Processing
Filbert Nuts

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Hot lye-acid baths followed by a cold water blast was found to be the most satisfactory process for peeling raw filberts. Even this process left a slight off-flavor and the color of the nuts was somewhat altered by the peel dye.

Roasting facilitates the peeling of filberts. Of the several roasting methods tried, oil roasting proved superior as far as peeling ease was concerned. A mechanical device was developed for peeling roasted filberts.

The optimum oil roast was obtained by roasting the nuts for 3 minutes at 300° to 320° F. in cocoanut oil.

The best oven roast was obtained at 400° F. for 7 minutes.

A filbert nut butter was developed. Basic considerations in the development of this product were: Obtaining a satisfactory grind; finding a stabilizer of the desired stiffening power; finding a material compatible with filbert nuts for use as a filler; and producing a finished filbert spread of suitable color, flavor, and texture.

Processing Filbert Nuts

By

RUTH C. MILLER and KENNETH A. DEVLIN[1]

Introduction

THE FILBERT NUT is perhaps the least publicized, least investigated nut on the American market. Known as the hazelnut in many sections, the filbert is in reality a selectively improved hazelnut.

The filbert has a relatively short commercial history. In 1927 the first commercially significant crop was produced. That crop was 60 tons, a strikingly small harvest as compared with the 1947 crop of nearly 9,000 tons.[2] The western valleys of Oregon and Washington are the only significant producing areas of the United States, and it is from this territory that the United States crop figures are compiled. Oregon, incidentally, produces approximately 87 per cent of this total yield.

The introduction of filbert trees to the Pacific Northwest began in the late 1800's with the arrival of a few young trees from Nevada City, California, which in turn, were originally imported from France. Mr. Henry A. Henneman, filbert grower in the Portland area for the last 25 years and past president of the Western Nut Growers Association, is credited with identifying about 40 varieties of filberts.[3] The orchards Mr. Henneman has cultivated and enlarged in the last 33 years now contain approximately 90 varieties of filberts in addition to a number of walnut varieties.

The major portion of the filberts grown in the Pacific Northwest are of the Barcelona and DuChilly varieties. These two varieties are grown in the same orchards because an essential phase of filbert culture is the cross-pollenization of two individual varieties that bloom at the same time of the year. The Barcelona variety is predominant on the market; however, there are sufficient DuChillys produced by the pollenizer trees scattered through the orchards to be of economic importance to the industry. Another pollenizer for the Barcelonas, the Daviana variety, is so similar in appearance that the two are mixed at harvest.

With the outbreak of the war, the foreign source of filberts was entirely cut off. This situation encouraged a large new planting of

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[2]Bureau Agr. Econ. special nut report. U. S. Department of Agriculture, July 1, 1948.
[3]Better Fruit, (Dec. 1941). p. 3 ff.

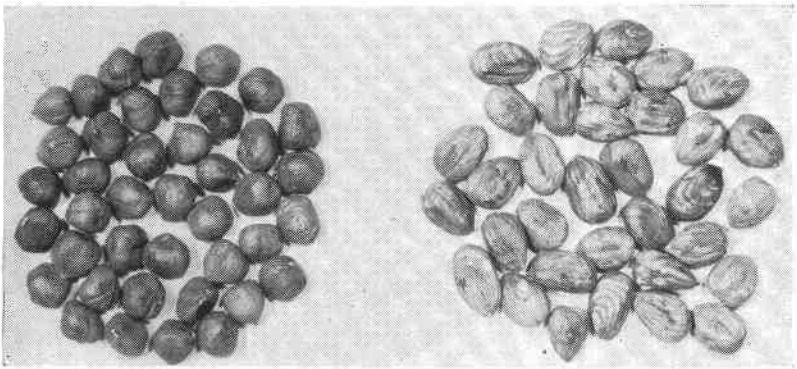

Figure 1. Barcelona and DuChilly varieties of filbert nuts.

young filbert trees which are now reaching maturity. Recently the importation of foreign nuts was resumed, accompanied by a partial removal of the high import tariff. It is easily seen by the filbert growers that these developments offer a serious threat to the supply-and-demand balance; the impending over-supply must be taken care of through new channels. For this reason work has been done and is being planned to adapt filberts to new uses and to incorporate them in new products.

Experimental Methods for Processing Filberts

Peeling (blanching) procedures

Peeling raw filbert nuts is more difficult than peeling other raw nuts because the pellicle covering the kernel is not readily loosened by the means usually employed in peeling nuts (*i.e.*, hot water blanch, use of abrasives, chemical treatment). Of these methods, the chemical treatment has been the most satisfactory up to this time.

Peeling Raw Filberts

Lye-acid treatment

In the peeling experiments, raw filbert nuts were treated with lye-acid baths[1] of various concentrations, and various combinations of alkalis and acids were used (see Table 1). The raw filberts were dipped into a hot alkali solution of known concentration for a measured period of time. This treatment was followed by an acid neutralization and a thorough washing with a strong stream of water for

[1]Lye-acid peeling process covered by U. S. Patent 2,273,183.

approximately one minute. In addition to accomplishing its primary purpose of removing any remaining chemical from the nut surfaces, the water blast removed the majority of the peels. The nut meats were, of course, quite soft and thoroughly wetted by the chemical bath and washing, and an off-flavor from the lye-bath was quite evident in many instances. It was noted, too, that the centers of the nuts acquired a pinkish color from the dye released by the peels.

Table 1. PEELING EFFECT ON RAW FILBERT NUTS WITH VARIED ALKALI-ACID TREATMENTS

Alkali	Acid	Temperature	Time	Results
3% NaOH	3% citric	Simmer	15 seconds	Approximately 100% removal of peels
4% NaOH	4% hydrochloric	Simmer	4 minutes	75% kernels fully peeled
4% Na_2CO_3	4% citric	Simmer	4 minutes	55% kernels fully peeled
4% $NaHCO_3$	4% acetic	Simmer	4 minutes	No peeling of nuts secured
4% NaOH	4% citric	Cold	4 minutes	Flavor impaired; no peeling
4% Na_2CO_3	4% citric	Cold	4 minutes	Skins unaffected; flavor impaired
4% $NaHCO_3$	4% citric	Cold	4 minutes	Skins unaffected; flavor impaired
4% NaOH	4% acetic	Cold	4 minutes	Skins unaffected; flavor impaired
4% Na_2CO_3	4% acetic	Cold	4 minutes	Skins unaffected; flavor impaired
4% $NaHCO_3$	4% acetic	Cold	4 minutes	Skins unaffected; flavor impaired
4% Borax	4% acetic	Cold	4 minutes	Skins unaffected; flavor impaired
4% NaOH	4% hydrochloric	Cold	4 minutes	Skins unaffected; flavor impaired
4% Na_2CO_3	4% hydrochloric	Cold	4 minutes	Skins unaffected; flavor impaired
4% $NaHCO_3$	4% hydrochloric	Cold	4 minutes	Skins unaffected; flavor impaired
4% Borax	4% hydrochloric	Cold	4 minutes	Skins unaffected; flavor impaired

In an effort to retard the lye penetration, a cold solution was used, but the lower temperature was much less effective in removing the peels. Consequently a longer period of treatment was required, and the same flavor difficulty arose as with the hot treatment.

Several alkali-acid combinations were used in order to secure the comparative efficiencies of the chemicals. The alkalis used were sodium hydroxide, sodium carbonate, sodium bicarbonate, and borax; the acids were hydrochloric, citric, and acetic. These investigations indicated that a 15-second treatment with simmering 3 per cent sodium hydroxide followed by a 15-second neutralization in simmering 3 per cent citric acid solution produced the best peeling results.

The peeling effected by this treatment was approximately 100 per cent efficient. These nuts, however, did have a slight discoloration and there was evidence of the lye-treatment in the flavor, whether

eaten after peeling only or after an oven roast following the peeling. Because of the altered flavor and appearance, it was felt that another peeling method must be developed to obtain the highest quality product.

Steam and hot water treatments

Other agents employed in peeling raw filberts were hot water, steam jets, pressure, and vacuum systems. It was found that a strong jet of steam concentrated at one point on a nut for approximately one minute would loosen the peel and split it off. If a large system of steam jets were so arranged as to individually treat each nut, reasonably complete peeling would result. This method does discolor the nuts slightly from the dissolved peel dye, and further study would be necessary to determine the effect of the hot water on the oil and protein content. A small layer of the nut appears to be thoroughly soaked with water. This soaking might seriously impair the flavor if the product were stored for some time.

Placing raw filberts in boiling water for various lengths of time softened the peel and penetrated into the kernel, but the skin readhered immediately after even slight cooling of the nuts. Similar results were obtained by holding the raw filberts in steam under atmospheric pressure, or by subjecting them to steam at higher pressures or in a partial vacuum. The substance which attaches the peel (spermaderm) to the filbert kernel must be "cut" by some agent other than hot water if a permanent loosening effect is to be obtained.

As mentioned earlier, further work is necessary to solve the problem of peeling raw filberts if the best quality product is to be obtained. It is desirable that the chosen peeling agent have as little penetrating effect on the kernels as possible, whether it be moisture, chemical action, or abrasive. In this way the best nut flavor and keeping quality will be preserved.

Peeling Roasted Filberts

A series of peeling experiments were conducted on roasted filbert nuts. Oven or dry roasting and oil roasting were tried.

Oven-roasted filberts

Oven roasting for various periods of time at various temperatures produced a low yield of fully peeled nuts, the remainder of the lot being only partially peeled or totally unpeeled. The peeling method used for this series of oven roasts was a simple hand rubbing of the nuts over a coarse ¼-inch mesh screen. The lots were small enough so that all of the nuts received thorough agitation. All peeling treat-

ments indicated that the DuChilly variety was less easily peeled than the Barcelonas.

Optimum treatment conditions, for both peeling and flavor, were found to be 400° F. for approximately 7 minutes (see Table 2). At higher temperatures, it was found that surface scorching took place before the nuts were well roasted, and this scorching did not facilitate peel removal, nor was the flavor as desirable. Lower temperatures did not produce the desired roasted flavor and did not loosen the peels.

Table 2. PEELING EFFECT ON FILBERT NUTS OVEN-ROASTED AT VARIED TIMES AND TEMPERATURES

Filberts	Fahrenheit temperature	Time	Results
	Degrees	*Minutes*	
Raw, untreated	400	7	Centers excessively browned; peels easily removed; good roasted flavor
Raw, dehydrated 24 hours (150° F. air flow)	300	10	Outer peel dark but not loose; no roasted flavor
Raw, dehydrated 24 hours (150° F. air flow)	400	7	Peels dark, easy to remove; roasted flavor
Raw, dehydrated 24 hours (150° F. air flow)	400	5	Peels not loose; slightly roasted flavor
Raw, dehydrated 24 hours (150° F. air flow)	700	2	Burnt kernels, no peeling; no roasted flavor
Raw, dehydrated 24 hours (150° F. air flow)	900	½ to 1	Scorched in both cases, peels not loose; no roasted flavor
*Raw, lye-peeled, dehydrated 16 hours	400	7	Brown kernels; dry, hard; flavor desirable
*Raw, lye-peeled, dehydrated 16 hours	400	5	Tan color; kernels dry; slightly roasted flavor

* Roasted for flavor comparison only.

Table 3. PEELING EFFECT ON FILBERT NUTS OIL-ROASTED AT VARIED TIMES AND TEMPERATURES

Fahrenheit temperature	Time	Results
Degrees	*Minutes*	
248	3	No change in flavor; little effect on skin removal
311	3	Slightly browned; skins loosened; poor flavor
320	2¼	Skins well loosened; medium brown; flavor good
329	2	Skins well loosened; medium brown; flavor good
338	2½	Skins well loosened; well browned; very good flavor
347	3	Skins well loosened; quite brown; "too roasted" flavor
365	3	Skins well loosened; dark brown; burnt flavor
374	¾	Skins tight; medium dark; flavor good
338	1	Skins tight; medium brown; flavor less roasted than desirable
386	2	Skins tight; very dark; flavor good

Oil-roasted filberts

Filbert nuts were roasted in oil to determine whether this type of roast would increase the percentage of peels removed as compared to the dry-roast treatment (see Table 3). It was found that a short roast at a high temperature did not loosen the peels as completely nor give as good flavor to the nuts as did a heavier roast in which the nut centers became a dark golden brown.

Peels are more readily removed from oil-roasted nuts if the product is allowed to "cure" for a 24- to 72-hour period after roasting. Excess oil on the surface of the nuts is absorbed during this time. But if the filberts are held for a week or more after roasting, a certain amount of moisture is absorbed by the nuts and may explain the lower peeling efficiency on roasted nuts stored for a week or longer.

Peeling devices tested

A number of peeling methods and peeling devices were tried and modified to find a means of removing the peels efficiently and in a completely mechanical operation. One system involved a machine which subjected the nuts to a shaking motion combined with intermittent sharp taps to the containing chamber. The floor of the chamber was fitted with screens of various meshes. Repeated trials with such types of abrasive action proved entirely unsatisfactory.

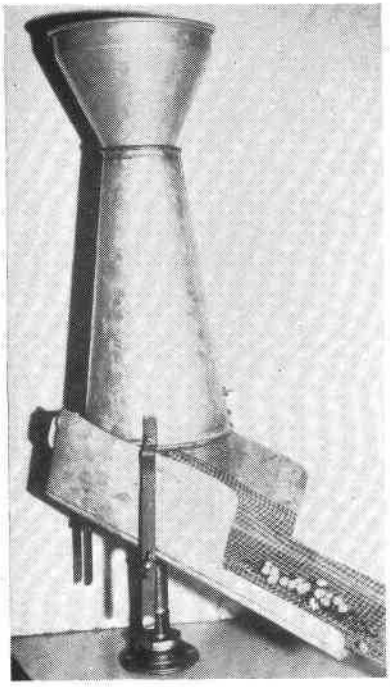

Figure 2. Peeler developed to remove skins from roasted nuts.

Another mechanical device consisted of a perforated metal cone surrounding a series of long stiff brushes which revolved against the cone and carried the material through it. This method was unsatisfactory because a large number of the nuts were deeply scored and a considerable proportion lodged in the coarse brushes.

A third peeling device involved a bowl-shaped screen into which a mechanically propelled stirrer

was fitted. The peeling efficiency of this machine was quite high, but only batch lots could be handled. A continuous process was desired.

Several variations of the brush and screen principle were tried. A coarse-mesh wire screen cylinder was constructed to fit around a cylindrical brush with a clearance of approximately ½ inch. The nuts were fed into the upper end of the vertical cylinder and emptied out the lower end. Some scoring of the kernels was noted. Although efficiency was not as high as desired, this particular application merited further adaptation and reorganization.

Device recommended

The final peeling apparatus developed consists of a tapered, rotating brush mounted on a motor-driven shaft in a perpendicular position. This brush is constructed to fit inside a rubber-lined metal cone that can be moved up and down mechanically and held at any position—thus allowing the space between the brush and cone to be adjusted. The revolving brush carries the nuts around in circles while spiral ridges on the rubber lining of the cone carries them downward. The nuts flow down between the brush and cone from a hopper at the top of the conical system. This type of apparatus assures a constant flow without danger of clogging.

Roasting Procedures

Flavor and appearance are the two most important characteristics to consider in preparing a food product. A roasted flavor was found to alter the prejudice some people had against the flavor of raw filberts. With this in mind a series of experiments were carried out to determine a roast which would result in a superior product.

Oven roasting

Oven roasts, utilizing both unpeeled and chemically peeled nuts, were found to penetrate the kernels satisfactorily in a fairly narrow range of temperatures, 360° to 410° F. (see Table 2). At higher temperatures the surface of the kernels was roasted while the centers were unaffected. At lower temperatures the nuts became dry and brittle but did not have the desired roasted flavor.

Several roasting times and temperatures were tried with lye-peeled, dehydrated but unpeeled, and wholly untreated filbert nuts. The time of roast was correspondingly shortened as the temperature was increased. The method employed in oven-roasting was very simple. Stored filbert nuts were taken from cool storage, put into a flat container in a single layer and roasted in a regulated oven until

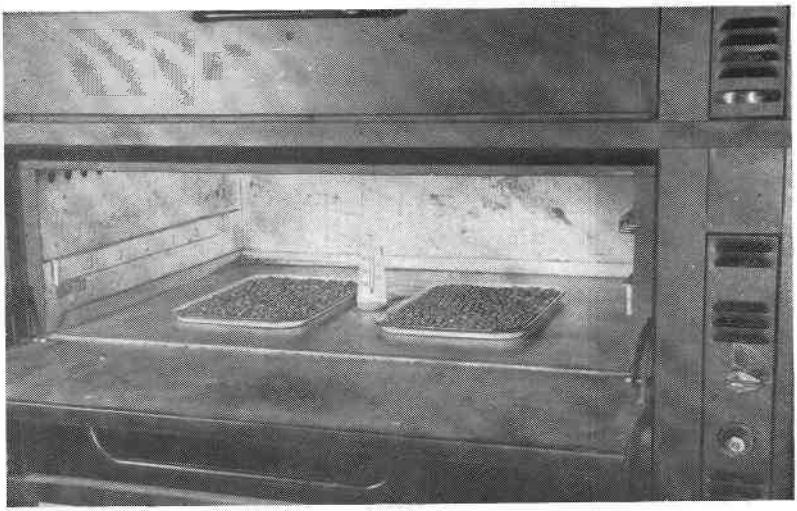

Figure 3. The type of oven roasting equipment used.

the nuts were brown in the center when split, or until sample kernels were very dry and brittle.

It was concluded from the results of a number of roasts that a 7-minute roast at 400° F. was the most satisfactory for raw filberts, whether lye-peeled, dehydrated, or untreated. The flavor was superior to that of other roasts. Incidentally, the peels were more easily removed after this roast than others, which is of interest in the commercial preparation of blanched nuts.

Figure 4. Barcelona filbert nuts: raw, oil roasted, and peeled oil roasted.

Oil roasting

It was found that an oil roast increased the ease of peeling filberts. In addition, the flavor developed by oil roasting was consid-

ered superior by those who tasted the oven-roasted and oil-roasted nuts comparatively.

Considerable discussion as to the kind of oil most suitable for roasting, from the standpoint of flavor, led to a series of roasts using four oils which are available for such use. The roasting efficiencies of cocoanut, peanut, corn, and filbert oils were compared as well as the flavors resulting from these roasts. The time of each roast at each temperature was fairly constant for the four oils; the indicator of the desired roast for the nuts was the turning of the kernel centers to a golden brown. Barcelona and DuChilly samples were roasted simultaneously; the samples were approximately one-fourth pound in weight. These samples were placed in a divided wire basket and lowered into the hot oil, cooked and drained, and then placed on absorbent paper to further drain and cool. The nuts were allowed to stand 24 hours before a flavor comparison was made.

It was felt that the moisture content of the filberts had a definite bearing on the length of time required for oil roasting. For this reason, all nuts were taken directly from cool storage, held at a tem-

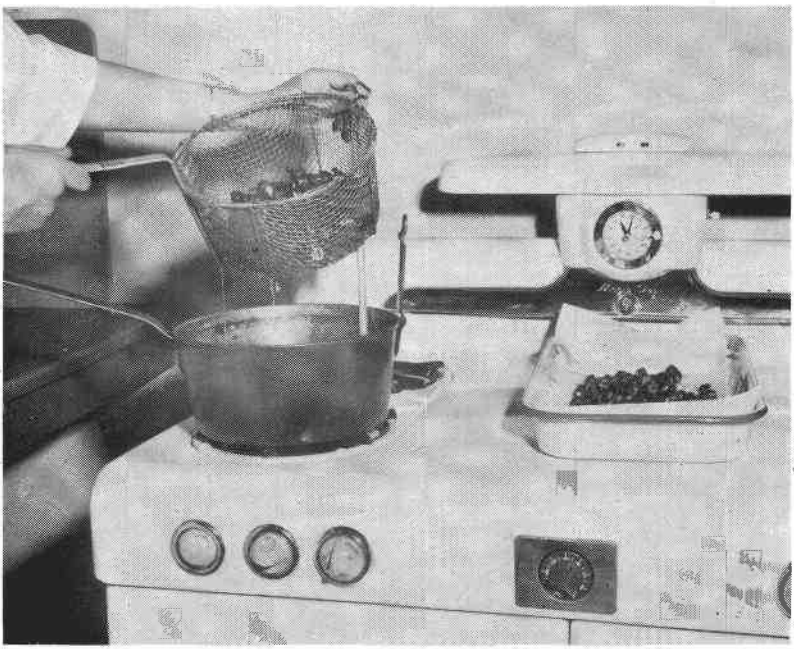

Figure 5. The type of oil roasting equipment used.

perature of 34° F. and with a relative humidity of 85 to 95 per cent, in order to maintain as much uniformity of samples as possible.

The following oil roasting method produced the most acceptable roasted filberts: Cocoanut oil, most satisfactory from the flavor and an economic standpoint, was heated to a temperature of 300° to 320° F. The nuts were lowered into this oil in a screen basket and allowed to cook for 3 minutes, or until the center of a halved nut was a medium brown color. The nuts were then drained of excess oil and allowed to cool. For best peeling results, the nuts were allowed to stand or "cure" for 24 to 72 hours after roasting so that any surface oil was absorbed by the nuts.

Electronic roasting

Electronic roasting consisted of placing a small quantity of the nuts between the electrodes of a 27 megacycle electronic oven. Since the quantity of material to be cooked must be standardized to secure comparable results, a specified number of nuts was used in each roast.

The nuts roasted more rapidly in the centers than they did on the outer kernel. This was probably caused by the presence of air and moisture in the nut cavity which facilitates arcing of the electric current; hence, scorching took place around this cavity. The nuts not scorched at the center were similar in flavor and appearance to oven roasted filberts.

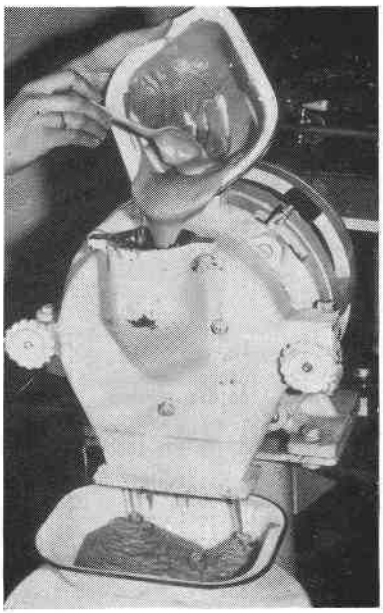

Figure 6. Bauer laboratory model peanut butter grinder.

While fair results were secured, there were a few nuts in each lot scorched by the arcing. Additional work will be necessary to overcome the problems encountered in this preliminary observation.

Filbert Butter

During the early phases of the experimental work, raw unpeeled filbert nuts were used in the preparation of filbert butter samples. But this butter proved unsatisfactory for two reasons: First, the flavor of raw filberts

was less acceptable than that of roasted nuts, and second, the ground nut peels were unsatisfactory from a texture and appearance standpoint. Oil roasted, peeled filbert nuts were used in nearly all of the experimental work on filbert butter preparation.

It was felt that a satisfactory filbert spread could be made by following the general procedures of peanut butter manufacture. The texture of products like peanut and filbert nut butters is of primary importance. Texture may influence the consumer to nearly as great an extent as flavor. A special Bauer laboratory model peanut butter mill was obtained in order that the filbert nuts could be ground to the fineness of smooth peanut butter.

Stabilization (hardening)

The problem of stabilizers is of secondary importance in the development of a good filbert butter. But there are two conditions which make stabilization of filbert butter necessary: First, the high oil content of the nuts, and second, the ease with which this oil separates from the nut solids when the nuts are very finely ground to make smooth butter. The principle on which stabilization is based involves the thickening or emulsifying of the substance that may separate from the solid material. The liquid filbert oil was emulsified by using a solidified hydrogenated oil. A commercial hydrogenated peanut oil, Onesta,* was tried with some success. In amounts necessary to obtain stabilization of the filbert nut oil, however, a slight off-flavor was detected in the butter. Glycerine was also tried, but a sweet flavor resulted.

The best stabilizer from all viewpoints was another solidified oil, glyceryl mono-stearate. With this oil a well-firmed product was obtained and no change of flavor was detected.

Fillers

The economic aspects of producing a filbert butter, if this butter is to compete on the market with peanut butter, indicate that an extender or filler is necessary to lower the cost of the filbert product to a comparable level.

Experimental materials were added in various proportions to find something that would have the same texture and color as roasted peeled filberts when ground, and that would not noticeably alter the flavor. A number of raw and roasted grains were tried, as well as soybeans, dehydrated potatoes, potato chips, and various other materials. The final product, which was felt to be most suitable for introduction to the market, contained roasted ground wheat in the ratio of 1 part wheat to 3 parts of filbert nuts by weight.

* Produced by Proctor and Gamble Co., Ivorydale, Ohio.

Procedure

The formula evolved from these experiments follows:

70 per cent roasted peeled filbert nuts
25 per cent roasted ground wheat
1 per cent salt
4 per cent glyceryl mono-stearate

The ground wheat, whole nuts, and salt were mixed together. The glyceryl mono-stearate was then melted in a small container and sprinkled through the mixture. This combination was ground twice through the Bauer mill, set for a smooth grind. The purpose of the second grind was to mix the ingredients more thoroughly, particularly the stabilizer which hardens immediately upon cooling. It must be finely divided to be effective. After the second grind, the butter was ready for bottling.

Acknowledgments

The authors wish to express their appreciation to the Northwest Nut Growers for contributions of filbert nuts used in the experimental work, to the Proctor and Gamble Company for supplying a quantity of the stabilizer, Onesta, and to Professor Ernest H. Wiegand, Head, Food Technology Department, Oregon State College, for his guidance and interest in the work.

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