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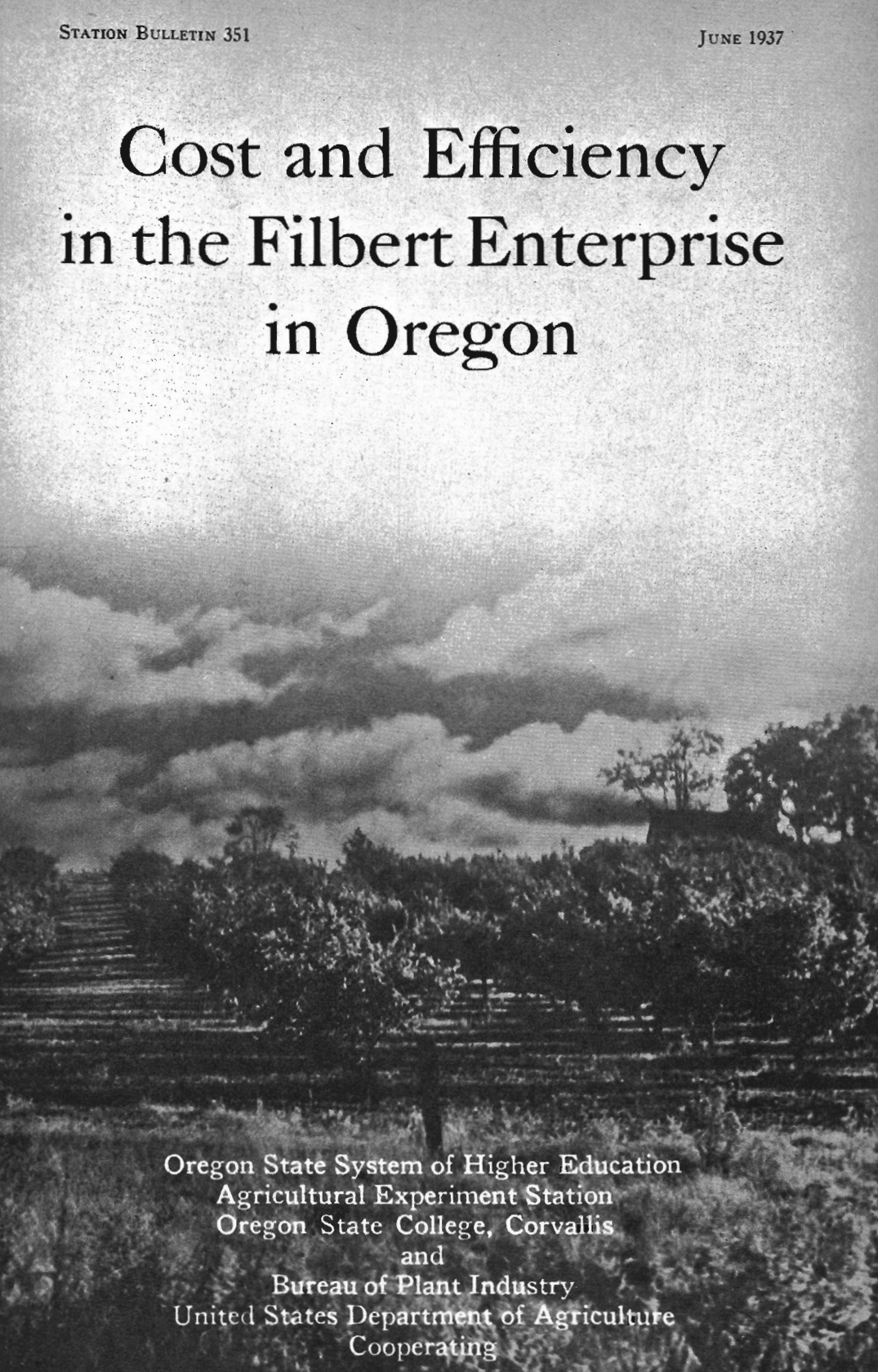
Cost and Efficiency in the Filbert Enterprise in Oregon



Oregon State System of Higher Education
Agricultural Experiment Station
Oregon State College, Corvallis
and
Bureau of Plant Industry
United States Department of Agriculture
Cooperating

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SUMMARY

THE SITUATION. There are approximately 11,000 acres of filbert trees in western Oregon and Washington. This is 98 per cent of all the filbert trees in the United States. Slightly more than 97 per cent of this acreage has been planted during the past fifteen years. At present (1937) 47 per cent of the acreage is nonbearing and another 29 per cent is not yet in full bearing. Thus only 24 per cent of the total filbert acreage is in full bearing.

Prior to 1928 practically all of the shelled and unshelled filberts consumed in the United States were imported from Mediterranean countries. By 1936 about half of the unshelled nuts consumed were furnished by domestic producers. The other half of the unshelled nuts and all of the shelled nuts were imported.

The trend in United States filbert consumption was sharply downward from 1924 to 1935. During this same period only a slight downward trend occurred in the consumption of all nuts. The 1936 consumption of filberts was slightly above the low levels reached in 1934 and 1935, while the 1936 consumption of all nuts reached a higher level than in 1924. Filberts are subject to very strong competition from pecans, English walnuts, Brazil nuts, and cashew nuts.

The 1936 United States consumption of filberts represents the production of about 15,000 acres of trees in full bearing. Approximately half of this consumption was in the shelled form and half in the unshelled. When in full bearing the present 11,000 acres will produce more than the 1936 consumption of unshelled nuts but somewhat less than the total consumption of all filberts. If a substantial tariff against imported nuts can be maintained and if growers are willing to take shelled-nut prices for a substantial portion of their product, there is no immediate prospect of producing more filberts than will be consumed. On the other hand, there are at least 400,000 acres of strictly first-class filbert land in the Willamette Valley and planting is going ahead rapidly. Overproduction from future planting is, therefore, a very real danger.

OBJECTIVES OF STUDY. The objectives of this study were to determine: (1) the cost of growing a filbert orchard to bearing age (6 years), together with the factors affecting such cost, and (2) the cost of producing filberts from bearing orchards and the factors affecting such costs.

DESCRIPTION OF STUDY. The study, which was made by the survey method, was confined to the Willamette Valley counties, for they contain 97 per cent of all the filbert trees in Oregon. Data on the cost of producing filberts were obtained for the 1932 and 1933 crops and data on orchard growing costs for the period 1928-1934. Fifty different bearing orchards and 20 different young orchards are included in the study.

Filberts are usually produced on diversified rather than specialized farms. The average filbert farm contains 92 acres, of which two-thirds is crop land. The average filbert orchard consists of 10.2 acres of bearing and 6.7 acres of nonbearing trees.

THE COST OF A FILBERT ORCHARD AT BEARING AGE. The average young filbert orchard comes into profitable bearing at about 6 years of age. The average net cost of a filbert orchard at this age is $317 per acre. Of this amount

$164 represents the value of the land before planting and $153 is the net growing cost for the first 5 years.

The gross cost of growing a filbert orchard to bearing age was $174 per acre, but during the growing period filberts valued at $21 per acre were produced. This reduced the net growing cost to $153 per acre.

Of the total net growing cost per acre $58.83, or 38.4 per cent, is a direct cash expenditure. This cash expenditure includes hired labor, trees, taxes, tractor operation, and cover-crop seed.

The chief items of growing cost and the percentage each is of the total are as follows: man labor, 24.3 per cent; horse labor, 3.1 per cent; purchased trees, 24.3 per cent; materials and miscellaneous items, 12.4 per cent; depreciation on machinery and equipment, 3.1 per cent; and interest on land and equipment investment and accrued growing costs, 32.8 per cent.

In terms of operations performed the division of growing costs is: overhead, 35.6 per cent; trees and planting, 30.6 per cent; tillage, 23.6 per cent; fertility upkeep, 4.4 per cent; care of trees, 4.2 per cent; and harvesting nuts, 1.6 per cent.

Costs of growing a filbert orchard vary somewhat from year to year as the dollar cost of items used in growing the orchard change, but vary even more widely from farm to farm during the same year, owing to differences in growing methods.

MAJOR FACTORS INFLUENCING THE COST OF ESTABLISHING A FILBERT PLANTING. The planting system used and the value of the unplanted land are major factors affecting the cost of a filbert orchard at bearing age.

Orchards in which the trees were spaced 24 to 25 feet apart were less costly and as high yielding when in full bearing as orchards in which the trees were spaced more closely.

Intercropping reduces the net cost of growing the orchard by 43 per cent as compared with orchards not intercropped.

COSTS OF PRODUCING FILBERTS. The cost of producing filberts in 1932 on orchards of bearing age was $52.37 per acre or 13.2 cents per pound field run. In 1933 the total cost was $59.29 per acre or 7.5 cents per pound. The lower per-pound cost in 1933 was chiefly a result of heavier yields.

The 1933 filbert crop, averaging 791 pounds per acre, is fairly representative of normal per-acre production for the Willamette Valley. Yields per acre in subsequent years were: 1934, 808 pounds; 1935, 899 pounds; 1936, 952 pounds. Owing to the light yield in 1932 (averaging 395 pounds per acre) the analysis of filbert costs, presented herein, pertains only to the 1933 crop.

The principal costs incurred in producing filberts and the percentage each is of the total cost are: man labor, 31.9 per cent; horse labor, 2.1 per cent; materials and miscellaneous, 9.6 per cent; depreciation on machinery and equipment, 3.4 per cent; and interest on the bearing filbert investment, 53.0 per cent.

The value of the average bearing orchard was estimated by the farm operator at $614 per acre. This figure is approximately twice the cost of establishing a filbert orchard. Many filbert growers, therefore, do not actually have the money invested in their orchards that the reported market values indicate.

Of the total labor cost of producing filberts 71 per cent was for harvest operations and 29 per cent was for nonharvest operations. About half the labor used in producing filberts is hired on a contract basis.

Depreciation and interest costs on machinery and equipment used in filbert production are low as no special equipment is required for filberts, and the filbert enterprise shares these costs with other farm enterprises that require the same type of equipment.

Cash costs of producing filberts amounted to $17.57 per acre, while the noncash costs amounted to $41.72.

Wide farm-to-farm variations were found in the cost of producing filberts during the same year. The fact that 9 per cent of the filbert growers cooperating in this study produced nuts for less than 5 cents per pound, and 36 per cent produced for less than 7 cents per pound, indicates that low costs are possible.

MAJOR FACTORS INFLUENCING COSTS AND PROFITS. Yield per acre is the most important factor affecting the cost of producing filberts.

Filbert yields averaged higher on bottom soils than on valley floor soils and higher on valley floor soils than on hill soils.

Filbert orchards normally increase in productivity up to at least 10 years of age. The acreage of filberts in Oregon more than 10 years of age is too small to give any adequate indication of the productivity of trees of these ages.

No significant difference in yield could be detected because of variations in number of filbert trees planted on an acre or because of the practice or absence of fertility-upkeep operations. The soils in most of the orchards studied possess high natural fertility.

The per-acre value of the bearing orchard was found to increase as the yield per acre increased. This increasing value did not affect the cost of production as the additional yields absorbed the increased interest costs.

The outlook for profits in the filbert enterprise indicates that future market values for bearing orchards may tend to approach the cost of establishing these orchards. This indicates that lower interest costs are probable.

Considerable variation was found in the efficiency with which orchard labor operations were performed. Some improvement, particularly in harvesting efficiency, appears possible.

The price received, as well as the cost of production, influences the profits made from filberts. Improvement of the market organization of the industry and the production of high-quality filberts seem to offer possibilities for maintaining the best possible prices.

Cost and Efficiency in the Filbert Enterprise in Oregon*

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THE SITUATION

FILBERT production has been one of the most profitable and rapid-growing farm enterprises in the Pacific Northwest. As a whole this development has been on a sound basis and most growers have made excellent profits from their orchards. During the past few years, however, the conditions that favored the spectacular development of the filbert industry appear to be changing very rapidly. These changes are not as yet generally recognized and the industry appears to be going ahead on the basis of former conditions. It is believed that future profits from the filbert enterprise will largely depend on the extent to which growers recognize the present-day situation and adapt their operations accordingly.

Location and development of the filbert enterprise in the United States. The production of filberts in the United States is confined almost exclusively to western Oregon and Washington. Western Oregon contains 83 per cent and western Washington 15 per cent of all the filbert trees reported in the 1930 census. These two areas appear to possess climatic and other conditions especially conducive to filbert production. Satisfactory yields are usually obtained; nuts of a high quality are produced.

The production of filberts on a commercial scale is among the newer of the farm enterprises in the Pacific Northwest. A few successful plantings of a commercial size were made as early as 1900, but more than 97 per cent of the existing plantings have been made during the past 15 years (Table 1). In 1936 there were slightly more than one million filbert trees in Oregon and Washington, which at the prevailing distance of planting probably occupied about 11,000 acres of land. Prior to 1927 the commercial tonnage of filberts produced in western Oregon and Washington probably did not exceed 50 tons, while the 1936 crop amounted to approximately 1,850 tons.† A further increase in filbert production appears inevitable owing to the fact that in 1936 47 per cent of all the filbert trees in this area

*Acknowledgments. The authors express their appreciation and thanks to the many filbert growers who cooperated with them in this study. They also express their appreciation to the managers of filbert-marketing associations, county agents, and staff members of the Oregon Agricultural Experiment Station who have so generously assisted them in assembling data used in this study.

†Production estimates made by the Division of Crops and Livestock Estimates, Bureau of Agricultural Economics, United States Department of Agriculture.

were 5 years of age or less and were nonbearing, while another 29 per cent were between 6 and 9 years of age and hence were not yet in full bearing (see Table 1).

Table 1. DISTRIBUTION OF FILBERT TREES BY AGE GROUPS, 1936
(For principal filbert-growing counties of western Oregon and Washington)

State and County	Number of trees by year of planting and age group						
	1935 1 year old or less	1931-34 2 to 5 years	1927-30 6 to 9 years	1920-26 10 to 16 years	1910-19 17 to 26 years	1909 or prior years 27 years or older	Total filbert trees
Oregon							
Washington	18,819*	65,519	51,229	33,715	842	258	170,382
Marion	14,335	48,596	36,926	43,510	2,641	52	146,060
Yamhill	12,391*	43,127	39,581	32,890	2,842	46	130,877
Lane	10,587	55,891	34,480	23,809	2,639	224	127,630
Clackamas	15,916	48,428	33,024	23,259	5,908	330	126,865
Polk	5,159*	17,911	12,039	6,643	1,583	743	44,078
Linn	3,679*	12,815	17,360	8,299	689	.....	42,842
Benton	1,691*	5,844	10,630	5,730	1,979	8	25,882
Multnomah	1,879	4,019	7,913	7,740	168	764	22,483
Douglas	400*	1,618	4,237	1,747	5	.....	8,007
Jackson	120	614	4,402	311	2	60	5,509
TOTAL for western Oregon counties	84,976	304,382	251,821	187,653	19,298	2,485	850,615
Washington							
Clark	12,654	39,602	29,549	22,242	2,332	327	106,706
Whatcom	1,860	11,881	2,847	776	5	657	18,026
Lewis	561	11,108	4,547	956	101	42	17,315
Skagit	413	6,293	1,452	1,203	.....	.....	9,361
Skamania	1,000	1,155	2,000	1,997	685	.....	6,837
Cowlitz	917	2,508	2,943	244	99	23	6,734
Snohomish	540	2,785	1,842	864	.....	.....	6,031
Thurston	228	962	2,472	1,743	13	1	5,419
King	139	1,801	603	674	.....	.....	3,217
TOTAL for western Washington counties	18,312	78,095	48,255	30,699	3,235	1,050	179,646
GRAND TOTAL for western Oregon and Washington	103,288	382,477	300,076	218,352	22,533	3,535	1,030,261
Percentage of total filbert trees	10.0%	37.1%	29.1%	21.2%	2.2%	0.4%	100.0%

* Data for plantings 1 year old and less in counties indicated interpolated by authors, owing to lack of survey data for this age group. This interpolation also applies to the total column for the counties indicated.

Source of Data: Office of Agricultural Statistician for Oregon and Washington, Bureau of Agricultural Economics, United States Department of Agriculture. Data based on a special Fruit and Berry Survey made during 1935 and 1936 by use of W.P.A. workers.

World production and disposition of filberts. The Mediterranean Basin is the chief filbert-producing area of the world. Italy, Spain, and Turkey are the chief centers of production. Over the seven-year period 1929-1935 the average annual production in these three countries has been 84,800 short tons* (unshelled basis). Of this production about 82,502 tons* (unshelled basis) have been exported. Approximately three-fourths of these export filberts are shelled before they are exported and one-fourth are exported in the shell.

* Estimates by N. I. Nielsen, Agricultural Attache, American Embassy, Paris, France. All shelled nuts have been converted to a unshelled basis.

The United States has heretofore depended almost entirely on the export trade from the Mediterranean for its supply of shelled and unshelled filberts. During the seven-year period ending August 30, 1936, the United States purchased 10.5 per cent of the unshelled and 6.1 per cent of the shelled filberts exported from the Mediterrean area. The bulk of the shelled filberts were imported from Turkey, and the bulk of the unshelled filberts from Italy.

All filberts imported into the United States are subject to a tariff of 5 cents per pound on unshelled nuts and 10 cents per pound on filbert kernels. In the past this tariff has generally been effective in protecting domestic filberts from serious competition from foreign filberts. Exceptions to this occurred during those years when the money exchange rate gave the dollar a high purchasing value in the chief filbert-exporting countries.

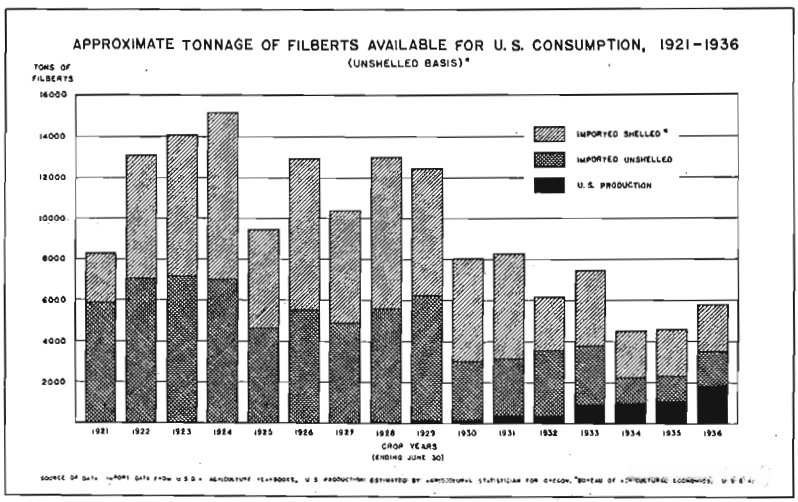

Figure 1. Approximate tonnage of filberts available for United States consumption, 1921-1936.

Consumption of filberts in the United States. Exact data on the consumption of filberts in the United States are not available. An approximation of this consumption can be obtained, however, by adding to the import tonnage the estimated tonnage of domestic production (see Figure 1).

The trend in the apparent consumption of filberts has been downward since 1924. This downward trend was gradual from 1925 to 1929 but became very abrupt in 1930, and reached a low point in 1934 and 1935. A slight upward trend was apparent in 1936 (Figure 1). Whether consumption in future years again reaches the high levels of 1921-1929, whether it remains at present low levels, or whether it approaches the prewar 1910-1914 figure of 7,000 tons, cannot be reliably predicted at this time. There are indications, however, that any increase in consumption of filberts will be in the face of strong competition from other kinds of nuts.

Filberts compete with other kinds of nuts. The quantity of filberts consumed annually in the United States is closely related to the total available supply of all nuts. Almonds, Brazil nuts, cashew nuts, chestnuts, pecans, and English walnuts are the chief kinds of nuts that compete with filberts. There has been much less variation in the total consumption of all nuts than in the consumption of individual kinds. Of the nuts listed above it appears that the consumption of filberts, almonds, and chestnuts is declining; while the consumption of Brazil nuts and cashew nuts is increasing; while the consumption of pecans and walnuts is fairly steady except as affected by large or small domestic crops.*

Of the four chief nut crops grown in the United States—namely, English walnuts, pecans, almonds, and filberts—all except almonds show an increased production during the past 14 years. As a result of this increasing domestic production and a fairly steady total consumption, the United States is now importing less nuts than during the postwar period of 1921-1929. Most of the decrease in imports has been in shelled and unshelled English walnuts, shelled and unshelled filberts, shelled almonds, and unshelled chestnuts. Offsetting these decreases to some extent are increases in the imports of shelled and unshelled Brazil nuts and shelled cashew nuts.

There is every indication that filbert growers will in the future be subject to even sharper competition from growers of other kinds of nuts, than in the past. With a rapidly increasing English walnut and pecan tonnage in the United States and a steadily increasing importation of cheaply produced Brazil nuts and cashew nuts from abroad, it appears likely that the consumer will be looking for bargains.

With such an outlook in prospect the value of a strongly unified marketing organization cannot be overemphasized. It is probable that "slipshod" grading, packing, and marketing by one or more marketing groups will do more to destroy the competitive standing of filberts in the nut market than any other factor.

The problem of overproduction. Owing to the limited domestic production as compared to total consumption and a tariff which protected the home market in most years, filbert growers have not been burdened with the vexing surplus problems which have faced the growers of many agricultural commodities. Because of the rapid increase in planting and production some growers and most filbert marketing agencies are now becoming cognizant of the problems they may have to face in moving future crops into consuming channels.

Filberts sold in the shell have in the past returned the grower a higher price than filberts that are shelled before marketing. Because of this price differential only a small amount of the marketable domestic crop has ever been shelled prior to sale to the consumer.

In 1936 approximately half of the unshelled filberts sold in the United States were from the domestic crop. This proportion promises to become steadily larger, and when the present acreage of planted orchard all attains bearing age it appears that enough filberts will be produced to

* Trends in consumption as indicated are based on data contained in United States Department of Agriculture mimeograph, *Some Economic Aspects of the Filbert Industry,* by James Poole, Agricultural Economist, General Crops Section, Agricultural Adjustment Administration.

meet the entire demand for unshelled nuts that existed in 1936. On the basis of 1936 consumption there is, however, no immediate prospect of producing more filberts than will be consumed as unshelled and shelled filberts combined if imports can be limited or excluded as the situation warrants.

The future demand for filberts is an unknown quantity, but the eventual extent of filbert plantings is equally unknown. Based on present yields and consumption it appears very likely that a surplus of unshelled filberts may be produced even if all new plantings were immediately stopped. As a matter of fact planting is going ahead rapidly instead of stopping, so the possible danger of an unshelled-filbert surplus in a few years, even if consumption increases substantially, is no idle fancy. If demand for unshelled filberts will not move the crop into consuming channels without disrupting the market, it will likely be necessary to shell the surplus stock and market it as kernels. Such a procedure will probably result in substantially lower returns to growers. Whether such a prospective reduction of returns is really serious or only irritating to the individual grower will depend upon the relationship between his production costs and the price received.

Production costs are a major factor in determining profits. The net farm income depends on the margin that exists between production costs and selling price for the commodities produced. To a large degree the price received is determined by factors that are not subject to the farmer's control. On the other hand many farmers can lower their production costs and increase their profits by introducing improved management methods.

In view of the situation as outlined in the preceding pages it is believed that filbert growers should be greatly interested in their cost of production. Heretofore filberts have been so profitable that almost every grower received some income above his production costs. This condition is typical of any newly established successful enterprise that is subject to limited competition. It is believed, however, that the filbert enterprise is now at or near the point of development where high-cost producers may be forced out of the filbert business unless they can lower their costs.

Some growers have advocated a restriction of planting as a means of limiting future production and maintaining profits. The justification of such a procedure as long as high costs are present in the industry is open to question. Even with severe competition in prospect farmers who can grow an orchard that will produce filberts at a low cost are probably justified in increasing their plantings for several years, even though at the same time high-cost orchards are being abandoned or pulled.

The remainder of this bulletin is devoted to a discussion of filbert orchard growing costs and filbert production costs. These data were obtained from representative filbert plantings, and it is believed that they accurately portray the present conditions of the filbert enterprise on Oregon farms. It is further believed that the facts set forth in this publication should enable the established or prospective grower to analyze accurately the opportunities offered by the filbert enterprise under his individual conditions.

OBJECTIVES OF STUDY

The general purpose of the study reported herein is to make available to filbert growers, and others interested, facts concerning the present economic status of the filbert enterprise on Oregon farms.

The specific purposes of the study have been to determine:
(1) The cost of growing a filbert orchard to bearing age (6 years).
(2) The factors that have a major influence on the cost and future development of a new filbert planting.
(3) The cost of producing filberts.
(4) The factors that have a major influence on the cost of producing filberts.

DESCRIPTION OF STUDY

The Willamette Valley is the principal filbert-producing area in Oregon. According to the 1930 census 97.5 per cent of all the filbert trees in Oregon are found in this area. Subsequent data issued by the office of the Oregon Agricultural Statistician, Bureau of Agricultural Economics, United States Department of Agriculture, indicate that since 1930 plantings in the Willamette Valley have continued to gain, while plantings outside of this area have tended to decrease. Owing to the dominance of the Willamette Valley in filbert production the study reported on herein was confined to the 9 counties comprising this area.

Of the nine Willamette Valley counties* five—namely, Washington, Marion, Lane, Clackamas, and Yamhill—contain approximately 80 per cent of the filbert trees found in this area. It is believed that the concentration of filberts within these counties has been occasioned chiefly by economic rather than physical conditions, for the remaining valley counties all contain large areas well suited to filbert production.

Method of study. Data were obtained from filbert growers by the survey method. In fact, each filbert grower cooperating in this study was personally interviewed by one or both of the authors, and every effort was made to obtain accurate and carefully thought out information. No selection of cooperators was necessary, for a rather complete canvass of commercial-sized plantings was necessary in order to obtain enough usable records to permit reliable averages to be computed.

Extent of study. Work on this study was commenced during the winter of 1932-33 by visiting 32 Willamette Valley filbert growers and obtaining from them data pertaining to their bearing orchards and the cost of producing the 1932 crop of filberts on these orchards. These data were supplemented during the following winter by similar data for the 1933 crop, which were supplied by 27 of the old cooperators and 18 new cooperators. The discussion of bearing filbert orchards and the cost of producing filberts, which follows, is based on data supplied by these 50 cooperators. The study of the cost of establishing a young filbert orchard was started during the spring of 1934. In this phase of the study, a total of 17 filbert growers cooperated and supplied data for 20 different filbert orchard tracts under their management. The discussion of orchard growing costs is based on the data contained in these 20 schedules. Altogether, therefore, data were obtained from 67 different farms. The locations of these farms by counties are shown in Figure 2. Of these farms 29 had bearing filberts only; 29 had both bearing and nonbearing filberts; and 9 had nonbearing filberts only. Of the total filbert acreage in the Willamette Valley it is estimated that

* The counties of Linn, Lane, Benton, Polk, Marion, Yamhill, Washington, Clackamas, and Multnomah constitute the Willamette Valley area.

about 21 per cent of the total acreage and 15 per cent of all plantings of 5 or more acres are included in this study.

Owing to the different ages of the trees and other variations found, it was seldom practicable to attempt to obtain cost data on the entire filbert planting of any individual farmer. As a result only 553 acres, or 81 per cent, of the bearing orchard, and 203 acres, or 45 per cent, of the nonbearing orchard on these filbert farms were included in the cost phase of this study. Other data such as varieties planted, kinds of pollenizers used, methods of planting, source and kind of planting stock used, and spacings used were obtained for all of the filbert orchards growing on the 67 farms included in the study.

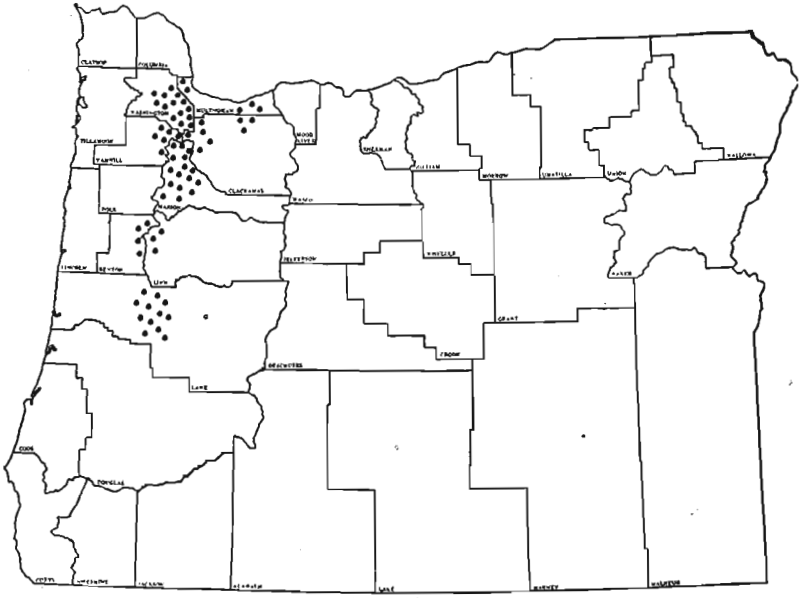

Figure 2. The filbert cost study was confined to the Willamette Valley counties.

The filbert farm. The term "filbert farm" is used in this study to describe farms on which filberts are an important enterprise. The reader should not conclude that the term "filbert farm" implies a high degree of specialization, for just the opposite is true. The filbert enterprise is found most frequently on a diversified farm, and the tools, teams, tractors, and other equipment used to operate this enterprise are also used for other enterprises on the same farm.

The average filbert farm contains approximately 92 acres, of which two-thirds is crop land and one-third is pasture or waste (Table 2). The filbert planting on this average farm consists of 10.2 acres of bearing and 6.7 acres of nonbearing filberts. Accompanying the filberts are 11.4 acres of other crops, chiefly English walnuts, sweet cherries, Italian prunes, and strawberries; and 31.9 acres of crops, which are principally hay and grain for livestock feed. The diversified character of the filbert farm, from the farm-

organization and management point of view, is one of its strong points, and is a feature which it is believed the filbert industry can well afford to encourage.

The average filbert farm is largely hypothetical, for few filbert farms would fit these figures exactly, but it does represent in one set of figures the general character of a farm on which this enterprise is found. Actually the filbert enterprise is found on practically every size of farm, ranging from small part-time or subsistence tracts near towns to farms containing more than 500 acres of land. Table 3 shows the variation that was found in size of farm for the 67 "filbert farms" covered in this study. Approximately 55 per cent of these farms contained between 20 and 100 acres of land, but five-acre tracts, quarter sections, half sections, and even larger farms, are also liberally represented in this array.

Table 2. THE AVERAGE FILBERT FARM
(An average of 67 Willamette Valley filbert farms included in Filbert Cost Study)

Land utilization	Total acres in farms	Average acres per farm	Percentage of farm area
	Acres	*Acres*	*Per cent*
Bearing filberts	681	10.2	11.1
Nonbearing filberts	450	6.7	7.3
Other fruits	761	11.4	12.4
Other crop	2,140	31.9	34.8
Total crop land	4,032	60.2	65.6
Pasture and waste	2,120	31.6	34.4
TOTAL	6,152	91.8	100.0

Two factors that account for much of the variation in size and character of the filbert farm are: (1) filberts can be grown without the specialized equipment required by many horticultural crops, and (2) except at harvest filberts are not a heavy user of labor. The time seems to be at hand when sprayers and other special equipment will be needed in order to grow filberts successfully, but up to date this enterprise has been handled with the equipment ordinarily present on every general farm, and hence has been introduced into the farming system with a minimum of expense. Moreover, the filbert work does not interfere greatly with the general labor program on large farms, and yet provides a desirable cash crop.

Table 3. VARIATION IN SIZE OF FILBERT FARMS
(For 67 Willamette Valley filbert farms included in Filbert Cost Study)

Variation in size of filbert farms	Number of farms	Percentage of farms
		Per cent
9 acres or less	6	9.0
10 to 19 acres	5	7.5
20 to 49 acres	19	28.3
50 to 99 acres	18	26.8
100 to 174 acres	9	13.4
175 to 259 acres	5	7.5
260 acres or more	5	7.5
TOTAL	67	100.0

The filbert plantings on any given farm are usually of several ages. The prevailing practice has been to plant a few trees each year or every

two or three years as money for this expansion becomes available. Owing to the fact that the procedure of establishing a filbert planting is not yet standardized, many groves represent a mixture of spacings and types of trees, as well as being of varying age. Fortunately, varietal recommendations of Oregon State Agricultural College and leading nursery men have been fairly well followed out, so no great mixture of varieties is found.

THE COST OF A FILBERT ORCHARD AT BEARING AGE (SIX YEARS)

The age at which a young filbert orchard will yield enough to pay production costs depends on several physical and economic factors. Physical factors such as type, depth, and fertility of soil, varieties including pollenizers planted, quality of the planting stock, care and skill used in planting the trees, amount and character of intercropping, general care of the orchard, disease or insect infestation; and economic factors such as cost of labor, cost of machinery operation, taxes, value of the unplanted land, and the price of filberts, all serve to increase or decrease the length of time needed for the orchard to become self-sustaining. It is believed, however, that over a period of time and with good-quality tree stock of adapted varieties, planted in suitable soil and properly cared for, the filbert orchard will carry itself during the sixth year. In this study, therefore, the accrued cost of growing a filbert orchard to the sixth year plus the value of the unplanted land was considered as the cost of establishing an orchard.

This study shows that the average net cost of a filbert orchard at 6 years of age is $317 per acre. Of this cost $164 per acre is the value of the filbert land before planting, and $153 per acre is the net growing cost for the first five years (Table 4). It is believed that the value of the unplanted land as reported herein is slightly greater than its normal value for agricultural use, owing to the fact that many filbert groves are located on small farms near towns where location rather than productivity is of major importance in determining land values. Equally suitable filbert land located farther from town could be acquired for less money.

The first year's growing cost plus the value of the unplanted land accounts for approximately 74 per cent of the total establishment cost. This fact is of little importance where filberts are set out on a diversified farm, but the heavy initial investment is of considerable importance to anyone considering either specialized filbert growing or the ownership of a young filbert orchard as an investment. Moreover, the large initial investment emphasizes the need for giving careful attention to all physical details such as depth, fertility, and moisture-holding capacity of the soil, quality of trees, variety, planting distances, and so forth, which will later affect the returns from this investment.

The cost of establishing a filbert orchard may be greater or less than the market value at any given time, for market value is based on the supply of and demand for filbert orchards, and is influenced by several factors, among which is the cost of replacement. Over a period of time, of course, the cost of establishing a filbert orchard will exercise a dominant influence over market value, for if market prices are less than the cost of establishing, planting will be decreased; and if higher than the cost of establishing, planting will be increased. Owing to the fact that filberts are a relatively

new enterprise and have in some instances been very profitable, the selling price for good-quality filbert orchards has usually exceeded the establishment costs reported herein. A factor that has tended to support these high prices has been the limited number of filbert orchards that could be sold without disturbing the entire farm set-up on which the planting was located.

COST OF GROWING THE FILBERT ORCHARD, BY ITEMS

The average gross cost of growing a Willamette Valley filbert orchard to six years of age is $174.22 (Table 4). During the growing period, however, approximately 191 pounds of filberts, valued at $21.20, were produced. When this production is credited to the gross cost a net cost of $153.02 per acre remains.

Of the total gross growing cost, $70.14 per acre, or approximately 40 per cent, is expended during the first year, and each year thereafter for the next four years the expenditure amounts to about $26 per acre, or 15 per cent of the total gross growing cost. The chief items of cost during the first year are trees, interest on the orchard land investment, and man labor, which includes the labor of the farm operator and members of his family. During the next four years interest on the land investment and accrued growing costs, man labor, taxes, and tractor costs are the chief expense.

An understanding of the method of computing the average growing costs is essential to a proper interpretation of these figures. Costs for each year were determined on the basis of the entire acreage studied. The entire input or cost of man labor, materials, horse labor, machinery use, taxes, interest, etc., was totaled and was divided by the total acreage to obtain the cost per acre. It should be understood that some operations such as cultivation were carried on more extensively on some acreages than on others, and some acreages were cover cropped, manured, or staked, and some were not. About 40 per cent of the young filbert acreage, moreover, was intercropped, and on these orchards the only costs charged to the filberts were those that apply to the actual area occupied by the tree, which was about 26 per cent of the land area in the orchard tract. Where intercropping was practiced, costs such as taxes, interest, cultivation, and cover-crop seed are materially reduced. Hence the average per-acre costs as herein presented show what the cost actually was. They represent a composite of all growing methods used, and do not show what the cost would be if any particular plan of growing were followed out. (See Appendix A for a further explanation of methods used in making the study.)

Growers who are interested in computing the probable cost of growing an orchard under any particular set of conditions can readily do so by applying local rates to the labor and material requirements for growing an orchard which are presented under the discussion of growing costs by operations. (See pages 19-27).

Trees. The cost of trees accounts for approximately 60 per cent of the first year expense or 24 per cent of the total gross cost of growing a filbert orchard. This percentage does not fully indicate the true importance of this item, for often the success or failure of the planting depends on the kind of trees set. Successful orchards are seldom obtained from cull trees, yet growers are often tempted to purchase such trees because they can obtain them at bargain prices.

All of the nonbearing orchards studied were either of the Barcelona or Brixnut variety, although in each case these orchards also contained suitable pollenizers. Approximately 95 per cent of the trees were purchased from local Willamette Valley nurserymen, and the remainder were home raised. The average cost of the Barcelona trees was 41½ cents each, and the average cost of the Brixnut trees was 79 cents each. All Brixnut trees are budded or grafted, which necessitates a higher cost.

The average rate of planting for the 20 young orchards studied was 87 trees per acre. Of these trees 12, or 14 per cent, were pollenizers, which is slightly more than the 11 per cent usually recommended. The most common pollenizers used in the Barcelona orchards were trees of the Du Chilly, Daviana, or White Aveline varieties, although such varieties as Montebello, Nottingham, and Edgewater were being used in an experimental way in some orchards. In Brixnut orchards, Bolwyller, which locally is known as Halls Giant was the only pollenizer used.

There are several methods of propagating filbert trees, and each method has enthusiastic advocates. Among the trees set out in the young orchards studied were blocks of trees representative of all common methods of propagation. Budding and grafting are universally used in propagating the Brixnut variety and to some extent in propagating the Barcelona variety. When this grafting or budding is done on a nonsuckering root stock such as the Turkish filbert (*Corylus Colurna*) the tedious job of suckering is eliminated. Tip layering, which is another method of propagating, represents an attempt to produce trees that will sprout fewer suckers than trees propagated by continuous layering. Of the Barcelona trees planted in the 20 young orchards studied, 90 per cent were propagated by tip layering, 8 per cent were produced by continuous layering, and 2 per cent were budded. The prevalence of tip-layered nursery stock represents a recent change in filbert propagation methods, for most of the bearing orchards studied were grown from trees that had been produced by continuous layering.

In the young Barcelona orchards two-year-old filbert trees 4 to 6 feet high were planted more frequently than any other size of tree. A few plantings were made from one-year-old trees. Grafted or budded filbert trees usually consist of a one-year-old top on a three-year-old root.

Man labor. The direct man labor required to set out and care for a filbert planting during the first five years amounts, in round numbers, to 136 hours per acre, and was valued at $37.17 per acre. In addition $5.13 per acre was expended for contracted work, which brings the total cost of man labor to $42.30, or an amount equal to the cost of trees (Table 4). This labor is exclusive of any work incidental to the production of intercrops, for such labor was charged directly to the intercrop. Labor of benefit to both the filberts and intercrop was prorated to each on the basis of area of ground occupied.

Of the total man labor used in growing the young filbert orchard, 31 hours was for setting out the orchard; 84 hours was for plowing, cultivating, and suckering; 4 hours was for fertility upkeep; and 17 hours was for miscellaneous operations such as pruning, spraying, replacing dead trees, rodent control, and harvesting whatever nuts were produced. The contract work was about equally divided between setting out operations, cultivation, and harvesting.

Approximately two-thirds of the direct labor was performed by the farm operator or an unpaid member of his family. This labor was valued at 26.1 cents per hour. Hired labor was valued at 29.8 cents per hour.

Contract-labor rates varied considerably, and for some operations appear to be largely dependent on the individual conditions and people concerned. For example, one job of hole digging was contracted at 8 cents per hole for holes 2 feet deep by 2 feet square. Another hole-digging job with holes 1½ feet deep by 1½ feet square was contracted at 4 cents per hole. In still another instance the entire job of hole digging and tree setting was contracted for 5 cents per tree. Most of the contracted cultivation was for the operation of disking in the cover crop. The rate for this operation varied from $2.50 to $3.00 per acre. The prevailing rate for harvesting the few filberts that were produced was 1 cent per pound for picking up, and ½ cent per pound for drying.

Horse labor. The growing of the average filbert orchard to bearing age required the use of 41 hours of horse labor per acre. This horse labor was performed with farm teams and was charged at 13 cents per horse hour.*

Miscellaneous costs. About 12½ per cent of the total growing cost is composed of items of a general or miscellaneous character. Of these, real-estate taxes on the orchard, tractor operation, cover-crop seed, and replacement trees, in the order named, make up 82 per cent of this item (see Table 4). In considering these miscellaneous costs it should be borne in mind that approximately 40 per cent of the orchards were interplanted with other crops for part or all of the growing period, and that on these orchards only that portion of the cost actually chargeable to filberts was considered in constructing Table 4. The effect of these intercrops on the cost of growing the filbert orchard will be fully discussed later.

Depreciation. The small amount of depreciation charge included in the growing cost is a reflection of the diversified character of filbert farms. Owing to the fact tools used for other crops can also be used to care for filberts, this cost item can be and is held to a minimum. If small filbert plantings, such as those studied, had to carry all the depreciation charge for machines needed for their care, the cost would in many cases be prohibitive.

Operation costs. The cost items just discussed under the headings of trees, man labor, horse labor, miscellaneous costs, and depreciation are sometimes referred to as operation costs to distinguish them from total costs, which include interest on land and equipment. The operation costs account for about two-thirds of the total growing cost.

Interest. A major item of cost in growing the filbert orchard is interest on the capital tied up in land, accrued growing costs, and equipment. A rate of 5 per cent was used to compute the interest charge on this capital. Over the five-year growing period the total interest charge amounted to $57.13 per acre, or 33 per cent of the total gross growing cost. Of this cost 61 per cent is for interest on the value of that part of the land used by the filbert trees; 34 per cent is for interest on the accrued growing costs; and

*This cost is based on data presented in Bulletin 250, Oregon Agricultural Experiment Station, *Cost of Horse Labor on Oregon Farms.*

5 per cent is for interest on the tractor and machinery investment chargeable to growing the filbert orchard.

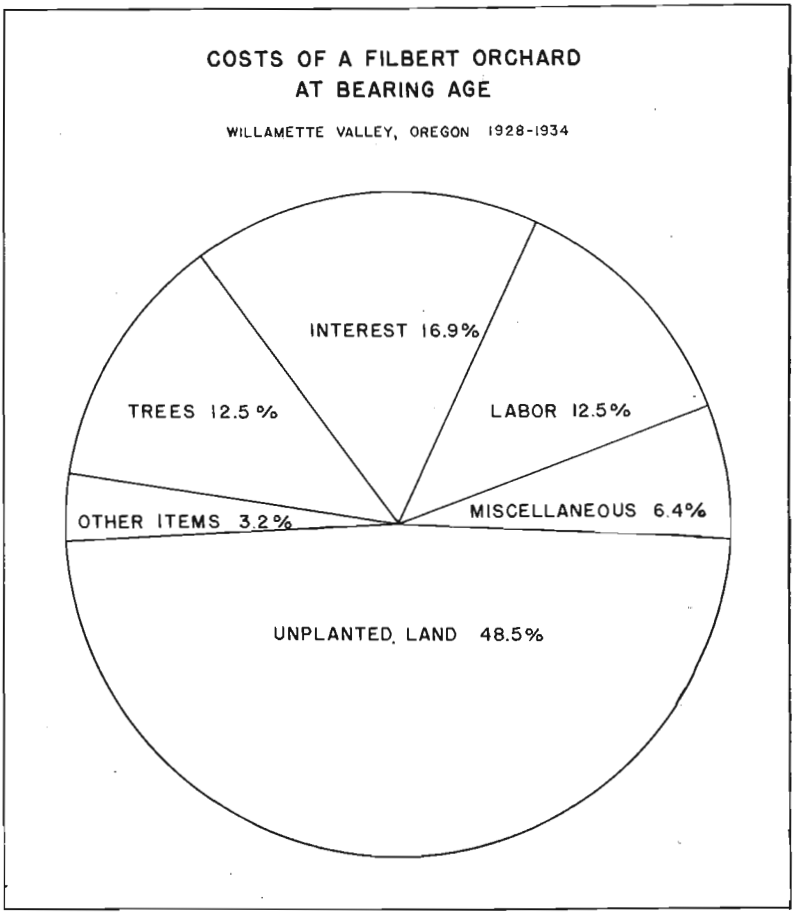

Figure 3. Costs of a filbert orchard at bearing age.

FILBERT ORCHARD GROWING COSTS, BY OPERATIONS

It is often advantageous to consider growing costs in terms of the operations performed in the orchard. To provide such data the costs presented in Table 4 have been regrouped according to the major growing operation with which they are associated.

The distribution of the gross cost of growing the filbert orchard is shown by Figure 4. The largest item of cost is overhead, which accounts for 35.6 per cent of the total growing cost. The remainder of the gross

growing cost is divided up, 30.6 per cent to trees and planting, 23.6 per cent to tillage, 4.4 per cent to fertility upkeep, 4.2 per cent to care of trees, and 1.6 per cent to harvesting the few nuts that were produced.

Overhead costs. Overhead costs, amounting to $61.99 per acre, consist of taxes on the growing orchard plus interest at 5 per cent on both the value of the unplanted land and the accrued growing costs. Of the total overhead costs 56 per cent was for interest on the unplanted land, 32 per cent was for interest on the accrued growing costs, and 12 per cent was for taxes.

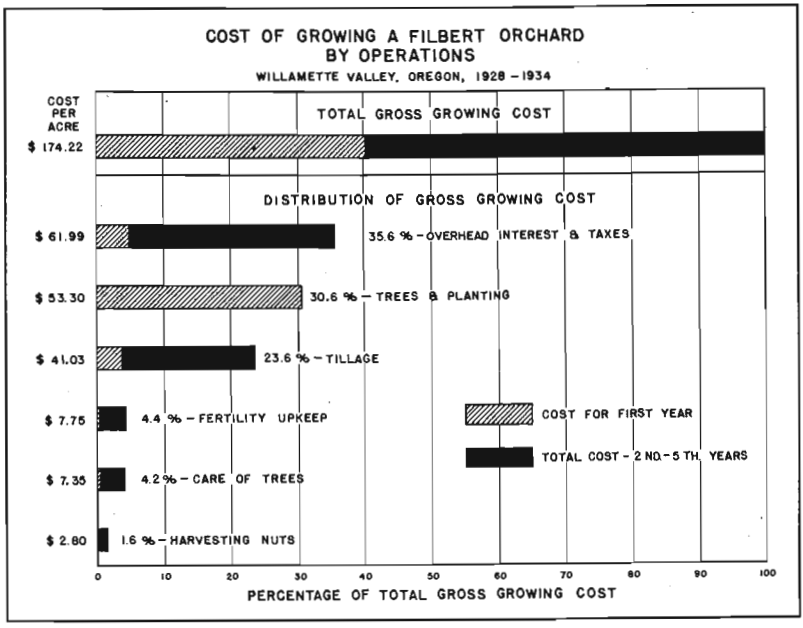

Figure 4. Cost of growing a filbert orchard, by operations.

Overhead costs are not, as a rule, very seriously considered by filbert growers. As pointed out on page 13, most filbert orchards are found on diversified farms. On such farms, taxes and interest (if any is paid) come out of the general farm income, and the farmer seldom segregates these costs to the various farm enterprises. In contrast to the general or diversified farmer, investors or specialized growers may find that overhead is a very burdensome charge unless they have ample capital to carry these costs through the entire orchard-development period.

Planting costs. The cost of planting, including the value of the trees set out, amounted to $53.30 per acre. Of this cost 79 per cent was for trees, 19 per cent was for labor, and 2 per cent was for a number of items, such as stakes, ties, marking pegs, trunk protectors, horse labor, and use of the farm automobile.

The planting operation is probably the most critical job faced by the filbert grower. If planting is well done and proper varieties are planted in suitable locations, the costs of planting may be similar to the averages just indicated. If, on the other hand, the grower errs in judgment in selecting his planting stock, or the location on which it is set, or does not plant the trees properly, the cost of planting in the form of decreased yields may continue to accrue over a long period of time.

The planting operation consists of several distinct jobs. These are: (1) laying out the planting plan and marking the tree locations, (2) digging holes, (3) setting trees, and (4) miscellaneous operations such as staking and tying, and putting on trunk protectors.

Laying out the planting. It requires, on the average, 5.5 man hours per acre to lay out the planting and mark the tree locations. This job requires a crew of 2 or 3 men. There are 3 common methods of doing this job; namely, (1) measuring with wires designed for this purpose, (2) sighting in the tree locations by use of poles, and (3) surveying the planting site with a transit. All three methods appeared to give satisfactory results. The advantage of the wire or sighting method over the transit method is that the farmer can avoid hiring the services of a surveyor.

Digging the holes. Most growers seemed to favor a hole 2'x2'x2', but variations were found from shallow holes 1½'x1½'x1' to holes 2½'x2½'x2½'. The labor required to prepare the holes depends, of course, on their size as well as on the condition of the soil. On the average 12.4 man hours per acre, or 16.4 man hours per 100 holes, were required to dig the holes. One grower contracted the job of hole digging at 4 cents each for holes 1½'x1½'x 1½' and at 8 cents each for holes 2'x2'x2'.

Setting trees. The job of placing the filbert trees in the ground requires on the average 16.7 hours of man labor per acre, or 22 man hours per 100 trees. This labor covers hauling the trees from the nursery, distributing them over the planting site, trimming of roots, and setting them in the ground. Two- to four-man crews are ordinarily used for this operation. Many growers follow the practice of setting the tree on a small mound within the hole. This method appears to permit a natural arrangement of the roots. Top soil is then sifted about the roots and firmly packed in by hand.

Miscellaneous planting operations. Staking and tying the trees to prevent them from growing crooked and putting on trunk protectors to control sun scald are operations that were performed on about 50 per cent of the young filbert groves studied. A few whitewashed the trunk of the young tree in lieu of using protectors. In the aggregate, where one or more of these operations was performed they required an average of 4.9 hours of man labor per acre.

Staking and tying do not appear to be necessary in all locations, but are necessary wherever orchards are in windy locations. Many growers follow the practice of deferring staking until needed, and then stake only those trees that show indications of developing crooked trunks. Stakes are usually cut from the farm wood lot or are made from waste lumber obtained from local sawmills. Any soft material such as burlap strips or old rags can be used for ties.

Table 4. ITEMIZED COST PER ACRE OF BRINGING A FILBERT ORCHARD TO BEARING AGE (SIX YEARS) 1928-1934

Data from 20 groves, averaging 10.6 acres in size and set 87.4 trees per acre

Cost item	Cost per acre				Percentage of gross growing cost
	For first year	Per year, second to fifth year inclusive	Total for entire five-year period		
			Amount	Cost	
					Per cent
Operator and family labor	$ 5.46	$ 4.53	90.3 hrs.	$ 23.62	13.6
Hired labor	7.37	1.56	45.4 hrs.	13.55	7.8
Contract labor	1.64	.87	.....	5.13	2.9
TOTAL MAN LABOR	$ 14.47	$ 6.96	.....	$ 42.30	24.3
HORSE LABOR	$ 1.10	$ 1.06	41.1 hrs.	$ 5.35	3.1
*FILBERT TREES	$ 42.30	....	83.7 trees	$ 42.30	24.3
Taxes	1.16	1.56	.....	7.39	4.2
Tractor operation (gas, oil, repairs)	.72	1.09	15.0 hrs.	5.09	2.9
Cover-crop seed	.56	.51	117.8 lbs.	2.59	1.5
Manure	.01	.24	1.33 tons	.96	.6
Commercial fertilizer	....	.42	63.5 lbs.	1.69	1.0
Stakes and tying material	.42	.01	37.4 stakes	.46	.3
Marking pegs	.04	....	57.2 pegs	.04	....
Replacement trees	.33	.56	5.2 trees	2.58	1.5
Use of automobile and truck	.05	.02	.....	.11	....
Rented equipment	.03	.05	.....	.22	.1
Protectors	.48	....	28.6 protectors	.48	.3
Spray	.01	....	.....	.02	....
Rodent-control materials	....	....	.....	.02	....
TOTAL MISCELLANEOUS	$ 3.81	$ 4.46	.....	$ 21.65	12.4
Depreciation on tractor	.80	1.16	.....	5.44	3.1
Depreciation on other machinery	.01	.01	.....	.05	....
TOTAL DEPRECIATION	$ .81	$ 1.17	.....	$ 5.49	3.1
TOTAL OPERATION COSTS	$ 62.49	$ 13.65	.....	$117.09	67.2
†Interest on land	7.24	6.92	.....	34.92	20.0
Interest on accrued growing cost	....	4.92	.....	19.68	11.4
Interest on tractor	.40	.52	.....	2.49	1.4
Interest on other machinery	.01	.01	.....	.04	....
TOTAL INTEREST	$ 7.65	$ 12.37	.....	$ 57.13	32.8
GROSS GROWING COST	$ 70.14	$ 26.02	.....	$174.22	100.0
Credit for filberts produced	....	5.30	190.8 lbs	21.20	12.2
NET GROWING COST	$ 70.14	$ 20.72	.....	$153.02	87.8
AVERAGE VALUE PER ACRE OF UNPLANTED FILBERT LAND					$164.00
NET GROWING COST PLUS VALUE OF UNPLANTED LAND					$317.02

* Applies to purchased filbert trees only.

† Owing to the fact that 40 per cent of the young filbert orchards were intercropped for one or more years during the growing period the interest charge as shown is less than interest at 5 per cent on the full value of the unplanted land (see Appendix A for methods used in computing costs).

Trunk protectors were used by about 25 per cent of the growers. All growers using protectors expressed themselves as being satisfied. Most of the protectors used were purchased.

Tillage. The cost of tillage, which includes all horse and tractor cultivation, hoeing, spading, and suckering, amounted to $41.03 per acre. Of

this cost, 59 per cent is for man labor, 13 per cent is for horse labor, and 28 per cent is for the use of machinery (interest, depreciation, repairs, and operation).

Figure 5. The trees in this 14-year-old orchard are becoming crowded.

Tillage costs are materially reduced where intercrops or interplants are used to fill in the vacant space between the young filbert trees, for under these conditions the filberts bear the cultivation cost of only a portion of the total land in the field. Of the young filbert orchards studied, 40 per cent were interplanted or intercropped and in these orchards 74 per cent of the land and the cultivation thereof was charged to the intercrop or interplant. Further discussion of the effects of interplanting or intercropping on growing costs is given on pages 31-32.

An average of 16½ man hours per acre per year were required for all tillage operations. Of the man labor required for tillage, 10 per cent was for plowing, 33 per cent was for operating horse- or tractor-drawn cultivating implements, and 57 per cent was for hoeing, spading, and suckering. This division of labor clearly illustrates the desirability of arranging the orchard so that a minimum of hand cultivation will be required and of selecting planting stock that will not sucker extensively.

Of 9.4 hours per acre required for hoeing, spading, and suckering, approximately 8.5 hours was for suckering. An absolute separation of the labor used for each of these jobs is virtually impossible as many growers sucker and hoe or spade and hoe at the same time. During the first year the time required for suckering an acre averaged only 2.7 hours, but this labor increased up to 10 and 12 hours per acre during the third and fourth years. In round figures, therefore, suckering the young orchard after the

first year required on the average from 1 to 1½ days of man labor per acre per year.

The tools used in cultivating the young filbert orchard are the ordinary tillage implements found on most general farms in the Willamette Valley region. Of the farms studied, 76 per cent used a plow, 76 per cent a disk, 53 per cent a spike-tooth harrow, 35 per cent a spring-tooth harrow, 53 per cent a weeder, 29 per cent a clod masher, 18 per cent a roller, and 18 per cent a one-horse cultivator.

There is no uniformity in the amount of cultivation given the young filbert orchards. Plowing or disking early in the spring is a universal practice. Following this, the average orchard received 8 cultivations with horse- or tractor-drawn implements, and 1 hoeing, which removed scattered weeds and those weeds too near the tree to be reached with other implements. During the season the average orchard was suckered twice. In comparison with these averages, some orchards received only 4 implement cultivations and 1 hoeing, while others received 19 implement cultivations and 2 hoeings. Likewise some operators suckered their orchards 5 times.

The purpose of cultivation is to conserve the soil moisture. Present information indicates that this can be effectively accomplished if weed growth is kept down. Dust mulches, formerly considered so important, are now believed to be unnecessary. The amount of cultivation required to keep down weed growth will vary from farm to farm. It is believed, however, that this can be effectively accomplished with less cultivation than was being used on many orchards.

Fertility upkeep. Of the young filbert orchards studied 80 per cent were cover cropped or manured or treated with commercial fertilizer one or more times during the 5-year growing period. Cover cropping was by far the most common fertility upkeep practice followed. Only 10 per cent of the growers used any commercial fertilizer, and but 25 per cent applied manure, while 55 per cent cover cropped. Of those growers who cover cropped approximately four-fifths did so regularly.

The average total cost of fertility upkeep for the 5-year growing period was $7.75 per acre. Of this cost 14 per cent was for man labor; 70 per cent was for cover-crop seed, manure, and commercial fertilizer; and 16 per cent was for horse labor and use of machinery, such as manure spreaders, wagons, and drills. An average of 3.5 man hours per acre annually was required to perform fertility upkeep practices in those cases where these practices were actually performed. Of this labor .6 hour was for cover cropping, 1.8 hours were for spreading manure, and 1.1 hours were for distributing commercial fertilizer.

Applications of commercial fertilizer were experimental in nature. Of the two growers using commercial fertilizer, one applied nitrate of soda at the rate of 2 pounds per tree for one year; the other applied a mixture consisting of one-third ammonium-phosphate and two-thirds complete fertilizer for three consecutive years, with the rate of application per tree varying from one-half pound the first year to one pound the second year, to three pounds in the third year.

Of the growers applying manure 40 per cent put on light applications, ranging from 2 to 4 loads per acre, which were applied only to the soil adjacent to the tree; while 60 per cent made heavier applications ranging

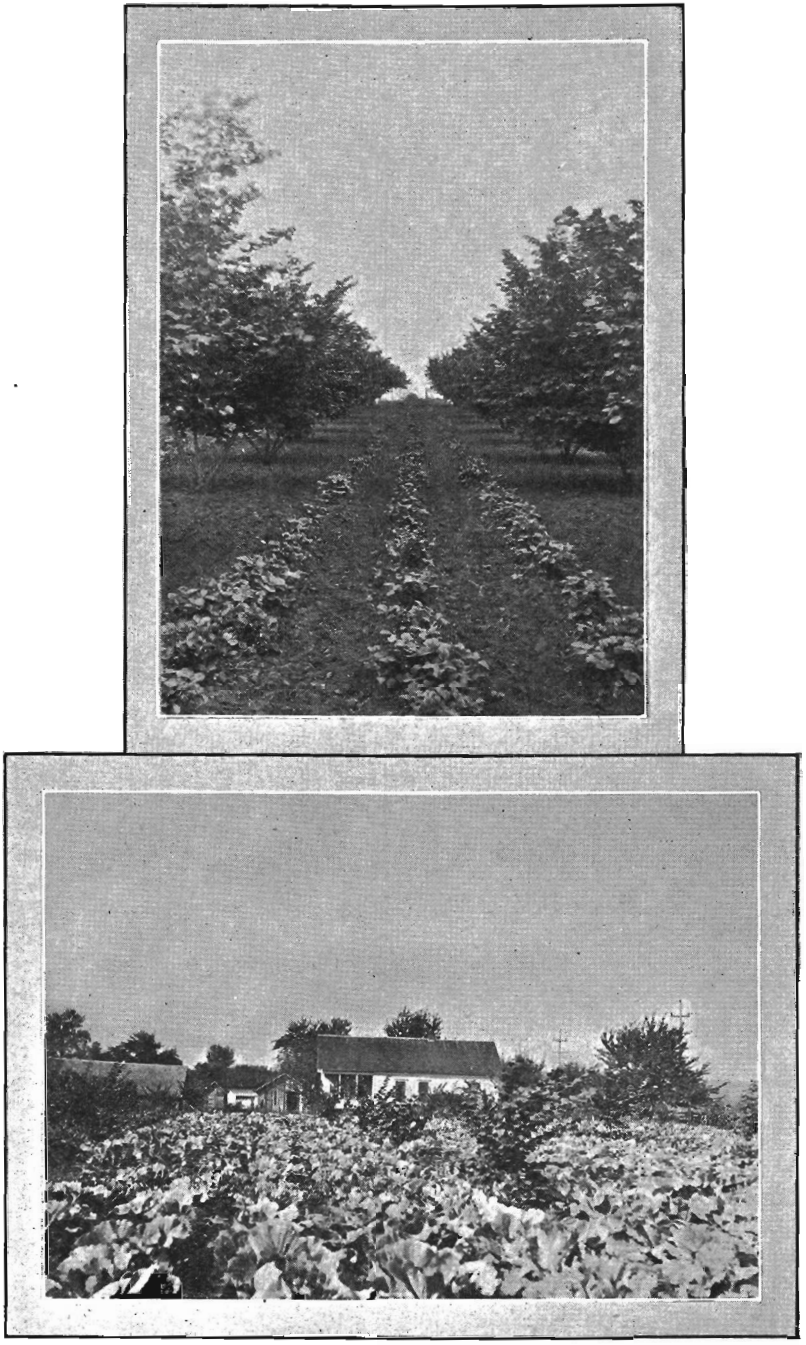

Figure 6. Two methods of intercropping often observed.

from 6 to 8 loads per acre, and were therefore able to cover more of the soil area. Most of this manure was purchased from neighboring farmers at from 50 cents to $1.00 per load; for it so happened that those farms that kept stock and produced manure used only limited amounts of manure on the young filbert orchard.

Vetch and grain were universally used for the cover crop where this practice was followed. Seedings were generally made in late September and the resultant crop turned under in April or May of the year following. The average seeding rate was 51 pounds per acre, and this seed cost on the average 2½ cents per pound. The seeding rate, which is lighter than usually recommended, is accounted for by the fact that some growers seeded only the tree rows. Where the entire orchard is seeded, 80 to 100 pounds of grain and vetch per acre in the proportion of 30 to 40 per cent grain and 60 to 70 per cent vetch is the usual seeding mixture.

Most of the young filbert orchards were planted on soil that possessed high native fertility. Doubtless this explains the nominal expense for soil fertility upkeep. Equally or perhaps even more important than fertility, however, is the factor of the moisture-holding capacity of the soil, for owing to light summer rainfall in Oregon the filbert tree makes its growth and matures a crop by drawing on stored soil moisture. Cover crops supply humus, which in turn not only improves tilth and fertility, but also tends to maintain the moisture-holding capacity.

It is believed that the prominence of cover cropping among the fertility-upkeep practices is fully justified and in fact should be increased. It should be pointed out, however, that cover cropping can be harmful as well as beneficial. Unless the cover crop is turned under before it begins to rob the soil of its stored moisture, considerable damage to the trees may result.

Care of trees. Costs incident to pruning and training, control of rodents, replacing dead trees, restaking, and similar miscellaneous operations have been grouped under the heading "Care of Trees." These operations cost on the average $7.35 per acre for the entire five-year growing period. Of this cost, 55 per cent was for man labor and 41 per cent was for replacement trees. The remaining 4 per cent covers items such as use of machinery, use of automobile to haul trees and materials, poison for rodents, traps, shotgun shells, etc.

An annual average of 3.2 man hours per acre was required to perform tree-care operations. Of this labor, about 63 per cent was for pruning and training, 20 per cent was for replacing dead trees, and 17 per cent was for all other operations such as rodent control, hauling water, restaking, etc.

On the average, approximately 6 per cent of the filbert trees set out are killed by sun scald, gophers, freezing, or other causes before they reach bearing age. As noted above, the cost of purchasing replacement trees and setting them out accounts for about half the cost for care of trees. In some instances tree losses were negligible while in other instances they were as high as 15 to 20 per cent. Growers using trunk protectors were unanimously of the opinion that these protectors served to reduce tree losses.

Harvesting nuts. In the second year some of the young orchards began to produce a few nuts. From the second to fifth years the percentages of the orchards yielding nuts were 10 per cent, 44 per cent, 85 per cent, and

88 per cent, respectively. For those orchards that yielded, the production per acre by years was 5. 7 pounds, 25.5 pounds, 55 pounds, and 171 pounds.

The harvesting of the nuts from the young orchards was practically all contract work. Prices for picking up varied from 1 to 3 cents per pound, while the cost of artificial drying varied from $5 to $10 per ton. Many of the nuts were dried in the open at no cash expense.

CASH AND NONCASH COSTS OF GROWING A FILBERT ORCHARD

The cost of growing a filbert orchard is not, as a rule, wholly a cash or out-of-pocket cost. Some filbert-orchard owners, it is true, have paid cash for all the work incidental to growing the orchard. Most of these owners are not living on and actually operating a farm, but are growing filbert orchards chiefly for investment purposes. The majority of the young filbert orchards, however, are located on farms where the farmer and his family have done much if not all the work incidental to setting and caring for the orchard.

Table 5. CASH AND NONCASH COST OF GROWING A FILBERT ORCHARD TO BEARING AGE (SIX YEARS) 1928-1934

Cost item	Five year growing cost per acre		
	Total	Cash	Noncash
Operator and family labor	$ 23.62	$	$ 23.62
Hired labor	13.55	13.55	.....
Contract labor	5.13	5.13	.....
TOTAL MAN LABOR	$ 42.30	$ 18.68	$ 23.62
HORSE LABOR	$ 5.35	.....	$ 5.35
FILBERT TREES	$ 42.30	$ 40.66	$ 1.64
Taxes	7.39	7.39	.....
Tractor operation (gas, oil, repairs)	5.09	5.09	.....
Cover crop seed	2.59	2.59	.....
Manure	.96	.30	.66
Commercial fertilizer	1.69	1.69	.....
Stakes and tying material	.46	.46	.....
Replacement trees	2.58	2.54	.04
Protectors	.48	.48	.....
Other miscellaneous costs	.41	.15	.26
TOTAL MISCELLANEOUS	$ 21.65	$ 20.69	$ .96
TOTAL DEPRECIATION	$ 5.49	.....	$ 5.49
TOTAL INTEREST	$ 57.13	.....	$ 57.13
GROSS GROWING COST	$174.22	$ 80.03	$ 94.19
Credit for filberts produced	$ 21.20	$ 21.20	.....
NET GROWING COST	$153.02	$ 58.83	$ 94.19

CASH COST = 38.4 per cent of Total Net Growing Cost.

Major cost items considered as noncash were the labor of the farm operator and unpaid members of his family, farm horse labor, home-raised trees, depreciation, and interest. The justification of classifying all interest as a noncash cost may be open to question, but it was so classified because accurate data on the proportion of farm indebtedness chargeable to the fil-

bert orchard was virtually impossible to obtain. It is believed, moreover, that indebtedness is not an important factor on the average filbert farm.

The average net cash cost of growing the young filbert orchards studied was $58.83 per acre, or 38.4 per cent of the total net growing cost. The expenditure for hired labor, trees, taxes, tractor operation, and cover-crop seed accounts for about 93 per cent of the cash outlay (Table 5). The net cash cost was found to vary considerably from farm to farm. The chief items accounting for this variation were tree costs and the amount of labor hired. Closely planted orchards (15'x15', or similar close spacing) set and cared for entirely by hired labor required the heaviest cash outlay per acre.

During the first year the extreme variation in cash costs per acre were from $156 to $1.67. The $156 cost was for a 6-acre orchard of purchased grafted trees set 14'x14' with half the labor of planting and care hired. The $1.67 cost was for a 6-acre orchard of home-raised tip-layered trees set 20'x20' and planted and cared for entirely by the farm operator and unpaid members of his family.

About two-thirds of the orchards reported net cash cost per acre of from $66 to $35 for the first year. Such costs are more representative than the extremes just noted, for they indicate what the majority of growers expend in cash. The extremes, on the other hand, point out the results of diverging from prevailing practices.

During the second to fifth years the annual gross cash cost of growing the young filbert groves varied from $17.67 to zero. Commencing in the fourth year, moreover, appreciable cash credits were available from the sale of nuts produced, which served to materially reduce the net cash expense. During the fourth year 38 per cent of the groves showed a cash credit greater than cash growing cost and during the fifth year 87 per cent showed a cash credit greater than the cash growing cost. In other words, by the fifth year the majority of the growers were selling enough filberts more than to pay all cash expenses. In fact, 25 per cent of the growers produced enough filberts during the fifth year to meet both cash and noncash growing costs.

The preceding discussion of variation in cash costs indicate that low cash growing costs are possible. Low cash costs are usually associated with orchards set out on established farms where much of the work of growing the orchard can be done by the farmer and his family. It is believed that this is an important factor in the future development of the filbert industry. When filberts can be grown as an enterprise in a diversified system of farming without an excessive cash capital outlay not only is a tendency toward concentration in such locations probable, but, as pointed out in the discussion on pages 16-19, such a concentration of the industry is already apparent. Such orchards can be cared for with the tillage tools and power used for the general farm operations and when in bearing should produce filberts at low total and cash costs per pound.

VARIATION IN FILBERT ORCHARD GROWING COSTS

Variation in cost from year to year. The dollar cost of growing a filbert orchard varies from year to year, for the cost of items such as trees, man labor, machinery operation costs, and cover-crop seed is continually changing. Growers who set out a planting when prices for labor and ma-

terials are favorable may find that considerable change has occurred before the orchard comes into bearing. Throughout this discussion references are made to quantity costs as well as dollar costs so that any scale of prices may be applied to the data. In this way, dollar costs may be determined for future periods when prices are either greater or less than during the 1928-1934 period.

Variation in cost during the same period. In addition to year-to-year variations in growing cost owing to changing prices of materials and labor, growing costs also vary from farm to farm during the same year owing to differences in growing methods or in efficiency of performing various operations. For example, some growers cultivate more than others; some cover crop or spread manure while others do not; and some put in several hours in pruning or training the trees while others do very little pruning or training.

For the twenty young orchards studied, it was found that first-year growing costs ranged from $27.00 per acre to $186.50 per acre. During subsequent years, gross annual costs ranged from $3.56 to $48.17 per acre, while annual net costs that allow a credit for all nuts produced varied from a credit of $38.00 to a cost of $48.17 per acre. The credit just noted occurred during the fifth growing year. In contrast to these wide variations, it was found that during the first year 63 per cent of the orchards were grown at a gross cost that was within a range of 20 per cent above or below average. During subsequent years, an average of 54 per cent of the orchards reported gross costs which were within a range of 20 per cent above or below average.

The rather spectacular variations that occur, as well as the large number of orchards reporting similar costs, suggest the possibility of discovering by analysis of costs for individual orchards more economical methods of growing young orchards than are now used by many growers. A later section of this bulletin is devoted to such an analysis.

In considering growing costs, filbert growers should remember that they are making a long-time investment. It is necessary, therefore, to consider carefully the quality as well as the cost of the orchard. Economy in growing costs is desirable only when such economy can be attained without injury to the quality of the planting.

MAJOR FACTORS INFLUENCING THE COST OF ESTABLISHING A FILBERT ORCHARD

Two factors—namely, the planting system and the value of the unplanted land—are outstanding in their effect on the cost of establishing the average filbert orchard.

PLANTING SYSTEMS USED FOR FILBERT ORCHARDS

Planting plans and tree spacings for bearing orchards, young orchards, and intended future plantings are shown in Table 6. This table shows a definite trend away from irregularly spaced rectanglar plantings to regularly spaced square and diagonal plantings. Another very definite trend is toward wider spacings, with 25-foot spacings planted on the square or diagonal being especially favored.

Table 6. PLANTING DISTANCES AND PLANS USED WHEN PRESENT BEARING ORCHARDS WERE SET AS COMPARED TO THOSE USED IN PRESENT-DAY YOUNG ORCHARDS AND INTENDED PLANS AND DISTANCES FOR FUTURE PLANTINGS

Planting plan and distance	For orchards now in bearing		For present-day young orchards		For future plantings	
	Number of orchards	Percentage of total	Number of orchards	Percentage of total	Number of orchards	Percentage of total
Feet		*Per cent*		*Per cent*		*Per cent*
Square						
14 × 14	....	....	1	3.2	....	....
15 × 15	....	....	1	3.2	2	3.1
16 × 16	1	1.6	....	....	2	3.1
18 × 18	2	3.1	2	6.4	....	....
19 × 19	2	3.1	....	....	1	1.5
20 × 20	22	34.3	6	19.5	10	15.5
21 × 21	....	....	1	3.2	....	....
22 × 22	8	12.5	3	9.8	6	9.2
23 × 23	....	....	1	3.2	....	....
24 × 24	6	9.4	2	6.4	8	12.3
25 × 25	8	12.5	8	25.9	23	35.6
28 × 28	....	....	....	....	2	3.1
Total for square plantings	49	76.5	25	80.8	54	83.4
Diagonal						
17 × 17	....	....	....	....	1	1.5
20 × 20	4	6.2	2	6.4	1	1.5
22 × 22	2	3.1	....	....	2	3.1
24 × 24	1	1.6	....	....	1	1.5
25 × 25	....	....	1	3.2	3	4.5
26 × 26	....	....	1	3.2	....	....
Total for diagonal plantings	7	10.9	4	12.8	8	12.1
Rectangular						
12 × 15	1	1.6	....	....	....	....
12 × 18	1	1.6	....	....	....	....
10 × 20	1	1.6	....	....	....	....
20 × 22	2	3.0	....	....	1	1.5
20 × 24	1	1.6	....	....	1	1.5
22 × 24	1	1.6	....	....	1	1.5
22 × 27	1	1.6	....	....	....	....
24 × 28	....	....	1	3.2	....	....
25 × 30	....	....	1	3.2	....	....
Total for rectangular plantings	8	12.6	2	6.4	3	4.5
GRAND TOTAL	64	100.0	31	100.0	65	100.0

Tree spacings. The subject of tree spacing always brings up the co-subject of tree thinning. Most growers using spacings of less than 20 feet in their young orchards expected to thin the trees when crowding commenced, while growers using spacings of 20 or more feet generally considered their planting as permanent. The chief argument used in favor of close planting is that returns during the early years are much greater, as there are more trees per acre and in effect close planting is comparable to intercropping.

The chief arguments against close planting are, first, that it is a rather costly method of using the land not required by the permanent trees, and secondly, that many growers will not remove the extra trees before they crowd and injure the permanent planting.

The average cost of planting a filbert tree, including the tree cost, amounted to 61 cents. The per-acre planting cost for a 15-foot spacing planted on the square would amount to $118 while the per-acre planting cost of a 25-foot spacing planted on the square would amount to $43. Obviously, close planting will add materially to the cost of establishing the grove. Whether subsequent returns will justify this cost could not be determined from this study, as there were not enough closely planted bearing orchards to yield reliable data.

The fact that in their future plantings the majority of growers intended to use wider spacing and plant only those trees desired for the permanent planting is believed to be significant. Until experimental evidence to the contrary is available, the experience of these established growers is probably the best available guide as to proper spacing.

Intercropping. The profitable use of land in the orchard not occupied by the roots of the young trees has always been a problem. Formerly when the bulk of the plantings were spaced 20 feet or less this problem was not as acute as at present when more of the wider spacings are being used. As previously mentioned, some growers have sought to meet this problem by close planting with the intention of thinning the trees when they crowd. Others have attempted to grow berries or annual crops between the tree rows, while more than half of the growers are clean cultivating all the land in the filbert orchard.

The necessity for intercropping is often acute on the small farm. On such farms, it is often economically impossible to forego the production from even a five-acre tract for the six-year period necessary to bring a filbert orchard into profitable bearing.

Kinds of intercrops used. Strawberries and corn are the chief intercrops used in young filbert orchards, although in individual instances blackcaps, loganberries, field beans, kale, and millet were used. Owing to the fact that a filbert tree grows rather rapidly, the use of long-lived crops such as cane fruits must be carefully handled if the trees and the intercrop are to be prevented from competing for plant-food elements and moisture. If such an intercrop is especially profitable it is sometimes difficult for the farmer to judge correctly when it should be removed.

The effect of intercropping on growing cost. Filbert growing costs for intercropped orchards were computed on the basis that the intercrop would carry all costs incidental to its production, including interest and taxes on the land actually occupied. When considered on this basis intercropping re-

duces the gross cost of growing the young filbert orchard very materially (Table 7). Approximately half of this reduction is in overhead items such as interest on the land and taxes. On the intercropped orchards, only 26.2 per cent of the soil area in the orchard was used by the filbert trees as compared to 100 per cent in the nonintercropped orchards.

The practice of intercropping did not appear harmful to the filbert trees. In fact, the intercropped orchards produced more nuts by the end of the fifth year than the nonintercropped orchards even though they had a few less trees per acre. This, however, is believed to be largely accidental. As long as the basic principle of intercropping is followed—namely, *do not allow the intercrop roots to compete with the filbert roots for plant food elements and moisture*—it is believed that no harmful effects are likely to result from this practice.

Value of Unplanted Filbert Land

Land acquires value because of its productivity and location. Filberts are not a bulky crop and are easily delivered to market even if the orchard is several miles from town. There is no occasion, moreover, to haul any quantity of materials from town to the orchard. Hence, any location value attached to a tract of filbert land above a nominal amount to cover all-weather roads, schools, telephone, electric lines, etc., is likely to be a burden that serves to increase costs without commensurate benefits.

Table 7. THE EFFECT OF INTERCROPS ON THE TOTAL COST OF GROWING FILBERT ORCHARDS 1928-1934

Cost item	Orchards with filbert trees only	Orchards with filbert trees and intercrop	All orchards (20)
TOTAL MAN LABOR	$ 46.82	$ 37.61	$ 42.30
TOTAL HORSE LABOR	$ 5.38	$ 5.28	$ 5.35
FILBERT TREES	$ 45.03	$ 38.83	$ 42.30
Taxes	$ 9.06	$ 5.82	$ 7.39
Cover-crop seed and fertilizer	5.76	4.37	5.24
Tractor operation	8.02	1.91	5.09
Other miscellaneous costs	4.69	3.35	3.93
TOTAL MISCELLANEOUS	$ 27.53	$ 15.45	$ 21.65
TOTAL DEPRECIATION	$ 8.50	$ 2.13	$ 5.49
TOTAL OPERATION EXPENSE	$133.26	$ 99.30	$117.09
Interest on land	$ 47.49	$ 21.10	$ 34.92
Interest on growing costs	20.83	18.48	19.68
Interest on machinery and equipment	4.01	.85	2.53
TOTAL INTEREST	$ 72.33	$ 40.43	$ 57.13
GROSS GROWING COST	$205.59	$139.73	$174.22
Credit for filberts produced	$ 14.78	$ 31.14	$ 21.20
NET GROWING COST	$190.81	$108.59	$153.02
Percentage of farms in each group	61.3%	38.7%	100.0%
Percentage of orchard land area used by filberts	100.0%	26.2%	63.1%
Average size orchard (acres)	8.3	12.0	10.6

Variations in the value of unplanted filbert land in the communities covered by this study are shown in Table 8. It is believed that much of this variation can be attributed to differences in location rather than differences in the productive value of the soil, although, as will be shown later, there was considerable variation in the kinds of soils. Many of the high values for unplanted land were from semisuburban districts inhabited mostly by part-time farmers who live on small tracts and work off the farm for most of their living. These farmers have in many instances planted filberts because this crop promised more income at less expense and trouble than alternative crops. Such plantings are a very definite factor in the present Oregon filbert industry and have, therefore, been included in this study.

Table 8. VARIATION IN THE VALUE PER ACRE OF CLEARED BUT UNPLANTED FILBERT LAND
(For 76 filbert farms in the Willamette Valley)

Value of unplanted filbert land per acre	Average value per acre	Number of farms	Percentage of total farms
			Per cent
$100 and less	$ 94	21	31.3
$101 to $150	137	21	31.3
$151 to $200	195	14	20.9
$201 and over	344	11	16.5
TOTAL and AVERAGE	$164	67	100.0

It is recognized that in most cases the filbert enterprise is not the determining factor in the kind or value of land purchased for a farm, for as a rule filberts are only a minor enterprise. Each year, however, some people do buy farms with the definite intention of establishing a substantial planting of filberts. In such cases particular care should be given to obtaining an economically priced unit.

High-valued unplanted filbert land is a distinct handicap to establishing an orchard at a low cost or to producing filberts at a low cost after the orchard attains bearing age. More than 60 per cent of the farmers cooperating in this study indicated that in their communities unplanted land of a

Table 9. VALUE PER ACRE OF CLEARED BUT UNPLANTED FILBERT LAND BY CHIEF SOILS
(For 54 filbert farms in the Willamette Valley)

Predominating soil series in filbert orchards	Number of farms	Average value of unplanted land per acre
Bottom and valley-floor soils		
Chehalis	7	$225
Newberg	3	211
Willamette	28	151
Hill soils		
Powell	5	153
Olympic	7	135
Melbourne	4	106

Note: Of the 67 orchards studied 54 were planted on one or more of the 6 soil series noted above. The other 13 orchards were planted on 6 other soil series. Of these 6 soils 4 are of questionable adaptability for orchards owing to lack of depth or drainage, while for the other 2 there were not enough orchards on each to give a reliable average.

quality comparable to the land they already had planted could be purchased for $150 per acre or less. This value is in line with the general productive value of the better grades of Willamette Valley soils. It is believed, therefore, that a purchaser seeking land on which to plant filberts can, if he so desires, obtain such land at a price that represents very largely production rather than location value. The prospective grower should realize, of course, that some land may have a high productive value for one crop but be virtually worthless for another. A complete description of the characteristics of soils adapted to filbert growing is given in Oregon Extension Bulletin 503.

The entire soil area covered by the filbert study has been surveyed and classified by federal and state soil-survey agencies during the past 17 years. By use of these classifications the filbert orchards studied were grouped according to the predominating soil in each orchard, and the value of unplanted land was computed for each soil group. These values are shown by Table 9 for the six soils found most frequently in the 67 orchards studied.

Highest values for individual soils were associated with bottom and valley-floor soils of the Chehalis, Newberg, and Willamette series. The bottom and valley-floor soils as a group, moreover, were more highly valued than the hill soils. The soundness of these relative values is confirmed by Table 19, which shows the effect of soil on yields from bearing orchards.

Variations in the value of unplanted land similar to those shown in Table 8 are also found within the same soil series. For example, although the average value of the Chehalis soils was $225 per acre, values ranged from $100 to $500 per acre. In other words, even though the better filbert soils as a group are more highly valued than less suitable filbert soils, such soils are still subject to overvaluation from the productive standpoint. If profit is the motive for planting filberts prospective growers can well afford to buy good soil a few miles from town in preference to fair or inferior soil at the same price, but located "close in."

OTHER FACTORS AFFECTING THE COST AND SUCCESS OF THE FILBERT PLANTING

Experienced horticulturists do not generally consider the growing of a filbert orchard to be an especially difficult or intricate job. Nevertheless many growers have come to appreciate the meaning of the adage "There's many a slip 'twixt the cup and the lip" before they were through with the job of bringing their orchard to bearing age. Lack of attention at the proper time or the incorrect performance of one or more of the details involved in planting or caring for the orchard may often cause considerable added expense, and may also injure the orchard.

A recent Extension Service Bulletin (No. 503) gives in detail information concerning methods of growing a filbert orchard. These recommendations represent the best available knowledge on this subject that has been accumulated to date by the industry and technical agencies. It is believed that these recommendations should be followed as closely as local conditions will permit.

COST OF PRODUCING FILBERTS

The cost of producing filberts from orchards 6 or more years old was studied during 1932 and 1933. The costs as finally determined include all items such as labor, materials, taxes, etc., for which cash was paid, as well as an allowance for noncash items of cost such as the labor of the farmer and members of his family, farm horse labor, depreciation, and interest at 5 per cent on the investment in the filbert enterprise. All per-pound costs pertain to field-run dry weights, which include culls as well as merchantable nuts. The costs as presented include all expense incurred up to the time the nuts are delivered to the packer.

For 1932 the study included 32 orchards containing 383 acres which produced 151,325 pounds of filberts. The average age of these orchards was 9 years. There were 101 trees per acre, and the average yield of filberts was 395 pounds per acre.

For 1933 the study included 45 orchards containing 553 acres, which produced 437,312 pounds of filberts. The average age of these 45 orchards

Table 10. COST OF PRODUCING FILBERTS, 1932 AND 1933 CROPS

(Data for 1932 are from 32 orchards, containing 383 acres which produced 395 pounds of filberts per acre. Data for 1933 are from 45 orchards, containing 553 acres which produced 791 pounds of filberts per acre.)

Cost item	Cost per acre		Cost per pound	
	1932	1933	1932	1933
Labor				
Man labor, nonharvest operations	$ 5.58	$ 5.50	1.4¢	.7¢
Man labor, harvest operations	5.46	13.41	1.4	1.7
TOTAL LABOR	$11.04	$18.91	2.8¢	2.4¢
TOTAL HORSE LABOR	$ 1.37	$ 1.26	.3¢	.2¢
Materials and miscellaneous				
Taxes	2.18	2.31		
Tractor operation	1.43	1.68		
Cover-crop seed and manure	1.11	.86		
Use of auto and truck	.29	.33		
Other miscellaneous items	.24	.53		
TOTAL MATERIALS AND MISCELLANEOUS	$ 5.25	$ 5.71	1.3¢	.7¢
Depreciation				
Depreciation on tractor	1.43	1.22		
Depreciation on other machinery and equipment	.55	.59		
Depreciation on dryer	....	.16		
Depreciation on other buildings	.09	.06		
TOTAL DEPRECIATION	$ 2.07	$ 2.03	.5¢	.2¢
Interest at five per cent				
Interest on bearing orchard	31.85	30.69		
Interest on tractor	.53	.36		
Interest on other machinery and equipment	.21	.22		
Interest on dryer	....	.08		
Interest on other buildings	.05	.03		
TOTAL INTEREST	$32.64	$31.38	8.3¢	4.0¢
TOTAL COST	$52.37	$59.29	13.2¢	7.5¢

was 10 years; they were also planted at the rate of 101 trees per acre; and produced an average yield of 791 pounds of filberts per acre. The orchards studied in 1933 included 27 of the orchards studied the previous year.

In analyzing the costs incurred in producing filberts considerable variation was found in the type and character of expenditures. For example, some growers cover cropped and some did not; some used one method of tillage and others used different methods. In considering the costs that are presented on the following pages as an average for all the acreage studied, the reader will obtain a clearer understanding of the data if the entire acreage included in the study is visualized as one large planting. For all important items, costs are also shown for those orchards that actually incurred the expense so that it can be determined just what each operation or item actually cost wherever it was used in producing filberts. Another important feature of the cost discussion herein presented is that costs are shown both in *quantities* and *dollars*. If desired, therefore, the dollar costs can be brought up to date at any time in the future by substituting current prices for the prices prevailing at the time this study was made.

The total per-acre and per-pound costs of producing filberts for 1932 and 1933 are presented in Table 10. For 1932 the per-acre and per-pound costs were $52.37 and 13.2 cents respectively, while in 1933 these costs were $59.29 per acre and 7.5 cents per pound.

The slightly higher per-acre costs and the drastically lower per-pound costs in 1933 as compared to 1932 are chiefly the result of the heavier yields obtained in 1933. Table 10 shows that most of the difference in per-acre costs was due to an increased cost for man labor for harvest operations. In other words, except for harvesting, the large 1933 crop was no more expensive to produce per acre than the smaller 1932 crop, but owing to the higher yield per acre the cost per pound was much less than in 1932.

It is believed that the 1933 filbert crop was fairly representative of normal production for the Willamette Valley. The remainder of the filbert-cost discussion will therefore be limited chiefly to an analysis of the 1933 costs. Production data for the years 1934, 1935, and 1936 which were obtained for approximately 63 per cent of the farms included in the study show the following per-acre yields; 1934, 808 pounds; 1935, 899 pounds; 1936, 952 pounds. Another factor to be considered is that many of the orchards included in the study had just reached their sixth growing year in 1932 or 1933, while the acreage of orchards 15 years or older was very limited. As Oregon filbert orchards become more mature, larger yields for the enterprise as a whole are likely.

MAJOR ITEMS OF COST IN PRODUCING FILBERTS IN 1933

The items of man labor and interest at 5 per cent on the filbert-enterprise investment accounted for 85 per cent of the cost of producing filberts. Materials, miscellaneous items such as taxes and use of automobile, and depreciation accounted for the remaining 15 per cent of the production cost. Owing to their domination it is to interest and man labor that the grower must look for any major economies in per-acre production costs.

The filbert orchard investment. Interest at 5 per cent on the bearing filbert orchard investment of $628 per acre amounted to $31.38 and account-

ed for slightly more than half the total cost of producing filberts. Of the total investment almost 98 per cent is in the bearing orchard itself (Table 11).

The bearing orchard investment. The average value of the bearing filbert orchard, which represents the owner's estimate of the normal market price of orchards of similar quality in his neighborhood, amounted to $614 per acre and is almost twice as much as the average cost of establishing a filbert orchard. In other words, most of the present-day bearing orchards could be replaced at a cost considerably below their current market value. The high value placed on bearing orchards is probably due (a) to the good profits returned by high-quality orchards during the early development of this industry; (b) to the fact that filbert groves are usually a unit in a diversified farm and if sold independently of the entire farm tend to disrupt the farm layout; and (c) to the inclination of buyers to pay something extra for a proved going orchard rather than take the time and accept the risks involved in growing the orchard.

Table 11. THE BEARING-FILBERT-ORCHARD INVESTMENT
(For 45 orchards studied during 1933)

Investment item	Number of orchards reporting the item	Per orchard reporting		Average investment per acre of bearing filberts (all orchards) (45)	Percentage of total investment
		Average investment per orchard	Average investment per acre of bearing filberts		
Bearing orchard	45	$7541.00	$ 614.00	$ 614.00	97.8
Tractor	26	163.00	11.00	7.00	1.1
Other machinery and equipment	40	62.00	5.00	4.00	.6
Drier	12	77.00	9.00	2.00	.3
Other buildings	10	33.00	2.00	1.00	.2
TOTAL	....	....	....	$ 628.00	100.0

It is believed that many farmers do not actually have the money invested in their orchards that the market values reported would indicate, and are therefore actually producing filberts at costs below those disclosed by this study.

Tractor and machinery investment. The low investment per farm and hence the low interest charge for items such as tractors and tillage implements are due to the fact that only a portion of the use of these machines is charged to the filbert enterprise, the remainder being carried by the other farm enterprises associated with filberts in the farm set-up. Here again the advantage of growing filberts on a diversified farm is clearly apparent.

Drier investment. Driers were found on only 12 of the 45 farms studied. The average value of these 12 driers was $77 (Table 11). The remaining farms either dried the nuts in the open or hired the drying done by a commercial drierman. Of those having driers only three had built these structures specifically for filbert drying. The most common practice was to build trays out of lumber and hardware cloth, and to rack these in a brooder house, old shed, or similar building. Heat for these improvised driers

was usually supplied by old wood stoves, brooder stoves, or similar equipment of low cash value. The average value of these improvised driers was about $45 each, while of the special driers one cost $100 and the other two, which were much larger, cost $300 each.

It is believed that in the future artificial drying will be more universally practiced than in the past, for as production and competition increase growers will be forced to deliver to the packer nuts of high quality and fairly uniform moisture content. Whether this will result in more commercial drying or more driers on filbert farms cannot be forecast with any degree of accuracy.

Other building investment. Other buildings used for filberts consist chiefly of machine sheds or barns used to store machinery or equipment used in filbert growing. Only 10 farms reported the use of such buildings. These buildings are usually found only on farms with the larger plantings and even then the investment charge applies to but a part of the buildings. On small plantings the building charge for equipment storage is too minor to justify calculation.

Labor costs. The cost of labor amounted to $18.91 per acre and accounted for approximately 32 per cent of the cost of producing filberts. Nonharvest operations accounted for 29 per cent and harvest operations for 71 per cent of this labor cost (Table 12). This cost includes the out-of-pocket expense for all work hired or contracted and in addition current wages for any work performed by the farmer or members of his family.

Table 12. DISTRIBUTION OF LABOR COSTS USED IN PRODUCING FILBERTS, BY TYPES OF LABOR
(For 1933 crop from 45 orchards)

	Hours per acre of labor other than contract	Cost per acre for labor other than contract	Cost of contract labor per acre	Total cost of labor per acre	Percentage of total labor cost
	Hours				*Per cent*
Nonharvest operation	20.3	$ 4.84	$ .66	$ 5.50	29.1
Harvest operations	18.2	4.00	9.41	13.41	70.9
TOTAL	38.5	$ 8.84	$10.07	$18.91	100.0

Approximately 53 per cent of the labor cost is for contract work of which contract picking is the outstanding item. The remaining 47 per cent is for day or hour work, which is fairly evenly divided between nonharvest operations such as tillage, suckering, and fertility upkeep, and harvest operations such as overseeing, picking, hulling, and drying.

Day and hour work. Aside from work contracted, producing a crop of filberts required 38.5 hours of man labor per acre (Table 12). Of this labor 11 hours was hired; 19.5 hours was work done by the farmer; and 8 hours was put in by unpaid members of his family. On the average the hired labor cost 21.8 cents per hour; the farmer's labor was valued at 24 cents per hour; and the unpaid family labor was valued at 21.9 cents per hour. Much of the family labor was for work such as hulling and gleaning which is difficult to hire or contract and obtain satisfactory performance.

Contract work. Harvest operations accounted for about 93 per cent of the contract work. The type and amount of work contracted, and the average and extreme low and high rates paid for this contract work are shown by Table 13. Nonharvest operations are usually not contracted except when the orchard is operated by an absentee owner or when it is on a farm too small to justify ownership of tillage tools. In contrast picking is almost always contract, for it is usually too big a job for the farmer and his family to handle and is ideally suited to this type of hiring.

Aside from the harvest operations of picking, hulling, drying, and hauling, contract rates are largely a result of individual bargaining between neighbors. Variations in rates such as shown for disking (Table 13) occur because of differences in supply and demand for outfits to do such work. Rates for harvest operations are fairly definitely established, however, and in any given community tend to be rather uniform for the same type of work. For picking the most common rate was 1 cent per pound (green weight), but on the final clean-up rates of 3 and 4 cents were common owing to the light drop. Drying rates vary by communities and are largely set by the commercial driermen. Hauling rates vary with the length of haul, amount of load, kind of road, and other pertinent factors.

Table 13. AMOUNT OF AND RATES FOR CONTRACT LABOR USED IN PRODUCING FILBERTS
(For 1933 crop from 45 orchards)

Operation	Number of orchards reporting	Number and kind of units of contract work	Average cost per unit contracted	Range in cost per unit contracted	Average cost of contract work per acre (all orchards-45)
Disking	8	262 acres	$ .92	60¢–$1.50	$ .44
Plowing	2	15 acres	$2.33	$2.00–$2.50	.06
Spring-tooth harrowing	1	30 acres	$ .40	.....	.02
Suckering	1	3,200 trees	2½¢	.....	.14
TOTAL FOR NONHARVEST OPERATIONS	....	.....	.....	.....	$ .66
*Picking	36	415,959 pounds	1.04¢	¾¢–4¢	$ 7.84
†Hulling	2	961 pounds	1.15¢	1¢–1½¢	.02
‡Drying	14	94,387 pounds	.6¢	½¢–1¢	1.03
Hauling	25	144.3 tons	$1.98	75¢–$4.65	.52
TOTAL FOR HARVEST OPERATIONS	....	.....	.....	.....	$ 9.41
TOTAL FOR ALL CONTRACT WORK	....	.....	.....	.....	$10.07

* The contract picking rate is for field-run nuts as picked up. Orchard weight is usually referred to as "green weight".

† In some cases hulling and picking were performed at the same time, and in these cases the hulling cost is covered by the picking cost. Aside from the Du Chilly variety hulling is seldom required.

‡ The drying rate is based on the weight of the sacked nuts as they come from the dryer. Such weight is referred to as "dry weight".

Seasonal distribution of labor. A virtue of the filbert enterprise is that the labor requirements do not seriously interfere with the labor requirements of the grain and hay crops commonly grown on Willamette Valley diversified farms. The big job in the filbert orchard is at harvesting time, which usually comes during the latter part of September and the fore part of October (Figure 7). At that time hay and grain crops are all harvested

and farmers are concerned with fall plowing and seeding, which are not usually rush jobs. Much of the filbert harvest is contract work, and jobs such as overseeing, washing, drying, and hauling from the orchard, which are not contracted, can often be performed by some member of the family other than the operator, especially where the operator can give them intermittant attention.

Table 14. MONTHLY DISTRIBUTION OF LABOR FOR A 12-ACRE BEARING FILBERT ORCHARD
(Based on average labor program for 45 orchards studied during 1933)

Month and chief type of work	Hours of day and hour work	Estimated number of hours required to perform contract work	Total hours of labor for month
	Hours	*Hours*	*Hours*
January—Pruning	7.0	....	7.0
February—Pruning	7.0	....	7.0
March—Manuring, pruning	15.9	....	15.9
April—Sucker, plow or disk	62.9	3.2	66.1
May—Horse or tractor cultivation, spade or hoe tree rows	42.3	2.3	44.6
June—Horse or tractor cultivation	26.3	2.0	28.3
July—Horse or tractor cultivation	15.7	....	15.7
August—Horse or tractor cultivation, rodent control	9.8	....	9.8
September—Sucker, rodent control, cover crop, prepare for picking, start harvest	168.6	196.2	364.8
October—Picking, washing, drying, hauling*	105.4	193.7	299.1
November—Usually no work performed	....	....	....
December—Cut and haul drier wood	2.1†	....	2.1†
TOTAL	463.0	397.4	860.4

* Harvesting starts during the latter part of September and is usually completed by mid-October.

† For filberts dried by operator by use of artificial heat. In 1933 only 18 per cent of the crop was dried in this manner.

Aside from harvesting, the monthly labor requirements of operating an average-sized bearing filbert orchard (12 acres) are nominal. Suckering, which is frequently done in April and again in September, requires about 7.6 man hours of labor per acre per year or 91 hours per season for an average 12-acre orchard. Aside from suckering, which accounts for about one-third of the nonharvest work, plowing, disking, machine cultivating, and spading or hoeing around the trees where the plow cannot reach are the more important jobs (Table 14). Even in April and September when the nonharvest work is heaviest a 12-acre orchard will not require more than one-fourth of the farmer's time if he does all of this work himself.

The monthly distribution, as shown in Table 14 and Figure 7, is based on the most common time of performing the various labor operations incidental to filbert production. Many farmers will, of course, vary this labor program to fit the needs of their farm or to take advantage of especially favorable weather.

Horse-labor costs. An average of 9.7 hours of horse labor per acre which cost $1.26 was used in producing the 1933 filbert crop on the 45 orchards studied.

About half of the 40 farmers who did the machine work in the orchard in person or by means of family labor or a hired man used horses to pull

part or all of these machines. Of these farmers 68 per cent used horses for all of the machine work; 16 per cent used horses for most of the machine work except plowing and disking, which were done with tractors; and 16 per cent used horses only for a few minor hauling jobs and did the remainder of the machine work with tractors.

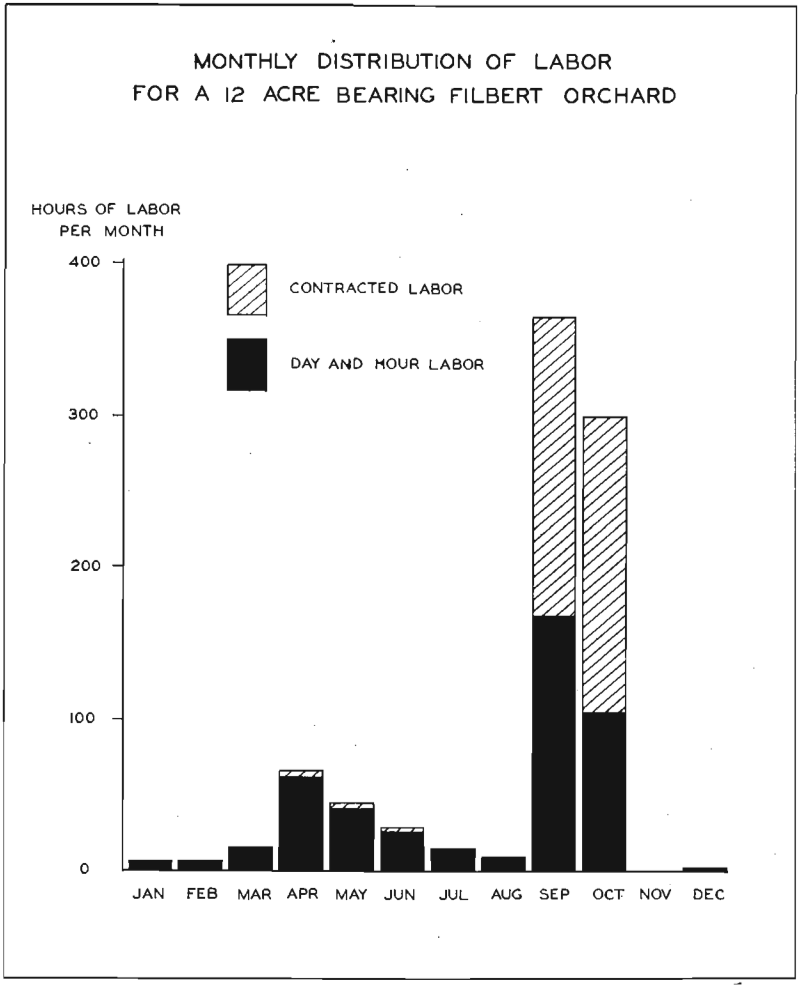

Figure 7. Monthly distribution of labor for a 12-acre bearing filbert orchard.

The use or nonuse of horses was determined almost wholly by the general type of farming followed, for only a few filbert orchards were large enough to become a factor in determining the kind of farm machinery or power that should be used.

All horse labor was charged to filberts at a flat rate of 13 cents per horse hour.* Those farmers who used horses for all of the machine work used an average of 36 hours of horse labor per acre during the season. Where both tractors and horses were used, the horse labor per acre was about half this amount.

Materials and miscellaneous costs. The cost of materials and miscellaneous items amounted to $5.71 per acre and accounted for 9.6 per cent of the cost of producing filberts. Of this cost 85 per cent was for four items; namely, taxes, tractor operation, cover-crop seed, and fertilizer. The extent to which these costs were incurred and the average cost per acre where they were incurred and for all the acreage studied is shown in Table 15.

Table 15. ITEMIZED MATERIALS AND MISCELLANEOUS COSTS USED IN PRODUCING FILBERTS
(For 1933 crop from 45 orchards)

Cost item	Number of orchards reporting the item	For orchards reporting the item		For all orchards (45)	
		Average quantity used per acre	Average cost per acre	Average quantity per acre	Average cost per acre
Taxes	45	.....	$2.31	.....	$2.31
Tractor operation	26	6.7 hours*	2.45	4.6 hours	1.68
Manure	8	5.3 tons	6.18	.5 tons	.60
Use of auto and truck	21	11.9 miles	.64	6.2 miles	.33
Cover-crop seed (vetch or peas and grain)	12	54.2 pounds	1.08	12.3 pounds	.25
Cover-crop seed (turnips)	2	.5 pounds	.10	.....	.01
Other miscellaneous items†	29	.....	.82	.....	.53
TOTAL	....	.....	.....	.....	$5.71

* On 5 of the 26 farms this tractor labor was supplemented by an average of 15.7 hours of horse labor per acre. This assistance from the horses did not lower the amount of tractor work put in, for the amount and cost of tractor work per acre averages the same for the entire 26 farms as it does for the 21 that performed all machine work by use of tractor power.

† Includes rifle and shotgun shells for shooting rodents, sacks, fuel for the filbert drier, general machinery repairs, tractor hire, rodent poison, hire of general machinery, repairs on drier, insurance on drier, and paint for treating pruning wounds.

Slightly more than half of the filbert orchards, but almost 70 per cent of the filbert acreage, was cared for by using tractors. Likewise, about half the orchardists used cars and tractors or trucks in operating their businesses. Fertility upkeep by means of manuring or cover cropping was practiced on but 26 per cent of the filbert acreage. A surprising fact concerning the cover cropping was the light rate of seeding practiced. Instead of seeding oats and vetch at the recommended rates of 80 to 100 pounds per acre, growers on the average actually seeded but 54.2 pounds of seed per acre. It is believed that additional expense for these fertility upkeep practices might be desirable.

Depreciation. Owing to the small investment in machinery and buildings that is chargeable to the filbert enterprise because it is usually located on diversified farms, the item of depreciation is of minor importance. For the entire acreage studied this cost averaged $2.03 per acre and accounted for 3.4 per cent of the total production cost (Table 16).

* Based on data presented in Bulletin 250, Oregon Agricultural Experiment Station, *Cost of Horse Labor on Oregon Farms.*

Of the 45 farmers cooperating in the study five hired or contracted all machine work and hence had neither investment in nor depreciation on tillage tools and other general equipment. Of the remaining 40 who did own machinery and equipment 53 per cent operated their filbert orchards with tractors, 32 per cent with horses, and 15 per cent with both tractors and horses. The type of tools and equipment used varied with the kind of power used. Driers and other buildings, the general character of which has already been discussed under the heading of investment, were found on about one-fourth of the farms, and owing to their low value do not add greatly to the depreciation item.

The rate of depreciation on general farm machinery such as plows, harrows, disks, etc., was charged at 13 per cent of the present value. On special equipment such as pails, sacks, traps for rodents, trailers, etc., the depreciation rate was based on the useful life of the equipment as estimated by the farmer. The combined depreciation rate for all other machinery and equipment, which includes these and similar items, amounted to 13.1 per cent. The depreciation on tractors, driers, and other buildings was also based on estimates by the farmer of the useful life for each individual machine or building. As shown by Table 16 the average depreciation rates were 16.5 per cent for tractors, 9.8 per cent for driers, and 10.2 per cent for other buildings.

Table 16. ITEMIZED DEPRECIATION COSTS ON MACHINERY AND EQUIPMENT USED IN FILBERT PRODUCTION
(For 1933 crop from 45 orchards)

Item	Number of orchards reporting the item	Rate of depreciation on present value	Average cost of depreciation per acre of bearing filberts for orchards reporting the item	Average cost of depreciation per acre of bearing filberts, all orchards (45)
		Per cent		
Depreciation on tractor	26	16.5	$1.86	$1.22
Depreciation on other machinery and equipment	40	13.1	.63	.59
Depreciation on drier	12	9.8	.88	.16
Depreciation on other buildings	10	10.2	.24	.06
TOTAL	....	....	....	$2.03

CASH AND NONCASH COSTS OF PRODUCING FILBERTS

An outstanding characteristic of filbert production is the low cash outlay required to grow and harvest a crop of nuts. Of the total production cost of $59.29 per acre only $17.57 or 29.7 per cent is cash or out-of-pocket cost. This cash cost amounts to but 2.2 cents per pound of harvested nuts (Table 17). The average filbert grower is therefore in a strong position temporarily to weather adverse economic conditions which result in low prices.

Low cash costs can be a detriment as well as a blessing. Unless growers generally recognize that over a period of years their returns must meet total production costs and not merely their cash costs the industry

cannot survive and prosper. With such low cash costs as prevail in the filbert enterprise there is danger that plantings will continue and competition increase until prices are forced to very low levels.

Any division of costs into cash and noncash groups must be more or less arbitrary. It is recognized, for example, that actually the operator labor and family labor are not entirely noncash in character, for the farmer must have some money income for this labor if he is to meet living expenses. Likewise, depreciation may not be entirely a noncash expense, for normally some replacement of machinery will take place every few years. The interest item also may become partly a cash expense if a mortgage exists. The division of costs as presented in Table 17 should therefore be considered as the minimum cash outlay required to produce a crop of filberts, or stated in another way the maximum amount that can be deferred if returns are inadequate to meet total costs.

Table 17. CASH AND NONCASH COSTS OF PRODUCING FILBERTS
(For 1933 crop from 45 orchards)

Cost item	Cash costs		Noncash costs	
	Per acre	Percentage of total cost	Per acre	Percentage of total cost
		Per cent		*Per cent*
Hired and contract labor	$12.46	21.1	$	....
Operator's labor	....	....	4.68	7.9
Unpaid family labor	....	....	1.77	3.0
TOTAL MAN LABOR	$12.46	21.1	$ 6.45	10.9
HORSE LABOR	....	....	$ 1.26	2.1
Taxes	2.31	3.9	....	....
Tractor operation	1.68	2.8	....	....
Cover-crop seed and manure	.26	.4	.60	1.0
Use of auto and truck	.33	.6	....	....
Other miscellaneous items	.53	.9	....	....
TOTAL MATERIALS AND MISCELLANEOUS	$ 5.11	8.6	$ .60	1.0
DEPRECIATION	....	....	$ 2.03	3.4
INTEREST ON FILBERT INVESTMENT (5%)	....	....	$31.38	52.9
TOTAL COST	$17.57	29.7	$41.72	70.3
COST PER POUND OF FILBERTS	2.2¢		5.3¢	

VARIATION IN THE COST OF PRODUCING FILBERTS

The cost of filbert production for 1932 and 1933 as presented in Table 10 illustrates very clearly how production costs may vary from year to year. On a per-acre basis this variation is usually narrow, but on a per-pound basis these variations are frequently wide. It is believed that the variations in cost from 1933 to date (1937) have been nominal, for yields have approximated 1933 yields and no radical change has occurred in labor and materials costs.

Production costs not only vary from year to year but also from farm to farm during the same year. Variations among the 45 orchards studied in 1933 are shown by Figure 8. These farm-to-farm variations are far more

significant than the year-to-year variations, for they denote differences in production efficiency, which are often subject to control by the orchard operator.

The array of costs shown by Figure 8 illustrates clearly why there is a continual farm problem. Even though a favorable relationship exists between average cost (7.5 cents per pound) and selling price, those producers with high costs were not making a profit. Because of this lack of profit they are likely to be highly dissatisfied with agriculture in general and the filbert enterprise in particular. The justification for such dissatisfaction is open to question when 8.9 per cent of the filbert growers were producing nuts for under 5 cents per pound, and more than a third of all growers were producing filberts for less than 7 cents per pound.

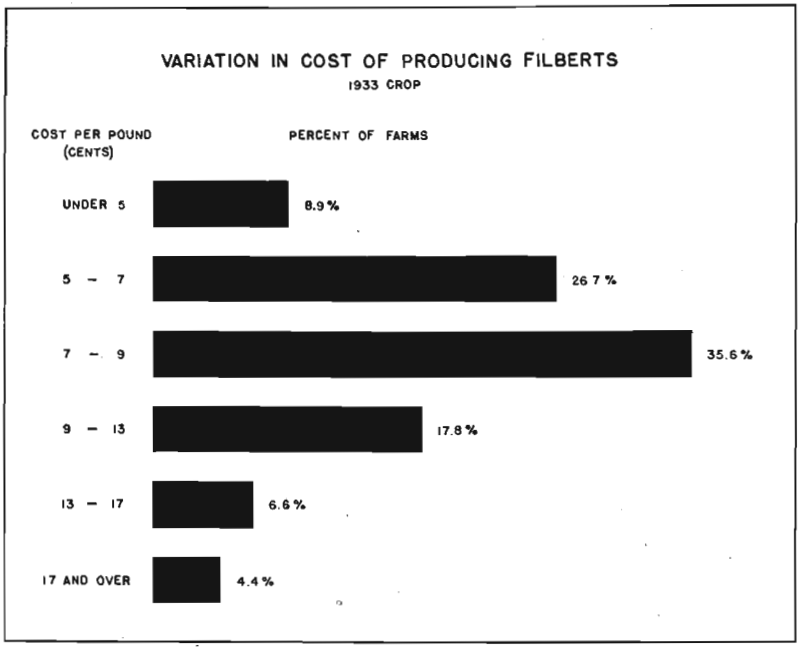

Figure 8. Variation in cost of producing filberts.

Wide variation in production cost between individual farms is characteristic not only of filberts, but also of most other farm enterprises. This variation is directly related to the fact that usually 50 per cent or more of the total cost of production of farm commodities is a noncash rather than a cash expense. As long as high-cost producers can meet their out-of-pocket costs and defer all or most of their noncash costs they may remain in business. Eventually, of course, when their machinery wears out or when prices fall below their cash costs of production, they are forced out of business.

When substantial groups of producers can and are producing filberts at a low cost it is believed that extremely high-cost production is largely

unnecessary. A major purpose of this study was to analyze the conditions associated with low-cost production, and to point out the major factors responsible for low costs. This analysis is presented in the following section of this bulletin.

MAJOR FACTORS INFLUENCING COSTS AND PROFITS

Analysis of the data obtained in this study reveals several factors that have a major influence on the cost of producing filberts. Of outstanding importance among these is the factor of yield per acre.

THE EFFECT OF YIELD ON THE COST OF PRODUCING FILBERTS

The cost per pound of producing filberts normally decreases as the yield per acre increases. This fact is illustrated by Figure 9, which shows the relation between yield per acre and production cost per pound for the 1933 crop. There is a very definite reason for this relationship. Of the total costs of production in 1933 approximately 75 per cent were incurred before any nuts were harvested. Obviously then if the yield is low each pound of nuts must bear a larger proportion of this nonharvest expense than if the yield is heavy. In the final analysis there is little difference between a low-producing filbert orchard and a factory running at less than full capacity. In either case the overhead costs, which must be paid regardless of the amount of salable product produced, are likely to wreck the business. While it is believed that most filbert growers recognize this fact, it is obvious that some have ignored it.

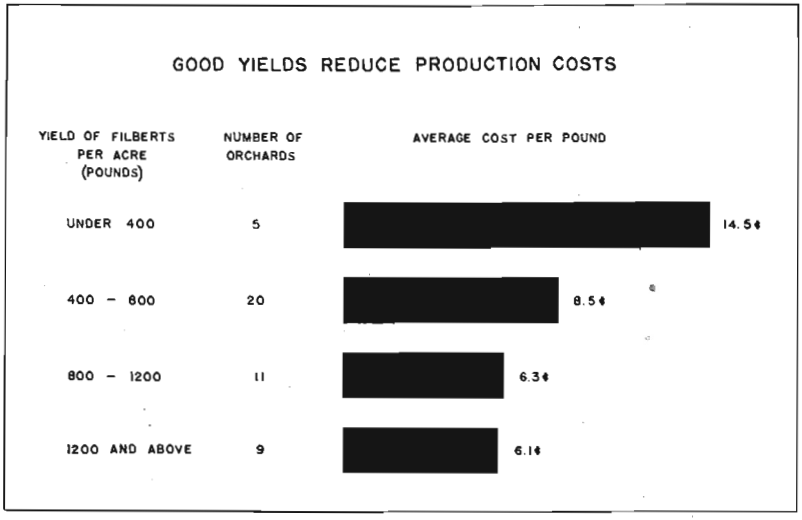

Figure 9. Good yields reduce production costs.

It may be possible to operate a low-yielding filbert orchard at a profit *provided* the capitalized value and the overhead interest costs can be reduced enough to offset the effects of this low yield. In 1933 approximately 52 per cent of the total cost of producing filberts consisted of interest at 5 per cent on the average bearing-orchard investment of $614 per acre. If, for example, a low-yielding orchard were valued at $100 per acre instead of $614 per acre, it might still be possible for the owner to compete with the owners of average-yielding orchards. Of course such a devaluation means that the person who grew or bought the poor orchard at full value is likely to lose a considerable part of his capital investment. Many purchasers of low-yielding orchards have discovered this fact after much of their savings have been dissipated. Owing to the uncertainty of production during future years it is believed to be extremely risky for any but the more experienced growers to attempt the purchase and operation of low-yielding filbert orchards.,

Table 18. THE EFFECT OF YIELD ON THE COST OF PRODUCING FILBERTS
(For a low-yield and an average-yield year, 1932 and 1933 crops)

1932 (a low-yield year)			1933 (an average-yield year)		
Yield of filberts per acre	Number of orchards	Average cost per pound of filberts	Yield of filberts per acre	Number of orchards	Average cost per pound of filberts
Pounds			*Pounds*		
Under 250	4	17.7¢	Under 400	5	14.5¢
250–400	14	15.9	400–800	20	8.5
400–550	5	11.2	800–1200	11	6.3
550 and above	9	10.2	1200 and above	9	6.1
ALL ORCHARDS	32	13.2¢	ALL ORCHARDS	45	7.5¢

The effect of yield on production costs per pound as shown by Figure 9 is not changed during a low-yield year (Table 18). The low yields obtained during 1932 resulted in very high individual and average costs per pound, but even so those growers with the better yields were the lowest-cost producers.

Table 19. EFFECT OF SOIL ON YIELD OF FILBERTS PER ACRE
(For 1933 crop from 45 orchards)

Kind of soil	Number of orchards	Average yield of filberts per acre	Average age of orchards
		Pounds	*Years*
Best bottom soils (includes soils of the Chehalis and Newberg series)	7	1022	11.6
Best valley-floor soils (includes soils of the Willamette series)	17	856	10.0
Other bottom and valley-floor soils (includes soils of the Amity, Sauvie and Veneta series)	6	815	10.4
Total for bottom and valley-floor soils	30	912	10.6
Hill soils (includes soils of the Olympic, Cascade, Melbourne, Powell, Carlton and Aiken series)	15	516	8.9
ALL ORCHARDS	45	791	10.1

Note: The soils listed above are the predominating soils found in the orchards studied. It should not be inferred that they are the only soils belonging in the groups listed.

The very beneficial effects of obtaining good yields may lead some to think that good yields are synonymous with success in making profits from filberts. Such a relationship is true, however, only when orchard values and production efficiency are in line with the average for the enterprise. Low costs per pound result only when high yields are associated with moderate per-acre costs.

Factors affecting yield. The importance of yield per acre as a factor affecting production cost suggests the desirability of giving close study to the factors responsible for variations in yield. The orchard records in 1932 and 1933 were carefully analyzed to determine the effect on yield of factors such as kind of soil, rate of planting, age of trees, and fertility upkeep. The relation of these factors to 1933 yields is presented in the following pages. Similar relationships were found for 1932.

Bottom soils are superior for filbert production. Filbert yields were found to be highest on medium- to heavy-textured, well-drained, bottom soils; next highest on similar textures of well-drained valley-floor soils; and lowest on hill soils (Table 19). These results are in line with other investigational results, which show that in general the fertility and available-moisture capacity of soils are less on valley-floor and hill soils than on the loam and clay-loam types of the well-drained bottom soils.

While the yield for hill orchards as a group was low, favorably located orchards returned yields comparable to the better valley-floor and bottom orchards. Likewise, some poorly located lowland orchards failed to produce the good yields that would be expected of orchards in such locations. These variations within the soil group indicate the need for careful study of each individual tract of soil before planting the filbert orchard.

Filberts, unlike other tree fruits and nuts, are not adversely affected by frosts which are more frequent on bottom than hill soils. Pollination occurs in late winter and early spring when below-freezing temperatures are frequent. Because of this characteristic filberts are ideally suited to take advantage of the superior productivity of bottom soils, where other similar crops can do so only at considerable risk of damage from frost or freezing.

The difference in yield between orchards located on bottom and valley-floor soils was much less than the difference between these two types of orchards and orchards located on hill soils (Table 19). Some of this tremendous spread may be due to the difference in age between the lowland and highland plantings, but at best this is of minor significance. Aside from the slight difference in age there is no apparent reason, other than the soil, to account for the fact that the bottom and valley-floor orchards produced 77 per cent more nuts than the hill orchards.

A factor that doubtless accounts for the poor showing of many hill orchards is the shallow depth of soil in these plantings. Past studies of hill-land fruit areas in Oregon have repeatedly brought out the fact that orchards were often planted on hill lands that were unprofitable to farm to grain. In the profitable grain-farming areas hill-land farmers did not turn to fruit growing but continued to grow grain. Subsequent soil studies have disclosed that the low grain yields and later the low fruit yields were probably due chiefly to the shallowness of the soil. From the filbert-yield records obtained it is quite apparent that to obtain high yields from hill soils it is necessary to have a very deep and fertile soil and preferably a north slope.

Soil drainage is believed to have a great influence on the yields obtained from the filbert orchard. Some bottom and valley-floor soils are not well drained, and the subsoil is saturated with water during most of the winter and spring. Growers seeking lowland soils for the purpose of planting filberts should carefully check this point by making borings, or their orchards may be very dissappointing. Frequently orchards planted on poorly drained soil appear to be very thrifty during the early years of growth. As the trees become larger, however, the root system fails to support the tree properly because the high water table limits the distribution of these roots. In effect the same results are obtained as if the orchard had been planted in a shallow soil.

Table 20. EFFECT OF AGE OF ORCHARD ON YIELD OF FILBERTS PER ACRE
(For 1933 crop from 45 orchards)

Age of bearing filbert orchard	Bottom and valley-floor soils			Hill soils		
	Number of orchards	Average age of orchards	Average yield of filberts per acre	Number of orchards	Average age of orchards	Average yield of filberts per acre
		Years	*Pounds*		*Years*	*Pounds*
Under 10 years	12	8.8	729	11	8.0	514
10 years and over	18	12.5	1,111	4	11.0	522
ALL ORCHARDS..	30	10.6	912	15	8.9	516

Table 21. TREND IN YIELDS FOR TWO GROUPS OF EVEN-AGED FILBERT ORCHARDS
(For 7 of the 50 orchards covered by filbert cost study)

Orchard number	Acres of bearing filberts	Predominating soil series	Age and yield per acre, by years						
			1936 13 years old	1935 12 years old	1934 11 years old	1933 10 years old	1932 9 years old	1931 8 years old	1930 7 years old
Group A			*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
8	5	Willamette	1049	1613	1170	1386	652	726	414
43a	4¾	Willamette	*	594	743	807	372	448	181
31	6	Amity	1211	1302	964	1040	319	646	287
30	10	Chehalis	1629	1905	1143	1321	440	688	312
			Age and yield per acre, by years						
....	....	.....	1936 12 years old	1935 11 years old	1934 10 years old	1933 9 years old	1932 8 years old	1931 7 years old	1930 6 years old
....	....	.....							
....	....	.....							
....	....	.....							
Group B			*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
29	20	Carlton	399	638	402	650	210	416	236
9	11	Willamette	*	863	881	787	387	566	*
40a	10	Olympic	1572	908	1293	760	445	399	307

* Yield data not available.

Yields increase as the orchard becomes older. The age at which a filbert orchard reaches maximum production is not definitely known. There are indications that yields may increase up to 20 or 25 years after the tree reaches bearing age. Doubtless many factors such as soil, exposure of orchard, care of the tree, fertility upkeep practices, and rate of planting may influence the age of maximum production.

For the orchards studied a definite increase in production as the trees increased in age was noted (Table 20). This increase was greater for orchards located on bottom and valley-floor soils than for orchards located on hill soils. It is believed that this is due to the greater depth, higher fertility, and higher available moisture capacity of these lowland soils. Table 21 indicates that, irrespective of the production from young orchards coming into bearing, the present bearing acreage of filberts will produce a gradually increasing tonnage of nuts for several years.

Predicting yields for orchards of various ages is a popular pastime whenever nut growers meet together. Owing to the mixture of various-aged trees in the orchards studied it was not possible to assemble extensive data on the exact effect of age on yield. A study of seven even-aged orchards indicates, however, that the yield trend on any given orchard is likely to be somewhat erratic (Table 21).

It has just been pointed out that there are several factors that affect yield, among which is the age of the tree. If all of these factors are favorable a large crop will likely result, but if one or more are unfavorable smaller yields will be obtained.

It appears that most filbert trees increase their production very rapidly from the sixth to the ninth or tenth years. Many well-located orchards will continue to increase their output after the ninth or tenth year, but data on the rate of this increase were not available from the orchards studied. It is believed that 10-year-old orchards where they are located on good soils possess the capacity to yield 1,000 or more pounds of filberts per acre annually. Whether such yields are obtained depends largely on a favorable combination of those factors that affect yield.

Table 22. EFFECT OF NUMBER OF TREES PER ACRE ON YIELD OF FILBERTS PER ACRE
(For 1933 crop from 45 orchards)

Number of bearing filbert trees per acre	Approximate spacing	Bottom and valley-floor soils			Hill soils		
		Number of orchards	Average number bearing filbert trees per acre	Average yield of filberts per acre	Number of orchards	Average number bearing filbert trees per acre	Average yield of filberts per acre
	Feet			*Pounds*			*Pounds*
Less than 109..	Over 20	17	85	949	9	83	514
109 or more....	Under 20	13	125	873	6	112	521
ALL ORCHARDS	21	30	104	912	15	93	516

The planting distance does not affect yield. No significant difference in yield could be detected because of variations in the numbers of filbert trees planted on an acre. Growers using spacing of more than 20 feet obtained slightly heavier yields on bottom and valley-floor soils than growers using spacing of 20 feet or less. This difference was not large, however, and it did not occur in the hill orchards (Table 22); also individual cases were noted in which too close planting appeared to be causing crowding of the trees and where yields did not appear to be up to the anticipations of the growers, but such cases were the exception rather than the rule. It should be remembered that the average age of these orchards was only 10 years.

As they become older noticeable differences in yield may develop, if some of the fast-growing, closely spaced, bottom-soil orchards are not thinned. (See Figure 5.)

The data shown in Table 22 tend to confirm the judgment of the many growers who are using 24- to 25-foot spacings for their new plantings. During the early bearing years such spacings may not give as good yields as closer spacings, but at 10 years they appear to be fully as productive, and the danger of possible crowding is much less.

The effect of fertility upkeep on yields. Data on fertility-upkeep practices were not sufficient to show any relationship between such practices and the yields obtained. Of the 45 growers cooperating in the study 31 per cent had either entirely omitted cover crops or manure or had used these fertility practices for less than 25 per cent of the time during the life of the orchard. At the other extreme were 29 per cent of the growers who cover cropped or manured their orchards regularly. Intermittant cover cropping or manuring was practiced by the remaining 40 per cent of the growers.

The beneficial effects of cover cropping and manuring are generally recognized. On several of the individual orchards studied these practices appeared to be yielding desirable results. It should be remembered, however, that most of the filbert orchards were planted on very fertile soil, and practices designed to maintain fertility are not likely to show startling results over a short period of time.

Other factors which may affect yield. In addition to the major factors just discussed, which are more or less common problems, low yields may also result from other causes, some of which are very difficult to determine, and some of which are clear-cut but are of only local significance. Some of the more common of these minor factors are as follows:

(1) Lack of the proper kind or sufficient quantity of pollinating varieties has retarded yields in some orchards. For the industry as a whole, however, it appears that pollenization is well taken care of. A complete discussion of filbert pollenization is given in Oregon Extension Bulletin 503.

(2) The selection of adapted varieties has not been difficult for growers and has not generally affected yields, as only two varieties, the Barcelona and the Brixnut, have been generally advocated by nurserymen. Of these varieties Barcelona plantings predominate. It was not possible in this study to obtain sufficient data on comparative production from Barcelona and Brixnut plantings to warrant conclusions as to their relative desirability. The chief problem in selecting planting stock is to obtain top-quality trees. During some years of active demand nurserymen have sold out all of their best-quality trees very early in the season. In such instances it is probably more desirable to wait another year before planting than to accept inferior trees. Several cases were noted where yields were quite low apparently because of the poor quality of planting stock.

(3) Lack of sufficient moisture during the late summer to mature the nut crop is beginning to worry some growers. This problem is often associated with sandy-textured bottom soils. Although still

in the experimental stage irrigation appears to be the best probable solution to this difficulty. Where irrigation is not possible tree thinning may be necessary so that the available moisture will be used by fewer trees.

(4) A few orchards were observed where the general care (pruning, cultivation, hoeing, suckering) was insufficient. Likewise some orchards apparently received an excessive amount of care. Except where badly neglected no direct correlation appeared to exist between care and yield. It is believed therefore that (a) moderate pruning, (b) enough cultivation and hoeing to keep down weed growth, and (c) one or two regular suckerings are preferable and more economical than the constant care given by some and the almost entire lack of care by others.

THE EFFECT OF THE BEARING-ORCHARD INVESTMENT ON THE COST OF PRODUCING FILBERTS

Valuating the filbert orchard. Interest at 5 per cent on the estimated current value of the bearing orchard accounted for 52 per cent of the cost of producing filberts in 1933. As disclosed by this study this value was approximately double the cost of growing these orchards. It appears therefore that the average filbert grower who has grown his own orchard has considerable "watered capital" in this orchard when he values it at the current market price. Under such conditions it is possible to lower the cost of producing filberts considerably simply by revaluating the orchard, for such a revaluation can be done without actually impairing the cash investment. Operators who have purchased orchards at current values do not of course have the same opportunities to revalue as grower-operators.

Valuation of the orchard is not a major factor affecting the costs of producing filberts as presented in this bulletin (Table 23). Examination of the cost records obtained disclose that current valuations are closely in line with yields and hence any increase in interest costs due to a higher value is readily absorbed. There is some tendency for orchards valued at less than $600 per acre, as a group, to be slightly undervalued. Some of these orchards, however, are located on mediocre soil, or are located in districts where horticulture is not commonly practiced. It is believed that these factors justify a lower value than yield alone would indicate, for such orchards do not have as much potential value as those more favorably located.

Are current values for filbert orchards justified? The price asked for a bearing filbert orchard is usually closely related to its capacity to produce income. It appears that for the Willamette Valley as a whole filbert-orchard values are based on an expected net return of 5 to 6 per cent on the capital investment. Obviously if the profits from filberts go upward or downward filbert-orchard values are likely to follow.

All available evidence indicates that a filbert orchard will live and produce for many years. Except as it may be affected by sale or transfer, the filbert-orchard investment is, therefore, a long-time investment. It is believed that the soundness of investments of this type must be judged on the basis of the long-time outlook for profits, rather than on the basis of conditions prevailing at any given time.

The outlook for filberts as presented in the opening pages of this bulletin indicates that they may be somewhat less profitable in the future than in the past. Just how much decline, if any, will occur in filbert-orchard values cannot be predicted but it is reasonable to suppose that future values will be more nearly in line with growing costs than are present values.

EFFICIENT LABOR LOWERS THE COST OF PRODUCING FILBERTS

Labor costs accounted for approximately one-third of the total cost of producing filberts. Of this labor cost about three-fourths was for harvesting operations and one-fourth for other work, such as cultivating, suckering, pruning, and fertility upkeep. Some operators were able to perform these labor operations much more efficiently than others. To some extent, of course, this difference in efficiency was directly related to the individual, but in many cases it appeared to be due to conditions that could be changed by the operator if he so desired. In other words, efficient work in the filbert orchard is usually possible if the operator makes a study of the jobs to be done and works out practical and rapid methods of getting them done.

Table 23. THE RELATION OF BEARING-ORCHARD INVESTMENT TO THE COST OF PRODUCING FILBERTS

(For 1933 crop from 45 orchards)

Estimated current value of bearing orchard per acre	Number of orchards	Average value of bearing orchard per acre	Average yield of filberts per acre	Average age of orchard	Average cost per pound of filberts	Bearing orchard value per 100 pounds of filberts produced
			Pounds	*Years*		
Under $600	20	$452	689	9.3	6.9¢	$ 66
$600 to $900	15	684	773	10.9	8.1	88
$900 and over	10	956	1,135	10.7	7.7	84
ALL ORCHARDS..	45	$614	791	10.1	7.5¢	$ 78

Note: The orchard values presented in this table represent the cooperating farmers' estimates of the value of similar orchards in their communities. This table is published for information only, and is not to be construed as an attempt to set filbert orchard values.

Nonharvest operations. Plowing or disking the orchard, hand and machine cultivation, and suckering accounted for about four-fifths of the nonharvest work. Apparently almost every filbert grower has his own idea as to what and how many cultural operations are necessary. In general plowing or disking and suckering were less variable than machine cultivation and hoeing.

The number of cultivations on individual orchards varied from 0 to 32. In each case plowing or disking both ways was excluded in counting cultivations. Approximately 18 per cent of the orchards received 2 or fewer cultivations, and appeared to be under cultivated. Aside from these orchards, however, there was no indication that the amount of cultivation was affecting the orchard or the yields. Some of the best-yielding and best-appearing orchards were cultivated only 3 to 5 times.

Cultivation is not a major item of cost in producing filberts. On the average it accounts for about 14 per cent of the total production costs when

all labor, machinery, tractor, and horse labor expense incidental to cultivating is considered. It is believed, however, that the wide variation in the amount of cultivation given indicates clearly that some growers are incurring needless expense in performing these operations.

The correct amount of cultivation cannot be rigidly defined, for it will vary somewhat with the orchard and the season. The most recent data available on cultivation and moisture content of the soil indicates that control of weed growth is the primary objective of cultivation and when this is accomplished the orchard is usually sufficiently cultivated.

Table 24. THE COST OF HARVESTING FILBERTS VARIES

(For 1933 crop from 45 orchards)

Harvesting cost per pound of filberts*	Number of orchards	Average harvesting cost per pound	Average yield of filberts per acre
			Pounds
Under 1.5¢	14	1.3¢	851
1.5¢—1.9¢	12	1.7	826
1.9¢—2.3¢	12	2.1	715
2.3¢ and over	7	2.6	691
ALL ORCHARDS	45	1.8¢	791

* Includes all labor costs and interest, depreciation, repairs and operating expense on equipment used in harvesting, drying, and hauling nuts.

Harvest operations. Analysis of the individual cost records obtained for the 1933 crop discloses that there is wide variation in the cost of harvesting filberts (Table 24). In fact, average harvesting costs for the 14 farms with the lowest harvesting cost were just half as much per pound as for the 7 farms with the highest harvesting costs.

Most of the variation in harvest costs is due to differences in picking costs, although drying costs also tend to increase as the total harvesting cost increases. High picking costs seemed to be associated with low yield, weedy orchards, cloddy orchards, and an early leaf fall. All of these hinder or slow up the picking operation and either require higher contract rates, closer supervision of the picking, or additional gleaning.

A few growers were experimenting with mechanical methods of separating the nuts from the leaves and husks. The general procedure was to rake up the nuts and litter under the tree and then subject this material to shaking and blowing so that the nuts are separated out from the husks, leaves, and dirt. While still in the experimental stage some such procedure gives promise of reducing harvest costs where used under favorable conditions. For the present, however, most growers are likely to continue to harvest their crop by the "picking up" method. The foregoing reference to semimechanical harvesting was made to indicate that some growers are giving serious thought to increasing the speed and lowering the cost of this rather tedious job.

PRICE AFFECTS PROFITS

The profit derived from the filbert enterprise is the difference between the net farm price and the costs of producing filberts. As a group filbert growers appear to have been more interested in trying to increase profits by obtaining better prices than by lowering production costs. Costs usually

vary much more than price, however, and doubtless many individual farmers have lost money by giving all of their attention to the minor factor in the profit equation. It is possible, in some instances, for farmers to increase the price received for their filberts. Such opportunities should be taken advantage of even though the gain may not be large.

The approximate average net price received by Willamette Valley filbert growers for filberts sold in the shell during the seven-year period 1930 to 1936 were as follows:

Crop year	*Average net price received by farmers for filberts sold in the shell*
1930	14.3¢
1931	12.1¢
1932	8.9¢
1933	12.7¢
1934	9.6¢
1935	12.5¢
1936	14.3¢
Seven-year average	12.1¢

These prices are based on data obtained from several cooperative nut associations, operating in the Willamette Valley area. All association packing and marketing costs have been deducted and the resultant net prices have been weighed according to the volume of the total crop handled. They represent net returns to the grower for all varieties and sizes of graded filberts sold in the shell. They do not include any returns from culls that may have been cracked, but the returns from such nuts are almost negligible. Net prices for field-run nuts, which include culls, will average 1 cent per pound less than the prices indicated, but in individual years have varied from ¾ to 1.4 cent less owing to varying percentages of culls.

Factors affecting the price of filberts. An analysis of the many factors that may influence the price of filberts is outside the scope of this study. Two factors, however—marketing organization and quality of product—will be discussed briefly.

Organized marketing is essential. The prices and returns received by filbert growers are determined chiefly by supply and demand, which in

Table 25. OPENING PRICES FOR BARCELONA FILBERTS BY YEARS, 1930-1936
(All prices are F.O.B. Portland for graded nuts packed in bags)

Year	Filbert grade		
	Large	Fancy	Baby
1930	18 ¢	16 ¢	12 ¢
1931	16.5	15	12
1932	13	12	10
1933	17	15	12
1934	12.5	11	10
1935	15.5	14	13
1936	17	16	15
AVERAGE	15.6¢	14.1¢	12 ¢

Source of Data: North Pacific Nut Growers Association.
Note: The foregoing prices are set prior to harvest and are based on estimates of supply of and demand for filberts. In some seasons unforeseen conditions have made it impossible to maintain these prices.

turn are the resultants of many forces. There is little that the individual grower can do to improve the general price level for filberts except to cooperate with other growers in setting up efficient marketing machinery to handle the crop. This is very important, however, if filberts are to compete successfully with other kinds of nuts. During recent years filberts appear to be losing ground in the United States nut markets.

The filbert industry appears to be too small and too localized to permit any considerable amount of individualism or factionalism among groups of growers without a resultant loss of markets and possibly lower prices. It is believed that highest prices can be obtained only if the industry works together harmoniously in putting out a top-quality product at a price that will appeal to the consumer. Heretofore there has been a wide spread between domestic production and consumption of unshelled filberts. Close cooperation between growers and grower groups was not essential in order to move the crop. With increased production almost a certainty and with an immediate prospect of a very narrow margin between production and demand for unshelled filberts, the need appears to be urgent to cater to consumers by standardizing the pack and stabilizing prices. Only a united industry can accomplish these objectives.

Table 26. PERCENTAGE OF FILBERTS IN EACH GRADE, BY YEARS, 1930-1936
(For all varieties of graded filberts sold from orchards included in filbert cost study)

Year	Number of orchards reporting*	Pounds of filberts graded	Filbert grades				
			Large†	Fancy‡	Baby§	Culls	Total
			Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
1936	28	354,159	54.3	34.7	2.9	8.1	100.0
1935	30	345,976	35.4	45.1	8.4	11.1	100.0
1934	40	392,500	39.5	48.2	4.1	8.2	100.0
1933	42	419,485	28.7	57.3	8.3	5.7	100.0
1932	44	198,133	31.4	53.9	5.3	9.4	100.0
1931	38	227,529	29,9	52.9	9.7	7.5	100.0
1930	32	145,041	42.7	46.6	4.7	6.0	100.0
AVERAGE	....	.....	37.4	48.4	6.2	8.0	100.0

* Of the 50 bearing orchards studied comparable grades were available only for the orchards indicated.
† Includes Jumbo grade.
‡ This grade termed standard for 1931 and prior years.
§ Includes Peewees.

Quality filberts bring higher prices. Irrespective of the general price level for filberts, individual growers who produce few culls and a high proportion of large filberts normally receive more for their crop than growers who produce many culls or small filberts. Reference to the opening prices for the various grades of Barcelona filberts for the seven-year period 1930 to 1936 shows that filberts graded "large" are priced from 1 to 2 cents per pound higher than filberts graded "fancy" and from 2 to 6 cents per pound higher than filberts graded "baby" (Table 25). The grower who has few culls also has more salable nuts per ton of production and hence obtains a larger return from his crop than the grower with many culls.

The quality of the filbert crop varies from year to year and from farm to farm during the same year and over a period of years. Yearly variations in filbert grades for the seven-year period 1930 to 1936 are

shown by Table 26. A study of the filbert grades for 25 individual orchards for this same seven-year period shows that on one-third of the orchards the crop graded 50 per cent or more large, on another third it graded from 40 to 50 per cent large, and on the remaining third it graded less than 40 per cent large.

Little is known about the factors determining the grade of filberts. Doubtless many things—such as grading technique in the packing plant, effective pollination of the blossom, soil moisture, soil fertility, parent varietal stock, vigor of the tree, and yield—could influence the grade of nuts produced. A study of these or other factors as they affect grade may be desirable in the near future, but was not possible in this study.

Appendix

METHODS USED IN OBTAINING AND ANALYZING THE DATA

Field data used in the filbert cost study were obtained by the survey method. Analysis of the data was made chiefly by grouping and cross-tabulating.

COLLECTING THE FIELD DATA

The first step in collecting the field data was to prepare detailed field schedules. Space was provided in these schedules for recording all of the cost items pertaining to bearing and nonbearing filbert orchards, and also for recording management factors believed to be important in the operation of filbert orchards. Copies of the field schedules used may be obtained from the Department of Farm Management, Oregon Agricultural Experiment Station.

The second step in collecting the field data was to arrange a personal interview with the filbert grower. These interviews usually required from two to four hours. During this time all pertinent data concerning the filbert orchard were recorded in the field schedule.

Some of the filbert growers had kept cost accounts, but most of the cost data are based on growers' estimates. The principle was followed of discussing each cost item such as labor, materials, machinery costs, etc., in detail and in terms with which the orchard operator was intimately acquainted.

Procedure used in recording field data for young orchards. The field schedule was so arranged that all information of like character was recorded on the same page or on a continuing series of pages. This procedure provides an orderly method of discussion and prevents the confusion that often occurs when the discussion moves back and forth over a variety of topics.

The physical set-up and history of the orchard, and values of unplanted land, were discussed first. Following this, intercropping, if any, was analyzed. The detailed labor program and materials and miscellaneous expense for the first year were next discussed. Then the labor program and the materials and miscellaneous costs for the current year, together with any variations between the first and the current years were recorded. Finally all data pertaining to machinery and equipment investment, depreciation, and operating cost and the allocation of these between young filberts and other farm enterprises were obtained.

All of the data just referred to were collected at one visit. If the young orchard was 2 years old only 2 years' data were available, while if it were 5 years old data were recorded for all 5 growing years.

Procedure used in recording field data for bearing orchards. The methods used in obtaining data for bearing orchards were similar to those used in the young orchard. Important variations are as follows:

(a) Yields and grades of filberts were obtained from the records of the buyer where available, rather than by estimate from the farmer.

(b) Annual visits were made for each of two years, 1932 and 1933, to obtain the bearing-orchard data, while for the young orchards all data for the entire growing period of the young orchard were obtained at one time.

(c) Depreciation on all general farm machinery was charged at a flat rate of 13 per cent of the present value instead of being separately estimated for each machine.

TABULATING AND ANALYZING THE FIELD DATA

The data on the field schedules were copied to an office sheet which was designed to facilitate tabulation. At the time of this transfer all necessary extensions, adjustments, and computations were made. Each office sheet, therefore, represents the summarized costs for an orchard for one year. By tabulating and averaging these summarized data the cost tables that are presented in this bulletin were obtained.

Tabulation of data for nonbearing orchards. An office sheet was made up for each year of growth of each young orchard. This office sheet, then, presents the cost of that particular orchard for a given year. Average yearly costs were obtained by adding and averaging the total costs for each year group. For example: first-year costs were obtained for 19 orchards containing 203 acres, second-year costs for 19 orchards containing 205 acres, while the fifth-year costs apply to 8 orchards containing 66½ acres. Total costs for the five-year period are the sum of the average yearly costs.

The determination of costs for nonbearing orchards was complicated by the problem of allocating joint costs for those orchards that were intercropped. This problem was met by plotting the planting system used and computing the approximate area of soil occupied by the intercrop and the tree including their respective root systems. Any vacant soil area was charged to the tree. Where row crops were used for intercropping one-half the distance between the individual rows was allowed for each outside row, to cover the area occupied by the plant roots of the plants in these rows.

Of the nonbearing orchards for which cost records were obtained 38.7 per cent were intercropped, and on these orchards only 26.2 per cent of the soil area in the orchard was used by the filbert tree during the growing period.

The items of cost. Filbert orchard growing costs, as determined in this study, have been divided up into 6 groups; namely, man labor, horse labor, filbert trees, materials and miscellaneous, depreciation, and interest.

Man-labor costs cover all the work of the farm operator or unpaid members of his family and all hired or contract labor that was put in on the filberts. All work pertaining to intercrops was omitted from the filbert cost schedule. Hired and contract labor was charged at the rate paid plus any perquisites (board, lodging, etc.,) furnished by the farmer.

Rates for operator and unpaid family labor were based on the farmer's estimate of the current wage, including board and lodging, for such labor in his neighborhood. All of these rates are given in the bulletin text.

Farm horse labor used in the young filbert orchard was charged at 13 cents per horse hour, which is the average cost of horse labor in the Willamette Valley as determined by a special study reported in Bulletin 250, Oregon Agricultural Experiment Station. Hired horse labor was charged at cost. Any horse labor used for the benefit of the intercrop was charged to the intercrop.

Filbert trees were charged at cost at whatever point delivery was accepted. In some cases they were delivered to the farm by the seller and in other cases the farmer hauled them from the nursery.

Materials and miscellaneous costs cover a wide variety of expense (see Table 4). Taxes on intercropped orchards were allocated to filberts and intercrops on the basis of the soil area occupied by each. Expense for tractor operation was allocated on the basis of hours of use for nonbearing filberts as compared to total use and costs for the entire farm. Manure and cover-crop seed used on the young filbert orchard were charged at cost if purchased or at sale value at the farm if produced there. Automobile and truck use for filberts was charged at 5 cents per mile. Stakes, ties, and pegs were usually made by the farmer and were charged to the filberts according to their estimated value. Replacement trees, trunk protectors, rented equipment, spray, commercial fertilizer, and rodent-control supplies were charged at cost.

Depreciation on tractors and other machinery is a joint cost that was allocated to the filberts according to the proportion of use in the young filbert orchard for each machine involved. This proportion was estimated by the farmer. The value of the land in the filbert orchard was estimated by the farmer on the basis of what similar land could be purchased for in his neighborhood. Interest on land at 5 per cent was allocated to the filberts according to the percentage of the orchard area occupied. Beginning with the second year interest was charged on the accrued filbert-growing costs of all previous years. Tractor and other machinery investment and interest on this investment were determined in the same manner as depreciation.

Tabulation of data for bearing orchards. The methods used in tabulating the bearing-orchard data were very similar to those used for nonbearing orchards. Owing to the lack of intercrops in the bearing orchard the complex problem of allocating joint costs was simplified. Joint machinery and equipment costs were, however, still prevalent owing to the location of this enterprise on general diversified farms.

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E. F. Torgerson, B.S.....Associate Soil Scientist (Soil Survey)

Other Departments

Agricultural Chemistry

J. S. Jones, M.S.A.....Chemist in Charge
R. H. Robinson, M.S.....Chemist (Insecticides and Fungicides)
J. R. Haag, Ph.D.....Chemist (Animal Nutrition)
D. E. Bullis, M.S.....Associate Chemist (Food Products Industries)
M. B. Hatch, M.S.....Assistant Chemist

Agricultural Engineering

F. E. Price, B.S.....Agricultural Engineer in Charge
H. R. Sinnard, M.S.....Associate Agricultural Engineer (Farm Structures)
C. I. Branton, B.S.....Assistant Agricultural Engineer

Bacteriology

G. V. Copson, M.S.....Bacteriologist in Charge
J. E. Simmons, M.S.....Associate Bacteriologist
W. B. Bollen, Ph.D.....Associate Bacteriologist

Entomology

D. C. Mote, Ph.D.....Entomologist in Charge
W. J. Chamberlin, Ph.D.....Associate Entomologist
J. C. Chamberlin, Ph.D.....Assoc. Entomologist; Truck Crops and Garden Insects*
B. G. Thompson, M.S.....Assistant Entomologist
S. C. Jones, M.S.....Assistant Entomologist
K. W. Gray, M.S.....Field Assistant (Entomology)
W. D. Edwards, B.S.....Field Assistant (Entomology)

Home Economics

Maud M. Wilson, A.M.....Home Economist

Plant Pathology

C. E. Owens, Ph.D.....Plant Pathologist in Charge
S. M. Zeller, Ph.D.....Plant Pathologist
F. P. McWhorter, Ph.D.....Plant Pathologist*
B. F. Dana, M.S.....Plant Pathologist (Div. Fruits and Vegetable Crops Diseases)*
F. D. Bailey, M.S.....Associate Plant Pathologist (Insecticide Control Division)*
P. W. Miller, Ph.D.....Assoc. Pathologist (Div. Fruits and Veg. Crops and Dis.)*
G. R. Hoerner, M.S.....Agent (Hop Disease Investigations)*
A. R. Sprague, Jr., Ph.D.....Assistant Pathologist (Cereal Diseases)*
H. H. Millsap.....Agent (Division of Fruits and Vegetable Crops and Diseases)*

Publications and News Service

C. D. Byrne, M.S.....Director of Information
E. T. Reed, B.S., A.B.....Editor of Publications
D. M. Goode, B.A.....Editor of Publications
J. C. Burtner, B.S.....Associate in News Service

Branch Stations

D. E. Stephens, B.S.....Supt. Sherman Br. Expt. Sta., Moro; Sr. Agronomist*
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F. C. Reimer, M.S.....Superintendent, Southern Oregon Br. Expt. Station, Talent
D. E. Richards, B.S.....Supt. Eastern Oregon Livestock Br. Expt. Sta., Union
H. K. Dean, B.S.....Superintendent, Umatilla Br. Expt. Station, Hermiston*
O. Shattuck, M.S.....Superintendent, Harney Valley Br. Expt. Station, Burns
H. B. Howell, B.S.....Superintendent, John Jacob Astor Br. Expt. Sta., Astoria
R. G. Johnson, B.S.....Acting Supt., Squaw Butte Range Experiment Station
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