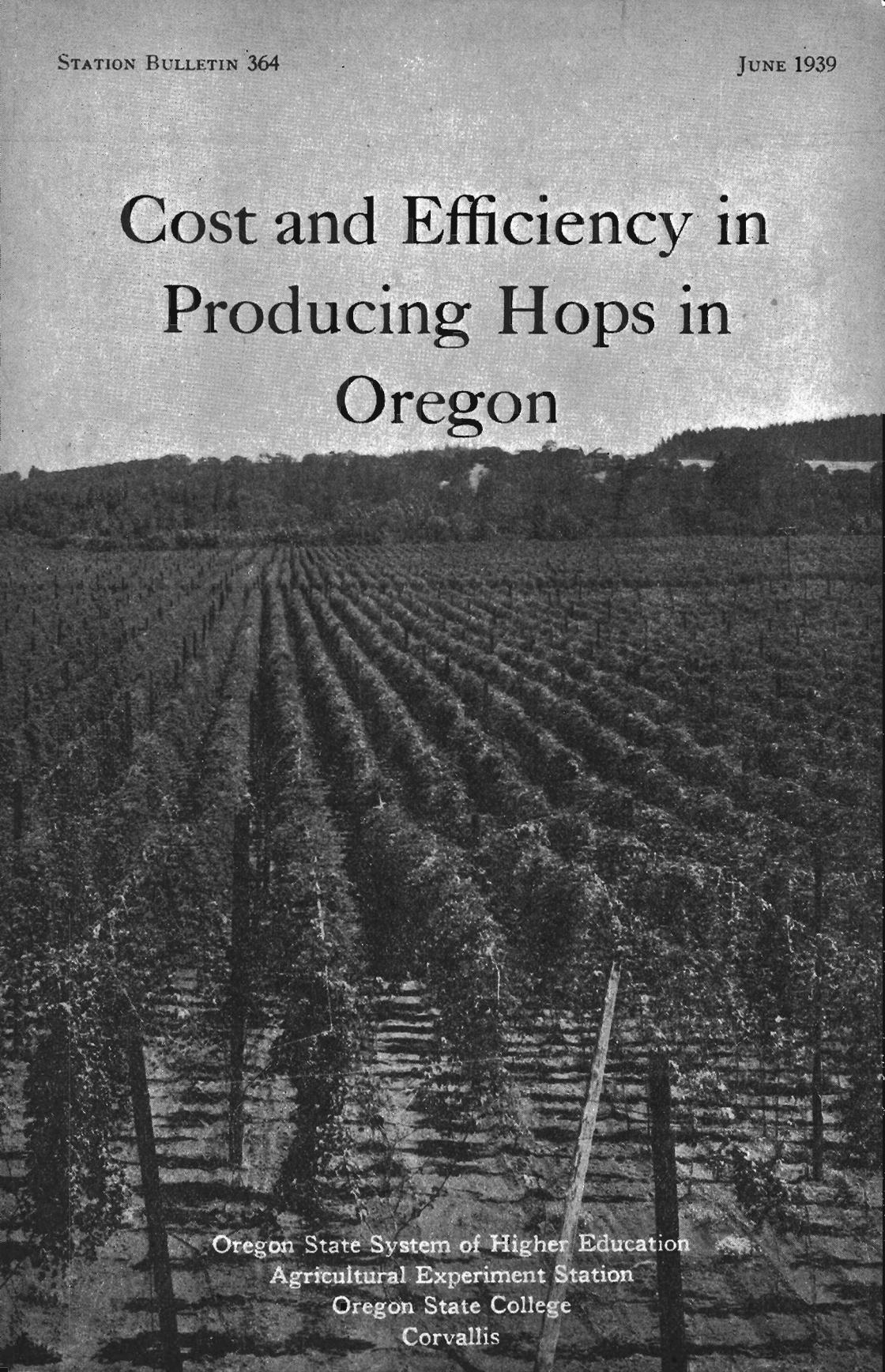


# Cost and Efficiency in Producing Hops in Oregon



Oregon State System of Higher Education  
Agricultural Experiment Station  
Oregon State College  
Corvallis

## SUMMARY

The Willamette Valley, where soil and climatic conditions are especially well suited to hops, produces about half of all the hops grown in the United States.

The average cost of producing hops in Oregon during a three-year study, 1934-1936, was 18.6 cents per pound. The average yield obtained on 8,408 acres of hops in 172 production records was 889 pounds of dried hops per acre.

In 1934 and 1935, with hop yields of 989 and 973 pounds per acre respectively, the average costs were approximately 17 cents per pound each year, while in 1936, with a yield of only 706 pounds, the average cost was 21.9 cents.

The chief costs of hop production were (1) man labor, 57.1 per cent; (2) materials, equipment operation, and general expense, 23 per cent; and (3) interest and depreciation on the hop investment, 18.7 per cent. All other costs amounted to only 1.2 per cent. Of the total man labor cost, 84 per cent was for hired and contract labor, averaging \$78 cash outlay per acre of hop land.

The total cash or out-of-pocket cost amounted to 13 cents per pound, or 71 per cent of the total cost. This cash cost must be met before the farmer receives anything for his labor or for the use of his land and equipment and therefore creates a heavy financial risk to the producer.

The prices received for the 4,367,000 pounds of hops reported sold during the three-year period of the study averaged 22.8 cents per pound. The prices of hops sold in 1934 varied from 10 to 40 cents per pound, averaging 18 cents. Prices received in 1935 averaged 16 cents, while those in 1936 averaged 34 cents. These average prices do not correspond exactly with current quotations at the time because they include a number of very favorable contracts in 1934 and 1935 and a few unfavorable ones in 1936. The market quotations, which had dropped to 7 cents in April, 1936, rose to 45 cents by November because of the short crop occasioned by the serious infestation of downy mildew and red spider in the summer of 1936.

The three-year average cost of production on all the valley-floor yards was 20 cents per pound on an average yield of 664

### SUMMARY—*Continued*

pounds per acre, compared to a cost of 18.7 cents per pound on bottom-land yards having an average yield of 1,027 pounds per acre.

In 1934 and 1935 the valley-floor yards, however, despite a lower average yield, had a slightly lower pound-cost than the bottom-land yards and only in 1936 when the former had unusually low yields did the average pound-cost exceed that of the bottom-land yards.

In general, yield per acre was an important factor in determining the production cost per pound on the hop farms studied.

Growers having the largest expenditures per acre for cultivation and training also had the highest yields per acre without, however, influencing the cost per pound. Additional expenditures for the purpose of obtaining *record* yields tend to raise production costs per pound.

Extremely low yields increased the pound-cost not only of harvesting and drying hops but total costs as well.

Medium-sized yards had the lowest cost of production, largely because the size of business was big enough to utilize equipment and labor economically, particularly in conjunction with a diversified farming system, yet not so large as to require high expense per acre for such items as supervision and various facilities for hired labor. The larger hop enterprises, usually located on bottom land, had the largest investment per acre in land and trellis, hop buildings, and machinery. Moreover, the large specialized hop grower more commonly performed all the routine practices, including spraying or dusting, regardless of the market price outlook.

## TABLE OF CONTENTS

	Page
SUMMARY .....	2
OBJECTIVES .....	5
THE SITUATION .....	5
DESCRIPTION OF THE STUDY.....	10
DESCRIPTION OF FARMS .....	13
CAPITAL INVESTMENT .....	15
COSTS THE BASIS FOR IMPROVING INCOME.....	16
THE COST OF HOP PRODUCTION.....	16
Major Items of Cost .....	18
Cash and Noncash Costs .....	20
Cost of Drying Hops .....	23
Fixed and Seasonal Costs.....	25
Variation in Cost of Production.....	27
MAJOR FACTORS INFLUENCING COSTS AND PROFITS.....	30
Yield Is a Dominant Factor.....	30
Factors Influencing Yield and Cost.....	32
Labor Requirements .....	36
Operating Efficiency .....	39
Size of Yard .....	42
Grade and Price as Factors.....	42
SOME SPECIFIED OPERATION COSTS AND PRACTICES.....	43
COST OF ESTABLISHING AND MAINTAINING NEW HOP YARDS .....	46
CONCLUSIONS ON THE SITUATION AND OUTLOOK FOR THE HOP ENTERPRISE IN OREGON .....	51
APPENDIX A. METHODS USED IN OBTAINING, COMPIL- ING, AND ANALYZING DATA .....	52
APPENDIX B. DETAILED AND SUPPLEMENTARY TABLES	54

# Cost and Efficiency in Producing Hops in Oregon\*

G. W. KUHLMAN and R. E. FORE

## OBJECTIVES

The objectives of this study were as follows:

1. To determine the cost of producing hops in Oregon.
2. To analyze the major factors in the operation of the hop enterprise that affect the cost of production.
3. To suggest adjustments within the enterprise that should increase efficiency, reduce production costs, and increase the net income of the hop grower.

## THE SITUATION

**Hop production in the United States and in Oregon.** Hops have been grown in nearly every state of the Union, but at the present time Oregon, Washington, and California produce practically all of the commercial hops in the United States. Production has centered along the Pacific Coast partly because of the favorable climatic and soil conditions and partly because this area has been relatively free from some of the serious disease and insect pests found in other hop-growing regions.

Oregon has ranked first in the United States in the production of hops since shortly after the close of the World War. The largest acreage in Oregon was reached in 1935 when 26,000 acres were reported in production.† This represented two-thirds of the national total and almost one-fifth of the estimated world acreage. New York at one time produced over 75 per cent of the hops grown in the United States but at present has only about three hundred acres. Wisconsin was also known as a hop-growing state at one time, but has dropped entirely out of commercial production.

**Hops, a world commodity.** Much of our hop production has entered into international trade and therefore the status of the hop enterprise in Oregon has been affected by world conditions. During the World War, for example, all the major hop-producing countries of Europe partly abandoned or neglected hop production in favor of the much more urgent need of food production. This situation increased the demand for American hops. After the War, however, recovery of the hop enterprise abroad was rapid and this led to a decline in hop exports from the United States.

\* Acknowledgments: The authors express appreciation to the hop growers, dealers, county agents, and others whose helpful cooperation has made this study possible. Special credit is due H. E. Selby, formerly Acting Head of the Department of Farm Management, and D. C. Smith, formerly Assistant Agronomist, both of whom helped launch this project; to Clair Wilkes, formerly Assistant in Farm Management, for help in taking the field records and in compiling the data; and to D. Curtis Mumford, Head of the Department of Farm Management, for aid in the preparation of the manuscript.

† United States Department of Agriculture: Agricultural Statistics, 1936.

The advent of prohibition in this country in 1919 further reduced the demand for American hops during this post-war period of adjustment.

As prices dropped below the cost of production growers suffered heavy losses both at home and abroad. Gradually the unfavorable price situation induced some curtailment of hop acreage, thereby helping to restore the balance between world production and consumption. Unfortunately, however, the investments of many individual growers were sacrificed in the process.

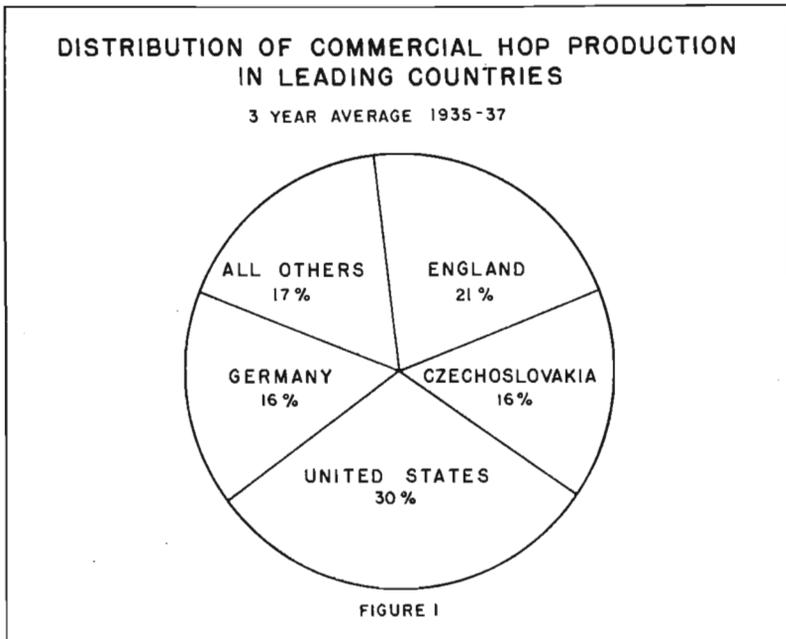


Figure 1. Among the other countries important in hop production are Poland, Yugoslavia, France, and Belgium.

Table 1. HOPS: ACREAGE AND PRODUCTION IN LEADING COUNTRIES (EXCLUDING RUSSIA)\*  
Three-year average, 1935-1937

Country	Production		
	<i>Acres</i>	<i>1,000 pounds</i>	<i>Per cent</i>
1. United States .....	34,633	39,100	30.4
2. England and Wales .....	18,220	27,440	21.3
3. Czechoslovakia .....	28,849	20,882	16.2
4. Germany .....	24,542	20,300	15.8
5. France .....	4,602	4,662	3.6
6. Yugoslavia .....	7,983	4,478	3.5
7. Poland .....	8,300	3,776	2.9
8. Australia and New Zealand†.....	1,790	3,361	2.6
9. Belgium .....	2,256	2,790	2.2
10. Canada† .....	1,093	1,685	1.3
11. Hungary and Rumania.....	339	223	0.2
TOTAL.....	132,607	128,697	100.0

\* U. S. Department of Agriculture. Agricultural Statistics, 1937 and 1938.

† Average of 1936 and 1937 only.

**Shifts in production.** In recent years the United States has taken the lead among the hop-growing countries of the World, accounting for 30 per cent of the total production during the three-year period from 1935 to 1937 (Figure 1). England, Czechoslovakia, and Germany, together with this country, accounted for 83 per cent of all the commercial hops grown during this period (Table 1). Of the American production, Oregon contributed 52 per cent, California 25 per cent, and Washington 23 per cent (Figure 2).

This revival of interest in the production of hops in the United States followed liberalization (and ultimate repeal) of the prohibition amend-

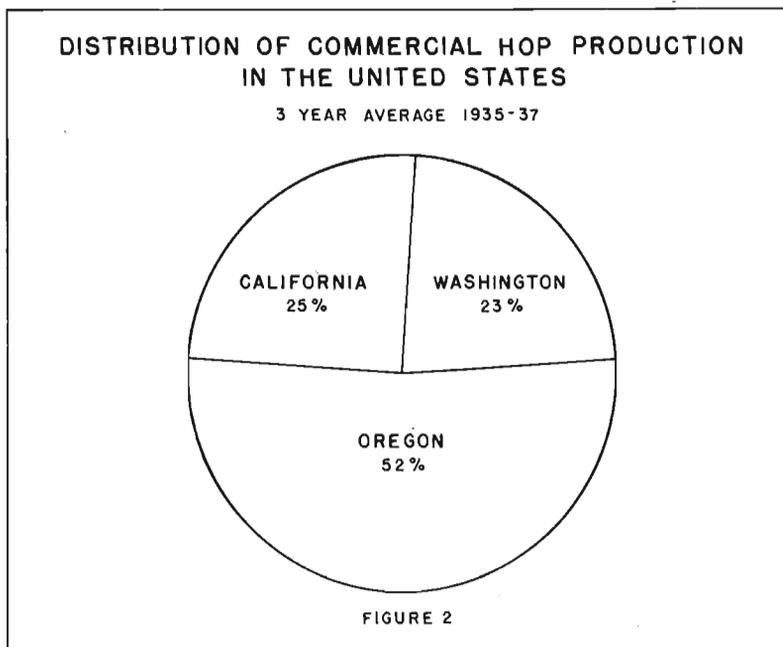


Figure 2. Commercial hop production in states other than Oregon, Washington, and California is negligible.

ment in 1933. High prices that year, due to inadequate supplies of hops, stimulated an immediate expansion in acreage (Table 2). By 1935, the harvested hop acreage had increased to 38,900 acres, an increase of 77 per cent over the 22,000 acres harvested in 1932. In Oregon, hop plantings were increased from 15,500 acres in 1932 to 23,000 acres in 1934, or about 50 per cent (Table 3). Prices dropped from 30 cents a pound in 1933, the highest season average price since 1920, down to an average of 15 cents a pound the following year. Despite the low prices received in 1934, the largest hop acreage on record in Oregon was reported in 1935 when 26,000 acres were harvested. With an above-normal yield that year of 992 pounds per acre the total production in the state was an all-time record of

25,792,000 pounds. The average price for the 1935 season dropped to 9.9 cents a pound, placing many growers in a very unfavorable financial position.

Table 2. HOPS: UNITED STATES PRODUCTION, CONSUMPTION, NET EXPORTS, AND PRICE, BY YEARS, 1915-1936\*

Year	Acreage harvested	Pro-duction	Con-sumption	Net exports†	Consumption and net exports	Per-centage of supply used‡	Farm price§
	<i>Acres</i>	<i>1,000 pounds</i>	<i>1,000 pounds</i>	<i>1,000 pounds</i>	<i>1,000 pounds</i>	<i>Per cent</i>	<i>Cents</i>
1915	44,653	52,986	37,452	18,946	56,398	106	11.7
1916	43,900	50,595	41,959	14,077	56,036	111	12.0
1917	29,900	29,388	33,481	3,571	37,052	126	33.3
1918	25,900	21,481	13,925	9,584	23,509	109	19.3
1919	22,000	28,320	6,441	26,499	32,940	116	77.4
1920	27,000	33,555	5,989	18,340	24,329	72	35.7
1921	27,000	29,340	4,453	18,385	22,838	78	24.1
1922	23,400	27,744	4,556	14,418	18,974	69	8.6
1923	18,440	19,751	3,815	18,546	22,361	113	18.8
1924	20,350	27,670	3,256	15,615	18,871	68	10.3
1925	20,350	28,573	3,426	13,983	17,409	61	21.8
1926	20,800	31,522	3,149	13,045	16,194	51	23.1
1927	24,600	30,658	3,071	10,830	13,901	45	22.9
1928	26,200	32,944	2,735	8,176	10,911	33	19.3
1929	24,400	33,195	2,627	5,817	8,444	25	11.4
1930	19,500	23,447	2,197	4,526	6,723	29	14.8
1931	21,400	26,410	1,841	2,507	4,348	17	13.8
1932	22,000	24,058	7,767	-2,518	5,249	22	17.5
1933	30,300	39,965	26,235	1,939	28,174	70	30.4
1934	36,800	43,150	31,773	1,515	33,288	77	14.5
1935	38,900	42,310	34,516	-351	34,165	81	9.8
1936	30,900	25,156	37,005	-8,307	28,698	114	27.4
Average	27,200	31,900	14,160	9,500	23,660	74	21.7

\* "World Hop Review", November 18, 1938. Bureau of Agricultural Economics, U. S. Department of Agriculture.

† Year beginning September; (-) net imports.

‡ Includes estimated consumption by breweries plus net amount of hops exported.

§ Price, December 1, 1924-1931; season average price, 1932-1936.

Prices. Few agricultural commodities present so wide a variation in prices from year to year as hops. The average annual farm price of hops in Oregon fluctuated during the 24-year period, 1915-1938, from the low point of 9.9 cents a pound just mentioned for 1935 to the high point of 65.9 cents a pound, which was received in 1919. The yearly average price during this 24-year period was 22.2 cents a pound. For the six highest-price hop seasons in this 24-year period the price averaged 37.7 cents a pound, with the yields in these six years averaging 673 pounds per acre. In addition to the direct effect that short crops had on the price, there were the additional factors of the World War that disrupted normal production, distribution, and consumption, and the initiation of prohibition in the United States, followed by eventual repeal.

Undoubtedly occasional high prices have greatly increased the interest in hop production from time to time. Prices paid to individual growers in Oregon have ranged from a few cents to about one dollar a pound. Owing to such great fluctuations in price, hop growing, from a business standpoint, becomes extremely variable and in many respects uncertain. A commodity that can in some years be produced and sold for several times its cost, as has been known to occur in hops, stimulates a lively speculative feeling that may be turned to keen disappointment on the part

of those who rush into this enterprise without adequate preparation, experience, or financing.

Table 3. HOPS: ACREAGE, PRODUCTION, YIELD, AND FARM PRICE IN OREGON, 1915-1938\*

Year	Total acreage	Total production	Average yield	Average price per pound	Gross income per acre
	<i>Acres</i>	<i>1,000 pounds</i>	<i>Pounds</i>	<i>Cents</i>	<i>Dollars</i>
1915	20,000	21,000	1,050	12.9	135
1916	20,000	19,000	950	11.6	110
1917	10,000	5,000	500	35.0	175
1918	10,000	3,500	350	28.7	100
1919	8,000	6,400	800	65.9	527
1920	12,000	8,700	725	37.7	273
1921	12,000	9,240	770	24.5	189
1922	12,000	9,600	800	10.8	86
1923	11,550	8,339	722	26.1	188
1924	12,000	13,800	1,150	13.7	158
1925	13,000	15,600	1,200	23.7	284
1926	13,000	14,950	1,150	24.2	278
1927	16,742	15,185	907	20.9	190
1928	17,000	15,609	982	19.0	187
1929	17,000	18,445	1,085	12.0	130
1930	14,000	15,630	1,025	12.4	127
1931	15,500	16,988	1,096	13.8	151
1932	15,500	13,020	840	17.5	147
1933	19,000	21,565	1,135	30.0	340
1934	23,000	19,550	850	15.0	128
1935	26,000	25,792	992	9.9	98
1936	21,000	11,530	530	29.0	154
1937	22,300	24,530	1,100	17.0	187
1938†	21,500	16,555	770	20.0	154
Average	15,920	14,552	915	22.2	203

\* Data for years from 1915 to 1930 inclusive, were taken from Oregon Station Bulletin 288, Table XV (Statistics obtained from confidential records of Oregon hop dealers.). Data for subsequent years were taken from the U. S. Yearbook of Agriculture.

† Preliminary report: Bureau of Agricultural Economics.

The adverse aspects of hop production from the price standpoint are shown when the six low-price years during the period, 1915-1938, are summarized. Prices during these six years averaged only 11.6 cents per pound, or almost 50 per cent less than the average of 22.2 cents for the 24-year period. The yields during these six years of lowest prices averaged 984 pounds an acre, or just slightly above the long-time average of 915 pounds. The average price of the 12 remaining or more nearly normal crops from the standpoint of both yield and price was 19.6 cents a pound. This average price corresponds closely with the average production cost of 18.6 cents per pound, as determined in this study, of a large number of hop yards in Oregon during the three-year period, 1934-1936.

**Markets.** Hop prices, of course, fluctuate with production and consumption both at home and abroad. No satisfactory substitute has yet been discovered to take the place of hops in the brewing industry, and few commodities are quite so limited to a single use. Hence the grower has contended with declines in price and consequent loss in years of large world surpluses, or in cases of poor quality, or from other causes. Some of the major hop-producing countries are further influencing the situation by the use of various control measures such as subsidies, quotas, and tariffs. The United States is normally a hop-exporting country (Table 2). Imports, however, rose sharply following repeal until in 1936 with a short

crop this country had net hop imports of 8,307,000 pounds. Net hop imports were also made in 1935 and 1932, whereas net exports were made in all other years since 1914, with a maximum of 26,499,000 pounds net export volume in 1919.

Data in Table 2 show an average annual production of 31,900,000 pounds of hops in the United States, but account for a combined disposal by breweries and net exports of only 23,660,000 pounds, or 74 per cent of the available supply. A possible partial explanation of this difference is (1) that during the prohibition era some hops were used in the manufacture of "hop flavor" which was on the market in considerable quantities, presumably for use in making "home brew," and (2) that from year to year many of the older hop stocks have been diverted from the brewing industry and sold for bedding or fertilizer or merely destroyed.

**Need for economic research on cost of production.** In the light of the foregoing facts it is evident that the individual hop grower cannot hope to permanently safeguard his investment merely by adjusting his own output of hops to local conditions or even to the world market, but must keep his costs of production in line with the long-time average income possible to him from this enterprise. The experienced hop grower is familiar with the fact that his hop enterprise involves a high investment in plantings, buildings, and machinery, and requires large cash expenditures for operation. Also, most growers have at some time suffered the losses or additional expenditures that accompany insect and disease infestations. Sooner or later they experience the effects of unfavorable weather conditions and of labor difficulties. Farmers who have never produced hops, attracted by the widely reported though infrequent high yields or prices, generally are not aware of the many serious hazards of the enterprise. Many growers are not familiar with methods of studying the various factors affecting their cost of production.

**Cost study requested by hop growers.** The present study was undertaken at the request of the research committee of the Oregon Hop Growers' Association, which asked the Oregon Agricultural Experiment Station to cooperate with producers in compiling information on the cost of production and on practices followed in a number of the hop yards representative of the enterprise in Oregon. The information presented in this bulletin is designed to be helpful to present hop growers interested in avoiding an unwise increase in the total hop acreage, and particularly to serve as a guide to those farmers who are still in the process of considering whether or not to include hops in their farm organization plan.

## DESCRIPTION OF THE STUDY

**Selection of areas.** The selection of the areas to be included in this study of the hop enterprise was made on the basis of their relative importance among the hop-growing regions of the State (Figure 3). Hop production in Oregon has always been centered chiefly in Marion and Polk Counties in the Willamette Valley. Although it is a minor crop from the standpoint of the state as a whole, within a 50-mile radius of Salem it is of major importance because it contributes such a large cash income to the community. The largest hop yards are found on the fertile bottom

**DISTRIBUTION OF OREGON HOP ACREAGE BY COUNTIES  
19,800 ACRES-1938**

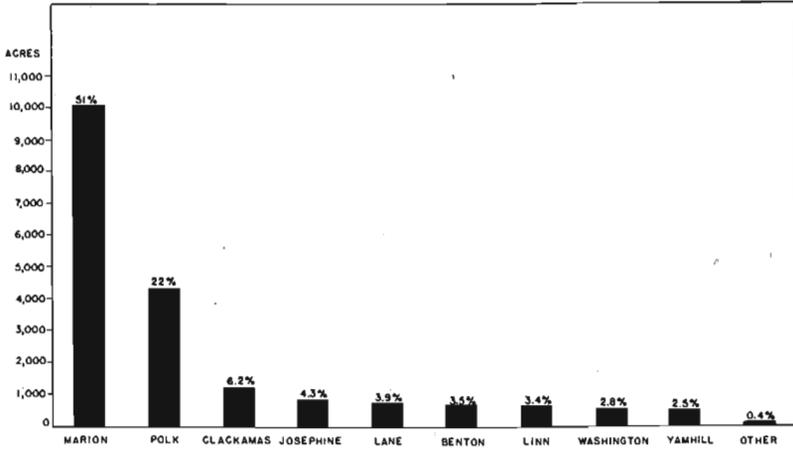


Figure 3. Data from Extension Circular 334, *Production and Income Statistics for Specialty Farm Products, Oregon, 1938.*

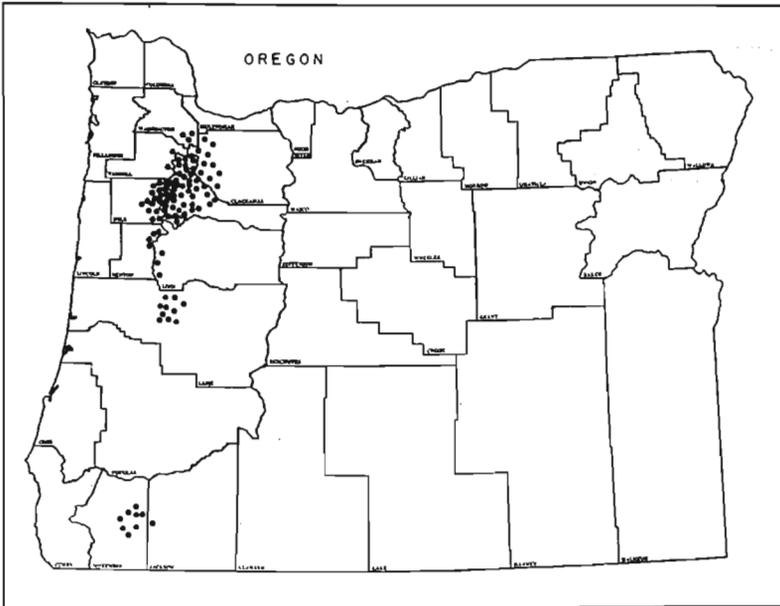


Figure 4. LOCATION OF THE 99 FARMS IN WILLAMETTE AND ROGUE RIVER VALLEYS COOPERATING IN STUDY, 1934-1936.

During the three-year period, 172 complete records were obtained, covering the cost of producing 7,211,855 pounds of dried hops on 8,408 acres.

lands along the Willamette River. A number of growers have excellent plantings on similar bottom-land tracts in southern Oregon. Many small and medium-sized yards are found on valley-floor soils and a few yards, mostly small in acreage, are located on hill soils. The only extensive plantings outside of the Willamette Valley counties are in the Grants Pass region. Smaller acreages are found in Douglas County and east of the Cascade Mountains in Umatilla County.

**Method and extent of study.** Survey records were taken from producers throughout the major hop-growing counties of the state (Figure 4). Field men from the Oregon Agricultural Experiment Station interviewed 99 hop growers, from each of whom was obtained a detailed record of the cost data pertaining to the production of hops on his farm. The field study covered the three-year period, 1934 to 1936 inclusive, during which a total of 172 annual production records was obtained (Table 4). In order to evaluate the findings fairly and to eliminate from the final results the variations due to differences in cost of labor and in methods of operation and management, the records, wherever possible, were taken each year from the same farms.

A considerable acreage of new hops had been planted in 1933 and 1934. The first year of this study was, therefore, devoted chiefly to finding the cost of establishing new plantings and trellises on 60 additional yards aggregating 1,105 acres in the Willamette Valley. In addition to these records on new yards, cost of production data for the 1934 crop were obtained on 24 bearing hop yards. The second year a total of 79 production records was obtained, the survey being extended to include growers in southern Oregon. The third year of the study 69 records were taken, largely from the same farmers as the previous year with the exception of a few who had abandoned the hop enterprise.

For purposes of tabulation and discussion, the averages of each year's cost-of-production data, unless otherwise specified, are combined for the three-year average. Thus the 172 individual records on bearing hop acreage covering the cost of production during three years may be considered as applying to one great hop yard of 8,408 acres, producing 7,211,855 pounds of dried hops. In 1934, the hops made a satisfactory yield and suffered very little from pests. In 1935, an even larger prospective crop later suffered some damage or loss from spider, aphid, storms at harvest time, and in some instances labor difficulties, with the result that only 83 per cent of the crop was harvested on the farms studied. Rather suddenly dur-

Table 4. HOPS: PERCENTAGE OF TOTAL ACREAGE IN OREGON INCLUDED IN STUDY, BY YEARS, 1934-1936

Year	Records in survey	Acreage o. hops in survey	Oregon hop acreage*	Percentage of hops in survey
		<i>Acres</i>	<i>Acres</i>	<i>Per cent</i>
1934 .....	84†	2,006†	23,000	8.7†
1935 .....	79	3,830	26,000	14.7
1936 .....	69	3,677	21,000	17.5

\* Agricultural Statistics, 1936 and 1937.

† Includes 60 records on cost of establishing new yards aggregating 1,105 acres, or 28 per cent of the estimated new acreage set out in 1933-34.

ing the 1936 season Oregon hop yards were seriously infested with aphid and spider and an especially severe attack of mildew. Growers, desperate under the ruinously low prices that prevailed prior to that time, had economized on, or even eliminated, some of the customary operations wherever possible in order to enable them to continue in business. Suddenly prices skyrocketed almost overnight as the prospective crop withered away on the vines. Each grower had to plan his own campaign for combating the infestations. No one could predict just what measures would be justified in each case. Variable factors such as increasing costs, uncertainty as to prices, changing weather conditions, and inadequate or costly equipment facilities had to be considered in mapping a suitable emergency program. As would be expected, the final results of the different procedures followed were likewise extremely variable that year. Since an occasional repetition of such experience is not improbable, the inclusion of the costs in this adverse season with the costs under the more favorable conditions in 1934 and 1935 is deemed justifiable on the basis of its being representative of what the hop enterprise as a whole might expect over a period of years.

DESCRIPTION OF FARMS

Records were taken from operators of farms having hop acreages ranging from as small as 6 acres, including practically no harvesting or

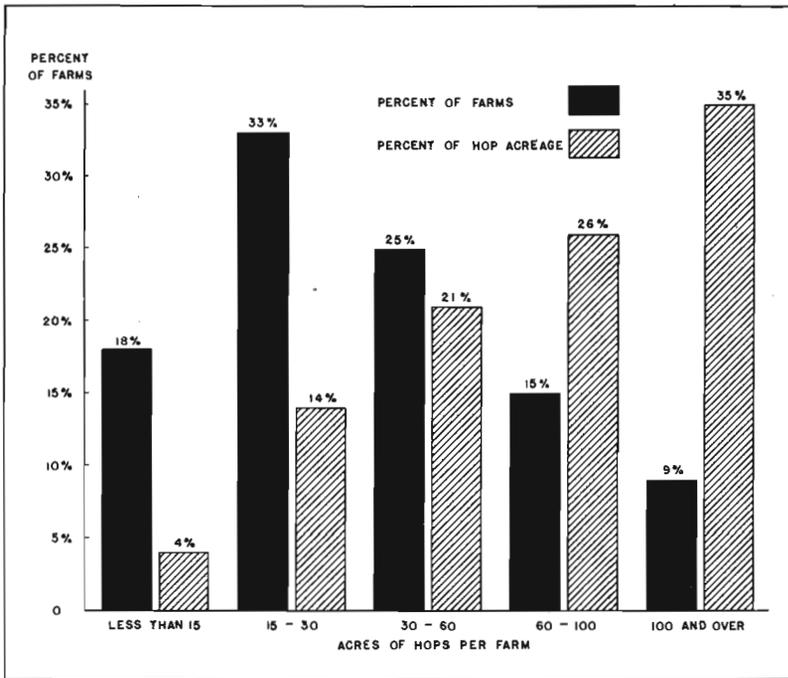


Figure 5. DISTRIBUTION OF HOP YARDS BY SIZE, OREGON, 1935  
 Many small hop plantings are found on diversified farms in the Willamette Valley, but the large specialized hop farms predominate in total hop acreage.

drying equipment, up to units of several hundred acres and no other major sources of income (Figure 5). As a rule the farms with the larger yards were fully equipped with driers, cooling rooms, and storage, and some camp-ground facilities for the transient laborers who were hired at harvest time. Between these extremes were quite a number of growers who, although they produced hops as a major source of income, had more or less diversified their program by maintaining some additional enterprises. Even though the smaller hop acreages are typical in Oregon, the limited number of growers with very large plantings has dominated the situation in some respects because of extreme specialization and large volume of production.

**Use of farm acreage.** During the second year of the survey, data were obtained indicating the general organization of each farm studied. The average size of the 79 farms was approximately 174 acres with about 57 per cent of the area in cultivation in 1935 (Table 5). The hop enterprise,

Table 5. UTILIZATION OF LAND ON HOP FARMS, OREGON, 1935  
Average of 79 farms

Use of land	Number of farms reporting	Average acreage per farm reporting	Average acreage per farm (all farms)
		<i>Acres</i>	<i>Acres</i>
Hops .....	79	48½	48½
Wheat .....	25	20	6
Oats .....	36	21	10
Barley .....	9	16	2
Hay and seed .....	54	24	17
Corn, potatoes .....	25	11	4
Orchard and miscellaneous .....	37	9	4½
Fallow .....	13	16	3
Tillable pasture .....	8	36	4
<b>TOTAL TILLABLE</b> .....	79	99	99
Other pasture and woods .....	62	86	68
Farmstead and waste .....	68	8	7
<b>TOTAL AREA IN FARM</b> .....	79	174	174

averaging 48½ acres on these farms, was usually a major source of income. The balance of the plow land included an average of 18 acres in small grain crops, 17 acres in hay and seed crops, 4 acres in other cultivated crops, 4½ acres in orchard, 3 acres in summer fallow, and 4 acres in tillable pasture. Untillable pasture and timber on these farms averaged 68 acres, and the remaining 7 acres included farmstead, lanes, and waste. While an average is not typical of all farms in the group it does indicate that considerable diversity of production was found on many of these farms.

**Livestock kept.** Many of these hop growers were less concerned with livestock than with crop production. Nevertheless, most hop farms had

some livestock, as shown in the following summary of the 79 farms studied in 1935:

<i>Kind of livestock</i>	<i>Number of farms reporting</i>	<i>Average number of livestock on farms reporting</i>
Horses .....	65	3
Milk cows .....	60	5
Other cattle .....	27	5
Sheep and goats .....	19	115
Swine .....	34	13
Chickens .....	55	77
Turkeys .....	6	15

The majority of these farmers used tractors in their hop yards. On the tractor-equipped farms, the chief function of the horses was to pull the sleds on which the workers stood while training the vines on the trellis wires.

A few hop growers maintained a flock of sheep primarily to control the grass that persisted around the borders of the hop yard and to strip the lower leaves off the hop vines. These operations, particularly the latter, otherwise would have required hand labor.

### CAPITAL INVESTMENT

The present or inventory value of the capital investment in the hop enterprise, including the planting and trellis, the drier, and the share of other buildings, machinery, and equipment chargeable to hop production, as estimated by the 79 growers cooperating in this study in 1935, amounted to a total averaging \$355 per acre (Table 6).

Table 6. HOPS: TOTAL CAPITAL INVESTMENT PER YARD AND PER ACRE, BY MAJOR ITEMS, OREGON, 1935  
Average Size of Yard—48½ Acres

<i>Item</i>	<i>Average investment per yard</i>	<i>Average investment per acre</i>	<i>Percentage of total investment</i>
Land in hop yard.....	\$8,450	\$174	<i>Per cent</i> 49
Plants .....	1,820	38	11
Trellis .....	2,230	46	13
Drier and storeroom.....	2,300	47	13
Machinery* .....	2,410	50	14
<b>TOTAL</b> .....	<b>\$17,210</b>	<b>\$355</b>	<b>100</b>

\* After the inventory of all machinery and equipment used on hops (except the automobile and truck) was taken, the proportion chargeable to the hop enterprise was estimated. (The cost of using the automobile and truck was more conveniently determined on the basis of a flat rate for mileage covered by each vehicle.)

Land of the quality represented in these hop yards was conservatively appraised by the respective growers at an average value of \$174 an acre. Thus the land comprised almost half of the total hop investment. The complete hop yard, including trellis and plants, was estimated at an average value of \$258 an acre. The difference of \$84 between the value of the land and the value of the planted hop yard presumably represents approximately the average inventory value of the trellis and plants. The share of

the farm machinery and equipment used in hop production was carefully estimated and its present value appraised by each operator. The average inventory value of the machinery and equipment thus determined amounted to \$2,410 a farm, or an average of \$50 per acre on the basis of the total hop acreage. Hop driers and other buildings used in connection with hop production were inventoried at \$2,300 a farm, or an average of \$47 for each acre of hops.

The initial capital required in establishing a new hop enterprise would, of course, be somewhat higher than these figures, which are for the most part on used equipment. Both the amount of equipment and the investment in equipment varied much on the different hop farms and from one region to another.

### COSTS THE BASIS FOR IMPROVING INCOME

The following analysis reveals that the costs of the various operations varied widely among the different growers, some having costs considerably above and others considerably below the average cost. The findings should be especially helpful to those growers having higher than average costs in any phase of their production. By ascertaining the items on which they are expending more effort than the average of all growers and by recognizing the fact that certain of their costs are higher than the average, the individual growers should be enabled to focus their attention on these particular items and thus try to work out means for reducing their costs so as to leave a larger margin of profit from their hop production.

### THE COST OF HOP PRODUCTION

The average cost of producing 7,211,855 pounds of hops, dried and delivered at the warehouse, was \$162.70 per acre, or 18.6¢ per pound (Table 7). This represented the total production for the three years, 1934-1936, from 8,408 acres of land. In the three-year period, two crops—those of 1934 and 1935—were about normal, yielding 989 and 973 pounds per acre, respectively. The 1936 crop, though very light on many farms, averaged 706 pounds per acre for the 69 yards studied that year. The average yield on the farms in the survey for the three-year period therefore was 889 pounds of harvested hops per acre. This figure is roughly comparable to the ten-year average (1927-1936)\* of 960 pounds reported for the state as a whole because the yields reported for the farms in this study are based on the total acreage, including headlands, while official crop statistics are reported on the basis of actual acreage planted or the hill-count basis. If the headlands comprising approximately 10 per cent of the hop acreage were deducted from the total acreage in this study, the average yield on the hill-count basis actually was 988 pounds per acre. (The headlands for trellis anchoring and turn-arounds are here included to get the total cost of hop production because they are as necessary to hop growing as is the larger adjacent area that produces the hops.)

\* Hop Report, October 12, 1938. Bureau of Agricultural Economics.

Table 7. HOPS: COST OF PRODUCTION PER ACRE AND PER 100 POUNDS, BY INDIVIDUAL ITEMS  
 Average of three years, Oregon, 1934-1936  
 172 records, 8,408 acres of bearing hops, producing 7,211,855 pounds of dried hops  
 Average size of yard, 46.4 acres; average yield, 889 pounds per acre

Expense item	Cost per acre	Cost per 100 pounds*	Percentage of total cost
<i>Labor</i>			
Hired labor .....	\$ 29.64	\$ 3.42	18.3
Contract labor .....	48.34	5.48	29.7
Operator's labor and supervision.....	13.27	1.54	8.2
Family labor .....	1.51	.17	.9
Total man labor.....	\$ 92.76	\$10.61	57.1
Horse work .....	2.02	.23	1.2
TOTAL LABOR.....	\$ 94.78	\$10.84	58.3
<i>Materials</i>			
Replacing poles and plants.....	\$ 1.96	\$ .20	1.2
Fertilizer and cover-crop seed.....	3.63	.41	2.2
Stakes and string.....	3.83	.43	2.4
Sprays and dust.....	2.36	.29	1.5
Camp wood and lighting.....	.65	.07	.4
Drier fuel and electricity.....	2.07	.24	1.3
Sulphur and kiln cloth.....	.93	.11	.6
Burlap and twine.....	3.13	.35	1.9
Small tools, etc.....	.55	.06	.3
TOTAL MATERIALS.....	\$ 19.11	\$ 2.16	11.8
<i>Equipment</i>			
Tractor operation .....	\$ 2.94	\$ .33	1.8
Sprayer operation .....	.52	.06	.3
Automobile, truck and shipping expense.....	3.43	.39	2.1
Irrigation expense .....	.46	.05	.3
Drier repair .....	1.09	.13	.7
General machinery repair .....	.42	.05	.2
TOTAL EQUIPMENT EXPENSE.....	\$ 8.86	\$ 1.01	5.4
<i>General expense</i>			
Fire insurance .....	\$ 2.11	\$ .24	1.3
Compensation insurance .....	1.46	.17	.9
Property tax .....	2.26	.27	1.4
Rent on equipment.....	.38	.04	.2
Interest on cash to run business.....	3.00	.34	1.8
Telephone, postage, etc.....	.30	.04	.2
TOTAL GENERAL EXPENSE.....	\$ 9.51	\$ 1.10	5.8
<i>Depreciation</i>			
Depreciation on machinery.....	\$ 2.98	\$ .35	1.8
Depreciation on drier and equipment.....	4.45	.52	2.7
Depreciation on other buildings and equipment .....	1.00	.12	.6
Depreciation on trellis.....	4.60	.53	2.9
Depreciation on irrigation system.....	.27	.03	.2
TOTAL DEPRECIATION.....	\$ 13.30	\$ 1.55	8.2
TOTAL OPERATING EXPENSE.....	\$145.56	\$16.66	89.5
<i>Interest (5%)</i>			
Interest on bearing yard.....	\$ 12.63	\$ 1.46	7.8
Interest on drier and equipment.....	2.94	.33	1.8
Interest on other buildings and equipment.....	.55	.06	.3
Interest on machinery .....	.90	.11	.5
Interest on irrigation system .....	.12	.02	.1
TOTAL INTEREST.....	\$ 17.14	\$ 1.98	10.5
TOTAL COST (3-year average).....	\$162.70	\$18.64	100.0
TOTAL COST, 1934.....	\$169.61	\$17.15	.....
TOTAL COST, 1935.....	\$163.87	\$16.85	.....
TOTAL COST, 1936.....	\$154.63	\$21.92	.....

The data shown in this table are unweighted averages for the three-year period, 1934-1936.

\* In order to avoid third-place decimals, the cost items have been reported on the 100-pound basis instead of the pound basis. To find cost per pound, therefore, the dollar values may be read as cents.

**Cost by years.** The costs for 1934 and 1935 were practically identical—17.15 and 16.85 cents per pound, respectively. The short crop of 1936 had a slightly lower acre cost because there were fewer hops to be picked, but mainly on account of the low yield coupled with unusual expenditures for pest control the pound cost rose to 21.92 cents for that year. (For itemized cost by years see Appendix B, Table 29.)

**Cost defined.** The total cost as here presented includes both the cash expenditures and an estimated value of the noncash items. Costs include (1) reasonable wages for the operator and members of his family, as well as for hired and contract labor, (2) cost of horse work, (3) outlay for materials and repairs, (4) allowance for depreciation of equipment and buildings, and (5) a fair charge for interest on the capital used in the farm business figured at the rate it would earn if invested in other equally safe channels. The cost statement (Table 7) is itemized in such a manner that costs exclusive of interest may be observed as well as the complete cost. For example, the cost of producing hops, exclusive of any interest charge for the capital, was 16.66 cents per pound.

### MAJOR ITEMS OF COST

**Cost of direct and contract labor.** Nearly three-fifths of the cost of producing hops in the three-year period, 1934-1936, was for man labor. Of this cost, 84 per cent was listed as hired labor and contract labor expense and only 6 per cent as direct labor expense for the operator and his family. The remaining 10 per cent was for the indirect labor of the operator. The average hourly wage figured for each type of direct labor, based on the prevailing wage in the community, was as follows:

<i>Direct labor</i>	1934	1935	1936	<i>Average</i>
Hired labor .....	27.8¢	26.6¢	28.5¢	27.6¢
Operator's labor .....	25.9	32.0	29.5	29.1
Family labor .....	24.2	25.6	25.7	25.2

The weighted average wage for this man labor was 27.7 cents per hour. On the average yearly direct labor requirements of 126 hours per acre the cost was therefore \$34.92 per acre. The hourly wage rate includes the value of board and lodging whenever the latter were furnished. Hop growers, however, were generally getting their unmarried hired help without furnishing these perquisites. Some of the married workers who remained the year round received the use of a cottage and a garden plot as part of their total wages although they may have been employed by the month, the day, or the hour instead of by the year. The tractor operator, for example, was usually employed by the hour, while the men who directed the harvest and drying operations invariably were paid by the day. Some of the diversified farmers still paid their labor on the monthly basis. But regardless of the basis on which they employed workers, very few hop growers found it necessary to furnish board during the three years covered by this survey.

The eight-hour day for hired labor predominated, excepting that during the picking season the day laborers usually worked 9 or 10 hours a day. The longer day was necessary for the harvest crew because it had to get the picking equipment out ahead of the pickers in the morning and remain to bring in the last batch of picked hops at night.

Contract work ranged all the way from performing a single operation, such as stringing, to the entire operation of a hop acreage throughout the year including drying, baling, and delivering the crop to market. The hop enterprise is adapted to contract operation because of the nature of the planting and the accompanying trellis structure. Since most of the operations must follow the rows of hop plants, it is a relatively simple matter to assign a specified task to a worker or to a crew of workers at a certain rate for the whole job. In picking hops, for example, the practice of payment by weight of green hops enables the wives and children of the hop pickers to contribute their part-time services along with the full-time labor of the head of the family. The adults in such a case can be held responsible for instructing and requiring the children to pick over the vines carefully, and to keep foreign materials out of the containers. The wage for labor in baling the hops after they were dried was commonly paid to a crew of men on the bale basis, even though the baler itself was part of the grower's equipment.

**Cost of indirect labor or supervision.** The active operator of a farm business usually apportions his time among several enterprises. If he kept a record of his time put in for actual labor performed he probably would be unable to account for all of the time he really had contributed. Much of a farmer's time may be occupied by incidental demands like getting the hired help started on a task, conferring with buyers or salesmen, going to town after supplies, and generally supervising the business. In this study an effort was made to have the hop grower himself determine the portion of his total year's work that should be charged to hops and at what price he could replace that service if he hired a capable substitute. From this total amount of labor allocated to hops was deducted the amount of work he actually had done in performing specified hop operations. The remainder constitutes the item of indirect labor or supervision. This indirect time averaged about  $5\frac{1}{2}$  months of the year at \$80 a month, which would be \$440 a year on the average yard of 46 acres. In addition to this the operator's direct labor was valued at \$175, or a total labor charge for the operator's time on hops averaging \$615 a year, or \$13.27 per acre. Much of the operator- and family-labor expense listed here represents work done on the smaller yards where the need for hiring help was largely confined to the harvest season. Conversely, in the larger yards the operator frequently assumed the role of a manager, and the value of his entire services (usually at a rate far above the average mentioned) appears in the item of supervision except in rare cases when it was absorbed directly as part of the cash items.

**Cost of horse work.** Horse work accounts for only about one per cent of the total cost of hop production since very few of the hop growers were depending entirely on horses for motive power. They were used to a limited extent on the diversified farms for cultivating the hops, and quite generally on all farms for pulling the training sleds along the hop rows.

**Materials, equipment, and general expense.** Aside from labor, the largest item of total cost, 11.8 per cent, was for materials. Other items of cash outlay were for equipment operation, 5.4 per cent, and general expense, 5.8 per cent. These three items together constituted 23 per cent of the total cost.

**Depreciation of investment.** Another group of costs, depreciation on all equipment (except automobile and truck) used in connection with hop production, amounted to 8.2 per cent of the total cost.

**Interest on investment.** The third largest item of total cost, 10.5 per cent, is the charge for interest (at the rate of 5 per cent) on the present total capital represented in the enterprise. If there is a mortgage or other debt, a considerable part of the total investment charge must be paid, of course, in cash, and since in bad years this might be a very difficult expense to meet, it is an important item.

### CASH AND NONCASH COSTS

**Cash costs.** The average cash cost of producing hops during the three-year period 1934-1936 was 13 cents per pound, or 71 per cent of the total cost (Table 8). This percentage varied only slightly for the individual

Table 8. HOPS: COST OF PRODUCTION; CASH AND NONCASH  
Average of three years, Oregon, 1934-1936

Item	Cash cost		Noncash cost	
	Cash cost per acre	Percentage of total cost	Noncash cost per acre	Percentage of total cost
		<i>Per cent</i>		<i>Per cent</i>
Hired labor .....	\$ 29.64	18.3	.....	.....
Contract labor .....	48.34	29.7	.....	.....
Operator's and family direct labor.....	.....	.....	\$ 5.28	3.3
Supervision .....	.....	.....	9.50	5.8
<b>Total man labor.....</b>	<b>\$ 77.98</b>	<b>48.0</b>	<b>\$ 14.78</b>	<b>9.1</b>
Horse work .....	.....	.....	2.02	1.2
<b>TOTAL LABOR.....</b>	<b>\$ 77.98</b>	<b>48.0</b>	<b>\$ 16.80</b>	<b>10.3</b>
<b>Materials .....</b>	<b>\$ 19.11</b>	<b>11.8</b>	.....	.....
Equipment operation .....	8.86	5.4	.....	.....
General (insurance, taxes, etc.).....	9.51	5.8	.....	.....
Depreciation .....	.....	.....	\$ 13.30	8.2
Interest on investment .....	.....	.....	17.14	10.5
<b>TOTAL COST (3-year average).....</b>	<b>\$115.46</b>	<b>71.0</b>	<b>\$ 47.24</b>	<b>29.0</b>
<b>TOTAL COST, 1934.....</b>	<b>\$124.57</b>	<b>73.5</b>	<b>\$ 45.04</b>	<b>26.5</b>
<b>TOTAL COST, 1935.....</b>	<b>\$115.63</b>	<b>70.6</b>	<b>\$ 48.24</b>	<b>29.4</b>
<b>TOTAL COST, 1936.....</b>	<b>\$106.20</b>	<b>68.6</b>	<b>\$ 48.43</b>	<b>31.4</b>

years, 73.5 per cent in 1934, 70.6 per cent in 1935, and 68.6 per cent in 1936. Obviously many of the growers cannot long survive if hop prices are not sufficient to meet at least the cash costs. The chief item of cash cost was for hired and contract labor (Figure 6). Most of this labor was employed in harvesting the crop. With a low yield, as in 1936, the harvest costs are correspondingly less and hence the proportion of cash costs are less with low yields. The proportion of total costs paid in cash is usually higher on large yards than on small yards because most or all of the labor on the former is hired while on the latter much of it is family labor and hence is a noncash item.

**Noncash costs.** Noncash costs of production during the period studied constituted 29 per cent of the total cost. The chief noncash items are for the operator's own labor, family labor, depreciation, and interest on the

investment. These items are largely fixed charges that do not vary much from year to year. The hop yard must be cared for whether there is a crop or not, and at least the smaller operators do much of the work themselves. Depreciation and interest on the investment go on regardless of production (Figure 7).

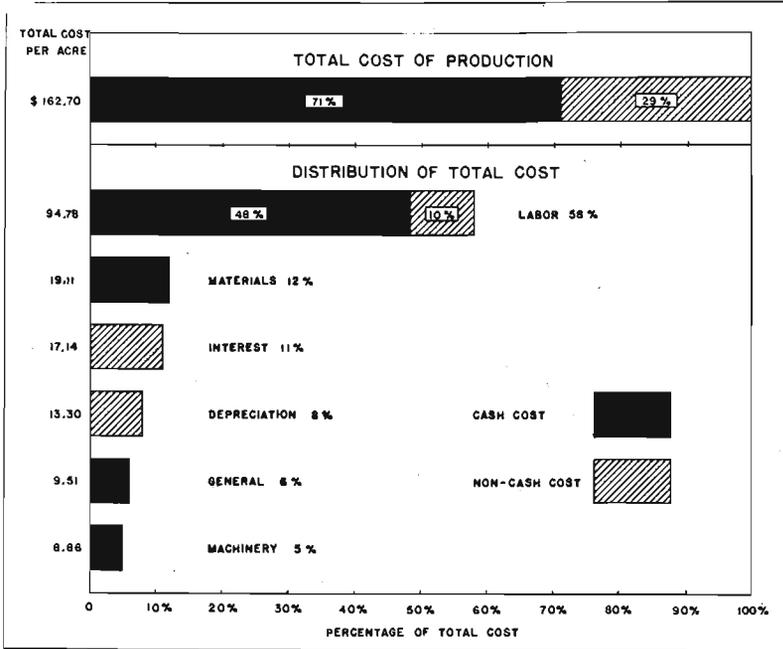


Figure 6. DISTRIBUTION OF THE TOTAL, CASH, AND NONCASH COSTS OF HOP PRODUCTION PER ACRE IN OREGON, 1934-1936.

The cost of each major item, cash or noncash, is shown at the left, and the percentage of the total cost of each item is shown on the horizontal scale.

Interest on capital is considered as a noncash item in this study because, while many of the growers have some indebtedness on their business, it is difficult to determine the portion to be charged to hops. The policy of a uniform rate of interest covering the entire average investment for the year was adopted because rates of interest paid varied widely; amounts of indebtedness changed during the year; and some growers were reluctant to divulge these matters, which they considered to be of a personal nature.

Many farmers think only in terms of those costs that represent immediate cash outlay and disregard such important items as the value of their own labor and that of the family, the use of horses, machinery, and the land for growing the crop. Since *total* cost is the long-time determinant or measure of the profitableness of an enterprise, it is important to understand fully the difference between cash costs and the total cost of production, realizing, however, that such a distribution must necessarily

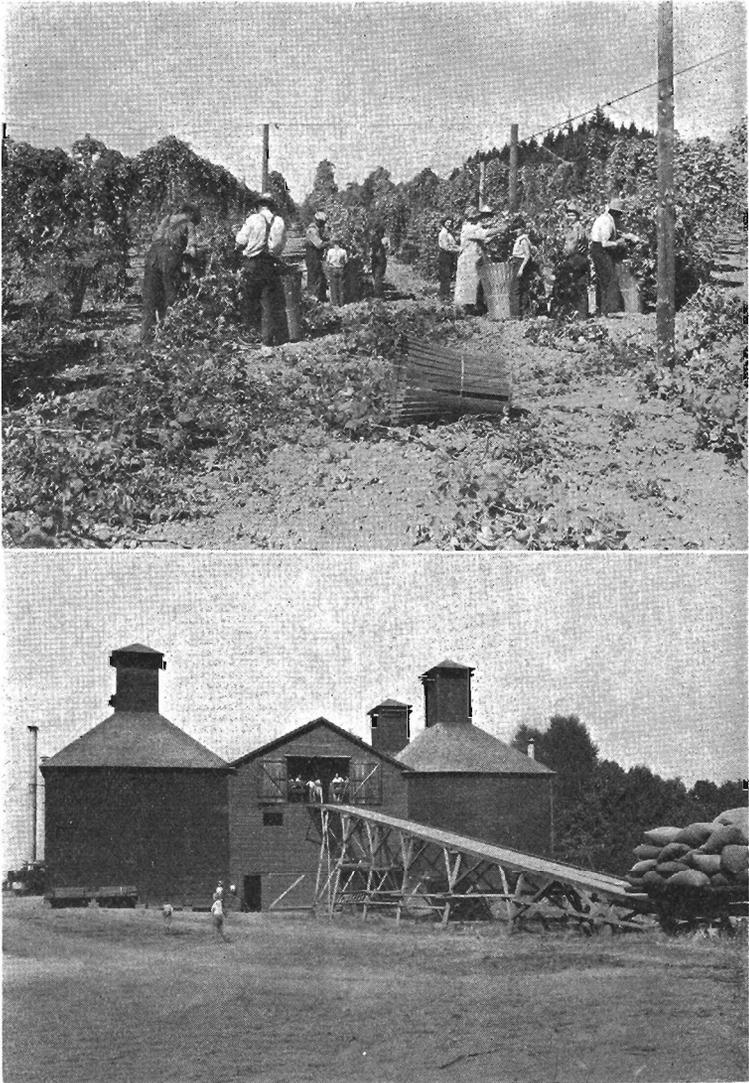


Figure 7. LABOR AND EQUIPMENT EXPENSE ARE THE BIG ITEMS IN THE COST OF PRODUCING HOPS.

(Upper) Entire families of pickers join in harvesting the crop, the wage being based on the weight of the green hops picked. (Lower) The hop drier is one of the costly items of the capital investment, averaging \$2,300 per farm, or \$47 per acre of hops at present inventory values.

be somewhat arbitrary. While it is possible that prices or yields so low as to pay only the cash costs involved in operating the enterprise may enable many producers to continue in the hop business for several years, distress is eventually felt when the farmer actually needs additional cash for such capital items as new machinery, new horses, and payments on mortgages. A farmer and his family, moreover, must depend largely upon the earnings of their own labor for a satisfactory livelihood and if an enterprise does not return a wage for this labor their standard of living must suffer accordingly.

In the final analysis of the situation, an enterprise cannot long survive in present-day economy unless it is able to pay *all* costs and perhaps a fair profit or compensation for risk.

Hops a high-risk enterprise. Few farm enterprises show such a high percentage of cash cost as hops. This enterprise must be considered in the high-risk group, for light crops or low prices may cause considerable cash loss. The experience of certain hop yards in 1936 affords an excellent example of a serious condition that can arise occasionally, as shown by the following figures:

	<i>Average yield in pounds per acre</i>	<i>Cost per acre</i>	<i>Cost per pound</i>
20 high-cost yards.....	151	\$ 96	63.5¢
20 low-cost yards.....	1,080	195	18.1

For the 20 high-cost operators there was little comfort in the fact that their acre-cost was low, for much of that cost, amounting to 63½ cents a pound on the small yield of 151 pounds per acre, was not met by the average price of 34 cents a pound received. Some of those hops were sold on contract for as low as 12 cents a pound.

### COST OF DRYING HOPS

Total cost of drying. The cost of drying hops on the farms cooperating in this study during the three-year period, 1934-1936, was \$9.03 per ton of green hops (Table 9). This cost includes all items of expense except the indirect labor and the interest on cash to run the business, which, though charged to the hop enterprise as a whole, would fall proportionately on the different phases of production.

Approximately a fourth of the drying cost was for man labor, which is generally hired (Figure 8). Other items of expense were interest, depreciation, and repairs on the drier and equipment; oil and wood for fuel; electricity for power and light; sulphur, kiln cloth, fire insurance, and a small amount for contract drying and for rent of a drier. Data on the operation of 185 drier kiln units were obtained in the survey (Table 10). Using \$9.03 as the average cost of drying a ton of green hops, as shown in Table 9, the approximate cost for operating driers of any given capacity could be estimated, assuming that the cost per ton does not vary materially with size of drier. Thus the average daily total cost of operating one of the smallest-sized driers, with a capacity of 2 tons of green hops a day,

would be about \$18; the cost for the 3-ton sized drier would be \$27 per kiln of hops dried; the cost for the 3½-ton size would be about \$32 per day; and that for the largest or 6-ton sized kiln would be approximately \$54 per day. In other words, kiln rent should vary about as the kiln size.

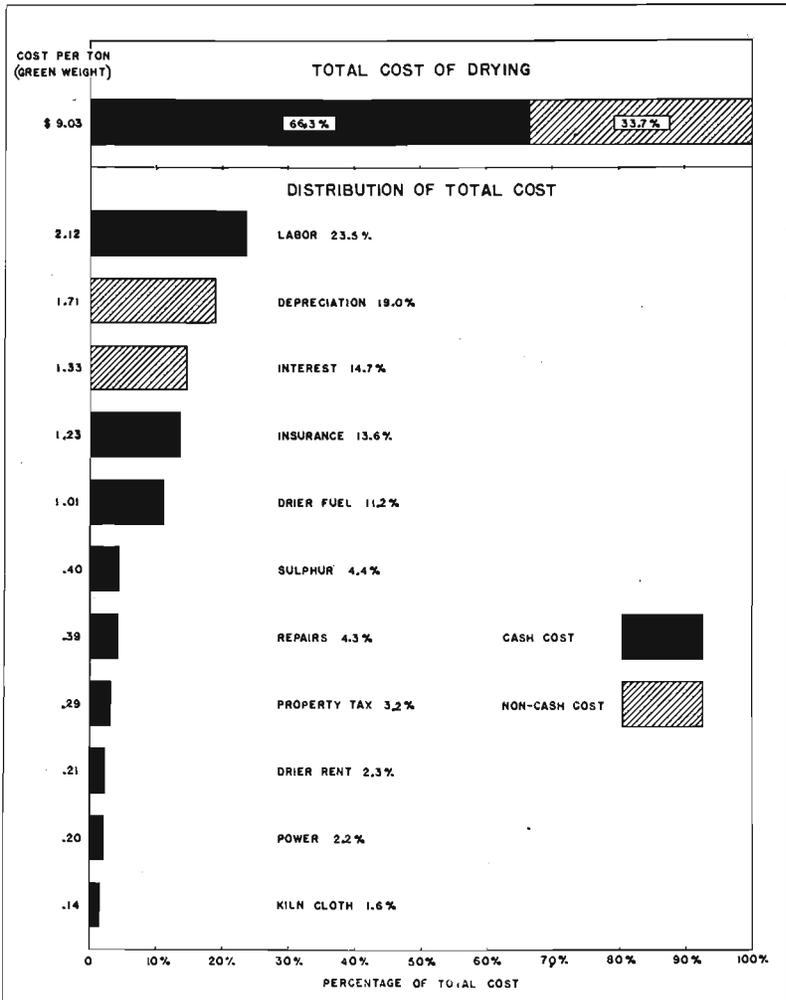


Figure 8. DISTRIBUTION OF THE TOTAL, CASH, AND NONCASH COSTS OF DRYING HOPS IN OREGON, 1934-1936.

The cost of each major item, cash or noncash, is shown at the left, and the percentage of the total cost of each item is shown on the horizontal scale. Ordinarily 50 pounds of green hops are reduced to approximately 12 to 14 pounds in the drying process.

Table 9. HOPS: COST OF DRYING, CASH AND NONCASH; BY INDIVIDUAL ITEMS, OREGON, 1934-1936.\*  
Average of 172 records

Item	Total cost per ton (green weight)	Percentage of total cost	Cash cost per ton	Noncash cost per ton
Man labor .....	\$ 2.12	23.5	\$ 2.12	.....
Sulphur .....	\$ .40	4.4	\$ .40	.....
Kiln cloth .....	.14	1.6	.14	.....
Drier fuel .....	1.01	11.2	1.01	.....
Power .....	.20	2.2	.20	.....
Fire insurance .....	1.23	13.6	1.23	.....
Drier rent and contract drying.....	.21	2.3	.21	.....
Property tax .....	.29	3.2	.29	.....
Repairs .....	.39	4.3	.39	.....
<b>TOTAL GENERAL EXPENSE.....</b>	<b>\$ 3.87</b>	<b>42.8</b>	<b>\$ 3.87</b>	.....
Depreciation .....	\$ 1.71	19.0	.....	\$ 1.71
Interest on investment .....	1.33	14.7	.....	1.33
<b>TOTAL COST (3-year average).....</b>	<b>\$ 9.03</b>	<b>100.0</b>	<b>\$ 5.99</b>	<b>\$ 3.04</b>
TOTAL COST, 1934.....	\$ 10.96	.....	\$ 7.18	\$ 3.78
TOTAL COST, 1935.....	8.44	.....	5.47	2.97
TOTAL COST, 1936.....	7.68	.....	5.33	2.35

\* The cost of drying, on a dried-weight basis, was 1.78 cents per pound. (See Appendix B, Table 31, for variations in the itemized cost of drying.)

Table 10. HOP DRIERS: SIZE AND CAPACITY OF KILNS; DEPTH AND TEMPERATURE OF HOPS, OREGON, 1935  
185 kilns having daily capacity of 1,129,170 pounds green hops

Size of kiln floor	Number of kilns	Depth of hops on floor	Average temperature (Fahrenheit)	Average period of drying	Average weight of green hops to a kiln
		<i>Inches</i>	<i>Degrees</i>	<i>Hours</i>	<i>Pounds</i>
24 feet square or less.....	51	23	138	19	4,000
25-29 feet square .....	55	23	140	18	6,000
30-32 feet square .....	73	23	140	17	7,000
33-36 feet square .....	6	32	146	16	12,000

A few of the small growers were dependent on custom drying of their hops. The rates for this service were not well established. Usually other considerations growing out of neighborly cooperation were involved. The commonly mentioned rate was \$5 a kiln, which might or might not include man labor or fuel. The costs found on this large number of driers throughout the hop-growing areas of Oregon provide a basis for establishing rental rates according to service rendered.

Among the 185 drier units studied in 1935, 142 were the natural-draft type and 43 were the fan-type or so-called "re-circulation" driers, equipped with power-operated fans. Drying hops in the latter or modern type of drier is considered to be more efficient as to time required and size of building needed for a certain tonnage, but a segregation of these costs was not attempted in this study.

Cash and noncash costs of drying hops. Of the total cost of drying, two-thirds, or \$5.99 per ton, was paid out in cash, chiefly for labor, fuel,

and fire insurance (Figure 8). The noncash items consisted of interest and depreciation on the drier and equipment.

### FIXED AND SEASONAL COSTS

Certain of the costs of producing hops are fixed costs, remaining almost constant from year to year regardless of the size of the crop, while other costs are seasonal in nature and vary from year to year according to the yield. A study of the distribution of costs on this basis was made for the one year of 1935 when the largest number of records was taken and the conditions were most nearly typical for all farms. (For itemized fixed and seasonal costs see Table 30, Appendix B.)

**Fixed costs.** The fixed costs of hop production were almost one-fourth (22.9 per cent) of the total cost, or \$37.84 per acre (Table 11). The chief items constituting fixed costs were interest and depreciation on the investment. Fire insurance, property tax, building repairs, and incidentals were relatively small expenditures that, however, had to be paid in cash each year. Interest and depreciation were treated as noncash costs, although, as previously mentioned, interest in cases of mortgage or other indebtedness was actually paid in cash.

Table 11. HOPS: COST OF PRODUCTION SUMMARY BY FIXED AND SEASONAL COSTS, AND BY NONCASH AND CASH ITEMS  
79 farms with an average yield of 973 pounds per acre, Oregon, 1935

Item	Cost per acre			Cost per pound	Percentage of total
	Noncash	Cash	Total		
Fixed costs .....	\$31.91	\$ 5.93	\$ 37.84	3.8¢	22.9
Preharvest costs .....	11.87	39.51	51.38	5.3	31.5
Harvest costs .....	4.57	70.08	74.65	7.7	45.6
<b>TOTAL COST.....</b>	<b>\$48.35</b>	<b>\$115.52</b>	<b>\$163.87</b>	<b>16.8¢</b>	<b>100.0</b>

**Seasonal costs.** The seasonal costs, in 1935, included preharvest costs of \$51.38 per acre, and harvest costs of \$74.65 per acre, or 31.5 per cent and 45.6 per cent, respectively, of the total cost of production. Preharvest costs were about equally divided into those for man labor and those for materials and power for the field work. Approximately three-fourths of this preharvest cost was cash expense.

Harvest costs, which vary from year to year according to the yield and the wage scale, consisted largely of man-labor expense and nearly all of these harvest items were cash costs. With a very heavy crop of hops, the fixed cost per pound is low in relation to the seasonal costs while with a light crop it is much higher. (The variation in costs with varying yields is shown in Figure 13, page 33.)

**Summary of fixed and seasonal costs.** The cost figures when grouped as shown in Table 11 indicate the amount of cash required to finance the seasonal operations. In years when prices for hops are extremely low, the grower can determine whether it will pay to harvest the crop at all. For example, in a year with prospects for a typical half-ton crop, if a price as low as 8 cents a pound were obtainable, this price would pay the harvest expense (at the costs shown), leaving a return of \$3.00 an acre above the

cost of harvesting. Each additional cent above this price would increase the net acre return above harvesting expense another \$10. These relationships are true even though the price would mean a heavy loss on the total cost of production.

VARIATIONS IN COST OF PRODUCTION

The cost of hop production in the major producing areas of Oregon has been presented and discussed as a whole. The next step is to consider the costs from the standpoint of the individual grower. In Table 12, the 172 records have been grouped according to their respective costs of production. In Figure 9, the percentage of the records in each cost group, both for the individual years and for the whole period, is presented graphically.

Table 12. HOPS: VARIATION IN COST OF PRODUCTION PER POUND; BY COST GROUPS, OREGON, 1934-1936  
Average price received was 22.8¢ a pound

Cost per pound	Number of records	Percentage of records		Average cost per pound	Total acreage of hops	Cumulative percentage of acreage
		<i>Per cent</i>	<i>Per cent</i>			
Below 15¢ .....	42	25	25	13.8	1,503	18
15¢ to 20¢ .....	55	32	57	17.5	3,371	58
20¢ to 25¢ .....	23	13	70	22.1	1,693	78
25¢ and over .....	52	30	100	35.7	1,841	100
TOTAL.....	172	100	....	18.6	8,408	....

The average price received by the grower for the 4,367,000 pounds of dried hops reported as sold during the three-year period was 22.8 cents per pound. The largest group of growers is credited with producing hops over the three-year period at an average cost of 17½ cents per pound, while costs for the next largest group averaged 35.7 cents per pound, or more than twice as much. Altogether, about three-fifths of the growers had total costs of production lower than the price received for the hops. In other words, this large group of growers at the average price received for their hops was able to meet all cash costs and in addition they received payment in cash for all noncash costs, including depreciation, 5 per cent interest on the hop investment, and wages for their own and family labor. Moreover, a large percentage of the group had a clear profit remaining above these costs during the three-year period.

On the other side of the cost picture is a large group of growers with high costs, some of which ran far beyond 50 cents per pound for individual years.

Variation by years. Naturally some years are better than others. The percentage of yards that produced hops at a cost of less than 20 cents per pound each year is as follows:

- 1934.....71 per cent
- 1935.....85 per cent
- 1936.....19 per cent

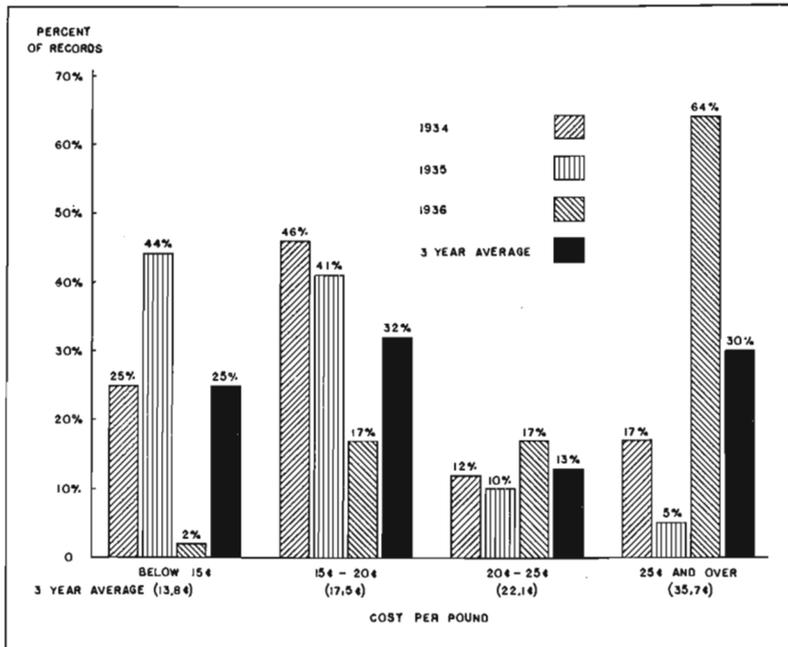


Figure 9. PERCENTAGE OF RECORDS IN DIFFERENT COST GROUPS EACH YEAR OF THE STUDY, OREGON, 1934-1936.

In 1935, a total of 85 per cent of all cooperators had costs under 20 cents per pound, whereas in the adverse season of 1936 a total of 81 per cent of the growers had costs of 20 cents or higher.

**Variation in yearly cost on the same farm.** Costs will necessarily vary from year to year on the same farm (Figure 10). Such variation is graphically presented for 65 individual farms on which records were taken for at least two successive years. This classification includes 19 records taken in 1934 that were repeated in one or both of the following years, 65 records in 1935, and 60 in 1936.

A careful study of this chart shows that cost of production does vary on the same farm from year to year but that a few farms have a tendency to be consistently low and a few farms have a tendency to be consistently high. The bad crop conditions of 1936 caused a high cost of production for that year on some of the low-cost farms, but did not affect all of them.

The cost line, as it passes through the data for each farm, shows the average cost for the two- or three-year period for that farm. The price line that crosses the diagram shows the average price paid the growers during the three-year period.

The hop enterprise on all farms whose average cost line is below the average price line was profitable for the period as a whole, while on all farms with average cost lines above the average price line hops were generally unprofitable.

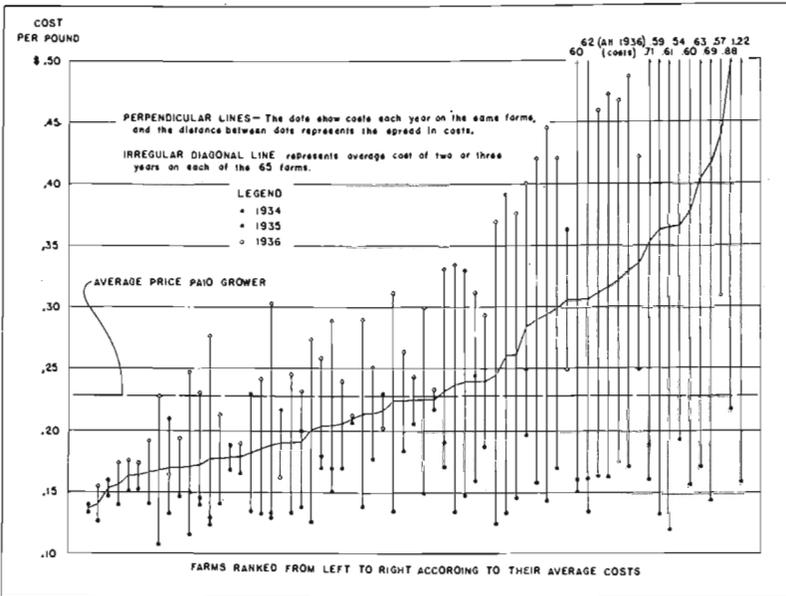


Figure 10. Cost of production varies somewhat on the same farms year after year. Some producers tend to be consistently low, while other producers are erratic. Oregon, 1934-1936.

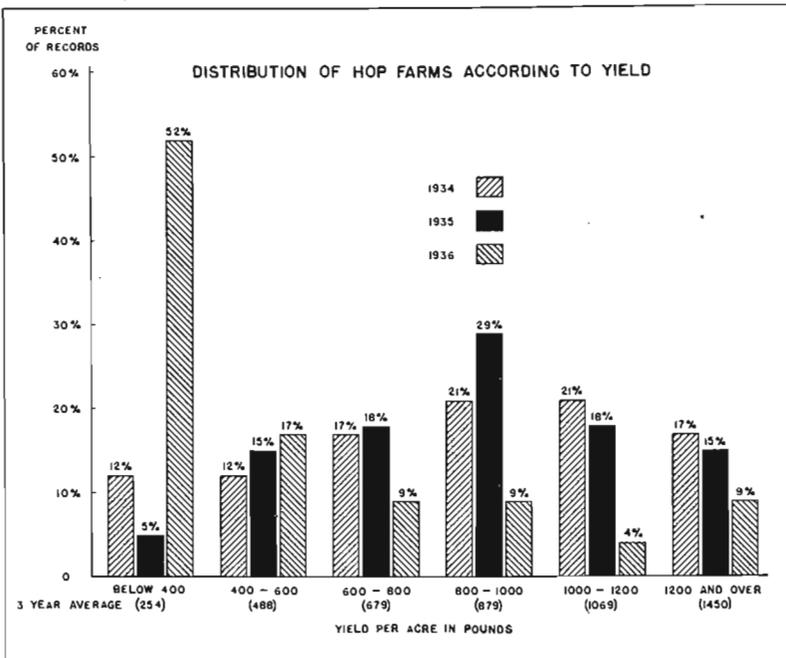


Figure 11. Hop yields in Oregon varied greatly, not only from farm to farm in any one year but also from year to year on the same farm.

When a farm has a consistently low cost, the operator has probably developed a definite system and a measure of efficiency in operation and management that bring satisfactory results year after year. Even well-organized farms, however, may occasionally suffer from conditions beyond the operator's control. On the other hand, the high-cost farms occasionally have a fairly low-cost year, but not frequently enough to make them really successful. On some of these farms, the low-cost year is an indication of the possibility that improving the operation and management may gradually lead to consistently low-cost production.

## MAJOR FACTORS INFLUENCING COSTS AND PROFITS

The major factors most dominant in their effect on cost and profit as determined in this study are:

1. Yield per acre and the various factors affecting yield.
2. Labor efficiency in production and harvest.
3. Volume or size of business.
4. Grade and price.

In addition to these major factors there are usually minor factors, one or more of which at times may affect cost of production to a considerable extent, but which on the whole, year after year, are of no great importance. There are also some factors, such as character of the season, that are beyond the control of the farmer.

### YIELD IS A DOMINANT FACTOR

Low cost per pound generally associated with high yield. The extent of variation in hop yields each of the three years studied is illustrated in Figure 11. High yield alone does not always result in low cost of production on an individual farm yet its influence on costs in any group of farms is apparent. Since most operations, aside from harvesting, would appear to cost about as much for a light as a heavy crop, and further, since costs for interest, taxes, and depreciation are practically constant, it is obvious that low costs per pound are likely to be associated with good production (Figure 12). Some very efficient farms can produce hops fairly cheaply even with low yields, but in general the production cost per pound rises with low yields and decreases with good yields. Therefore, though the cost per acre in this study increased with higher yields because of the additional harvesting expense, the cost *per pound* decreased (Table 13).

Table 13. HOPS: EFFECT OF YIELD PER ACRE ON COST OF PRODUCTION PER POUND; BY YIELD GROUPS, OREGON, 1934-1936  
Average of 172 records

Yield per acre	Per-centage of records	Average yield	Average cost per pound	Average cost per acre
	<i>Per cent</i>	<i>Pounds</i>	<i>Cents</i>	
Below 400 pounds .....	25	254	37.2	\$ 95
400-600 pounds .....	15	488	22.8	111
600-800 pounds .....	14	679	19.4	131
800-1,000 pounds .....	20	879	17.4	154
1,000-1,200 pounds .....	13	1,069	15.7	169
1,200 pounds and over .....	13	1,450	16.7	242
<b>ALL YARDS.....</b>	<b>100</b>	<b>889</b>	<b>18.6</b>	<b>\$ 163</b>

In the group yielding more than 1,200 pounds per acre, the cost per pound was slightly higher than in the group yielding from 1,000 to 1,200 pounds. Even though this difference in cost is relatively small, it may indicate that some growers in this group are incurring excessive expense in their efforts to obtain record yields (Figure 12).

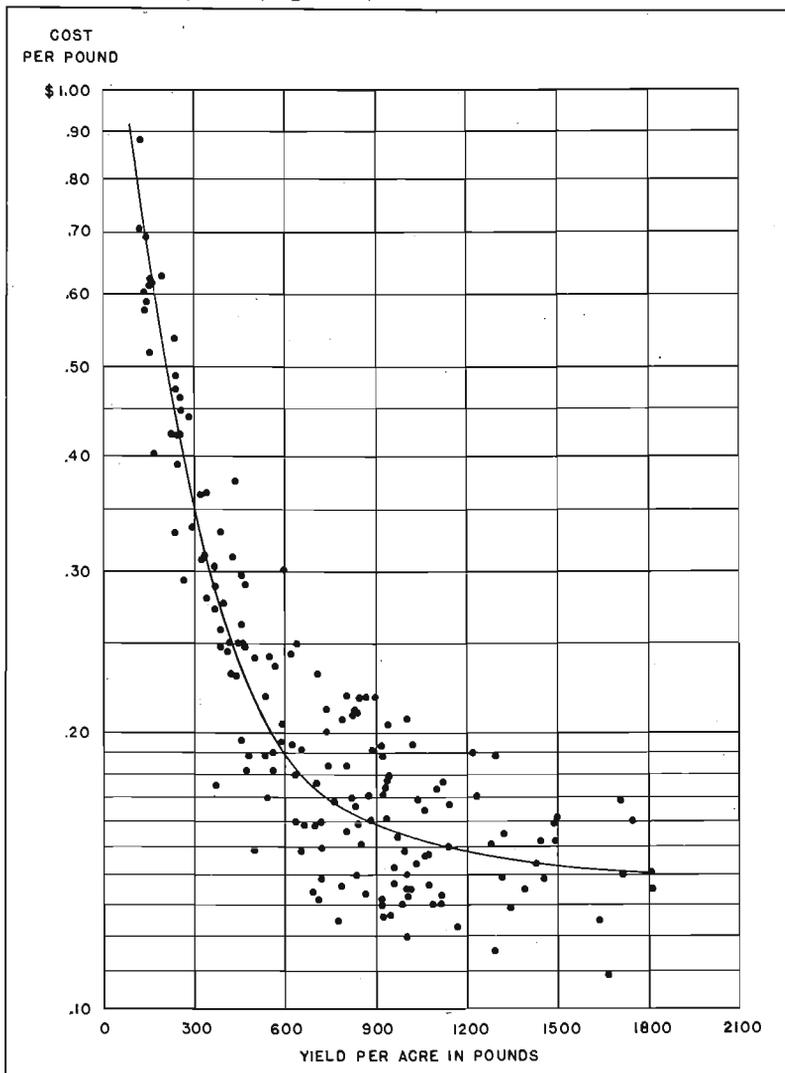


Figure 12. Good YIELD REDUCES COST OF PRODUCTION, OREGON, 1934-1936.

The average price received by cooperators for hops sold over the three-year period was 22.8 cents. On the basis of this average price received, three-fifths of all the records in this study showed yields large enough to make a profit above their total cost of production.

The fixed cost per acre, as shown in Figure 13 for the year 1935, changed very little with increased yield except in the highest-yield group with its heavier trellis and equipment investment. In contrast, the preharvest cost per acre, such as fertilizing, irrigation, and training increased somewhat on the farms with the larger yields, which indicates more effort was put into production. The cost of harvesting, of course, increased directly as the yield increased.

The effect on cost *per pound*, of increasing yield which is the very opposite of its effect on cost per acre, is shown in the lower half of Figure 13. Fixed costs and seasonal preharvest costs per pound declined considerably with higher yield, whereas harvest costs per pound declined very little or none.

**Yield required to pay cost.** The data showing the relation of cost to yield will enable the grower, on the basis of this study, to determine approximately what yield would be required to cover the cost of production at varying prices for hops.

The study has shown that hop-production costs were about 18 cents per pound on an average yield of around 900 pounds per acre. The grower producing that yield under conditions similar to those experienced in this study could therefore break even if he received 18 cents for his hops. When yield and price drop below this amount, it means lower wages for the operator and unpaid family labor and less than 5 per cent interest return on the investment, or else the owner must put a lower value on the low-yielding yards than has heretofore been done. A yard yielding less than an average of 600 pounds per acre will have difficulty in competing with the higher-producing yards unless there are steps the operator can take, at a reasonable expense, to increase yields or otherwise reduce his cost per pound.

### FACTORS INFLUENCING YIELD AND COST

**Many factors influence yield.** Although the effect of pests, such as downy mildew, aphid, red spider, and of practices in pruning, stringing, training, and cultivation were observed, none of these could be definitely measured by the survey method of study.

The factor that most affected the yield of hop yards was the type of soil and its location. Other yield factors measured or observed that seemed important were (1) irrigation, (2) maintenance of soil fertility, (3) variety of hops, and (4) age of yard.

**Effect of soil type and location.** Hops in Oregon are found almost exclusively either on the rich bottom lands along rivers and creeks or on the main valley-floor (bench land) soils of the Willamette Valley (Table 14). The three-year average cost of production on all the valley-floor yards was 20 cents per pound on an average yield of 664 pounds per acre compared to a cost of 18.7 cents per pound on bottom-land yards having an average yield of 1,027 pounds per acre.

Failure to harvest a considerable portion (estimated at 17 per cent) of the good crop produced on the bottom-land yards in 1935 reduced the recorded yield of that year. Harvesting of the entire crop would have effected a corresponding lowering of the cost shown for these farms. In

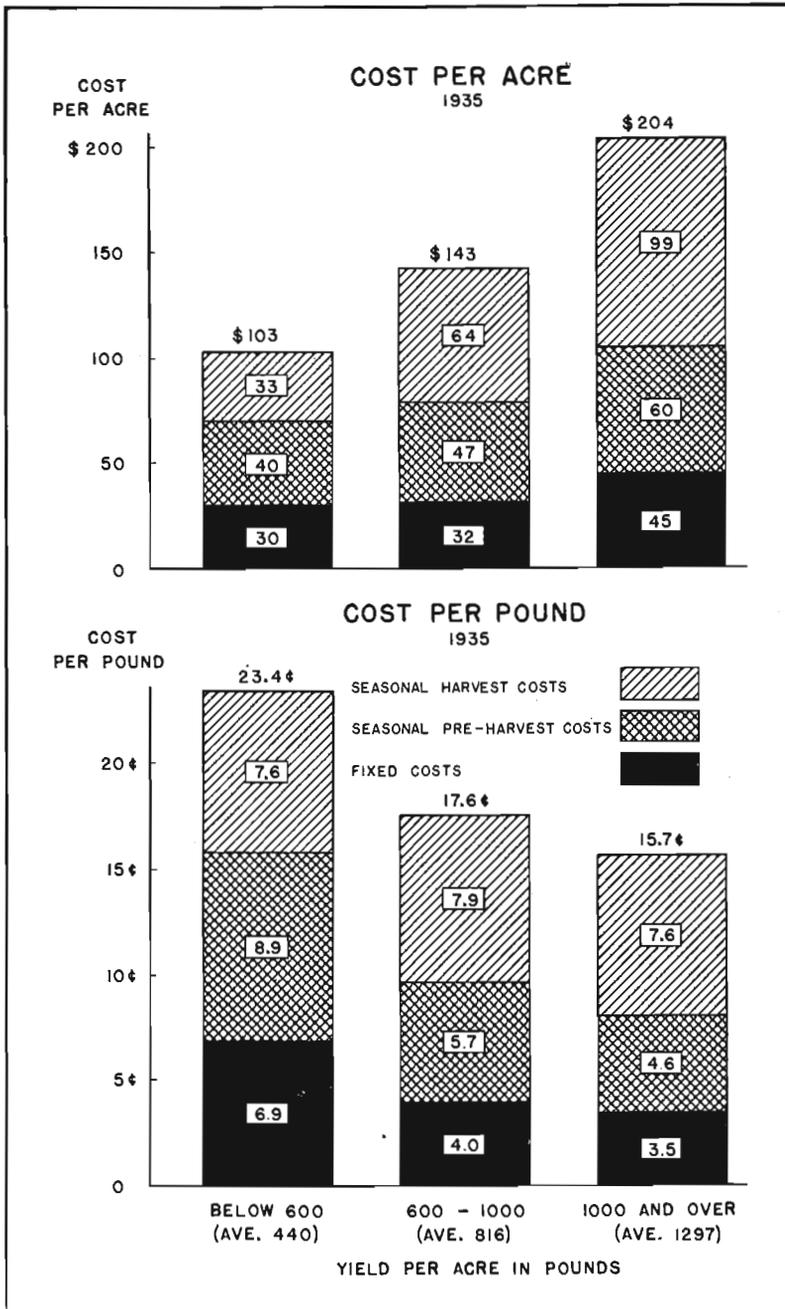


Figure 13. FIXED AND SEASONAL COSTS OF PRODUCTION AT VARYING YIELDS, OREGON, 1935.

The upper half of the figure shows that both fixed and preharvest costs *per acre* remain relatively constant at different yields but harvest costs increase directly with yield. The lower half of the figure shows that both fixed and preharvest costs *per pound* decline rapidly with increase in yield.

1936, the production of valley-floor yards in turn suffered more severely from mildew and aphid than did the bottom-land yards.

Table 14. HOPS: RELATIONS BETWEEN TYPE OF SOIL, YIELD, AND COST FOR 52 BOTTOM-LAND YARDS AND 75 VALLEY-FLOOR YARDS, OREGON; BY YEARS AND THE THREE-YEAR AVERAGE, 1934-1936.

Location of yard	Yield per acre				Cost per pound			
	1934	1935	1936	Average	1934	1935	1936	Average
	Pounds	Pounds	Pounds	Pounds	Cents	Cents	Cents	Cents
Valley-floor soils .....	760	821	416	664	16.0	15.2	28.7	20.0
Bottom-land soils .....	1,252	1,028	802	1,027	18.0	17.3	20.7	18.7

Detailed data for the two years, 1935 and 1936, are shown separately here in order to point out the variation in results occurring from one year to another on these two kinds of soils (Table 15). The chief differences in the acre-cost of production on bottom-land and main valley-floor yards in 1935 were for fertilizing, training, spraying, irrigation, interest, and miscellaneous expense—a total difference of \$53 per acre in favor of the latter for that year. The extra expense incurred on the bottom-land yards resulted in a somewhat better yield, but nevertheless a 2-cent higher cost per pound.

In 1936, the costs for spraying the valley-floor yards were unusually high because of disease and pest infestations. While the reduced yield decreased the acre-cost on these yards it increased the pound-cost to 28.7

Table 15. HOPS: COST OF PRODUCTION ON BOTTOM-LAND AND VALLEY-FLOOR SOILS, OREGON, 1935 AND 1936

Item	Cost per acre			
	1935		1936	
	Bottom land	Valley floor	Bottom land	Valley floor
Trellis maintenance .....	\$ 8.94	\$ 8.17	\$ 8.03	\$ 8.13
Stand maintenance .....	4.19	2.68	2.32	3.25
Fertilizing .....	4.99	2.64	3.61	2.84
Cultivation .....	9.83	9.55	8.61	9.74
Training .....	17.44	13.63	15.95	15.13
Spraying, spiking, etc. ....	6.83	2.94	7.60	8.98
Irrigation .....	2.86	.....	2.31	.....
TOTAL PREHARVEST.....	\$ 55.08	\$ 39.61	\$ 48.43	\$ 48.07
HARVEST EXPENSE.....	\$ 87.85	\$ 60.52	\$ 81.23	\$ 42.75
Supervision .....	\$ 8.49	\$ 7.23	\$ 10.42	\$ 11.45
Automobile and truck .....	2.73	2.55	2.70	2.04
Compensation insurance .....	1.75	.75	2.09	.67
Property tax .....	2.59	1.93	2.63	2.02
Interest .....	14.63	10.80	14.42	11.13
Miscellaneous .....	5.14	1.50	4.32	1.33
TOTAL OTHER EXPENSE.....	\$ 35.33	\$ 24.76	\$ 36.58	\$ 28.64
TOTAL COST.....	\$178.26	\$124.89	\$166.24	\$119.46
Number of farms .....	40	39	36	33
Average size of yard (acres).....	70	27	77	28
Yield per acre (pounds).....	1,028	821	802	416
Cost per pound (cents).....	17.3¢	15.2¢	20.7¢	28.7¢

cents for that year. The average acreage of the bench-land yards was only one-third as large as the average acreage of the bottom-land yards. Naturally more of the latter were specialized units with more elaborate equipment for spraying and drying. This added overhead, along with a higher acre-investment in the stronger trellis required for the heavier yields usually obtained on the bottom land, and a somewhat higher value of this land, accounts for the difference in interest cost on total investment.

**Irrigation of hop land.** Except for the cooperating hop growers in the southern part of the state, very few growers irrigated their hop lands. Only 11 of the 79 cooperators reported irrigating during 1935, and some of those did not irrigate their entire acreage. Since there were so few records and those few were all on bottom-land yards, it is impractical to measure statistically the effect of this irrigation on the yield of hops.

**Effect of fertility maintenance.** A study of the records shows that one-third of the hop yards received no fertilizer application or cover-crop treatment during the three-year period, 1934-1936. One-fourth of the yards received some of both treatments, but very few of the growers, especially those without sale contracts, were inclined to expend much cash for fertilization while hop prices were low. This is shown by the fact that the average yearly expense for fertilizing amounted to only \$4.52 an acre on the basis of all farms in the study. This cost was distributed as follows:

<i>Fertility practice</i>	<i>Cost per acre</i>
Commercial fertilizing .....	\$2.18
Manuring .....	1.85
Cover cropping .....	.49
<b>TOTAL COST .....</b>	<b>\$4.52</b>

While grouping of the records according to fertilizing practices indicated that yields increased with use of fertilizers, other factors like the type of soil also affected the yield sufficiently to overshadow the effect of fertilizing, especially since the latter usually occurred on only a portion of the yard during any one year.

**Effect of variety.** The predominant variety of hops found in Oregon was the Late Cluster. More than 90 per cent of the cooperating growers reported having part or all of their acreage planted to this variety. The average acreage of Late Cluster hops on the farms studied was 42 acres. Half of the growers had some Early Cluster hops, averaging 20 acres per farm. Only nine per cent of the farms reported Fuggles, averaging 24 acres each (Table 16).

Table 16. HOPS: RELATION OF YIELD PER ACRE TO VARIETY, OREGON, 1935 AND 1936

Hop variety	Yield per acre		Average of two years (1935-1936)		
	1935	1936	Number of records	Percentage of total acreage	Yield per acre
	<i>Pounds</i>	<i>Pounds</i>		<i>Per cent</i>	<i>Pounds</i>
Late Cluster .....	990	776	135	76	883
Early Cluster .....	923	435	73	20	679
Fuggles .....	1,282	598	14	4	940

Growers in many instances have diversified their hop plantings merely to extend the harvest season over a longer period of time, thereby reducing the peak load of labor in picking and drying and somewhat lessening the risk of loss from pests and adverse weather conditions. Apparently the market makes no distinction between the Early and Late Cluster varieties. Fuggles produced the highest average yield in this study, but that is partly due to the fact that this variety of hops is resistant to mildew and, moreover, was generally found only on the better soils or bottom lands.

**Effect of age.** The ages of hop plantings ranged from two years up to as high as 50 years. Several different-aged tracts were often found in one yard. Since the hops from these several tracts were not harvested separately there was no opportunity to measure the possible effect of age on production. Growers generally considered a yard in practically full production the year after the "baby" crop. With early spring planting, especially on bottom land, a fair yield was obtained the first year. Thereafter other factors usually exerted more influence on yield than did the matter of age. Most growers replant the missing hills each year, and thus virtually replace the bulk of the plants in the course of an operator's lifetime.

### LABOR REQUIREMENTS

**The labor program.** Labor was the most important cost item in hop production. The uneven distribution of the labor load through the year is one of the greatest weaknesses on any farm that specializes entirely on the production of hops. In Figure 14 is shown the monthly distribution of the year's total man labor amounting to 8,504 hours, including supervision, for a 20-acre hop yard. The latter represents the average acreage served by a one-kiln drier unit. The man labor for the year plotted on this diagram is based on the average amount of labor actually expended per acre as given on 79 hop-yard labor records taken in 1935. Some operators, of course, take less time and others take more time to do the hop work for the year than the average shown in the study. Also, the season of the year at which the work is done varies somewhat on different farms, in different locations, and in different years.

At harvest time, which usually covers several weeks beginning in late August and extending through the first half of September, the operator of a 20-acre planting must hire a large amount of help. During March, April, May, and June the time of about two men is required, assuming that the weather permits steady work, while during the remaining six months even the operator himself has only very limited hop work to do. In fact, some specialized growers, even with large acreages, vacate their premises during a part of the winter.

Thus from the standpoint of utilizing his time to advantage during the year on a 20-acre yard the operator cannot logically expect a labor return comparable with the income of operators in other types of farming where there is opportunity for them to utilize their own labor more fully.

**Labor requirements for hop production.** The amount of labor required to perform the different operations in producing hops is of interest to many growers in calculating work to be done, labor to be hired by the day or by contract, or in comparing operations with other growers.

Complete labor records were obtained, representing all conditions of soil, season, kinds of motive power and implements, and kinds of help. The average man-labor requirement per acre for each operation from all records of growers performing the operation is shown in detail for 1935

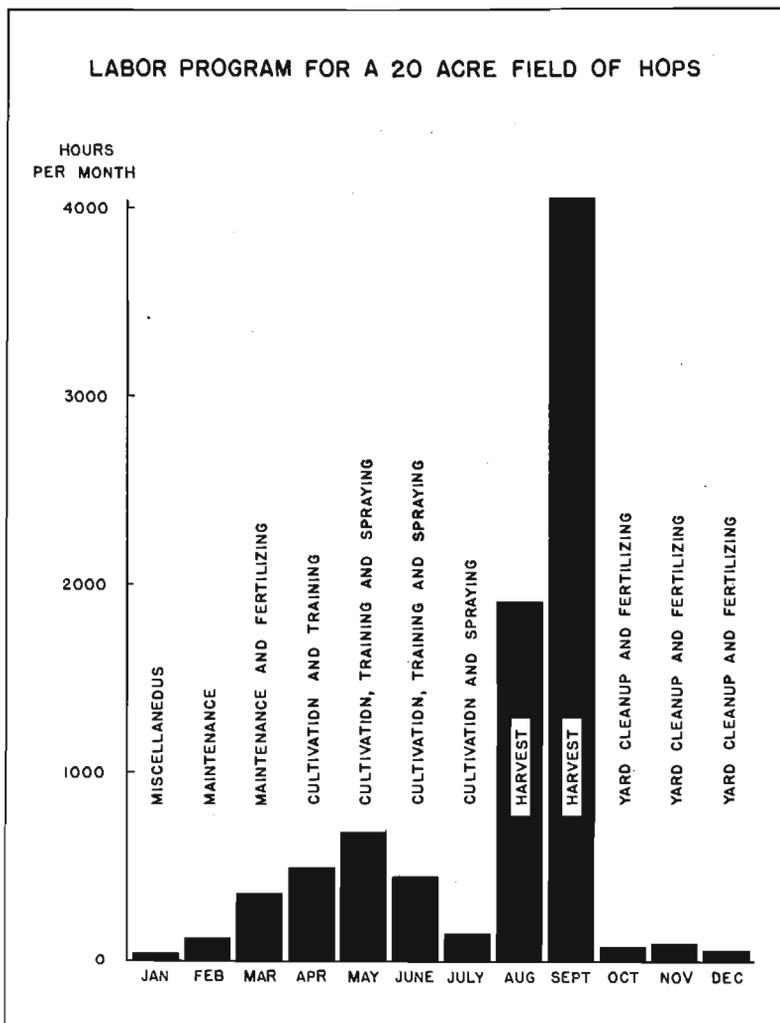


Figure 14. The man labor required in the production of Oregon hops was recorded by the type of work done and its distribution by months. On the basis of the average labor required annually per acre of hops, the estimated total requirement for a 20-acre hop yard would be 8,504 hours. Assuming 25 eight-hour days (200 hours) per month as a full-time job, a 20-acre hop enterprise provides full-time work for the operator only about six months of the year.

in Tables 17, 18, and 19. Management of many yards in 1936 was somewhat irregular from a labor standpoint, hence the data for that year are not included here.

All operations where tractors were used are compared with the same operation where horses were used. In each operation are noted (1) the total number of records averaged, (2) the total acreage covered for that operation, (3) the number of hours per acre required to perform the operation, and (4) the number of hours per acre required for each time over the field in the case of plowing and cultivating.

Table 17. HOPS: HOURS OF MAN LABOR, HORSE WORK, AND TRACTOR WORK REQUIRED PER ACRE IN PLOWING AND CULTIVATING HOP YARDS, OREGON, 1935

Operation	Number of records	Acreage covered	Percentage of total acreage	Times over	Total hours per acre			Hours per acre for each operation		
					Man	Horse	Tractor	Man	Horse	Tractor
Plowing (tractor) .....	40	2,089	80	1.9	2.2	.....	1.5	1.1	.....	.8
Plowing (horse) .....	27	543	20	2.2	5.8	9.1	....	2.7	4.2	....
Plowing (horse) (skinning out) .....	19	854	32	1.0	2.6	2.8	....	2.6	2.8	....
Cultivation (tractor) .....	33	1,872	83	11.2	6.3	.....	6.2	.6	.....	.6
Cultivation (horse) .....	19	386	17	10.7	12.2	24.2	....	1.2	2.4	....

Table 17 shows the large amount of machine tillage work performed on hop yards. Following the general practice of plowing the yard in both directions early in the spring to break the soil crust, the growers cultivated the land an average of about 11 times over. Eighty per cent of the plowing reported here was done with tractors supplemented in part with one-horse plows, which were used in the "skinning out" of the land nearest the hop rows. Eighty-three per cent of the cultivation was performed with tractors. A few of the growers, of course, used a combination of horse and tractor power.

Table 18 lists chiefly the miscellaneous and hand-labor operations in the hop enterprise (except harvesting), arranged more or less in the

Table 18. HOPS: HOURS OF MAN LABOR, HORSE WORK, AND TRACTOR WORK REQUIRED PER ACRE IN PERFORMING MISCELLANEOUS TASKS IN HOP YARDS, OREGON, 1935

Operation	Horse or tractor	Number of records	Acreage covered	Average number of hours per acre		
				Man	Horse	Tractor
Repairing trellis.....	horse	66	2,726	3.1	.8	....
Replanting .....	.....	41	1,712	5.5	.....	.....
Hoeing and pruning .....	.....	70	2,905	16.9	.....	.....
Fertilizing (commercial) .....	both	11	416	1.9	.6	.4
Staking .....	.....	49	2,061	2.5	.....	.....
Stringing .....	.....	72	2,846	7.3	.....	.....
Training on string .....	.....	72	2,846	23.8	.....	.....
Training on wire .....	.....	72	2,841	13.5	9.5	.....
Stripping and suckering .....	.....	58	2,222	11.5	.....	.....
Removing spikes .....	.....	7	620	10.3	.....	.....
Spraying .....	both	37	1,867	5.4	2.3	.7
Irrigating .....	tractor	10	648	14.0	.....	1.2
Seeding cover crop .....	both	24	1,067	1.1	1.1	.1
Hauling manure .....	both	30	407	6.6	5.9	.2

order of their performance. Here again a few growers combined their operations in a different manner, making it impractical to include all records in this summary.

Table 19. HOPS: MAN HOURS OF HARVESTING LABOR REQUIRED PER ACRE, OREGON, 1935

Operation	Number of records	Acreage covered	Man hours per acre
Preparing camp .....	35	1,950	1.6
Picking .....	72	3,041	249.0
Yard crew for pickers.....	70	2,925	23.5
Drying .....	63	2,799	14.0
Baling .....	74	2,184	4.2
Cleaning up vines .....	72	2,717	4.0

The largest labor items, those centering around the harvest season, are grouped in Table 19. Since picking is paid for entirely on the basis of weight of green hops harvested, the number of hours reported for that operation are only an approximation. It should be recognized also that all members of the picker's family usually assist him in picking. Consequently, it is expected that the women and children would not work as steadily the whole day as the men. The rather low average of 14½ pounds of green hops picked per hour, according to the study, therefore, may be about right. At prevailing rates of 1 to 1½ cents a pound in 1935, this amounted to a wage of between 15 and 20 cents an hour for all men, women, and children combined that were listed as employees.

**OPERATING EFFICIENCY**

Efficiency is getting the most work done in the least time and at the least expense. Various factors have a bearing on the efficiency of farm operation.

**Tractors generally used.** While the nature of the hop-yard layout precludes the use of large machinery, a rapid transition to fast-moving tractors using low-grade fuel oil was observed. Tractor fuel-oil prices were as low as 7 cents a gallon. A daily consumption of 20 gallons at this price amounted to a daily fuel cost of only \$1.40 for motive power that pulled a heavy disk and a smoothing implement (harrow or roller) in tandem arrangement and covered from 20 to 25 acres in a 10-hour day. The popularity of the tractor in large-scale hop production under those conditions was not hard to explain.

**Amount of tillage.** Cost of hop-yard cultivation ranged from an average of \$6 an acre for more than one-third of the farms studied up to an average of \$14 an acre for an equally large group of growers (Table 20).

Table 20. HOPS: COST OF CULTIVATION PER ACRE, YIELD, TOTAL COST PER POUND; BY CULTIVATION-COST GROUPS, OREGON, 1934-1936  
Average cultivation cost, \$10.37 per acre.

Cultivation cost per acre	Number of records	Acres in hops	Cultivation cost per acre	Yield	Total cost per pound
Less than \$8 .....	64	49	\$ 6	<i>Pounds</i> 709	<i>Cents</i> 19
\$8 to \$10 .....	43	33	9	803	18
\$10 and over .....	65	51	14	1,069	18

Increases in yield were associated with proportionate increases in the average cultivation cost per acre and did not result in any material change in the total cost per pound. Good yields, of course, may be partly attributed to superior soil fertility or other factors besides amount of tillage.

**Cost of training.** Training expense includes the cost of the stakes and string used in this operation, putting them into position in the yard, training the hop vines on the string, and as they reach the wire, placing them over the trellis wire. This is the largest preharvest expense on most farms. It amounted to an average cost of \$16.65 per acre for the three years of the survey (Table 21). More than one-third of these yards had training

Table 21. HOPS: COST OF TRAINING, YIELD PER ACRE, AND TOTAL COST; BY TRAINING-COST GROUPS, OREGON, 1934-1936  
Average cost, \$16.65 per acre

Training cost per acre	Number of records	Acres in hops	Training cost per acre	Yield	Total cost per pound
Less than \$12 .....	63	26	\$ 9	<i>Pounds</i> 629	<i>Cents</i> 18
\$12 - \$16 .....	51	39	14	849	19
\$16 and over .....	58	67	20	1,036	18

costs of less than \$12 per acre, averaging \$9, while the highest-cost group had an average cost of \$20 per acre. Training cost, like cultivation cost, varied directly with the yield, and therefore did not materially affect the pound cost of production.

**Efficiency in harvesting.** The greatest variation in cost of production would be expected in the largest item of expense—that of harvesting. This item, constituting over 35 per cent of the total costs, includes the cost of all labor used in picking and bringing the hops to the drier; the investment and other expense for baskets, sacks, and camp equipment; and expense for tickets, treats, and rustling or locating prospective workers.

Picking of the green hops is, of course, the major part (79 per cent) of the harvesting expense (Table 22). This cost will vary directly with

Table 22. HOPS: RELATIONS BETWEEN TOTAL HARVESTING COST, PICKER'S WAGE, YIELD PER ACRE, AND TOTAL COST OF PRODUCTION; BY HARVESTING-COST GROUPS, OREGON, 1934-1936  
Average cost, \$58 per acre, or 6.6 cents per pound.

Harvesting cost per pound (dried hops)	Number of records	Acres in hops	Yield per acre	Picker's wage a pound (green hops)	Total harvesting cost per pound (dried)	Total cost per pound
Less than 6¢ .....	76	28	<i>Pounds</i> 759	<i>Cents</i> 1.12	<i>Cents</i> 5.3	<i>Cents</i> 18.0
6¢-8¢ .....	62	71	1,027	1.35	7.0	18.4
8¢ and over .....	34	40	412	1.47	8.6	29.6

the rate paid per pound, and the rate depends on the supply of pickers available, the price of hops, and the yield. Thus in 1934 and 1935 with uniformly good yields on most yards, the picking rates did not vary widely from the average, which was 1.2 cents per pound, while in 1936 with an

average rate of 1.5 cents, some growers paid as high as 2 cents a pound where the yield was light. (A saving of 1 cent per pound green weight amounts to about 4 cents per pound dry weight.) Apparently the small operators with normal yields and with ample local pickers available were able to get their crop picked at a lower rate than the large operators, thus securing a greater degree of efficiency in harvesting. The average rates paid in 1936 were as follows:

<i>Cost of harvesting per pound (dried)</i>	<i>Number of records</i>	<i>Acres in hops</i>	<i>Pounds of green hops per acre</i>	<i>Picking wage per pound (green)</i>	<i>Total production cost per pound (dried)</i>
Less than 6¢....	4	22	471	1.2¢	23.1¢
6¢ to 7.9¢ .....	34	60	928	1.5	19.2
8¢ and over.....	31	49	422	1.6	29.9

The effect of yield on total cost is again very pronounced in the two large groups of records taken in 1936.

Efficiency in drying. Although the average cost of drying hops amounted to only 10 per cent of the total cost of production during this three-year period, or 1.8 cents per pound of dried hops, the drying costs varied from an average of only 1.2 cents for more than one-third of the records taken to an average of 2.6 cents for an equally large group of growers having high drying costs (Table 23). (For data showing itemized cost of drying see Table 31, Appendix B.)

Table 23. HOPS: RELATIONS BETWEEN DRYING COST, TOTAL COST OF PRODUCTION, AND YIELD PER ACRE; BY DRYING-COST GROUPS, OREGON, 1934-1936  
Average cost 1.8 cents per pound

<i>Drying cost per pound (dried hops)</i>	<i>Number of records</i>	<i>Acres in hops</i>	<i>Yield per acre</i>	<i>Average cost per pound for drying</i>	<i>Production cost per pound</i>
			<i>Pounds</i>	<i>Cents</i>	<i>Cents</i>
Below 1.5 cents .....	62	47	883	1.2	13.6
1.5-2.0 cents .....	50	57	1,014	1.7	18.3
2.0 cents and over .....	60	47	692	2.6	22.5

The variation in drying cost from year to year on the same farm is largely accounted for by the difference in the volume of hops dried. The effect of yield on most items of drying cost is again apparent, but the unit investment in drying equipment obviously is the main factor influencing the cost of drying hops. Fixed charges per pound of hops dried, such as interest on the investment, depreciation, insurance, taxes, and repairs on the drier, cannot be reduced to the minimum unless the full capacity of the drier is utilized, nor can maximum operation efficiency be attained as far as labor and fuel are concerned.

Cooperative drying or hiring the drying done by a neighbor is possible for some growers, but in years of heavy crops the possession of a drier is almost a necessity. Further study toward improvement of the technique of drying hops is being conducted by the Oregon Agricultural Experiment Station.

## SIZE OF YARD

With the combined expense for labor and depreciation on equipment constituting such a high proportion of the total cost of hop production (66.5 per cent), the assumption might be made that the larger yards would have a distinct advantage in economy of operation. More than half of the total number of yards studied contained less than 30 acres each, averaging 17 acres (Table 24). These small yards had an average cost of 21.1 cents a pound on a yield of 653 pounds per acre. Apparently the medium-sized yards, averaging 78 acres, were the most economical to operate during this three-year period.

Since many of the hop farms are specialized farms with few other sources of income, the size of the hop yard is of major importance as affecting the volume of business and the farm income as a whole. As shown in Table 24, the return to the grower for his labor and capital in-

Table 24. HOPS: RELATIONS BETWEEN SIZE OF YARD, MAN HOURS PER ACRE, YIELD, TOTAL COST, AND RETURN TO OPERATOR'S LABOR AND CAPITAL; BY HOP-ACREAGE SIZE GROUPS, OREGON, 1934-1936\*

Size in acres per yard	Number of records	Average acreage of hops	Man hours per acre (except contract)	Pounds produced per acre	Total cost per pound	Return to operator's labor and capital
Less than 30 .....	88	17	115	653	21.1¢	\$ 578
30 to 59 .....	43	41	110	831	19.4	1,871
60 to 99 .....	26	78	134	959	17.6	3,782
100 and over .....	15	200	137	1,026	19.3	5,532
ALL YARDS.....	172	46	126	889	18.6¢	\$ 1,759

\* The income was determined on the basis of the 47-year average price (1890-1936) of 19 cents per pound for the hops produced. (Price data taken from Agricultural Statistics, U.S.D.A.)

vestment in hops increases steadily as the size of the hop yard increases. Hence the specialized hop farm must have a rather large acreage to obtain a satisfactory income.

The explanation for the fact that the larger yards used slightly more labor than the smaller ones lies in the type of yard which predominates in each group. The larger yards, found chiefly on the bottom land, require somewhat more labor for maintenance and operation because of the higher trellis and the higher yields.

## GRADE AND PRICE AS FACTORS

The price and the demand for hops is affected by the quality of the crop. For many years growers and dealers dealt in cash hops and contracted for future delivery under a loosely applied system of grades that was largely a matter of common understanding and that was not subject to official administration. During periods of falling prices, disputes over the grades established by dealers were frequent. Requests by hop growers and dealers caused the Oregon Experiment Station to establish a research project for the purpose of evaluating hops under a definite system of standards. This work is being continued.

During 1938, officials in charge of the administration of the hop marketing plan made use of the available data in establishing the first officially recognized hop standards in this country. These were adopted and used for the handling of hops under the present marketing agreement.

About two-thirds of the hops covered in the survey for 1934 had been sold by January following harvest, bringing to the growers an average of about 18 cents a pound, the prices varying, however, from 10 cents to 40 cents a pound that year.

Many of the growers were in a deplorable financial condition in 1935. Prices offered to growers for that year's crop were from 9 to 12 cents a pound at harvest time. The large stocks of old hops on hand further depressed prices so that later in the season buyers were able to make purchases at about two cents less than these figures. Three-fourths of the 1935 hop crop grown by the cooperators in this study had been disposed of by the first of the new year, at prices averaging 16 cents per pound. This average, however, included several favorable contracts at 35 cents or higher. The balance of the 1935 crop that these growers sold during the following 12 months brought an average of 15½ cents per pound, largely because of higher prices following an infestation of downy mildew in 1936.

By the end of April 1936, prices had dropped to as low as 7 cents for the previous year's crop. Much of the 1936 crop had already been contracted at around 12 cents because growers were unable to finance their operations without advances from outside sources. Very suddenly a serious infestation of downy mildew in May and June of 1936, indicated a heavy decrease in yield and caused an upturn of prices until quotations reached 45 cents a pound in November. The survey shows that the co-operators received an average price of 34 cents per pound on the 80 per cent of their 1936 production which had been sold by the following March.

Although hop growers are confronted with a definite handicap by not having well-established and recognized market grades, it is apparent that while on the one hand the prices to individual growers are decidedly variable within any one year, on the other hand the long-time price over the 47-year period, 1890-1936, of approximately 19 cents a pound closely approaches the average cost of production of 18.6 cents a pound as reported for the three-year period of this study. This is of interest since generally cost and price tend to balance over a period of years.

## SOME SPECIFIED OPERATION COSTS AND PRACTICES

That hop production in Oregon is not only a highly specialized undertaking, but also that it is largely conducted by men of long experience with the business, is indicated by the fact that an average of 20 years of work with hops was reported by the 79 growers in 1935. Only nine men had less than five years of hop-production experience while eight men had had 40 years or more, and others reported a lifetime spent in this type of farming.

It would be logical to assume that at least some of the practices followed would have become fairly well standardized on those farms where hops had been grown for many years. Others would tend to vary with the particular local conditions existing in the different farming regions of

the state. A more detailed discussion of certain phases of hop production than was possible in the earlier sections of this report is given here.

**Replacing poles and plants.** Replanting the missing hills of hops is almost universally done each spring season, usually in connection with hoeing or grubbing of the yard. The roots are generally obtained from plants in nearby hills in the yard. This accounts for the low cash outlay of only six cents an acre for roots purchased each year. The distance between hills on the yards studied was as follows:

<i>Number of yards</i>	<i>Space between hills</i>
12	7 x 7 feet
20	7½ x 7½ feet
47	8 x 8 feet
2	9 x 9 feet

Hop poles or posts are usually cut in lengths that are several feet longer than the height of the trellis wire requires. This permits resetting them at least once after the buried end has decayed or broken off at the ground level. That great variation exists in the height of trellis on different yards is shown by the following data:

<i>Number of yards</i>	<i>Height of trellis wire</i>
3	8 feet
8	9 feet
24	10 feet
16	11 feet
21	12 feet
2	13 feet
4	14 feet
1	15 feet
2	17 feet
1	18 feet

Each season all poles in the yard are carefully inspected and any that appear weak are replaced by new ones. In spite of this precaution each year finds a number of trellises collapsing because of the weight of a heavy crop plus the stress occasioned by rains and windstorms. The average annual cost for replacing of poles was estimated at \$1.90 per acre. Fir and cedar wood were most commonly used for pole materials. Cedar was preferred in the bottom-land yards where the growth of hops is usually abundant and requires a high, sturdy trellis. Fir is usually cheaper in initial cost and has been reasonably satisfactory on the valley-floor yards where lower trellises are satisfactory for the vine growth obtained there.

**Depreciation of hop yards.** Because of the constant replacement of plants as they die out, most growers feel that their stands suffer no perceptible depreciation from year to year, and therefore no charge has been made for such a cost in this study. The consensus of experience among all the hop growers interviewed during the three years of the study was that the life of trellises was about 10 years. The wire usually outlasts the poles, depending of course on the kind and quality of each material used. Accepting \$46 an acre (the figure obtained in the survey) as the investment in trellis, the annual depreciation at the rate of 10 per cent would be \$4.60 an acre.

**Fertilizer and cover crops.** Only 18 of the 79 growers visited in 1935 used commercial fertilizer preparations such as Cyanamid, Ammophos, and Boneblack. Thirty-two of the growers applied some barnyard manure or straw materials, usually purchased from a neighboring farm or from a livestock establishment in town. Only 12 operators used any cover crop seed during this year, showing that this practice was not very common among hop growers in Oregon. The usual seeding consisted of vetch or some mixture of vetch with other grain, peas, or turnips. The cover crop is seeded in the fall and plowed or disked into the soil in late spring.

**Stakes and strings.** Small stakes or pegs made from ordinary fir firewood during the slack season, are driven into the ground near the plants early in spring. The strings are attached to the wire overhead and fastened to the peg for support. The hop vines are then trained to climb up the taut string and along the trellis wire. The most commonly reported sizes of string used were the 8-ply, 10-ply, and 6-ply, in the order named. Fifty-two operators used one string to each hill, and 25 operators used two strings to each hill. Either 2, 3, or 4 shoots were trained from each hill. Cost of string varied considerably from farm to farm, depending on the weight of material purchased, the number of strings used, and the length required for the height of trellis. Cotton cord was most commonly used.

**Sprays and dust.** Prevalence of such destructive pests as the aphid, the red spider, and the downy mildew disease has served to make spraying a reasonably well-established practice among hop growers in Oregon. Dusting (instead of spraying) has developed only in recent years, and therefore was done more commonly on a contract basis. In fact, many of the contracting growers did not even know the dust formula that was used on their hops.

**Camp wood and lights.** Most hop growers with large acreages have camp-ground facilities such as cabins or tents for the picking crew, together with a source of drinking water, toilet equipment, firewood, electric lights, and in some cases a retail store for dispensing food and other supplies to the workers and their families that camp on the premises for several weeks at harvest time.

**Drier fuel and electricity.** Hop driers equipped to burn cheap fir slab or cord wood predominate in Oregon, as shown by the fact that 73 of the 79 growers used wood fuel in 1935. In recent years, a number of growers have begun to use fuel oil and the forced-draft or fan type of drier structure, thereby shortening the time required to dry a batch of green hops.

**Sulphur and kiln cloth.** Considerable difference of opinion exists regarding the amount of sulphur that should be used in connection with drying the hops. The average amount used by all growers in the study was approximately six-tenths of a pound to each hundred pounds of green hops. The average price of this sulphur was around 3 cents a pound.

**Kiln cloth** is a burlap covering placed on the floor of the drying compartment. The replacements purchased during a season amounted to an average of one per farm, and the cost ranged from about \$7 for the smaller sizes up to around \$10 each for the larger sizes.

**Burlap and twine.** The dried hops are pressed into rectangular bales, each containing about 195 pounds of hops. Slightly more than five yards

of the burlap wrapping is required to cover this bale, which is then completely sewed up with a good quality of twine. Burlap averaged about 13 cents a yard, the total cost for burlap and twine being 69 cents a bale.

**Small tools.** Small tools include many of the common tools found on the general farm, and in addition a considerable supply of pruning knives, hoes, scales, thermometers, scoops, brooms, sacks, and baskets.

**Other practices.** Growers were asked how soon after drying they usually put their hops into the bale. Forty-two baled the same week, chiefly because they had no facilities for holding the crop in the cooling or storage rooms any longer. Twenty operators held their hops for from 10 to 14 days before baling. Only three men were equipped to wait three weeks or until the end of the drying period to bale their entire output. Experienced hop men believe that they get greater uniformity in quality if all the hops remain loose in a bin for a period of curing or sweating after leaving the drier.

Three-fourths of the growers cut the old vines and burn them as soon as possible after they have died down. This is usually after a heavy frost has occurred or about a month after harvest. The other growers waited until late winter or early spring. A number of these men disked the vines into the soil instead of burning them.

While still other practices were observed in the course of this study, the results are not included since they lacked either in completeness or in universal interest, thus making no specific contribution to the investigation.

**What does it cost to start a new yard?** The next and final section of this report gives a comprehensive picture of what is involved in establishing a hop planting. It should be recognized in this connection that the prices of labor and materials were at a comparatively low level when these plantings were made and the trellises constructed, and that low trellises were used in many of the yards studied.

## COST OF ESTABLISHING AND MAINTAINING NEW HOP YARDS

The large number of new hop plantings that were made during the period 1932-1934 afforded an opportunity to obtain data on costs of starting a new yard and of building the various types of trellis. Complete costs were taken on 60 tracts in the Willamette Valley, the majority of the records being for work done in 1934 (Table 25).

Detailed records of planting costs were obtained on 60 tracts containing 1,105 acres of hop land, and costs of trellis construction were taken on 57 yards totaling 1,126 acres. Since 38 of the 60 new plantings had been trained up on the strings and wires to produce a "baby" crop, the entire hop expense for the year was included in the cost of growing the planting, and then a credit for the hops produced was deducted from this total expense. As only one-third of the hops had been sold at the time the records were taken, the credit for the average yield of 158 pounds per acre was computed on the basis of the 1890-1930 average price of 19 cents a pound received by growers in Oregon, or a credit of \$30 an acre.

Deducting the value of hops sold the first year from the total cost of \$65.90 left a net cost for starting the hop planting of \$35.90 an acre. In addition \$45.77 an acre. Thus the sum of these two items, or \$81.67 an acre, reproduction to this expense was that for constructing the trellis, amounting to cents the net first-year average cost of establishing a hop yard. This figure is almost identical with the growers' estimates of value (\$84.00) that they attached to their bearing yards above the price of similar land not in hops.

Table 25. HOP YARDS: FIRST-YEAR COST OF ESTABLISHING PLANTINGS, OREGON, 1932-1934  
Growing cost: 60 yards, 1,105 acres  
Trellis cost: 57 yards, 1,126 acres

Item	Number of farms reported	Average acre-cost for items reported	Average acre-cost (all farms)
Fertilizing .....	21	\$ 5.14	\$ 1.85
Soil preparation .....	60	4.11	4.11
Planting .....	60	11.04	11.04
Replanting .....	19	2.64	.80
Cultivation .....	60	10.05	10.05
Training .....	39	8.38	6.04
Spraying and other pest control.....	13	2.40	.47
Preharvest operations .....	60	.....	\$34.36
Picking .....	38*	\$12.53	\$ 9.04
Drying .....	37	3.54	2.50
Baling .....	37	1.39	.99
Hauling to warehouse.....	24	.17	.09
Harvest operations .....	38	.....	\$12.62
Supervision .....	57	\$6.73	\$6.61
Compensation insurance .....	21	.85	.43
Use of automobile and truck.....	56	2.27	2.12
Taxes .....	60	1.94	1.94
Interest on yard @ 5%.....	60	7.02	7.02
Miscellaneous .....	51	1.09	.80
Other costs .....	60	.....	\$18.92
GROSS COST OF GROWING.....	60	.....	\$65.90
Credit for hops harvested.....	38	\$41.64	30.00
NET GROWING COST.....	.....	.....	\$35.90
Labor on trellis construction.....	57	\$10.27	\$10.27
Horse work, tractor, and truck use.....	57	.83	.83
Posts and anchors.....	57	10.73	10.73
Wire, hooks, spikes, etc.....	57	21.03	21.03
Supervision .....	57	2.91	2.91
TRELLIS COST.....	57	.....	\$45.77
TOTAL COST OF ESTABLISHING.....	.....	.....	\$81.67

\* Hops on one 10-acre field were sold green.

Costs are not all cash. The cash cost of establishing these hop yards constituted 61 per cent of the total cost (Table 26). Noncash items include the value of the work and supervision contributed by the operator and members of his family, depreciation of the equipment used on this acreage, and interest at five per cent on the value of the land and equipment involved for the year.

Variation in costs. The first-year growing cost varied widely among different yards. Fourteen of the 60 yards had net operating costs of less than \$25, averaging \$3 an acre after deducting the value of the baby hops

(Figure 15). Six yards had costs of more than \$55 an acre, averaging \$74. An important factor affecting the first-year growing cost is the yield of baby hops obtained. The low-cost group includes 6 yards for which the value of the first crop exceeded the growing costs, giving a profit instead of a net cost.

Table 26. HOP YARDS: CASH AND NONCASH COSTS OF ESTABLISHING PLANTINGS,  
OREGON, 1932-1934  
Growing cost: 60 yards, 1,105 acres  
Trellis cost: 57 yards, 1,126 acres

Item	Total cost per acre	Cash cost per acre	Noncash cost per acre
Operator and family labor.....	\$ 5.62	\$ .....	\$ 5.62
Picking (645 pounds green hops).....	7.17	7.17	.....
Other hired labor.....	11.82	11.82	.....
Contract operations.....	3.38	3.38	.....
Horse work.....	1.76	.....	1.76
Total labor and contract operations.....	\$29.75	\$22.37	\$ 7.38
Rent of equipment.....	\$ .22	\$ .22	.....
Tractor operation.....	2.24	2.24	.....
Use of automobile and truck.....	2.12	2.12	.....
Other equipment operation.....	.36	.36	.....
Total equipment operation.....	\$ 4.94	\$ 4.94	.....
Fertilizer, manure, and cover-crop seed.....	\$ 1.43	\$ .73	\$ .70
Roots.....	6.87	6.87	.....
Stakes and training twine.....	1.55	1.55	.....
Spray material.....	.08	.08	.....
Wood, sulphur, and kiln cloths.....	.36	.36	.....
Burlap and sewing twine.....	.62	.62	.....
Other harvest and miscellaneous supplies.....	.11	.11	.....
Total materials and supplies.....	\$11.02	\$10.32	\$ .70
Insurance.....	\$ .74	\$ .74	\$ .....
Taxes.....	1.94	1.94	.....
Depreciation.....	2.70	.....	2.70
Interest on investment @ 5%.....	8.20	.....	8.20
Supervision.....	6.61	.....	6.61
Total overhead.....	\$20.19	\$ 2.68	\$17.51
GROSS COST OF GROWING.....	\$65.90	\$40.31	\$25.59
Credit (158 pounds hops harvested).....	30.00	30.00	.....
NET GROWING COST.....	\$35.90	\$10.31	\$25.59
Labor on trellis construction.....	\$10.27	\$ 7.54	\$ 2.73
Horse work, tractor and truck use.....	.83	.04	.79
Posts and anchors.....	10.73	10.73	.....
Wire, hooks, spikes, etc.....	21.03	21.03	.....
Supervision.....	2.91	.....	2.91
TRELLIS COST.....	\$45.77	\$39.34	\$ 6.43
TOTAL COST OF ESTABLISHING.....	\$81.67	\$49.65	\$32.02
Percentage of total cost.....	100	61	39

Some growers did not erect the trellis the first season but merely allowed the young vines to grow along the ground, thereby making no pretense of producing a crop. For those yards in which this practice was followed the average first-year growing cost was \$38 per acre (Table 27). For 15 yards in which yields of less than 200 pounds an acre were obtained the cost was \$41 an acre, but for 23 yards with yields of 200 pounds or more the net cost was only \$29 an acre, or \$9 less than for the yards

not trained and harvested. Some growers preferred to postpone the construction of the trellis until the second year, by which time the plants would be better established.

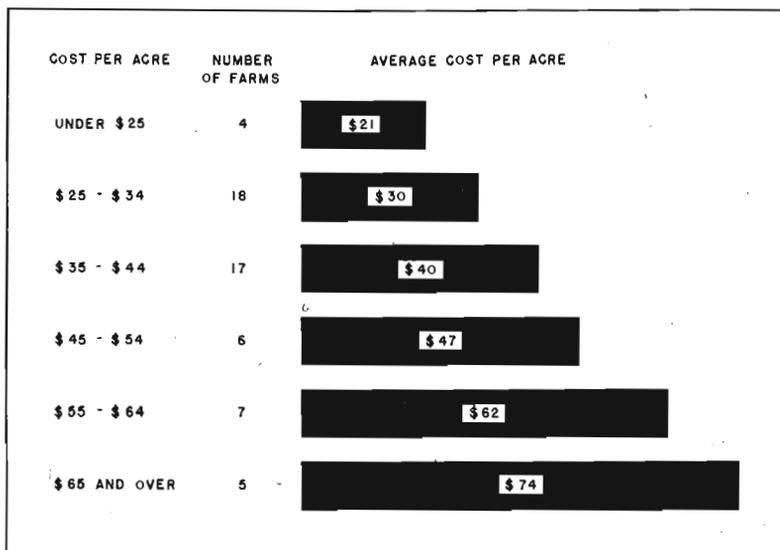


Figure 15. VARIATION IN NET COST OF ESTABLISHING HOP PLANTINGS, OREGON, 1932, 1933, 1934. The income from the crop of baby hops was the major factor in reducing the cost of establishing a new hop planting.

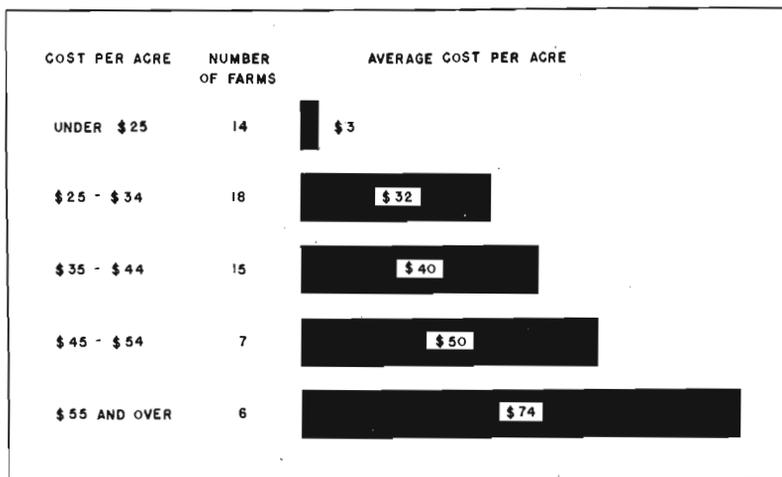


Figure 16. VARIATION IN THE COST OF HOP TRELLIS CONSTRUCTION, OREGON, 1932, 1933, 1934. The quality and height of the trellises are usually reflected in the amount expended for materials and construction. A substantial trellis is more economical in the long run than is a makeshift structure which later may collapse with a heavy crop, causing a serious loss.

Similar variation was found in cost of trellis construction (Figure 16). Some of these differences were due to the fact that bottom-land yards require heavier construction and to the fact that growers were inclined to adopt any possible economies during this period of adverse farm prices.

Table 27. HOP YARDS: EFFECT OF YIELD OF "BABY" HOPS UPON FIRST-YEAR GROWING COST, OREGON, 1932-1934

Item	Pounds of dried hops per acre		
	None harvested	1-199	200 and over
Number of yards .....	22	15	23
Average size of yard (acres).....	14	24	19
Yield per acre (pounds).....	....	57	354
Training and harvesting expense.....	\$...	\$11	\$38
All other costs.....	38	41	58
TOTAL GROSS COST.....	\$38	\$52	\$96
Credit for baby hops*.....	---	11	67
NET COST PER ACRE.....	\$38	\$41	\$29

\* Crop is credited at 19 cents a pound.

**Types of trellis.** While much variation was observed in the details of constructing the trellises, there were two main types of construction which for lack of better terms are called the *cross-wire* and the *single-wire* types. In a typical trellis of the first type, heavy black annealed wires, commonly as large as 0- or 00-gauge, extend across the hop yard at intervals of 30 to 50 feet, supported by posts spaced 30 to 40 feet apart, and strongly anchored at each side of the field. Lighter weight galvanized iron wires of 6 to 11 gauge, running along each row of hop plants, are suspended from the heavy cross-wires by hooks, and may be unhooked and let down at harvest. The twine upon which the hop vines are trained is tied to these lighter "string," "drop," "line," or "let-down" wires.

The single-wire type of trellis, which is less common, consists simply of a single galvanized wire, usually 6- to 10-gauge, for each row of hop plants. These wires are supported by posts at intervals of 30 to 50 feet, and are anchored at each end of the row. The cross-wire type trellis requires fewer posts in the yard and is preferred by most of the experienced growers, but it is more expensive to construct. The average cost of 51 cross-wire trellises was \$46.85 an acre as compared with \$31.23 an acre for 6 single-wire trellises (Table 28).

Table 28. HOP YARDS: COMPARATIVE COSTS OF CONSTRUCTING CROSS-WIRE AND SINGLE-WIRE TRELLISES, OREGON, 1932-1934

Item	Cross-wire trellises	Single-wire trellises
Number of yards .....	51	6
Average size of yard (acres).....	20	13
<i>Cost per acre:</i>		
Labor on trellis construction.....	\$10.58	\$ 6.02
Supervision .....	2.96	2.23
Horse labor, tractor and truck use.....	.84	.71
Posts and anchors.....	10.68	11.49
Wire, hooks, spikes, etc.....	21.79	10.78
TOTAL COST.....	\$46.85	\$31.23

Posts used in the different trellises ranged in size and quality from 12-foot unpeeled round fir at 4 cents each to 20-foot heavy split cedar costing 50 cents each. Wire varied from an entire trellis constructed of 11-gauge (partly second-hand stock at \$1.50 per 100 pounds) to a combination of 00-gauge cross-wire and 6-gauge string wire costing \$35 an acre for wire alone. Both the price of materials and the price of labor were, of course, at low levels when these data were obtained in 1934.

## CONCLUSIONS ON THE SITUATION AND OUTLOOK FOR THE HOP ENTERPRISE IN OREGON

The hop enterprise along the Pacific Coast has developed to its present status under a system of free though rigorous competition in the world market. The price to the domestic grower has been affected not only by local conditions of supply and quality, but also by the export demand often coupled with some form of restrictive foreign customs duty, and by the domestic demand influenced in turn by importations made by certain domestic brewers despite a protective tariff of 24 cents a pound.

There is little in the foreign market situation that holds promise of expansion in the export trade of this country during the forthcoming years. The trends in United States exports have been downward owing to governmental stimulation of production in foreign countries and the creation quite generally of effective trade barriers. In view of these trade barriers and because small surpluses often result in returns to producers below the cost of production, it would appear that the domestic hop industry as a whole should be definitely concerned with gearing production to market requirements. The Pacific Coast Hop Stabilization Corporation, under the Agricultural Adjustment Administration program, was designed at the outset to divert the entire stock of old hops and thereafter to prevent excessive accumulation from year to year.\* The plan involved allotting to each grower a fixed quota of hops that he could market during the year. The intention was to have growers endeavor to adjust their harvesting of hops to be sold in the domestic market to conform with their allotments, and to have brewers, dealers, and growers jointly support a reasonable level of prices that would establish a permanent and stabilized hop enterprise on the Pacific Coast.

Regardless of whether or not the hop grower favors a regulated market or a limitation of total hop acreage in Oregon, he cannot afford to overlook the opportunity he himself holds for the stabilization of his enterprise. He is usually in a position to strive for and effect certain economies in his operations, and improve the yield and quality of his own hop production so as to reduce his costs per pound and increase the price he receives to a point where he can compete advantageously with other growers. Finally, good farm-management practice suggests that, although hop growing is a costly undertaking and requires considerable technical knowledge on the part of the producer, specialization limited to this single enterprise is not advisable for the average farmer.

While the hop enterprise does not lend itself to a crop-rotation plan, nor contribute materially to a livestock-production program on the farm,

\* Proceedings, "The Pacific Northwest Advisory Board, Thirty-Eighth Regular Meeting, March 30, 1938, Portland, Oregon."

yet the hop grower who takes the trouble to develop a diversified production program is able to employ his farm machinery, his power equipment, and his own and family labor more advantageously over the entire year than can the specialized hop farmer with the one-crop system. Moreover, when adverse conditions arise in the hop industry the diversified farmer with a relatively small acreage in hops along with his other enterprises is able to retrench more effectively with regard to cash expenditures such as for labor, because his family is able to substitute in a large part for the usual amount of hired labor employed. The big specialized hop grower, on the other hand, is much more urgently concerned with receiving a substantial price for his hops since he is almost solely dependent on his hop receipts to pay all of the operating expense, which in many cases represents a considerable amount of short-term credit or borrowed money. The large hop grower consequently faces a serious situation whenever his crop is reduced or the price drops, for if he has no other resource to draw upon until the next crop season, the financing of future operations following a disastrous year is, for him, often difficult and sometimes impossible.

The findings in this study, by pointing out the importance of securing high yields of good quality hops at a reasonably low production cost per pound, should be helpful to the individual grower interested in increasing his efficiency. Having the data in terms of the physical requirements for hop production, such as the hours of labor and machinery used on an acre of hops, either the grower or the industry as a whole may readily estimate the approximate cost of hop production for any later period by simply adjusting the prices that the grower pays for the items of expense incurred in producing a specified yield per acre.

## Appendix A

### METHODS USED IN OBTAINING, COMPILING, AND ANALYZING DATA

The data for this study were collected by the survey method. Each cooperating grower was visited once during each year of study and a complete record of the year's business was obtained. Most of the details entered on the schedule were the farmers' estimates because complete farm records were not common. These schedules were obtained during the winter months when hop growers were able to spend sufficient time with the enumerator to work out a careful estimate of the facts pertaining to the year's business.

**Joint expense.** All farm expenses, both cash and noncash, which were incurred only in part for the hop enterprise, were charged to the hops in proportion to the benefit received. Likewise, all investment used jointly was charged to hops according to the amount of use.

**Taxes.** Taxes on hop land and equipment were computed from data in the county assessor's office, since it was found that the individual farmers did not have a clear conception of how their property tax was apportioned among the various farm enterprises.

**Rent.** A few hop growers rented land, buildings, or equipment. Where rent was not paid in cash but was paid in shares of crop, labor, etc., it was expressed in cash on the basis of market value and was recorded as a cash expense. If a whole farm were rented, the renter was treated as an owner and was charged interest on the investment, taxes, depreciation, etc., in lieu of rent in order to make all farms comparable on an investment basis. There were very few renters producing hops.

**Interest on operating cash.** Since many of the growers found it necessary to borrow money each season for paying the current operating expenses, the average amount of cash required for hops was determined and a flat rate per acre for the use of this money was then charged as a cash expense on all records.

**Drier fuel.** Purchased drier fuel was entered at the price delivered to the drier. Likewise, where wood was cut by the farmer the market value was estimated.

**Cover-crop seed and fertilizer.** Seed, both purchased and farm grown, used for cover-crop purposes in the hop yard was entered as a cash expense. Farm manure was charged to the hops at its cash value at the barn. All labor of applying fertilizer was charged as labor expense. Practically all of the cover-crop seed and manure was actually purchased.

**Man labor and horse work.** A very complete form was used to compile the various labor operations performed in the hop enterprise. Although the *total* yearly labor on an enterprise is an indefinite figure in the minds of many farmers, the grower is quite definite about the labor required for each *individual* operation. The enumerator recorded for each operation or job the farmer's estimate of the amount of work performed by the farmer, members of his family, and hired labor. Since most of the estimates were on an hourly basis, the wage rates were also expressed on the hourly basis, including value of board and lodging when furnished hired labor. In other words, the wage rate for family labor was based on what hired labor was receiving for similar work in the region.

In addition to the actual time that the farmer spends at specified hop work, he generally does a considerable amount of other work around the farm that should be charged to the various farm enterprises. Each farmer was asked to apportion his total year's time among his various enterprises. From his estimate for the hop enterprise was deducted the actual time he put in on the hop work, and the remainder was entered as *supervision*.

Horse work was charged at a flat rate of 10 cents an hour. The usual rate for hired horses was a dollar a day.

**Contract labor.** Contract labor, quite common in hop production, was charged as labor expense although, of course, it often included the use of equipment and fuel as well as labor.

**Interest.** The present investment or inventory value of hop land and equipment was determined and interest was charged uniformly at five per cent.

**Depreciation.** Depreciation on buildings and equipment was obtained by dividing the present value by the remaining years of usefulness. The

average rate of depreciation for the trellises was estimated as 10 per cent by a number of the more experienced growers and that rate was then used on all farms.

No depreciation was charged against the hop planting. Most growers maintained their stands by annually replacing all missing hills.

**Machinery-operation cost.** Interest and depreciation on machinery were computed separately from the operation costs and were entered under interest and depreciation. Total machinery cost may be obtained by adding together the operating costs and interest and depreciation on machinery.

## Appendix B

### DETAILED AND SUPPLEMENTARY TABLES

Table 29. HOPS: COST OF PRODUCTION PER ACRE AND PER POUND; BY INDIVIDUAL ITEMS OF COST, OREGON, 1934-1936

Year	Number of farms	Total acreage	Total yield	Yield per acre		
				<i>Acres</i>	<i>Pounds</i>	<i>Pounds</i>
1934.....	24	901	890,862		989	
1935.....	79	3,830	3,724,315		973	
1936.....	69	3,677	2,596,678		706	

Item	Cost per acre			Cost per pound		
	1934	1935	1936	1934	1935	1936
<i>Labor</i>						
Hired labor .....	\$27.79	\$31.45	\$29.68	2.8¢	3.2¢	4.2¢
Contract labor .....	55.59	47.73	41.70	5.6	4.9	5.9
Operator's labor and supervision .....	12.97	12.25	14.58	1.3	1.3	2.0
Family labor .....	1.79	1.71	1.03	.2	.2	.2
Total man labor.....	\$98.14	\$93.14	\$86.99	9.9¢	9.6¢	12.3¢
Horse work .....	1.94	2.37	1.76	.2	.2	.2
<b>TOTAL LABOR.....</b>	<b>\$100.08</b>	<b>\$95.51</b>	<b>\$88.75</b>	<b>10.1¢</b>	<b>9.8¢</b>	<b>12.5¢</b>
<i>Materials</i>						
Replacing poles and plants.....	\$ 4.55	\$ .92	\$ .41	.5¢	.1¢	.1¢
Fertilizers and cover-crop seed .....	5.00	3.07	2.84	.5	.3	.4
Stakes and string .....	4.54	3.45	3.50	.5	.4	.5
Sprays and dust .....	1.47	2.16	3.44	.1	.2	.5
Camp wood, lighting, etc. ....	.61	.61	.74	.1	.1	.1
Drier fuel and electricity .....	2.24	2.07	1.91	.2	.2	.3
Sulphur and kiln cloth.....	1.11	.90	.77	.1	.1	.1
Burlap and twine for baling .....	3.48	3.35	2.55	.4	.3	.4
Small tools, etc.....	.23	.92	.50	....	.1	.1
<b>TOTAL MATERIALS.....</b>	<b>\$23.23</b>	<b>\$17.45</b>	<b>\$16.66</b>	<b>2.4¢</b>	<b>1.8¢</b>	<b>2.5¢</b>
<i>Equipment</i>						
Tractor operation .....	\$ 3.72	\$ 2.79	\$ 2.33	.4¢	.3¢	.3¢
Sprayer operation .....	.24	.75	.56	....	.1	.1
Automobile, truck and shipping expense .....	3.53	3.47	3.28	.3	.3	.4
Irrigation expense .....	.22	.61	.54	....	.1	.1
Drier repair .....	.37	1.69	1.20	.1	.2	.2
General machinery repair.....	.38	.58	.31	.1	.1	.1
<b>TOTAL EQUIPMENT EXPENSE.....</b>	<b>\$ 8.46</b>	<b>\$ 9.89</b>	<b>\$ 8.22</b>	<b>.9¢</b>	<b>1.1¢</b>	<b>1.2¢</b>

Table 29. HOPS: COST OF PRODUCTION PER ACRE AND PER POUND; BY INDIVIDUAL ITEMS OF COST, OREGON, 1934-1936—Continued

Item	Cost per pound			Cost per acre		
	1934	1935	1936	1934	1935	1936
<i>General expense</i>						
Fire insurance .....	\$ 2.48	\$ 1.73	\$ 2.13	.2¢	.2¢	.3¢
Compensation insurance .....	1.17	1.48	1.74	.1	.2	.2
Property tax .....	1.90	2.41	2.48	.2	.2	.4
Rent on equipment .....	.62	.39	.12	.1	....	....
Interest on cash to run business .....	3.00	3.00	3.00	.3	.3	.4
Telephone, postage, etc. ....	.33	.10	.47	....	....	.1
TOTAL GENERAL EXPENSE .....	\$ 9.50	\$ 9.11	\$ 9.94	.9¢	.9¢	1.4¢
<i>Depreciation</i>						
Depreciation on machinery .....	\$ 2.83	\$ 3.03	\$ 3.08	.3¢	.3¢	.4¢
Depreciation on drier and equipment .....	3.67	5.01	4.65	.4	.5	.7
Depreciation on other buildings and equipment .....	.58	1.21	1.22	.1	.1	.2
Depreciation on trellis.....	4.60	4.60	4.60	.4	.5	.6
Depreciation on irrigation system .....	.20	.30	.31	....	....	....
TOTAL DEPRECIATION.....	\$ 11.88	\$ 14.15	\$ 13.86	1.2¢	1.4¢	1.9¢
TOTAL OPERATING EXPENSE.....	\$153.15	\$146.11	\$137.43	15.5¢	15.0¢	19.5¢
<i>Interest</i>						
Interest on bearing yard .....	\$ 12.11	\$ 12.90	\$ 12.90	1.2¢	1.3¢	1.8¢
Interest on drier and equipment .....	2.91	3.11	2.79	.3	.3	.4
Interest on other buildings and equipment .....	.27	.75	.62	....	.1	.1
Interest on machinery.....	1.02	.90	.77	.1	.1	.1
Interest on irrigation system .....	.15	.10	.12	....	....	....
TOTAL INTEREST.....	\$ 16.46	\$ 17.76	\$ 17.20	1.6¢	1.8¢	2.4¢
TOTAL COST.....	\$169.61	\$163.87	\$154.63	17.1¢	16.8¢	21.9¢

Note. (....) represents less than .05 of one cent.

Table 30. HOPS: TOTAL COST OF PRODUCTION, FIXED COSTS, SEASONAL COSTS, INCLUDING BOTH PREHARVEST AND HARVEST COSTS; BY CASH AND NONCASH ITEMS, OREGON, 1935  
79 farms with an average yield per acre of 973 pounds

Item	Noncash cost per acre	Cash cost per acre	Total cost per acre	Percentage of total cost
<i>Fixed costs</i>				
Interest on yard .....	\$ 12.90	.....	\$ 12.90	7.9
Interest on drier and equipment.....	3.11	.....	3.11	1.9
Interest on machinery and other buildings.....	1.75	.....	1.75	1.0
TOTAL INTEREST.....	\$ 17.76	.....	\$ 17.76	10.8
Depreciation on trellis .....	\$ 4.60	.....	\$ 4.60	2.7
Depreciation on drier and equipment.....	5.01	.....	5.01	3.1
Depreciation on machinery and other buildings .....	4.54	.....	4.54	2.7
TOTAL DEPRECIATION.....	\$ 14.15	.....	\$ 14.15	8.5
Fire insurance .....	.....	\$ 1.73	\$ 1.73	1.0
Property tax .....	.....	2.41	2.41	1.5
Building repairs .....	.....	1.69	1.69	1.0
Miscellaneous .....	.....	.10	.10	.1
TOTAL OTHER FIXED COSTS.....	.....	\$ 5.93	\$ 5.93	3.6
TOTAL FIXED COSTS.....	\$ 31.91	\$ 5.93	\$ 37.84	22.9
<i>Seasonal costs (preharvest)</i>				
Man labor for trellis repair.....	\$ .17	\$ .67	\$ .84	.5
Man labor for stand maintenance.....	.75	2.98	3.73	2.3
Man labor for fertilizing.....	.18	.71	.89	.6
Man labor for cultivating.....	.67	2.67	3.34	2.0
Man labor for irrigating.....	.19	.75	.94	.6
Man labor for spraying.....	.33	1.32	1.65	1.0
Man labor for training.....	2.40	9.56	11.96	7.3
Man labor for supervision (75% of total for year) .....	5.20	1.30	6.50	4.0
TOTAL PREHARVEST MAN LABOR.....	\$ 9.89	\$ 19.96	\$ 29.85	18.3
TOTAL PREHARVEST HORSE WORK.....	\$ 1.98	.....	\$ 1.98	1.2
Poles and roots .....	.....	\$ .92	\$ .92	.6
Spray material .....	.....	2.16	2.16	1.3
Fertilizers .....	.....	2.78	2.78	1.7
Cover-crop seed .....	.....	.29	.29	.2
Stakes and string .....	.....	3.45	3.45	2.1
Tractor operation .....	.....	2.79	2.79	1.7
Automobile and truck operation.....	.....	2.80	2.80	1.7
Sprayer operation .....	.....	.75	.75	.5
Irrigation operation .....	.....	.61	.61	.4
Machinery repair .....	.....	1.50	1.50	.9
Interest on operating cash.....	.....	1.50	1.50	.9
TOTAL MATERIALS AND MACHINERY.....	.....	\$ 19.55	\$ 19.55	12.0
TOTAL PREHARVEST SEASONAL COSTS.....	\$ 11.87	\$ 39.51	\$ 51.38	31.5
<i>Seasonal costs (harvest)</i>				
Man labor for picking.....	.....	\$ 46.33	\$ 46.33	28.2
Man labor for yard crew.....	\$ 1.32	7.84	9.16	5.6
Man labor for drying.....	.83	3.30	4.13	2.5
Man labor for baling.....	.30	1.20	1.50	.9
Man labor for supervision (25% of total for year) .....	1.73	.44	2.17	1.3
TOTAL HARVEST MAN LABOR.....	\$ 4.18	\$ 59.11	\$ 63.29	38.5
TOTAL HARVEST HORSE WORK.....	\$ .39	.....	\$ .39	.3

Table 30. HOPS: TOTAL COST OF PRODUCTION, FIXED COSTS, SEASONAL COSTS, INCLUDING BOTH PREHARVEST AND HARVEST COSTS; BY CASH AND NONCASH ITEMS, OREGON, 1935—Continued

Item	Noncash cost per acre	Cash cost per acre	Total cost per acre	Percentage of total cost
Drier fuel and electricity.....	.....	\$ 2.68	\$ 2.68	1.7
Sulphur and kiln cloth.....	.....	.90	.90	.6
Burlap and twine.....	.....	3.35	3.35	2.0
Shipping expense.....	.....	.67	.67	.4
Rent of equipment.....	.....	.39	.39	.3
Compensation insurance.....	.....	1.48	1.48	.9
Interest on operating cash.....	.....	1.50	1.50	.9
TOTAL GENERAL HARVEST COSTS.....	.....	\$ 10.97	\$ 10.97	6.8
TOTAL HARVEST SEASONAL COSTS.....	\$ 4.57	\$ 70.08	\$ 74.65	45.6
TOTAL SEASONAL COSTS.....	\$ 16.44	\$ 109.59	\$ 126.03	77.1
TOTAL FIXED AND SEASONAL COSTS.....	\$ 48.35	\$ 115.52	\$ 163.87	100.0

Table 31. HOPS: COST OF DRYING, SHOWING VARIATION; BY INDIVIDUAL COST ITEMS, OREGON, 1934-1936

Item	Average pound-cost of drying hops			
	Below 1.5¢	1.5-2.0¢	2.0¢ and over	All farms
Number of records.....	62	50	60	172
Average acreage per yard.....	47	57	47	46
Average pounds of dry hops per acre.....	883	1,014	692	889
Cost of man labor in drying.....	.36¢	.41¢	.57¢	.42¢
Fuel oil.....	.06	.06	.04	.05
Drier wood.....	.19	.12	.22	.15
Electricity.....	.02	.04	.04	.04
Sulphur.....	.06	.09	.08	.08
Kiln cloth.....	.02	.03	.04	.03
Contract or rent for drier.....	.10	.02	.01	.04
Property tax.....	.03	.06	.09	.06
Insurance.....	.17	.24	.32	.24
Interest.....	.13	.26	.46	.26
Depreciation.....	.13	.32	.67	.33
Repairs.....	.02	.09	.10	.08
TOTAL COST OF DRYING.....	1.23¢	1.74¢	2.64¢	1.78¢

## OREGON STATE BOARD OF HIGHER EDUCATION

Edward C. Pease .....	<i>The Dalles</i>
F. E. Callister .....	<i>Albany</i>
Beatrice Walton Sackett .....	<i>Marshfield</i>
C. A. Brand .....	<i>Roseburg</i>
E. C. Sammons .....	<i>Portland</i>
Robert W. Ruhl .....	<i>Medford</i>
Edgar William Smith .....	<i>Portland</i>
Willard L. Marks .....	<i>Albany</i>
Herman Oliver .....	<i>John Day</i>
Frederick M. Hunter, Ed. D., LL.D. .... Chancellor of Higher Education	

### STAFF OF AGRICULTURAL EXPERIMENT STATION

*Staff members marked \* are United States Department of Agriculture  
investigators stationed in Oregon*

Geo. W. Peavy, M.S.F., Sc.D., LL.D. ....	President of the State College
Wm. A. Schoenfeld, B.S.A., M.B.A. ....	Director
R. S. Besse, M.S. ....	Vice Director
Esther McKinney .....	Accountant
Margaret Hurst, B.S. ....	Secretary

#### Division of Agricultural Economics

E. L. Potter, M.S. ....	Agr'l. Economist; In Charge, Division of Agri. Economics
<i>Agricultural Economics</i>	
W. H. Dreesen, Ph.D. ....	Agricultural Economics

#### Farm Management

D. C. Mumford, M.S. ....	Economist in Charge
G. W. Kuhlman, Ph.D. ....	Associate Economist
W. W. Gorton, M.S. ....	Research Assistant
H. L. Thomas, M.S. ....	Associate Agricultural Economist Soil Conservation*
J. C. Moore, M.S. ....	State Land Planning Specialist, Division of Land Utilization*
V. W. Baker, B.S. ....	Assistant Agricultural Economist, Division of Land Utilization*

#### Division of Animal Industries

P. M. Brandt, A.M. ....	Dairy Husbandman; In Charge, Division of Animal Industries
<i>Animal Husbandry</i>	

R. G. Johnson, B.S. ....	Animal Husbandman
O. M. Nelson, B.S. ....	Animal Husbandman
A. W. Oliver, M.S. ....	Assistant Animal Husbandman
B. W. Rodenwold, M.S. ....	Assistant Animal Husbandman

#### Dairy Husbandry

G. H. Wilster, Ph.D. ....	Dairy Husbandman
L. R. Jones, Ph.D. ....	Associate Dairy Husbandman
H. P. Ewalt, B.S. ....	Assistant Dairy Husbandman
Arless Spielman, B. S. ....	Research Fellow (Dairy Husbandry)

#### Fish and Game Management

R. E. Dimick, M.S. ....	Wildlife Conservationist in Charge
F. P. Griffiths, Ph.D. ....	Assistant Conservationist*
A. S. Einarsen, B.S. ....	Associate Biologist, Bureau Biological Survey*
Frank Groves, B.S. ....	Research Assistant (Fish and Game Management)

#### Poultry Husbandry

H. E. Cosby .....	Poultry Husbandman in Charge
F. L. Knowlton, M.S. ....	Poultry Husbandman
W. T. Cooney, B.S. ....	Research Assistant (Poultry Husbandry)

#### Veterinary Medicine

J. N. Shaw, B.S., D.V.M. ....	Veterinarian in Charge
E. M. Dickinson, D.V.M., M.S. ....	Associate Veterinarian
O. H. Muth, M.S., D.V.M. ....	Associate Veterinarian
R. W. Dougherty, D.V.M. ....	Associate Veterinarian
A. S. Rosenwald, B.S., D.V.M. ....	Assistant Poultry Pathologist
O. L. Searcy, B.S. ....	Technician
Roland Scott, D.V.M. ....	Research Assistant (Veterinary Medicine)
C. R. Howarth, D.V.M. ....	Research Assistant (Veterinary Medicine)
Marion Robbins, B.S. ....	Technician in Poultry Pathology

#### Division of Plant Industries

G. R. Hyslop, B.S. ....	Agronomist; In Charge, Division of Plant Industries
<i>Farm Crops</i>	

H. A. Schoth, M.S. ....	Agronomist; Division of Forage Crops and Diseases*
D. D. Hill, Ph.D. ....	Associate Agronomist
R. E. Fore, Ph.D. ....	Assistant Agronomist*
Elton Nelson, B.S. ....	Agent, Division of Fiber Plant Investigations*
Louisa A. Kanipe, B.S. ....	Junior Botanist, Division of Seed Investigations*
H. H. Rampton, M.S. ....	Assistant Agronomist; Division Foreage Crops and Diseases*
L. E. Harris, M.S. ....	Assistant Agronomist
H. E. Finnell, M.S. ....	Assistant Agronomist
A. E. Gross, M.S. ....	Research Assistant (Farm Crops)

#### Food Industries

E. H. Wiegand, B.S.A. ....	Horticulturist in Charge
T. Onsdorf, M.S. ....	Assistant Horticulturist

STATION STAFF—(Continued)

Horticulture

W. S. Brown, M.S. D.Sc. Horticulturist  
 H. Hartman, M.S. Horticulturist (Pomology)  
 A. G. B. Bouquet, M.S. Horticulturist (Vegetable Crops)  
 C. E. Schuster, M.S. Horticulturist, Div. Fruit and Vegetable Crops and Diseases\*  
 W. P. Duruz, Ph.D. Horticulturist (Plant Propagation)  
 G. F. Waldo, M.S. Ass't. Pomologist, Div. Fruit and Veg. Crops and Diseases\*  
 E. Hansen, M.S. Assistant Horticulturist (Pomology)

Soil Science

W. L. Powers, Ph.D. Soil Scientist in Charge  
 C. V. Ruzek, M.S. Soil Scientist (Fertility)  
 M. R. Lewis, C.E. Irrigation and Drainage Engr., Bureau Agric. Engineering\*  
 R. E. Stephenson, Ph.D. Soil Scientist  
 E. F. Torgerson, B.S. Associate Soil Scientist (Soil Survey)  
 James Clement Lewis, B.S. Research Fellow in Soils

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  
 M. B. Hatch, M.S. Assistant Chemist  
 L. D. Wright, 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  
 W. M. Hurst, M.A. Agricultural Engineer, Bureau Agricultural Engineering\*

Bacteriology

G. V. Copson, M.S. Bacteriologist in Charge  
 J. E. Simmons, M.S. Associate Bacteriologist  
 W. B. Bollen, Ph.D. Associate Bacteriologist  
 C. P. Hegarty, Ph.D. Research Assistant (Bacteriology)

Entomology

D. C. Mote, Ph.D. Entomologist in Charge  
 J. C. Chamberlin, Ph.D. Asso. Ento. (Div. Truck Crops and Garden Insects)\*  
 A. E. Bonn, B.S. Junior Entomologist (Div. of Truck Crops and Garden Insects)\*  
 H. A. Scullen, Ph.D. Associate Entomologist  
 B. G. Thompson, M.S. Assistant Entomologist  
 S. C. Jones, M.S. Assistant Entomologist  
 K. W. Gray, M.S. Assistant Entomologist  
 W. D. Edwards, M.S. Assistant Entomologist  
 H. E. Morrison, M.S. Assistant Entomologist  
 Joe Schuh, M.S. Research Assistant (Entomology)  
 G. R. Ferguson, B.S. Research Assistant (Entomology)

Home Economics

Maud 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 Veg. Crops and Diseases)\*  
 F. D. Bailey, M.S. Associate Plant Pathologist (Insecticide Control Division)\*  
 P. W. Miller, Ph.D. Assoc. Pathologist (Div. of Fruit and Veg. Crops and Dis.)\*  
 G. R. Hoerner, M.S. Agent (Division of Drug and Related Plants)\*  
 R. F. Grah, B.S. Agent (Division of Drug and Related Plants)\*  
 R. Sprague, Ph.D. Associate Pathologist (Div. of Cereal Crops and Diseases)\*  
 John Milbrath, Ph.D. Research Assistant (Plant Pathology)

Publications and News Service

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

Branch Stations

Leroy Childs, A.B. Supt. Hood River Branch Experiment Station, Hood River  
 F. C. Reimer. Superintendent Southern Oregon Branch Experiment Station, Talent  
 D. E. Richards, B.S. Supt. Eastern Oregon Livestock Br. Expt. Sta., Union  
 H. K. Dean, B.S. Supt. Umatilla Br. Expt. Sta. (Div. W. Irrig. Agri.), Hermiston\*  
 Obil Shattuck, M.S. Superintendent Harney Branch Experiment Station, Burns  
 H. B. Howell, B.S. Supt. John Jacob Astor Branch Experiment Station, Astoria  
 R. G. Johnson, B.S. Acting Supt. Squaw Butte Regional Range Experiment Station  
 G. A. Mitchell, B.S. Supt. Pendleton Branch Station (Dry Land Ag.), Pendleton\*  
 G. G. Brown, A.B. B.S. Horticulturist, Hood River Br. Expt. Sta., Hood River  
 Arch Work, B.S. Supt. Medford Sta. (Asso. Irrig. Engr., Div. of Irrig.), Medford\*  
 E. S. Deegan, Ph.D. Asso. Pomologist, Div. Fr. & Veg. Cr. & Dis., Medford\*  
 Bruce Allyn, B.S. Junior Irrigation Engineer (Division of Irrigation), Medford\*  
 L. G. Geutner, M.S. Associate Entomologist, So. Ore. Br. Expt. Station, Talent  
 J. F. Martin, M.S. Junior Agronomist, (Div. Cereal Crops and Dis.), Pendleton\*  
 M. M. Oveson, M.S. Superintendent Sherman Branch Experiment Station, Moro\*  
 R. W. Henderson, B.S. Research Assistant, Sherman Branch Experiment Sta., Moro  
 R. E. Hutchinson, M.S. Asst. to Supt. Harney Branch Experiment Station, Burns  
 J. R. Kienholz, Ph.D. Jr. Pathologist, Div. Fr. & Veg. Cr. & Dis., Hood River\*