

thorax sp. which will develop only on the navel orangeworm.

The culturing of the navel orangeworm was initiated in this laboratory in February 1962, using off-grade and fragmented walnut meats as food for the larvae. The following May a medium of Pablum, honey, glycerine, and water—commonly used for wax moth production—was substituted for walnut meats. The medium currently in use is a modification of the Pablum medium in which wheat bran has been substituted for Pablum. The moth oviposition units and oviposition substrate have been developed and quite well standardized at this time. The egg production available using present methods and equipment is considered adequate to support the parasite production demands of the foreseeable future.

Although methods are being developed for culturing *P. flavitestacea* on either host, the Mediterranean flour moth will probably be the one utilized for large scale production because the eggs of this host can be obtained in larger numbers more efficiently in terms of labor and space than those of the navel orangeworm. When the release program develops and expands, the production of this parasite can be conservatively predicted at 100 to 150 thousand per month.

The culturing method for *Holcothorax* is rapidly shaping up. The unique biology of this parasite should lend itself to the production of large numbers of adults in a mass culture program.

Leopoldo E. Caltagirone is Assistant Entomologist, Kevin P. Shea is Laboratory Technician II, and Glenn L. Finney is Associate Specialist in the Division of Biological Control, University of California, Berkeley. Photos were taken by F. E. Skinner.

CALIFORNIA AGRICULTURE

Progress Reports of Agricultural Research, published monthly by the University of California Division of Agricultural Sciences.

William W. Paul.....*Manager*
Agricultural Publications
Jerry Lester.....*Editor*
California Agriculture

Articles published herein may be republished or reprinted provided no advertisement for a commercial product is implied or imprinted. Please credit: University of California Division of Agricultural Sciences.

California Agriculture will be sent free upon request addressed to: Editor, California Agriculture, 207 University Hall, 2200 University Avenue, Berkeley 4, California.

To simplify the information in California Agriculture it is sometimes necessary to use trade names of products or equipment. No endorsement of named products is intended nor is criticism implied of similar products which are not mentioned.



MILK CONSUMPTION *and* TODAY'S CONSUMER



MEASURED in terms of cash receipts from farm marketings, dairying is the second largest agricultural activity in California, and California is the third most important dairy state in the country. In 1962, approximately 10,000 farms produced and sold slightly more than 8 billion pounds of whole milk for a total of \$398 million. This represents nearly 12% of the total farm income for the State. Furthermore, it has been estimated that California families spend about one-fifth of their food dollar for dairy products. The stability of the dairy industry therefore is clearly of vital concern. And when there is mounting evidence, as there is today, of a critical imbalance between the production and consumption elements of the industry, every effort is required to achieve an understanding of its underlying causes so that corrective action may be taken promptly.

Dynamic changes have been taking place throughout the Nation in recent years, both in production and consumption patterns. In California, total milk production has been increasing significantly—from less than 6 billion pounds in 1951 to over 8 billion pounds in 1962—primarily because of a remarkable increase in average productivity per cow. A continued rise in production is indicated during the next decade or more, and total milk production may go as high as 11 billion pounds in 1975.

Total sales

Total sales of fluid milk and related products (class I) have also increased in California—from about 3 billion pounds in 1950 to almost 5 billion pounds in 1962. Primary factors in this increase have been our burgeoning population and a steadily rising purchasing power. A continued increase in total usage of fluid milk and milk products is expected in the coming years as population growth remains unchecked and per capita income continues to rise. It is estimated that by 1975 the demand for class I milk products may total 8.9 billion pounds.

While increasing income and population have been effecting increases in the total demand for milk and milk products, other influences have been at work to counteract these gains. As a result, per capita consumption of milk and milk products has not kept pace with population growth, either in California or in the Nation as a whole. This is true in spite of higher incomes, expanded school milk programs, and increased sales promotion and advertising budgets. The early fifties saw a steady rise in per capita

consumption of fluid milk until its peak was reached in 1956 at an annual level of about 135 quarts in California and slightly over 142 quarts in the United States generally. Since 1956 there has been a steady decline, with consumption in this state consistently at a lower level than in the United States. By 1962, per capita consumption had dropped to little more than 119 quarts in California and 124 quarts in the Nation.

Surplus supplies

The disparity between rising production and declining per capita consumption of fluid milk has been reflected particularly in an increasing buildup of surplus supplies of market milk and excess processing and distribution facilities. Many industry members have testified to the complexities of the problems posed by excess supplies of Grade A milk and have called for some form of remedial action by the Director of Agriculture, who has authority for administering the milk stabilization program for the state. Because of the recognized importance of milk as a food, the consumer is also deeply affected by the serious problems of the industry, particularly since they remain not only unresolved but even appear to intensify with changing social and economic conditions. Thus, all three sectors of our society—industry, government, and the consumer—have a vital stake in an early solution to the dairy industry's difficulties.

It has become increasingly apparent that the current pressures facing the industry are not unlike the conditions which gave birth to the milk stabilization law in the thirties. Two approaches have been recommended for correcting the critical imbalance and easing existing stresses. One would attempt to solve specific problems by means of further modification of the milk stabilization law, already repeatedly modified over the years to meet immediate problems. Various measures have been recommended, including price decreases—all designed to reduce production rates and bring under control the prevailing tendency toward expansion of output.

The second approach has been suggested not as an alternative but as an independent move to solve the production-consumption imbalance by means of a direct attack on the problem of declining milk consumption. Its immediate objective would be to halt the downward trend of per capita consumption; its ultimate goal, to reverse the trend. In the past few years, the industry has tried to gain these

objectives by intensified sales promotion and advertising campaigns and by imaginative projects in nutrition education—all with the aim of awakening greater consumer demand for milk and milk products. Failure of these programs to arrest the decline in per capita consumption has led the industry to a careful reappraisal of its many-faceted selling efforts, with a view to improving their effectiveness. Increased funds have been allocated to expanded activities in research, nutrition, and public relations. Among the research projects now receiving thoughtful consideration is a comprehensive and up-to-date investigation of consumers' milk buying and utilization patterns and consumer attitudes toward milk as a beverage. The findings of such a study should yield some useful answers to the central question: "Why has per capita consumption been trending downward?"

A number of studies in the past dozen years have explored milk consumption patterns in various parts of the country. Only one study has been made of the patterns of consumption peculiar to California: *Consumption of Dairy Products by Urban Families in California* (California Experiment Station Bulletin 767, April 1959). Conducted in 1952 and 1953 by Jessie V. Coles of the University of California, this study sought to determine the quantities of dairy products consumed by families, their uses in the home, and some of the factors influencing usage. It was found that weekly food expense, annual income per family and per person, and the number of persons (especially children) in the family seemed to be closely related both to the quantities of milk used and the expenditures for fluid milk. On the other hand, no definite relationship appeared to exist between the use of fluid milk and the occupation of the major family earner or the education of the homemaker. Studies in other states however, show that fluid milk consumption increased as the education of the homemaker increased. In some regions, education has been found to be an influential factor in the consumption of milk in low- and middle-income families, but appears to have little influence in high-income families.

Income effects

Almost all of the families surveyed in the Coles study used some fluid milk. Households with higher total incomes and highest food expenses used the largest average quantities of milk. Studies in other regions indicated that per capita

consumption seems to increase as incomes rise from low to medium groups, but no uniform pattern was evident for the upper-income group. There may be a point above which income ceases to be of significance in the consumption of fluid milk, but where this point occurs will depend in some measure upon the general price level and cost of living in any particular market as well as other pertinent factors.

Among families within the same income bracket, consumption may show considerable variation because of differences in the composition of families in terms of age, sex, and race or nationality. Families with children generally consume greater quantities of milk than families composed only of adults. It has been found that, except at the age of six and under, more males than females drink milk; also, that the average male adult drinks more milk than the average female. The greatest difference in milk consumption between males and females apparently occurs in the teen-age period from age 13 to 19—according to one recent nationwide survey, which showed that average consumption remained constant during those years but showed an early decline for females. Both sexes showed a marked decrease in consumption in the young adult years (20 to 24).

A significantly smaller consumption of fluid milk by nonwhite families than white families at all levels of income was indicated in most studies which explored this subject. However, nonwhite families consumed more evaporated milk, chocolate milk or chocolate drink, and butter-milk.

Seasonal variation

Several studies showed that consumption of milk varies somewhat with the seasons. In California it was found that children from 1 to 12 years of age averaged slightly more in summer, but teen-age boys and girls averaged slightly more in winter. All age groups of adult men and women drank larger quantities in summer.

Studies involving the relationship between milk prices and milk consumption indicated that high prices are generally associated with lower consumption rates and vice versa. However, lowering the price apparently is not a sufficiently strong inducement to effect large upward changes in milk usage.

Other factors reported to have some degree of influence on milk consumption include the availability of milk in public places (including vending machines),

facilities for keeping milk in the home, and the method of distribution of dairy products. For example, college men living in dormitories or fraternities often drink more milk than those eating in restaurants, and the placing of milk vending machines on campuses may increase the consumption of milk by students.

A few studies have been directed toward determining reasons for individual variations in milk consumption. Some researchers have merely inquired into consumers' opinions about milk; others have delved more deeply into consumer attitudes toward milk as a beverage. Some investigators have indicated that psychological and sociological factors may have an important influence on milk usage by individual consumers, particularly among teen-age girls, young adults, and older persons. Indeed, they suggest that these subjective factors may provide the real reasons for the continuing decline in per capita milk consumption.

Unfavorable image

A few tentative explanations for this decline have been advanced. Articles published in recent years have tended to create a most unfavorable image of milk and to raise grave doubts about its healthfulness. Substitute products such as powdered milk and frozen juices have become increasingly available and have been considerably improved in quality and acceptability. An increased use of prepackaged food products and prepared mixes seems also to have contributed in no small degree to the decline in usage of fluid milk. Finally, homemakers appear to have become increasingly concerned about diet and weight control with the result that the diet of the average American family is shifting toward a reduction in calories.

Thorough research into these and other influences would be invaluable, and some preliminary analyses have been made. For example, a survey was made of newspaper and periodical literature since 1954 for articles dealing with the relationship between milk and such subjects as cholesterol, arteriosclerosis, heart ailments, strontium 90 and iodine 131, weight control, nutrition, and diet. A graphic comparison of the incidence of these articles with per capita milk consumption in California disclosed that (1) the frequency of such articles had increased perceptibly and (2) the upward trend in per capita consumption had been reversed. Further analysis would be required before any causal relationship between these two occurrences can be supported.

In a preliminary "time series" analysis of California milk markets since 1952, per capita consumption was related to a number of independent variables. It was found that trend—a noneconomic variable—was most significant of those tested, including milk prices, disposable income, and age distribution of population.

In another tentative analysis, per capita consumption data for five federal milk markets in the United States were related to such variables as income, milk prices, the median level of education, age distribution, and the proportion of non-white population. Regional differences were found to be the most influential variable; and significantly, after allowing for the effect of other variables, per capita consumption was lowest in the Pacific region.

Other than these preliminary explorations, milk consumption patterns in California have not been examined since the Coles study of 1952-53. As indicated earlier, a comprehensive research project is presently under consideration for the dual purpose of (1) investigating and analyzing today's patterns in consumers' purchases and uses of milk and milk products, and (2) discovering the psychological elements which may have a dynamic effect on the consumer's attitude toward milk. By a comparison of current milk consumption practices with those of a decade ago, an attempt will be made to learn what changes have occurred in the intervening years. Implicit in those changes may be some valuable clues to specific causal factors, while the analysis of consumer attitudes should provide an explanation of existing individual variations in milk consumption.

When the seemingly multitudinous factors which affect the consumption of milk and dairy products are determined, it may be possible to discover the underlying causes for the continuing decline in per capita consumption. Once these causes are uncovered and brought into focus, the dairy industry can plan an effective program to counteract the negative influences, promote an increased utilization by consumers, and reduce fluid milk surpluses. At the same time, since milk and dairy products are still considered by nutritionists to be important sources of valuable nutrients, increased milk consumption may bring about an improvement in the health and well-being of the average individual.

Miriam Revzan is Assistant Specialist in the Experiment Station, Agricultural Economics Department, University of California, Berkeley.