

which are capable of spreading the disease at an alarming rate during the growing season if conditions are favorable for the disease, and (2) oospores or winter spores, which are thought to be the chief means of carrying the disease over from year to year. Most of the damage is caused by the effects of the disease on the young vines that develop from the crowns in the spring. These are stunted, causing the so-called "spikes", which prevent the vines from producing a crop (fig. 16). Under favorable conditions the disease also attacks the hop cones in the late summer and causes a direct loss by lowering the quality of the product. Entire fields are in some cases destroyed, while in others the damage is frequently sufficient to deprive the grower of all profit from his crop.

Problem Approached in Two Ways

In 1930 the Bureau of Plant Industry in cooperation with the Oregon Agricultural College undertook an investigation of the disease to assist growers in combating its effects. The problem was approached in two ways: (1) To provide practical control measures in the hop fields, and (2) to develop new varieties resistant to the disease. The first includes studies of the behavior of the disease, its propagation, and the conditions that determine its spread and virulence, also the formulation of methods of control by means of sprays and dusts and of practical cultural methods that minimize its spread. Information of this kind is constantly being brought to the attention of growers in order to provide immediate assistance. The second line of investigation cannot give immediate practical results but seeks rather to provide new commercially useful varieties partly or fully resistant to the disease to replace in the future those now grown and which are especially subject to attack.

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DRIED Skim Milk Added to Other Foods Improves Their Nutritive Value The manufacture of dried skim milk is one of the more recent developments of the dairy industry. The past 15 years have been marked by a steady increase in the utilization of and demand for this product, and today it is manufactured to some extent in practically every State. Production has increased steadily from 41,893,000 pounds in 1920 to 288,114,000 pounds in 1933.

Process of Manufacture

To produce a dried skim milk of excellent quality only the best quality of skim milk can be used. Nothing is added to the skim milk prior to its desiccation, hence the product contains only the solids not fat, plus some milk fat and moisture, and the yield is about 8½ to 9 pounds of dried product per 100 pounds of skim milk.

One of the following processes is usually used in its manufacture.

Atmospheric roller process: Steam-heated drums are so arranged that partially condensed skim milk is spread in a thin layer on their outer surface. During the revolution of the drum the adhering film

of milk dries and is then scraped off. This dry film is reduced to a powder by revolving brushes or other grinding devices.

Vacuum drum process: This is really the roller process with the roller or drum enclosed in a chamber which is maintained at a partial vacuum during the drying operation, thus making it possible to dry skim milks at temperatures below their respective normal boiling points.

Spray process: The fluid skim milk, sometimes partially condensed, is sprayed into a current of heated air which removes the water and leaves the milk solids as a finely divided powder. Various devices are used to separate the powder from the moist air.

Flake process: Partially condensed whipped skim milk is spread on a wire belt which passes through a heated chamber wherein currents of hot air are directed against it. The dried product is removed from the belt in the form of flakes.

Nutritive Value of Dried Skim Milk

The approximate percentage composition of dried skim milk is as follows: Proteins 38, lactose 50, salts 8, fat 1, and moisture 3 percent, and it represents an energy value of over 1,800 calories per pound, which is greater than that of most foodstuffs, calculated on a similar basis.

An analysis of average whole milk indicates that the ratio of proteins to fat is approximately 1:1.08, while the ratio of sugar to fat is approximately 5:3.8. The relative biological caloric value of the constituents as foods would be as shown in table 7.

TABLE 7.—Relative total caloric value of constituents in fluid whole milk

	Parts per 100 parts milk	Heat of combustion calories per gram	Relative total caloric value	Approximate percentage of total
Fat.....	3.8	9	34.2	} 50+
Protein.....	3.5	4	14.0	
Sugar (lactose).....	5.0	4	20.0	
Salts.....	.7			

These figures indicate that approximately one-half of the energy value of milk is contained in the solids not fat, or the skim milk.

Energy values alone, however, do not indicate the total value of the skim-milk solids. Foods are needed not only because they furnish energy but also because they furnish material with which tissues are repaired and new tissues are formed. The salts of milk which are found largely in the skim milk are especially valuable food constituents in this respect. Their readily assimilable calcium and phosphorous compounds furnish mineral constituents essential to development and proper growth. The proteins are readily digestible and assimilable and are more nutritive than those of most foodstuffs. The lactose, in addition to having a high caloric value, is especially beneficial in regulating the intestinal flora and seems also to be superior to other carbohydrates in some respects for the growth of young animals. Skim milk is an especially valuable human food also because of its vitamin G (B₂) content, and should, therefore, be a constituent

of the diet of all people in regions where pellagra is of frequent occurrence. It may also contain traces of vitamin D and even vitamin C.

From a consideration of the research work to date on the vitamin content of dried skim milk, it may be said that the approved processes of drying now used do not expose the product to high enough temperatures for a sufficient period of time to materially affect any of the vitamins except the antiscorbutic vitamin C. This vitamin is abundant in most vegetables and citrus fruits, which should be a part of every diet whether the milk used be a liquid or dried product. In the feeding of infants and children a milk diet should also be supplemented with sources of vitamin D, such as cod-liver oil and egg yolk, and the individuals should be subjected to direct sunlight frequently.

Uses of Dried Skim Milk

The almost completely digestible and assimilable milk proteins and the readily metabolizable calcium and phosphorous compounds in dried skim milk, make it especially valuable as a constituent of the diets of children and adults, and of the feed of growing animals.

The most convenient method of supplementing the diet with milk solids not fat is that of adding dried skim milk to foods in daily use. A few of them are breads and cakes, biscuits and crackers, ice cream, candy, chocolate drinks, sausages, meat loaf, custards, puddings, sauces, gravies, etc. Often the dried skim milk improves the texture, appearance, and flavor of the product in addition to enhancing the nutritive value.

For the same reasons that skim milk is one of the most valuable of human foods, it is also one of the best foods for other animals and for fowls. This fact has been appreciated by the most successful raisers of calves, chickens, dogs, goats, foxes, etc. Work at the Minnesota Agricultural Experiment Station has shown that with the gradual decrease of the quantity of whole milk fed to a calf during the first 14 days, skim milk should be added to the feed in increasing amounts up to the sixtieth day. The value of this method of feeding has been confirmed by work at other stations, and dried skim milk has been found to be a convenient form of skim milk to use as a grain supplement in these cases.

Incorporation of liberal quantities of dried skim milk into the diet of growing chicks has been reported to be effective in protecting them against coccidiosis. Workers at the California Agricultural Experiment Station recommend the use of dried skim milk in their feeds to the extent of 40 percent of the weight of the dry materials. Other workers at the Wisconsin and New York (Cornell) stations also recommend the liberal use of dried skim milk in the feeds of chickens.

Most of the dried skim milk produced at present is used in the manufacture of bread and ice cream. Considerable quantities of the lower grades of the product and some of the better grades are used in poultry and animal feeds. Dried skim milk insures a ready source of skim milk solids of uniformly good quality, is economical in handling and storing, and is convenient to use. These advantages have been recognized by the industries mentioned and are also being recognized by farmers in many localities, who maintain a supply of the product for use in the feeds of their farm animals. Smaller units of trade, i. e.,

hotels, clubs, etc., also are aware of the many advantages of the product. This is especially true in the areas of low milk production.

Handling and Storing

With the increased manufacture and greater use of this product has come the need for more convenient methods of handling it, especially in smaller lots.

Dried skim milk should be maintained at a low moisture content throughout the period of its use in order to prevent spoilage. Because of its avidity for moisture, moistureproof containers are the only assurance against these changes. For the trades wherein large quantities are used the product is usually packed in specially constructed barrels. With greater general use of the product by the smaller manufacturers, and in the household where consumption is limited, a need has arisen for moistureproof cartons or packages which will facilitate the distribution of small quantities to the retail trade.

The laboratories of the Bureau of Dairy Industry have found that bags of bond paper containing a laminated glassine inner liner, or well-constructed and waxed paper cartons, will exclude moisture over long periods even in a relatively humid atmosphere and can, therefore, be used in the retailing of this product in small lots. Further research work along this line will undoubtedly result in the disclosure or development of other types of containers that can be used for this purpose and should aid materially in the greater distribution and use of dried skim milk.

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DUTCH Elm Disease Must be Eradicated to Save American Elm

Wide-spread destruction faces the American elm through the spread of the Dutch elm disease, caused by a deadly fungous parasite introduced from Europe. The presence of this disease in the vicinity of New York Harbor was discovered in June 1933, but subsequent observations indicate that it may have become established there as early as 1929. It is now known to have invaded an area of approximately 2,500 square miles in New Jersey, New York, and Connecticut, within a 40- to 50-mile radius of New York City. By October 1934 more than 7,500 diseased trees had been located in this center of infection. Presumably many more are diseased but had not at that time developed characteristic external symptoms.

In practically all the States east of the Rocky Mountains the American and other species of elm constitute an irreplaceable public asset. In the Northeastern States particularly the American elm is the characteristic shade tree along streets and about dwelling houses. As such, this species has an economic value that runs into many millions of dollars. The enhanced value of real estate due to the presence of elm shade trees in many parts of the United States may hinge on the success of the campaign against this disease in the restricted area at present infected.¹

¹ After this article was written the Public Works Administration on the recommendation of the Department allotted \$677,000 for combating the Dutch elm disease. Owing to a provision made by Congress, that the regular appropriation will be reduced by an amount equal to any amount that may be allotted for this purpose from Federal emergency appropriations, the amount actually available for combating the Dutch elm disease, including the location and removal of potentially diseased and dying elm trees, is \$527,000. Work under this allotment was started early in 1935.