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od, and generally good agreement among the six fields counted over the duplicate microplates.

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References


ASPECTS OF PESTICIDES AND ANTIBIOTICS AS THEY RELATE TO THE DAIRY INDUSTRY

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It is desirable and timely, in the light of the developments in statutory and regulatory procedures, and their application, in recent months, to take stock of the aspects of these agents as they relate to the dairy industry.

The effect of strict interpretation of the assignment of law as it applied recently to specific products such as cranberries, and to poultry, is all plain to see. It must not be forgotten that the application of the same basic principles of law to foods, and to milk, has been going on for a long, long time. Since 1896, over 20 acts have been stipulated by Congress dealing with various aspects of production, processing and distribution of foodstuffs. It may be presumed that these have had serious consideration in their enactment, and that the intent was for the public welfare. There have been, of course, multitudinous applications of law by the 48 states, among which the differences are indeed confusing in many respects.

For the moment, attention is being focused specifically on aspects of antibiotics and pesticides, since the application of the Amendment to the 1938 Food, Drug and Cosmetic Act has brought light on problems in their use.

Some consideration should be given to the status of need of both antibiotics and pesticides in their respective areas of application.

Mastitis, in all its implications, is probably as far from satisfactory control and elimination, as it ever has been in the history of modern dairying. There is ample reason to believe that the difficulty of control of mastitis has increased in recent years. Changes in farm dairying alone have altered conditions of cow care, and herd management from the individual personal care of a limited number of cows to industrialized care of several hundred of animals.

The number of farms with milking animals is constantly decreasing, by some 30 per cent in 15 years, and the amount of milk per cow, and per farm, has been increasing in like manner in a similar period. There exist fully industrialized, as well as privately farm operated milk producing centers.

For a period of years, diligent progress was made in the control of mastitis by good herd management, proper feeding, modern controlled milking techniques, and by sound sanitation procedures. Much of this seems to have been forgotten in the convenient adoption of the "miracle" drug, originally found successful in part, in treatment of streptococcal infections. But the control and elimination of mastitis has not been simplified, nor achieved by this trend,
primarily because of the change in udder flora, and failure of the infection to respond to the treatment. Dairymen generally are becoming discouraged by the failure of antibiotics to solve their mastitis problems, and are turning with renewed interest to methods formerly taught, in prevention.

**USE OF ANTIBIOTICS IN THE DAIRY INDUSTRY**

The magnitude of the mastitis problem should be considered also in terms of the extent of use of antibiotics. It is reported that the total amount of antibiotics certified for use by FDA for oils and ointments in the first quarter of 1960 was equivalent to an annual rate of 2876 million units annually, or 510 units per quart of milk produced. Elsewhere it is reported that the quantity of combination penicillin and dehydrostreptomycin in batches certified in 1959 for use in dairy animals by injection was 34.2 trillion units penicillin and 48.1 million grams dehydrostreptomycin, equivalent to 1500 units per quart. Thus the total disappearance of antibiotics in the dairy industry is at the rate of 2000 units per quart. The dollar value of antibiotics used for mastitis treatment is reported at 27 million in 1955. The breakdown of antibiotic sales in 1958 is reported at 380 million dollars for human dosage, 35 million dollars for veterinary dosage, 30 million dollars for animal feed, and 2 million dollars for preservative and pesticide uses. On the basis of projected sales in the next decade it is anticipated the usage of antibiotics in the dairy industry will increase. It is of interest to note that the role of antibiotics in food production other than in dairying is increasing. The quantities used in animal field supplements has increased from 196,000 pounds valued at 17.5 million dollars in 1951 to 795,000 pounds valued at 31.3 million dollars in 1957. The fate of feed antibiotics in milk production is in great need of scrutiny by the dairy industry.

**PESTICIDES**

The utilization of pesticides is constantly increasing in the United States. Recent reports for one of the largest states indicate that the area of land treated with pesticides has increased from about 200,000 acres in 1946 to over 7 million acres in 1958. The production of all pesticides has increased from 400 million in 1950 to 800 million pounds in 1959. The use of insecticides has increased from 200 million to 400 million pounds annually. The number of registered trade mark economic poisons has increased from 10,000 in 1949 to 90,000 in 1959. The economic advantage of pesticides is so vast in agriculture that it is hardly conceivable this system of augmenting food supplies would be abandoned.

The necessity of presence of pesticides in food products in our present system of economy is tacitly recognized in the application of the Amendments of the 1938 Food Drug and Cosmetic Act which provide for registration, review of technical data and establishment of tolerances for their presence in foodstuffs. It is variously estimated that without the use of such pesticides, the production of certain crops periodically would reach zero, and of food crops in their entirety, would decrease 10-30 per cent. The monetary annual losses due to weeds are estimated at 5 million dollars, and to insects, 3 million dollars. The threat of new pest hazards is constantly in the picture. and new applications and new developments in pesticides will in all probability be essential to thwart the possible effects of such intrusions.

The increase in agricultural production over the past several decades is due primarily to intense mechanization, to agronomic developments and to the uses of pesticides and fertilizers. It has been reported to Congress that 40-50% of the increase since 1942 in agricultural production is due to the use of agricultural chemicals. The trend in agriculture is intensity of production: larger herds, larger farms, larger yields per acre, and per animal, larger units of machinery. Farmers have heavier investments in facilities of land, buildings, machinery, cattle, irrigation, and so forth. Thus the use of pesticides is not only in the sense of correcting an infestation of weed, fungus or insect, but also in the sense of insurance against a possible hazard, and to protect the investment.

**DEFENSIVE PROBLEMS**

The utilization of antibiotics and pesticides has resulted in difficult defensive relations problems for the dairy industry. The use of ingredients, and materials, from the moment of origin of milk, until its manufacture, and distribution, is not continuously under a given process control of the processor. The history of milk, with respect to antibiotics and pesticides, is not known, until subjected to test. The processor, through definition, is prohibited both from procuring, and distributing milk, which by definitive terms, is adulterated. The actual control of the biochemical status of the milk by the processor is extremely difficult. It would seem there is greater need for placing responsibility for the presence of adulterants in raw milk where it logically belongs, rather than by a system of indirect mechanics of convenience. The processing organization cannot know, except by test, of the presence of such adulterants, and these tests are at present, entirely too time consuming.

The increase in the intensity of dairy farming has...
resulted in increased use of purchased grain, forage and supplement, grown elsewhere than on the dairy farm. The history of treatment of such feeds is in the hands of others who may never know the ultimate destination of their crops, whether poultry, animal or dairy farm. The dairy farmer, in turn, may never know the origin of the purchased feed, nor of its treatment. The dairy industry is in need of labeled forage and feed to better control the problem of transmitted pesticide. Even such identification may be without the desired effects. The identification of use of pesticides is not the whole story. Some pesticides carry over in soils for periods of several years; there may be accumulation, from a sequence of applications. Some chemicals degrade into forms even more toxic than their precursors. There are many forms of pesticides: nematocides, weedicides, fungicides, herbicides, insecticides, plus treatments such as defoliants, growth regulators, dessicants, and the like.

While there has been a considerable amount of research on the fate of chemical treatments of food crops used directly by humans, such as vegetable and fruit crops, there has been relatively much less on the fate of these applied to animal feeds, which represent a larger part of total agricultural production. The dairy industry needs to be cognizant of both areas of treatments, since fruits, nuts, and natural agents are used in frozen desserts and cheese. It should be noted that other branches of the food industry have had to deal with similar problems and have done so in a positive and forthright manner, e.g., the infant food business. In such products the presence of incidental chemical factors is as much, if not more of an anathema, as in the dairy industry. The fruit and vegetable industries, producing products destined for infant uses for example, do have specific and highly controlled agricultural arrangements for uses of chemical agents on contracted crops. These industries also have conducted intensive investigation of the effects of pesticides not only in terms of freedom from pests, but also in terms of yield, surface effects, effects on storage life, on color, flavor, fibrosity tenderness, deterioration during processing, composition of product, container corrosion, fermentation, drained weight, and so on. The extent of related effects of the agricultural chemicals on dairy products seems not to have been as completely investigated.

Zero Tolerance

Administratively the philosophy prevails that milk and its products must be "analytically free" of pesticides and antibiotics. There is a real need for a hard realistic fast look at the concept of "zero tolerance" for milk and its products. It is becoming increasingly apparent that in today's scheme of technology, and agriculture, and with increasing levels of sensitivity of analytical methods, there is no such thing as "zero" free milk. There is evidence that "zero" free levels cannot be found or applied to modern day mother's milk.

The sensitivity of methods of analysis for chemical agents in foods is obviously increasing. The necessity of increased control of the agents in the dairy world obviously will also have to increase. The matter of desirability of tolerances of antibiotics and pesticides in milk and dairy products has been and will be a subject for consideration for some time to come. If the dairy industry believes it wants to move in the direction of tolerances, it will of necessity have to establish better systems of complete reliable control of use of antibiotics and pesticides than it now has. This will be necessary to provide assurance not only to Food and Drug Administration, but to the public as well. Few people in the food industry realize the destructive effect on the cranberry industry of the seizure and condemnation of only a very minor part of the total cranberry crop. How then, will the assurance to the public develop? How seriously will the industry prosecute violations in order to retain public confidence? Cognizance should be had that there are problems in complying with the "pass or fail" values of a tolerance as well as with a zero tolerance. Levels which are below tolerance and acceptable may become objectionably above tolerance through uncontrollable variables: through transfer from change of feeds, through change in rations of the cows, through change in production of the cow, and so on. Moreover, there will be changes in composition of the milk: separation of fat (some agents may tend to follow the fat, or the serum), blending, standardization, concentration, and so on. These may change the status of acceptability on a tolerance basis. This, however, is no different a problem than already faced by other food manufacturers such as of soups, fruit purees, jams and jellies, and so on.

In many food operations, the useful fraction may be as little as 40-60% of the raw harvest product. With milk, the utilization is almost complete, except for mechanical losses. Thus while some industries may separate through waste, occluded chemicals, that in milk will be processed and perhaps even fraction-concentrated in product. In this connection, the waste of some foods (apple and citrus pulp) may be processed by concentration into animal feeds. The concentration of applied pesticides may render their use for dairy feeds questionable.

Assay Costs

There is great concern that the necessity of fre-
quent appraisal of the presence of the antibiotic and pesticide residues will become a costly burden. Many of the analytical procedures thus far developed are specific, and require extensive and expensive laboratory facilities and personnel. There are in use many pesticide agents, many of which may become adulterants; the use of antibiotics in feeds is increasing. Some practical means must be found to both reduce, and properly assign, the cost of these appraisals, and the supervision in control of use of the agricultural chemicals.

COTERIE OF THOUGHTS

Finally, in this coterie of thoughts, it may be wise to reflect that the problems of use of antibiotics will not become simpler by legislative fiat. The population of the world is increasing; the sobering thought is that surpluses exist only in the western world, and food deficiency is possible even in a foreseeable future. Man and his cultivated food supplies have many enemies: diseases, pestilence, insects, weeds. It has been stated that the effectiveness of one man in a chemical factory is equivalent in agricultural productivity to the work of 4,000 men armed with hoes. Thus, in the foreseeable future, the uses of agricultural chemicals, begun in France only some 20 years ago, will probably be with us a long time to come.

THE INCIDENCE OF POTENTIALLY PATHOGENIC STAPHYLOCOCCI IN DAIRY PRODUCTS AT THE CONSUMER LEVEL

I. FLUID MILK AND FLUID MILK BY-PRODUCTS

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Two hundred and seven samples of pasteurized dairy products obtained from consumer marketing channels were analyzed for the presence of staphylococci. Potentially virulent coagulase positive staphylococci were isolated from 3.4 percent of the samples examined. All of the various classes of products studied contained staphylococci, however, not all samples within a class contained the organism. The presence of coliform organisms and staphylococci did not correlate positively, leaving some question as to the source of contamination.

Research findings have shown a trend toward the development of antibiotic-resistant pathogenic staphylococci in dairy cattle undergoing mastitis therapy (11, 12, 13). McCoy (9) suggests the danger of the staphylococci developing resistance to some antibiotics and thereby limiting their use in treating human and animal infections. Numerous reports have indicated that antibiotic-resistant staphylococci have caused infections in hospital surgical patients and infants in nurseries throughout the country (4). Aside from this potential danger, is the ever-present menace of staphylococcal food poisoning. Increased incidence of staphylococci in the udder of dairy cattle has added significance to this problem (9). Recent reports incriminating dairy products in outbreaks of staphylococcal food poisoning have focused attention on the need for research in this area (2, 3, 7).

Increased importance of the problem and relatively little information available on it, prompted this survey of the incidence of potentially pathogenic staphylococci in dairy products at the consumer level. This paper reports results of studies on fluid milk and fluid milk by-products in original containers at the consumer level. Subsequent papers will report the results of similar examinations of powdered milk and a wide variety of cheese and frozen dairy products.

EXPERIMENTAL PROCEDURE

Samples.

Two hundred and seven samples of pasteurized dairy products processed in 42 plants were obtained during June and July, 1959, from retail outlets throughout Kansas. The samples included the following products: milk, low-fat milk, chocolate drink or chocolate milk, cultured buttermilk, half and half, coffee cream, and whipping cream.

The samples were held under refrigeration (35°F.)

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