Poker, Beat the Dealer, and Dice were played. The game was raided by the "local police"(?). The money was turned in for lottery tickets and the winners were given five silver dollars each as a souvenir of the West.

Numerous trips too were taken. The most extensive one was to historic Aspen, for a ride on the famous ski-tow up Ajac Mountain, two miles high. Additional features were provided for the entertainment of the ladies.

It was a great convention.

An outstanding event was the organization of the Council, as provided by the new Constitution. Those present from the affiliate organizations were:

Clarence O. Widder.....Wisconsin
P. Edward Riley.....Illinois
C. H. Holcombe.....Minnesota
Leslie E. Jenne.....Washington
J. Milo Wilson.....Michigan
J. H. Barlow.....Missouri
Paul Corash.....New York
James Burkett.....Iowa
Jim Sullivan.....Indiana
D. B. Morton.....Illinois
Nelson Hohl.....New York
C. M. Weber.....New York
B. O. Engle *.....California
K. G. Weckel, President, IAMFS...Wisconsin
H. L. Thomasson, Executive Secretary, IAMFS, New York
George A. West, Secretary-Treasurer, IAMFS, New York

* Observer for California

President Weckel announced that the purpose of this Council is to provide a means for bringing together the affiliate organizations to facilitate the handling of many problems of mutual interest in the development of the organizations and the professional work of sanitarians. He pointed out that the function of the Council is to advise the Executive Board in the operations of the affairs of the Association. He stated that the Association can serve the affiliates better now because the many activities which were formerly distributed between the secretary's office, the managing editor, and the publisher will now all be centralized in the office of the Executive Secretary, Mr. H. L. Thomasson. The Association plans to publish more news from the affiliates. Now we shall be in a better position to give the affiliates better service in *Journal* subscriptions through the centralization of Association matters at one point. Also, new matters of technical interest can be mimeographed out promptly to the members.

Executive Secretary Thomasson described his new office facilities at Shelbyville, a town of 12,000 people, with full time clerical assistance.

(Continued on page X)

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Authors

Titles

EDITORIAL NOTES

(Continued from page 169)

ment. There is perhaps no better example of the achievements to be gained for the general good and service of others than that of the Resolving of Concepts in the establishment of the 3A Sanitary Standards for Dairy Equipment, and in which many members of the Association participate. It is incumbent of all to accept responsibility in some form or another in the giving of self to the help of others; this may be in participating in the work of committees, or in work of the affiliate organizations, or in interesting others in the profession.

The tumbleweed gives up, and blows, and drifts with the wind.

In Matthew, Chapter 24, Verses 38, 39, it states, "For in the days that were before the flood, they were eating and drinking, marrying and giving in marriage, until the day that Noah entered into the Ark. And knew not until the flood came and took them away."

I believe we can take counsel from a statement made by Abraham Lincoln at Springfield, Illinois, on June 16, 1858, that "If we could first know where we are and whither we are tending, we could better judge what to do, and how to do it."

Our participation in the meetings and affairs of the Association is in keeping with these thoughts.

K. G. WECKEL, *President*
International Association of Milk and
Food Sanitarians, Inc.

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Bacteriological Aspects of the Evaluation of the Adequacy of Pasteurization

(Continued from page 172)

organisms should be determined in milk, cream, and ice cream mix.

Second, a heat-resistant, non-pathogenic test organism should be found whose heat-resistance is greater than that of the most heat-resistant pathogen. The slope of the thermal death curve of this test organism in various dairy products should be nearly equal to that of the most resistant pathogen.

Third, this test organism could be approved by health officials and made available to others for the determination of adequacy of pasteurization treatments.

Fourth, sufficient studies could then be made using the test culture in various dairy products so that curves could be prepared to show any combinations of time and temperature which would be comparable to presently accepted standards of pasteurization.

There will be ever-increasing requests by the dairy industry for the approval of new time and temperature combinations of HTST pasteurization for milk, ice cream mix, cream, chocolate milk, sherberts, and possibly other dairy products. A unification of methods of study and presentation of results will do much to bring about a more rapid approval of these pasteurization treatments.

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INDEX TO ADVERTISERS

ASSOCIATION NEWS

(Continued from page 180)

The *Journal* will be printed in the same town at one-half the present cost. Thus, facilities are available for expediting the work of the Association in serving the members promptly. This mail, "I knew it was big, but I had no real conception myself. Usually it takes a full half day to answer the correspondence currently that comes in every day . . ., and probably it will even get heavier than that. . . . I don't think there is a country in the world from which it does not come, . . . that's even Russia, too. We even have subscriptions in Russia and Czechoslovakia and France and Portugal and Spain and Italy, and I even get some in the language. I have a fruit merchant, an Italian, that I use for translations."

Practical Microscopy, by L. C. Martin and B. K. Johnson. Second edition. Published by the Chemical Publishing Co., Brooklyn, N. Y. 1951. 124 pages. 90 figures. $2.50.

This small book is a practical clear presentation of the principles of modern microscopy, including a chapter on ultra-violet microscopy and one on electron microscopy. It deals entirely with the optical and mechanical features so that the microscopist can use his instrument intelligently and to the best advantages by reason of his understanding of its structure and performance possibilities. The illustrations are numerous and well selected.

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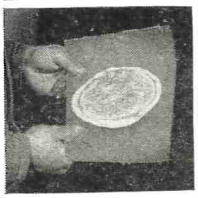

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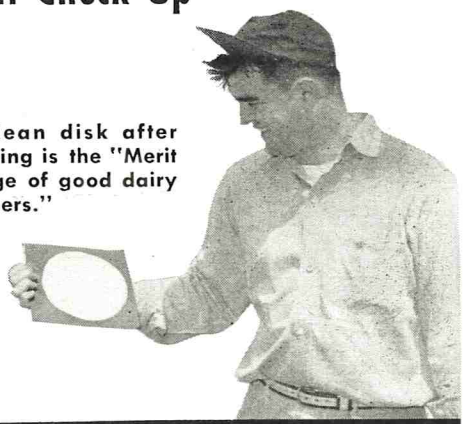

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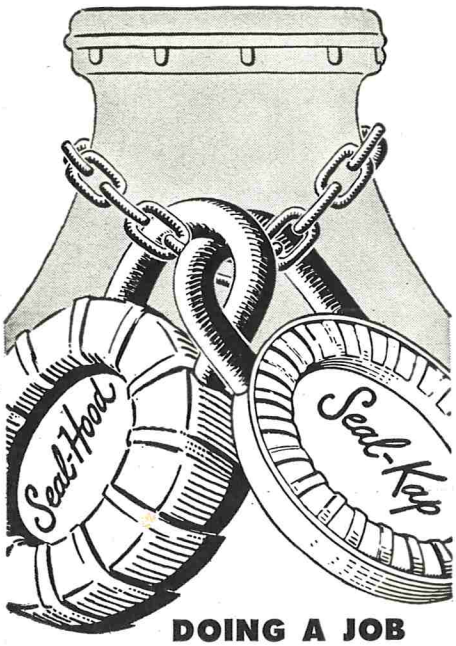

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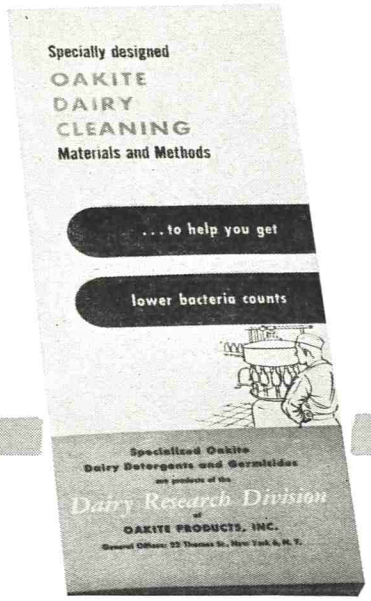

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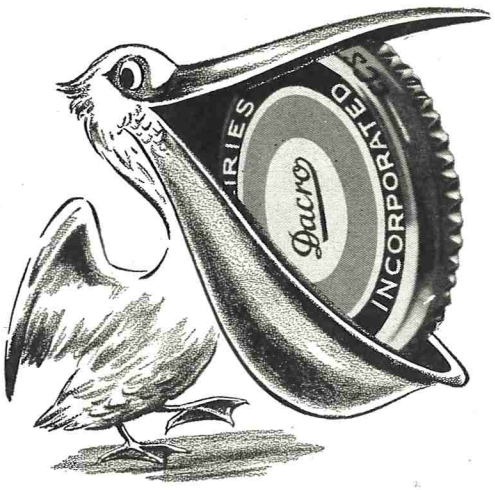

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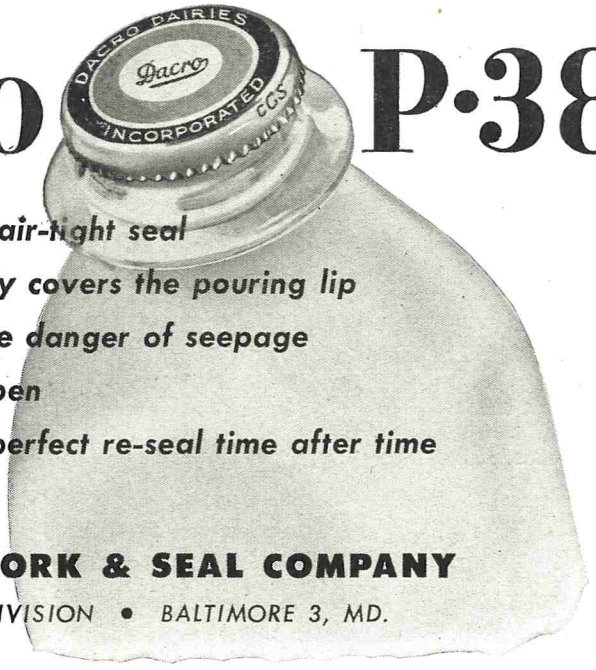

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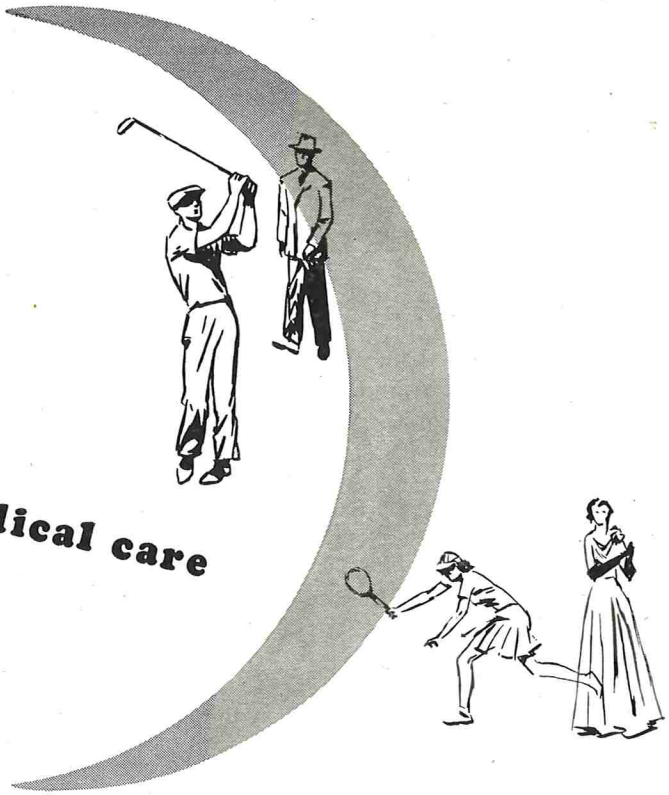

The first phase of medical care

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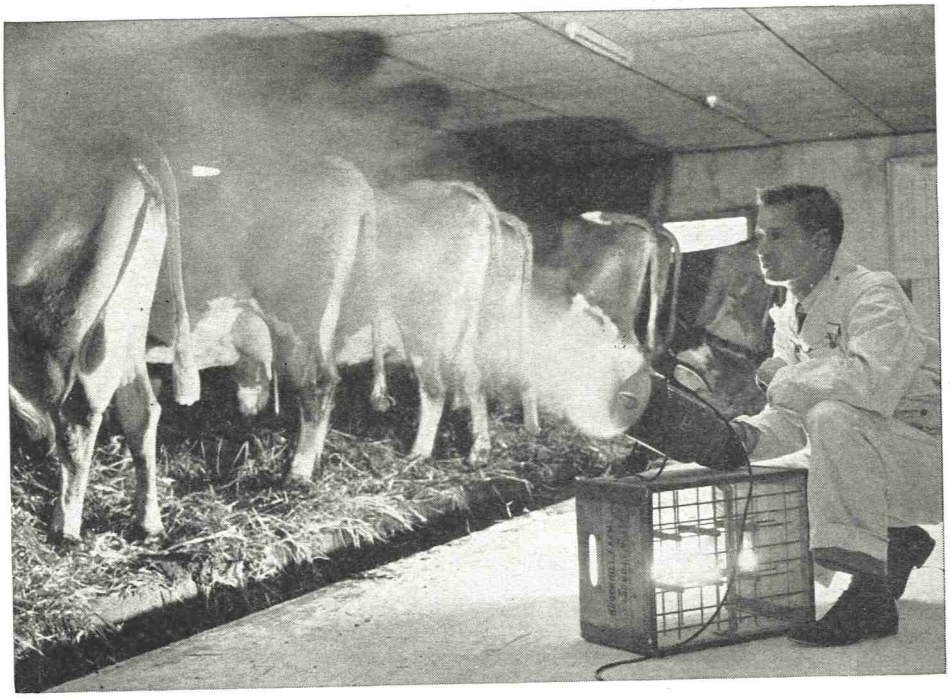
State College Test Controls Horn Flies with PYRENONE* Space Spray



The Pyrenone spray used at the college was applied with a portable space sprayer similar to the above. 17 applications were made during the 172 day season.

Horn fly population on 64 cows in a test by state college experiment station entomologists was kept down to a level which was considered effective control over a 172 day period using a Pyrenone space spray, according to a recent report. A total of 17 applications were made during the season, using a small portable sprayer.

The spray was directed over the backs of stanchioned dairy cows. No attempt was made to fill the barn with insecticidal fog. Time for treating the whole herd of 64 cows was 10 minutes per treatment or three hours for the complete season, and cost per cow was low.

Pyrenones are non-toxic to man and animals, and properly formulated insecticides based on Pyrenone are non-hazardous.

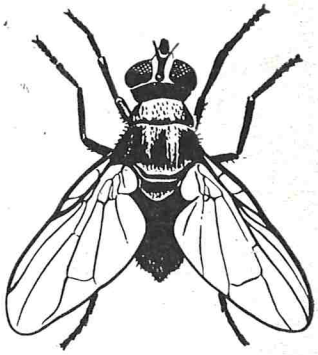
There's no substitute for sanitation.

Pyrenone*

*Reg. U. S. Pat. Off.

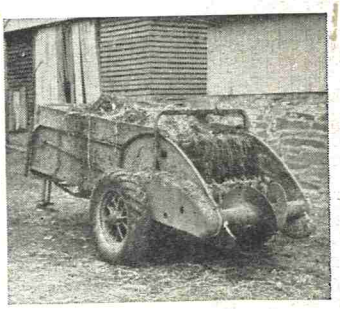
U. S. Industrial Chemicals Co. Division of National Distillers Products Corporation, manufacturers of the famous Pyrenone insecticides for the farm, food processing, transportation, storage and allied fields.

U.S.I.

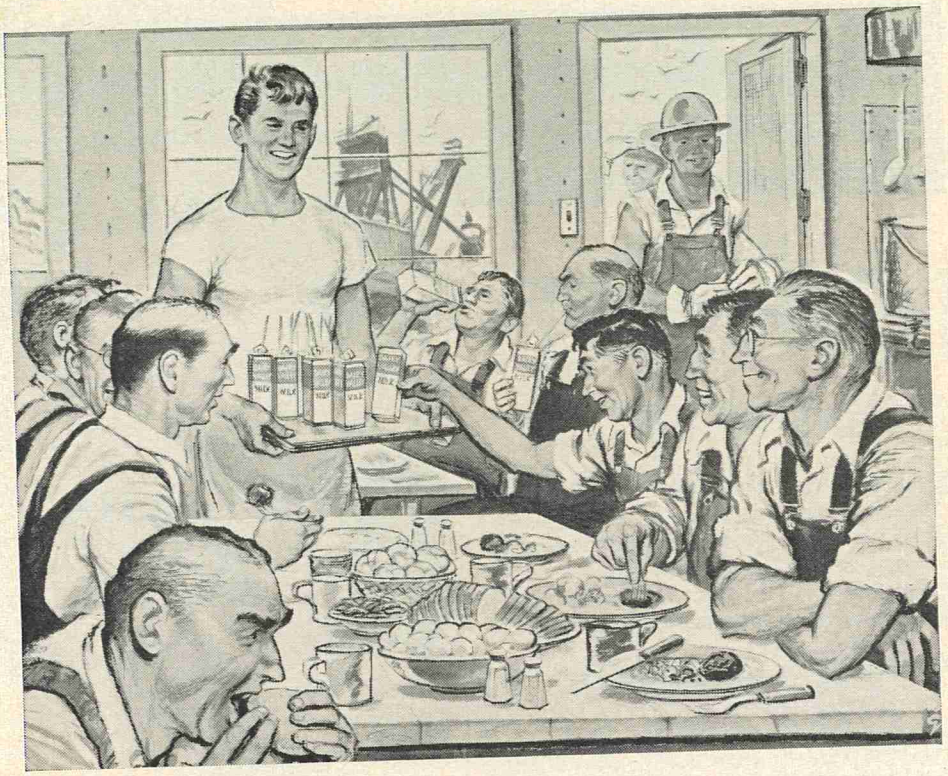


The Horn Fly

Horn flies feed almost entirely upon cattle and develop from eggs that are laid in cattle droppings. As many as four or five thousand horn flies often live on a single animal. When such a fly population is present it necessarily robs the animal of a large amount of its blood, energy and food. Undoubtedly such numbers weaken animals and cause many of them to become more susceptible to diseases and parasites. Pyrenone-based sprays are safe for use on animals and are proving effective for control of this pest.



Spreading manure before flies have a chance to breed plus thorough barn cleaning prevents heavy fly infestations. And don't overlook good barn drainage. Soil that's saturated with manure-laden water is a breeding place for flies.



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