TECHNIQUES FOR CHARACTERIZING OREGON SOILS FOR AGRICULTURAL PURPOSES IN TERMS OF PHYSICAL AND ECONOMIC PRODUCTIVITIES

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TECHNIQUES FOR CHARACTERIZING OREGON SOILS FOR AGRICULTURAL PURPOSES IN TERMS OF PHYSICAL AND ECONOMIC PRODUCTIVITIES

CHAPTER I

Introduction

During the past decade much interest has been generated in physical and economic soil productivities by those engaged in farm land valuation. Physical and economic soil productivity ratings interpret the complex of soil properties into a single rating which relates the qualities of the soil to agricultural crop responses. The appraiser is able to see at a glance what otherwise would require considerable time and effort in studying the properties of the soil in terms of the crops they would support and at what levels. Particularly have these productivity ratings been of interest to tax appraisers interested in tax equality.

With the above interest in mind this study is dedicated to the development of techniques for characterizing Oregon soils for agricultural purposes in terms of physical and economic productivities.

Physical and Economic Soil Productivities

Physical productivity is defined in terms of crop yields. It measures comparative yield responses of crops common to several soils. Implied in this procedure are defined levels of inputs usually centering around the typical farm operations. Where sufficient uniformity exists in land use, an index of these yields

can be computed as a measure of general soil productivity. The use of this concept has increased in recent years with the development of more detailed soil classification procedures.

Economic productivity may be defined in terms of gross or net returns imputed to a soil from revenues received from a crop or composite of crops representing the typical combination of crops grown on farms having that soil. Since gross returns do not carry much more meaning than do yields due to variability of input costs and because they do not lend themselves to aggregation, net returns are preferred and most commonly used. Net returns refer to that portion of gross revenue returned to land for its contribution as a factor of production; it is "net" in the sense that other factors of production have been paid.

Several methods have been used as a basis from which net returns can be computed. Where rental arrangements are common, the landlord's share approach is used; where custom operations are common and sufficiently broad these charges can serve as a basis; where neither of these methods can be used, it is necessary to use more formal budget techniques.

Economic productivity has found greater application than physical productivity because it lends itself to aggregation, it is additive, and it can also be capitalized into a price representing value - a procedure commonly used in all farm appraisal work. Apart from the actual dollars and cents of crop net returns, individually or aggregated over a complete soil, an index of economic productivity

can be calculated. The index is used to place the net returns of a group of soils in ratio to a single soil or some other common reference point. The index in this case becomes a general measurement of economic productivity not tied to any specific crop or monetary value.

Also, productivity ratings do not tend to lose their relative meaning as rapidly as price and input relationships change which serve as a basis for their development. This is one of the reasons why tax assessors have been interested in economic productivity ratings.

Productivity Ratings as a Tool to Equitable Tax Assessments

The equitable distribution of an ad valorem property tax is far more important in tax assessment procedures than the actual level of value established. Almost all states specify that property is to be assessed for tax purposes at some relationship to market value.[a] Implied in this concept is that market value reflects equality. This may or may not be so. Besides, all properties cannot be placed on the market to determine their value and, thus, a judgement must be made. In order for this judgement of value to approach market conditions, the very best and most accurate information is necessary. It is for this purpose that

a. "Market value" may not be specified, but words such as "true market value", "full cash value", "just value", or as in Oregon "true cash value" are used. All attempt to bring assessment values in line with market values. The Legislative Interim Tax Study Committee, in its report to the Governor of Oregon, recommended that the term "true cash value" as used with respect to the assessment of real and personal property for ad valorem tax purposes should be redefined to mean market value as of the assessment date. (30, p.1)

soil productivity ratings can have wide application.

According to W. G. Murray there are three tendencies usually evident in valuing land for tax assessments. "First, there is a tendency for any set of valuations to become fixed and to undergo little change in subsequent valuations. Second, what changes do occur are likely to be downward, with some properties being reduced more than others. And finally, as with loan appraisals, there is definite evidence of an excessive concentration of valuations about the average." (28, p. 11) Only the third one of these characteristics is relevant here. Stating this in another way is to say that highly productive properties are under-assessed and properties of low productivity are over-assessed. Oregon is no exception to this general tendency. In an Oregon Experiment Station bulletin published in 1928, W. H. Dreesen concludes, after presenting much evidence, "Real properties in the low value groups are as a whole over-assessed in both rural and city assessments. There is a slight tendency for the ratios of assessments of rural properties in some counties to rise in the upper value groups." (12, p. 4) That this condition has not completely disappeared is evident in Table 1 which was developed from data gathered in this study:

Table 1. Relationship of land values to their corresponding tax levy, Marion County, Oregon, 1958.[a]

Number of properties	Farmer estimated value	Tax levy	Tax as a percent of value
	$ per acre	$ per acre	%
29	600	5.21	.87
15	525	6.91	1.32
33	450	6.35	1.41
129	360	6.38	1.77
39	340	5.07	1.49
46	185	3.90	2.08
18	160	3.49	2.21

a. Since tax levies were reported in terms of farm units and farm units were often made up of a complex of soils, it was not possible to relate property taxes to the individual soils. Therefore, both the land values and the tax levies represent areas of associated soils. Land values were rounded to the nearest $5.

Even though mill levy differences may account for part of the variation in tax costs per acre and the taxes presented may represent more than cultivated acres, the differences are great enough and consistant enough to illustrate the point that under and over assessment still persists. The reappraisal program inaugurated in 1951 in Oregon was not complete in Marion County in 1958 when these data were gathered. This program, when completed, should do much to correct the tendency toward over taxing of low productive lands and vice versa.

It is easy to recognize the part soil productivity ratings can play as one of the major factors in equalizing tax assessment.

Productivity Ratings as an Aid to Farm Property Transactions

The sale of property involves a seller, a buyer and generally a real estate agency. This means generally that there will be three or more separate judgements of value made in the transaction. In order to bring about unity in this group, the best information available concerning the property being transferred is needed. Crouse and Everett define three types of value used in appraisal work: earnings value, location value, and home value. (11, p.37) Of these three, earnings value is the most important when considering land for agricultural purposes. Basic to arriving at a common understanding of earnings value is a knowledge of soils, crops, yields and costs of production typical of the area. These are the bases of physical and economic productivity ratings. A discussion of productivity ratings has become a part of many farm appraisal manuals and texts.

Farm property may also be transferred by lease to a tenant who, in effect, hires the use of land resource; the tenant pays either a cash payment or a payment in kind for the use of this resource. In establishing a lease arrangement satisfactory to both parties while returning an optimum product to society, it is essential to understand the nature of the soils involved, the crops they will support and at what levels and information about the costs of production. Again, these are the composition of economic soil productivities.

Productivity Ratings as a Guide to Farm Finance

Farm lending agencies are turning more and more to technical

information as a guide to purposeful agricultural lending and as a means of increasing loans while at the same time reducing risk. Trained specialists are being hired to consult with farmers about their financial needs. Prior to making a farm loan, where real estate is offered as collateral, a loan appraisal is usually made. A loan appraisal of real estate is basically no different from other types of farm appraisal. The item of prime importance is the ability of the farm to produce net returns available for debt reduction. Net returns are the basis of economic productivity ratings.

As with assessment appraisals, the tendency in appraising for real estate loan purposes is to over-value poor land and under-value good land -- a tendency to lean towards an average. The use of soil productivity ratings should prove useful in overcoming this tendency.

Economic productivities are also important in guiding production loans. The ratings themselves are not so important, perhaps, as their by-products. The individual input-output relationships of the several crops forming the economic productivity ratings of the individual soils are useful to both the borrower and the lender.

Physical and Economic Productivity By-products

As has already been hinted at there is a mass of data behind the economic productivity ratings which may be, for many purposes, as important as the ratings themselves. These data are in the form of crop input-output relationships as related to specific soils or to crops over several soils. It is difficult to divorce productivity

ratings from the material which formed them.

Physical and Economic Productivity Considerations as an Aid to Farm Management Decisions

There was a time when the major inputs for agricultural production were labor, management, and land. This is not the case in our present economy. Technologically we have advanced far beyond this point and it is now not unusual to find investments in farm machinery, buildings, perennial crops and other forms of capital are greater than the investment in land. For example, the investment in a strawberry crop may run as high as $300 per acre, excluding a land charge, before any harvest is received. In the production of hops, the yard investment alone may be over $300 per acre and onion producers may have an investment of over $500 per acre in storage buildings and transfer boxes. Production costs may be even higher than these investments. For example, annual production costs per acre for pole beans and strawberries may be over $1,000 and $600, respectively. This does not indicate that land is diminishing in its importance as a factor of production. It does indicate the necessity of soil classification coupled with information concerning physical and economic productivities. The manner in which a soil is able to combine with forms of capital affects greatly the net returns to the operator. In respect to strawberries, pole beans, hops and onions, the returns to land, land taxes and unaccounted management may be as high as $300, $250, $60 and $250 per acre, respectively, after paying a market return to the other

factors of production. Farmers recognize this in the prices they are willing to pay for additional pieces of property. It was found that farmers who were able to obtain contracts for the production of crops such as pole beans, strawberries and carrots were willing to pay $600 to $1,000 per acre for additional land. Soils which are highly adapted to onion production have sold for over $2,000 per acre.

Under this setting it is easy to realize that agricultural production is a complex of input-output relationships involving skilled management decisions. Information concerning soils, their adaptabilities to certain crops, the level of production which can be expected, capital requirements, prices which can be expected and an estimate of net returns is highly useful in decision making. In establishing physical and economic productivity ratings these are part of the many types of information presented. It is impossible to present in one volume all of the aspects of the separate crops involved, but it is anticipated that the information presented can be useful to farmers in making farm management decisions.

Physical and Economic Productivity Considerations as a Guide to Farm Adjustment Problems

The agricultural industry is not a static one. Great changes have taken place and at an accelerated rate. These changes have affected the whole structure of agricultural production. Technological changes in improved seeds and breeds, the use of fertilizers and chemicals, the replacement of man labor with powered machines

and improved marketing methods are but a few of the important ones. Also, there has been a change in consumer behavior which has greatly affected the demand structure. There have been great changes in both demand and supply. As a result many farmers have been forced off the farm, farm size has increased, capital investment requirements have increased, product specialization has increased and areas have changed in the products produced. The farm problem is one of our major domestic issues subject to lengthy congressional debate.

Adjustments do not come about without pain on the part of those involved. In order to make these production adjustments less burdensome the best technical information is needed. It is not advocated that soil productivity ratings, and the material out of which they are composed, are in any manner a complete answer but this type of information plays a necessary part. Even though soil classification techniques change due to improved methods and testing procedures, the classes themselves change more slowly. The types of crops a particular soil will support and at what levels and its combinability with labor, management and forms of capital in yielding net returns are valuable information in any land-use adjustment problem. Whether linear programming techniques, budget techniques or other analytical tools are used, this type of material finds application.

Physical and Economic Productivities as a Body of Information Useful to Technical Advisors on Agricultural Problems

Lastly, it is anticipated that the information used in constructing the individual soil productivities should be useful in

helping to solve some of the many diverse problems coming to technical advisors on agricultural problems. Information on ten different soils, or soil combinations, and 30 different major crops are presented. Although the information is not complete in all aspects of analysis, the body of material used in building up final net return figures used in computing the economic productivities of the several soils should prove useful. If not directly useful then, perhaps, it can be regrouped, combined and handled in a manner to fit the problem at hand.

Delimitations

The process involved in building up to the final productivity calculations has consumed much energy and judgement if for no other reason than magnitude alone. There are no doubt errors which have crept in partly due to the human factor and partly due to the process alone. The survey technique of collecting farm production information depends upon farmers' records and memory and the skill of the interviewer. Many of these errors are removed in aggregation, but there are bound to be a few that are unaccounted for. Also, the tabulation process is a human one and even though all calculations and transfers of information were at least doubly checked, there still may be errors which went unaccounted for. The more involved the production process, the greater chance there is of committing these types of errors. Great care has been exercised to keep errors to a minimum and it is felt that those remaining do not greatly affect the use of the data presented.

The survey technique used in this study, which will be explained in a later chapter, has resulted in biases which should be pointed out early. In the first place, a comparatively larger number of the large farms have been included than the small ones. This biases the data toward the large farmers. Secondly, only those farmers were included which were able to furnish production information and had experience sufficient to estimate usual yields. Also, it was impossible to get information if the farmer could not be contacted. These bias the data toward well established and, perhaps, more successful farmers and towards full time farmers. In areas where farm turnover is great, the typical picture is not presented. This became a problem on the less productive soils.

It should be stressed that soils were analyzed in terms of their ability to support cultivated agricultural crops. Other influences affecting land value were not considered.

The statistical material presented in this report was taken from a survey of farmers in Marion County, Oregon, covering the production year 1958. The soil productivities developed and their relative data have direct application to Marion County. Adaptations may be made to other Willamette Valley areas where the soils and crops are similar. The techniques developed and methods used, however, should be of value throughout Oregon.

CHAPTER II

Theoretical Considerations

This chapter is devoted to a discussion of some of the theoretical considerations and problems in calculating economic productivities of soils. As defined in Chapter I economic productivity, in the form of a net return or as converted into an index, relies upon the representativeness of the "net" as a return to the factor land or, in this case, soil. The traditional approach for determining net returns to land is to impute the residual, which is left after paying other factors for their contribution, to land. Under this system the accuracy of the imputed net to land is dependent upon the accuracy of the distribution to the other factors of production. The distribution problem as related to economic soil productivity will occupy the bulk of this chapter.

The same problems do not exist with physical productivities as with economic productivities. The accuracy of physical productivities is dependent upon the representativeness of the crop yields and distributions. These are physical considerations dependent upon statistical manipulations. The approach is rather straight forward. The same is true for inputs and prices when calculating economic productivity. Levels of inputs are defined in terms of existent farm situations and prices are chosen according to the purposes of the economic productivity. For these reasons the discussion is limited to the distribution problem in the imputation process.

Economic productivities can either stand alone or be converted into indices. Indices are relative measures in terms of some standard. As such, they are devoid of any monetery level. Economic productivity ratings are correlated with property values, however, and it is possible to test this relationship in terms of market values by statistical techniques. Since economic productivity indices are relative, the absolute values imputed to land in the distribution process may be above or below the marginal contribution of land and still not change the relative positions of the land units being rated. As long as the distribution techniques are the same on all soils being rated the biases are somewhat proportional and are lost in the conversion process.

For some purposes, however, it may be desirable to use the economic productivities of the various soils more directly. The method used in calculating economic productivity are very similar to the imputation process used in arriving at "earnings value" in land appraisal. A net return to land or soil is calculated in both situations. The reasoning behind the two procedures may be somewhat different in regards to the selection of crops and prices. The reference period changes with the purposes for which the appraisal is made.

Net returns in the appraisal process are used in estimating earnings value -- capitalized net returns (earnings) of the piece of property being appraised. Situations where net returns representing economic soil productivity may be used more directly in

estimating earnings value are largely associated with mass land appraisals similar to those used for taxation purposes where individual properties cannot be separately appraised. For other appraisal work such as transfer appraisal and loan appraisal the economic productivities are used as indicators only. The by-products, perhaps, become more important here than the general soil productivity rating themselves.

In broad perspective Hurlburt outlined the basic problems of pricing farmland as follows: "(1) Separating the real estate bundle into its component parts and determining the quantities of land of different qualities or grades; (2) estimating the earnings capacity of each grade of land under one or more combinations of factors; (3) translating the flow of income into a fund of present value; (4) distinguishing between firm (production) and family (consumption) expenditures and returns; and (5) evaluating nonmonetary phenomena." (18, p. 7) Economic productivity determinations are concerned primarily with numbers 1 and 2 of the above problems outlined by Hurlburt. Relative to number 1, Hurlburt concluded; "For land-pricing purposes, the basis for distinction between grades is productivity." (18, p.9) Again this illustrates the importance of economic productivity ratings in farm appraisal work.

Under the conventional purely competitive production model, market price would adequately reflect factor returns. At this level production would be at the place where average costs were at a minimum, marginal cost would equal marginal revenue and production

would be at an optimum level. Factors would be rewarded according to their marginal productivities. There would be no need to estimate returns to factors by computational procedures or the like.

Factor markets are far from being perfect and market prices may not be adequate measures of factor rewards. The degree of imperfection is not the same for all of the factors and, hence, the market price may be more representative for some factors than for others.

Labor, capital, management and land are the input categories generally recognized in agricultural production. The degree of competition in the pricing of these inputs is highly variable. For pure competition to exist, there must be large numbers of buyers and sellers, homogeneous products and free entry of production, and to make this competition perfect there must be, in addition, perfect knowledge and mobility of factors. It is easy to see that none of these factors fill all of these requirements; nevertheless, each factor must be valued.

The Adding-up Problem

Even if it were possible to determine the marginal productivities for all of the factors of production except land, if the distribution to land was based upon residual techniques, it is possible to either under or over reward land for its contribution. This is commonly known as the adding-up problem. The question is whether or not the total product will be exhausted if each input factor is given a proportion of the total equal to its marginal product times the number

of units of the product used; symbolically: $P = \frac{\Delta P}{\Delta L} \cdot L + \frac{\Delta P}{\Delta C} \cdot C + \frac{\Delta P}{\Delta S} \cdot S + \frac{\Delta P}{\Delta M} \cdot M$ where P refers to total product; L, C, S, M refer to labor, capital, land and management respectively; and the Δ's refer to marginal units. This is referred to as Euler's theorum. The answer is a conditional one. The total product will be exhausted only if production is such that elasticity of production is equal to one ($E_p = 1$) which happens only in two cases: one, when the average product is equal to the marginal product; and two, under constant returns to scale, i.e. a linear homogeneous production function. It is assumed that all factors are included in the imputation process. Under increasing returns to scale the product will be over-exhausted and under decreasing returns to scale there will be a residual.[a]

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a. The mathematical proof of this may be shown as follows: Let Z be the total product and X and Y the factors of production.

1. With decreasing returns to scale:

$Z = 2X + 3Y - Y^2$

$\frac{dz}{dx} = 2$

$\frac{dz}{dy} = 3 - 2Y$

This is the marginal productivity of the factors. We test to see if total product is exhausted.

$Z \stackrel{?}{=} 2(X) + (3 - 2Y)Y$

$Z \stackrel{?}{=} 2X + 3Y - 2Y^2$

From our production function above we know that:

$Z = 2X + 3Y - Y^2$

So, $2X + 3Y - Y^2 > 2X + 3Y - 2Y^2$

Therefore, total product is not exhausted

2. With increasing returns:

$Z = 2X + 3Y + Y^2$

(continued next page)

There are situations in agriculture when either of these two conditions possibly could be fulfilled. Under the static competitive model production will move towards the point where the marginal cost equals marginal revenue equals average costs equals price. This is so because at any point other than this there will be producers entering into the market or leaving the market depending upon profit or loss conditions. At this point Ep = 1.

Another situation which fulfills the conditions of unit elasticity is where farmers keep adding units of land and expanding horizontally. This condition is possible, however, only until management becomes limiting causing returns to scale to decrease. This condition is rather prevalent in many areas where farm size is increasing.

The last condition mentioned here where the distribution of

$\frac{dz}{dx} = 2$ $\qquad$ $\frac{dz}{dy} = 3 + 2Y$

$Z \; ? \; 2(X) + (3 + 2Y)\, Y$

$Z \; ? \; 2X + 3Y + 2Y^2$

$2X + 3Y + Y^2 < 2X + 3Y + 2Y^2$

Therefore, total product is over exhausted.

3. With constant returns to scale:

$Z = 2X + 3Y$

$\frac{dz}{dx} = 2$ $\qquad$ $\frac{dz}{dy} = 3$

as before, $Z \; ? \; 2(X) + 3\,(Y)$.

$2X + 3Y = 2X + 3Y$.

Total product is exhausted.

the marginal products just exhaust the total product is where the amount of change is so small that the summation of the marginal products cannot deviate greatly from the total. The residual would be present but would be rather infinitesimal.

It has been suggested that whatever disparity there is should be divided among the total input bundle rather than attributing this to land as is often done in the imputation process of land valuation. (17, p. 413) (18, p. 15) It is doubtful if this is very realistic since the tools of measurement commly available are too crude. Perhaps it is sufficient at this point to recognize that there is a possibility of imputing to one factor values which rightfully belong to another. More will be said about this in later paragraphs.

Distribution to Labor

As mentioned in an earlier paragraph competitive conditions are not present in agriculture and the degree of competitiveness may vary with the factors of production. Another variation is the dynamics - uncertainty complex. This calls for a look at the conditions of the individual factors in respect to the distribution problem. Any method of estimating factor earnings, in the absence of perfect knowledge, can only approximate the true marginal value products of the factors.

Generally speaking, agricultural labor is under employed relative to industrial labor. As such, both the average value product and the marginal value product of labor are lower in agriculture than in industry. The agricultural worker because of nonmonetary

amenities, other satisfactions and lack of knowledge has not transferred out of agriculture even where higher wages were available. This is not necessarily irrational on the part of farm labor. For the most part farm owner-operators contribute the bulk of the labor force. In addition to any labor and management earnings there are also investment returns and amenities and satisfactions which are enjoyed by the owner-operator. In other words, the owner-operator does not need to receive a market wage to keep him employed in agriculture. It is very possible that the differential between market wages and the wages owner-operators are willing to receive is capitalized into land values in the market place.

The wage rate necessary to keep farm owner-operators employed may be quite different between debt-free farms and mortgaged farms. Where there are principal and interest payments which must be made the wage rate needed to permit the owner-operator to remain in farming may be somewhat higher.

If hired labor is used at the level where its marginal value product is equal to its cost (wage rate) the returns to the fixed factors of production become larger as labor use is increased providing production is beyond the point where marginal and average products are equal. The rational producer will use labor to the point where its marginal cost (wage rate) is equal to its marginal revenue. The wage level may change upward, however, as mobility within and out of agriculture increases. As a result, the return to the fixed factor may decline. Much depends upon dynamic

conditions of other factors during the time wages are changing.

Where there exists a considerable degree of competition within an area the existing wage rate probably approaches labors' marginal value product for that area. The labor rate for the operator and his family can be based upon established rates for hired labor.

The existing wage rate is probably safe to use as a guide to estimating the returns to labor in the distribution process over the period during which wage rates are considered to remain unchanged. Beyond this point adjustments would be necessary if the residual returns to land were to be used in estimating earnings value in the land appraisal process.

Distribution to Management

Management input measurement has given economists trouble for a long period of time. Although there are at present highly refined techniques available there are still none which can be utilized for general distribution problems. It has been suggested that commercial rates commensurate with professional farm management agencies be used. These rates generally are based upon a percentage of the gross revenue. The assumption is that management increases with gross revenue. This may or may not be wholly true. The big question, however, is how accurate of an estimate is it? It is very doubtful if there is a sufficient number of these management agencies available for any degree of competition to exist. In many parts of the country their services are not even available. On the whole farmers do not engage their services. The management level may, also,

be quite different. It would seem that there are procedures available which are tied more closely to the farmer, who is doing most of the management.

It would appear that part of the problem is in accounting for the time spent in management activities. These activities may represent, at the farm level, time spent in farm record analysis, obtaining crop contracts, bargaining activities, supervision, etc. which often are overlooked in enterprise cost analysis. The other part of the problem is in arriving at a value for the managers time. Some of the management decisions may be made while the operator is engaged in labor activities. In final analysis, perhaps, the best which can be done at the present time is to account for the time spent and estimate a value for this time. The managers themselves may be better able to evaluate their time than anyone else based upon labor wages and opportunity costs.

Distribution to Capital

The capital market may be the most competitive of all the factors of production. For certain items such as fertilizers, chemicals, labor, etc. which are purchased each year a specific outlay is required. There is, however, connected with these a money outlay which could have been hired out on the market at some rate of return. The more difficult items are capital investments in farm machinery, buildings, fences, etc. of more permanent duration. It is possible here to make rather reliable estimates based upon depreciation, annual repair and the like. There are better opportunity

cost estimates for these items than for land.

It is quite probable that capital has not been employed in agriculture to the point where its marginal revenue is equal to its cost due to internal and external capital rationing together with lack of knowledge. It is very possible that part of this difference has been capitalized into land values.

Another problem involved here is that decisions to invest are ex ante but subject to change ex post if returns do not come up to expectations. The difference between the expected return and that which is actually experienced is, to a degree, associated with time consideration. The difference is probably larger for long term investments.

Nevertheless, in the distribution process earnings to factors must be approximated. Prospective resource owners will tend to choose among income - earning opportunities and shift from industry to industry so that to them the marginal efficiency of capital is equal. Perhaps, the best general guide available for estimating the return to capital is opportunity costs of similar investments.

Distribution to Land

The land market presents several serious problems. In the first place, the conditions of pure competition are hardly met in any sense. Buyers and sellers are few, knowledge is poor and the product is very heterogeneous. The observation that poor land is over-valued and good land under-valued in the market is evidence of this. Land is transferred as a bundle and, as such, too little attention is paid

to its component parts. Buildings need to be separated from the soil and the individual soils need to be differentiated. Probably the best tool available for differentiating soils is productivity ratings.

In looking at the peculiarities of each of the above input categories the conclusion which may be logically drawn is that some inputs, valued at their market price, come more closely to their marginal productivities than others. If this be the case, the use of these factors as guidelines may be a logical first approach. It should be kept in mind, however, that even though the problem of distribution is one of dividing the total product among the factors, the reward to any one factor cannot be estimated accurately by residual techniques unless the rewards to all other factors are accurately reflected. The problem is first one of estimating productivities and second, one of putting on a price.

It may be only a matter of time before some of the difficulties associated with the distribution of factor returns will be improved. Buyers and sellers are becoming better informed, technical advisors to agriculture have more knowledge about productivities, mobility is increasing and more is being learned about the component parts of the soil. As those in the processes of transaction become better informed the valuation process should become more efficient. This may improve in the face of a decrease in some of the other qualifications of perfect competition.

It is admitted that the use of the above imputation approach

in estimating the returns to land may return an amount which is above the marginal productivity of land. The use of imputed land returns in estimating market price may be a better guide than if the true returns were known. It seems possible that farm owners may be willing to capitalize some of the earnings of other factors, providing the earnings were above opportunity costs, into land values. Land is a necessary base for the use of farm labor, capital and management. Where marginal efficiencies in the use of these factors were expected to be high due to increasing market conditions or through the adoption of new technologies it seems possible that farm operators may be willing to sacrifice part of the profits of other factors to land investments.

Some Factors Affecting Farm Land Values Not Directly Related to Productivity

In the valuation process there are situations which should be recognized as affecting land values but not related to productivity. Two of these situations will be mentioned here. First, in recent years individuals have invested in land as an inflationary hedge. Market prices in this respect will not reflect current earnings value. Land receives, in this instance, too large a share of the total product at the expense of other factors, particularly where capital is limiting. Second, the value of marketing contracts may be imputed to land. It was found in this study that the same quality of land was valued much higher by those holding crop contracts. The contracts could not be bought or sold but the having

of a contract was, nevertheless, of value. Land in this case was probably receiving that which rightly belonged to the contract.

The last item to be considered in this chapter relates to the taxation of farm land. Once a land investment is made the tax cost associated with that land is outside the area of control by the individual land owner. The tax becomes a land associated fixed cost. The tax may be the determining factor as to whether the firm remains in production. This can be seen by looking at Figure 1.

Figure 1.

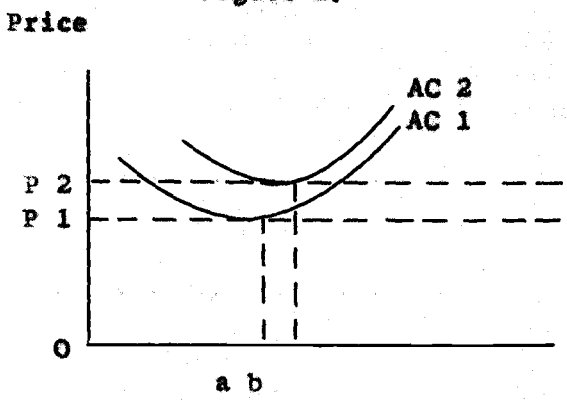
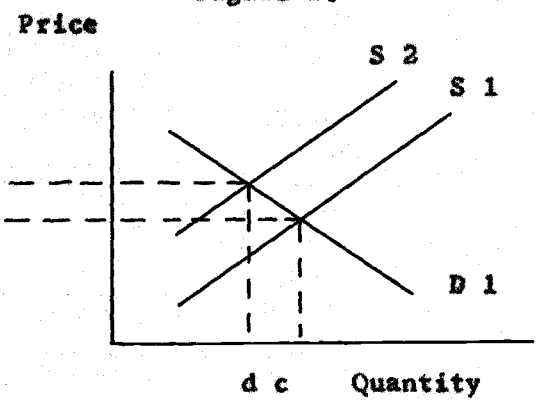


Figure 2.



We see here a typical firm's cost curve. The affect of an additional tax causes the firm's average cost curve to rise from AC 1 to AC 2. As a result, the firm's cost will be greater than its returns. This will cause some firms to go out of production and the price will rise along the marginal cost curve from P 1 to P 2. Those firms which remain in production will increase production from a to b.

The industry output will be less, however. This can be seen by looking at Figure 2. The supply schedule has shifted to the left from S 1 to S 2 and total output has moved from c to d.

The above may not take place where land does not go out of production but rather is taken over by a more efficient firm whose cost curves are below the firm's cost curve which is going out of production.

The effect of taxation can be seen in greater detail by considering tax changes in respect to two land units which will be referred to as L_1 and L_2. Assuming that the total quantity of these two land factors is fixed but that the quantity available to any one farmer is variable the equilibrium use of L_1 and L_2 can be illustrated as follows:

$$\frac{MVP_{L_1}}{P_{L_1}} = \frac{MVP_{L_2}}{P_{L_2}}$$

where MVP equals the marginal value product and P equals the price of land. If the above ratios are equal to one (1), the total quantity of land being used probably would not be equal to the total amount available. Therefore, assume that the above ratios are equal but at a level greater than 1.

If a tax were levied on L_1 but not on L_2 this would cause the ratios to become unequal. This would be true because the tax would tend to increase the cost or price of L_1. However, so long as MVP_1 was greater than P_{L_1}, L_1 would continue in production. Under this circumstance the product mix and total output would remain unchanged and other segments of the economy would not be greatly affected. However, if the resultant P_{L_1} should exceed MVP_{L_1} less L_1 would be used and the product mix and total output would be affected. L_1

owners would be made worse off relative to L_2 owners in both instances.

Now consider the situation where L_1 and L_2 are being used to the point where the ratio of their MVP's to their prices is equal to 1. In this case, an increase in taxes would result in a reduction in use. If the increase in taxes is not proportional to the respective MVP's both the product mix and the total output would be affected.

In general, it appears that property taxes would have more effect on the income of land owners than it would on output or product mix. It is possible, of course, to raise taxes sufficiently high to drive land out of production. It may, also, be possible to force land to be put to a more nearly optimum use if it is not being used in that fashion. For example, an increase in taxes may force land from an extensive use to an intensive use.

CHAPTER III

A Review of Selected Soil Productivity Rating Systems with Reference to Oregon Conditions

"One of the most promising developments in the field of soil science, as far as the appraiser is concerned, is the soil productivity rating, which designates in a single index figure the combined effect of many characteristics of the soil." (28, p. 99) The above quotation was taken from William G. Murray's now famous Farm Appraisal text and handbook. Physical and economic soil productivity ratings are defined and discussed briefly in Chapter I. These ratings were tied to crop production; soils may be rated, however, without direct reference to crops in terms of the important elements in soil classification. In order to evaluate and give meaning to the methods developed in the following chapters some of the important work done in other areas will be reviewed here.

The "Cornell" System of Economic Land Classification

The Cornell System of economic land classification does not attempt to measure the productivities of the individual soils but rather is an economic classification of farm business units. It is included here to illustrate a contrasting emphasis and also to show the importance of economic interpretations. Also, the limitations of pure productivity ratings can be seen more clearly.

The Cornell System is primarily an income expectancy rating

of farm business units. According to this criterion land areas are issued ratings as follows: Class I comprises areas where chances for success in full-time farming are extremely small. Class II comprises areas in which chances for success in farming are too small to expect full-time commercial operations to continue for long, though some are being carried on at present. Class III comprises areas in which farm income expectancies are generally low, though high enough to meet minimum requirements for continued operation over the next 15 years or more. Class IV consists of areas in which farms with medium income expectancies predominate. Farm businesses are larger, production is higher and there is a greater abundance of farm capital. Classes V and VI consist of areas in which a major proportion of the farms have high to very high income expectancies. Farm businesses are large, well organized and efficient.

The indicators used in arriving at a particular class are: past incomes, measures of business size, rates of production, amount and condition of capital investment, performance characteristics of soil, climate, and topography and like items. The most probable operator is assumed. Information is collected through soil maps, climatic data, census information, etc., and farm surveys. Cooperation is obtained from county agents, leading farmers and college specialists.

The System is justified theoretically on the basis that expectant purchasers do not act in accordance with marginal principles;

poorer lands have many bidders and the price is driven above the capitalized marginal value products. The opposite is true of good lands. Poor lands attract inefficient operators with limited capital. The assumption is that this will continue. Maladjustments in the pricing and taxing of land help to drive the less productive areas out of agriculture and to place the better areas in a stronger and stronger position.

The land classes are developed with prospective purchasers in mind but are useful guides to farm finance, aids extension workers and agricultural teachers in adjusting recommendation to various areas and assists in equating tax assessment.

Table 1 illustrates the characteristics associated with the several land classes and indicates items considered in their development. The figures in Table 1 are averages; there are differences within classes as illustrated in Table 2. (9, pp. 548-557) (10, pp. 1-19)

The part which income plays in designating the various land classes is highly evident and it is for this purpose that the system is discussed here. An individual soil class does not come to life until an interpretation is made regarding its purpose and potentialities. It is for this reason that the majority of the more recent soil survey reports discuss the individual soils in terms of crop adaptabilities and levels of production.

It is difficult to see how the Cornell System could be adapted to Oregon conditions. It would seem to have greater applications

Table 1. Major characteristics of full time commercial dairy farms in each land class, North Country survey data, 254 farms, St. Lawrence County, New York, 1955-56.[a] (10, p. 7)

Characteristics	Land Class I & II[b]	III[b]	IV[b]	V & VI
Number of farms	29	87	120	18
Size of business				
Acres operated	249	266	244	252
Acres of crops	71	83	87	107
Number of cows	20	26	30	36
Pounds of milk sold per farm	109,034	160,161	202,825	278,222
Man equivalent	1.4	1.7	1.7	1.8
Total work units[c]	351	456	517	636
Work units on crops	49	62	61	98
Work units on livestock	292	369	435	528
Rates of production[d]				
Crop index	85	104	109	109
Milk sold per cow	5,510	6,238	6,787	7,650
Milk sold per crop acre	1,752	2,222	2,518	2,644
Intensity of land use[d]				
Total expenses per acre of cropland	$72	$87	$98	$114
Cows per 10 acres of cropland	2.7	3.0	3.2	3.2
Labor efficiency				
Work units per man	254	286	315	351
Acres of crops per man	52	56	54	61
Number of cows per man	15	16	18	20
Pounds of milk sold per man	79,345	100,805	123,742	151,389
Capital and income[d]				
Total investment per farm	$14,700	$20,700	$23,200	$35,200
Non-real estate investment per farm	$7,700	$10,100	$12,800	$19,200
Real estate investment per crop acre	$111	$144	$129	$157
Real estate investment per 1000 lbs. of milk sold	$76	$72	$57	$65
Total investment per cow	$797	$847	$814	$997
Labor income 1955-56	$559	$579	$1,402	$2,006

a. Mean averages.

b. Includes the "X" and "Y" sub-classes of these land classes.

c. Includes work units on miscellaneous enterprises that are neither crops or livestock.

d. Rate and ratio figures are averages of individual farm rates and ratios.

Table 2. Distribution of full-time commercial dairy farms in each land class by labor income per farm, north country survey, 254 farms, St. Lawrence County, New York, 1955-56. (10, p. 17)

Labor income per farm, 1955-56	Land Class			
	I & II	III	IV	V & VI
	Percent of farms			
Loss of $1,000 or more	6	11	8	17
Loss of $1 to $999	20	28	16	11
0 - 499	17	14	13	6
500 - 999	10	10	8	11
1000 - 1499	24	8	13	11
1500 - 1999	20	6	7	6
2000 - 2499	3	7	3	0
2500 - 2999	0	5	5	0
3000 - 3999	0	8	12	11
4000 - 4999	0	3	4	11
5000 - & over	0	0	6	16
All sizes	100	100	100	100

where there are concentrated areas of similar type farming units operating at nearly the same level. Western Oregon with its dispersed farming and Eastern Oregon with its diverse farming hardly fit into this setting.

The "Storie" Soil-rating Index

While the Cornell System reflects one extreme, the Storie index reflects another. The Storie index is based entirely on the characteristics of the soil and is thus independent of other physical or economic factors that might determine crop use.

In Mr. Storie's words the method is as follows: "Percentage values are assigned to the characteristics of the soil itself, including the soil profile (factor A); the texture of the surface soil (factor B); the slope (factor C); and conditions of the soil exclusive of profile, surface texture, and slope -- for example, drainage, alkali content, nutrient level, erosion, and microrelief (factor X). The most favorable or ideal conditions with respect to each factor are rated at 100 percent. The percentage values or ratings for the four factors are then multiplied, the result being the Storie index rating of the soil." (38, p. 1)

Each factor is broken down into detailed classification to cover variations which occur in this factor; a rating is assigned to each variant beginning with a rating of 100 assigned to the most desirable characteristic. For example, 0 to 2 percent slope is rated 100 percent; 3 to 8 percent slope is rated 95 to 100 percent; 9 to 15 percent slope is rated 80 to 95 percent, etc. Each factor

has a potential rating of 100.[a]

After the rating has been performed the soil is classified into grades as follows: Grade 1 (excellent), between 80 and 100 percent; grade 2 (good), between 60 and 79 percent; grade 3 (fair), between 40 and 59 percent; grade 4 (poor), between 20 and 39 percent; grade 5 (very poor) between 10 and 19 percent; and grade 6 (nonagricultural), less than 10 percent. (38, pp. 1-4)

There are two major difficulties to the Storie index which cast doubt upon its widespread use. In the first place, it is assumed that the soil profile, the texture of the surface soil, the slope and other specified conditions are all equally important to crop production. Secondly, the percentages assigned to the specified conditions under each factor are individual value judgements. This is not to say that they are completely arbitrary but there is no indication of any attempt to test them empirically in terms of crop responses.

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a. Using the Storie index the rating of a soil is determined as follows: (38, p. 4)

Index for Ac1-CC (Altamont clay loam, rolling): This is a brown upland soil from shale parent material, bedrock at a depth of 3 feet. Rolling topography, moderate sheet erosion, with occasional gullies.

		Rating in percent
Factor A:	Altamont series, profile group VIII	70
Factor B:	Clay loam texture	85
Factor C:	Rolling topography	90
Factor X:	Moderate sheet erosion with shallow gullies	70
Index rating		70% x 85% x 90% x 70% = 37%

Physical Productivity Ratings

Physical productivity ratings are associated most closely with soil survey reports. Within the last decade their use has been popularized and most recent survey reports include productivity estimates to a greater or lesser degree; some may give yield estimates at one or more levels of inputs, some may give soil use estimates in terms of crop proportions and some may combine these features into indices of physical productivity. Illustrative of the use of crop yields is the Lucas County, Iowa, soil survey report. (33) Table 3 is extracted in part from this report.

Table 3. Estimated average acre yields of principal crops to be expected over a period of years, and corn productivity rating for the soils. (24, p. 9)

Soil	Estimated yields of crops										Corn productivity rating[c]
	A level of management[a]					B level of management[b]					
	Corn	Soy beans	Oats	Red clover	Alfalfa	Corn	Soy beans	Oats	Red clover	Alfalfa	
	Bu.	Bu.	Bu.	Tons	Tons	Bu.	Bu.	Bu.	Tons	Tons	
Beckwith silt loam	28	12	16	0.8	0.6	42	16	25	1.4	1.0	30
Edina silt loam	36	18	23	1.2	1.6	52	20	30	1.5	2.0	55
Haig silty clay loam	48	24	28	1.5	2.0	60	28	35	1.8	2.5	70
Wabash silty clay	35	18	20	1.6	1.8	45	20	25	1.8	2.0	Varied

a. Average level of management; no definite rotations, pastures are unimproved, adequate lime and some manure are used but no commercial fertilizer and no terracing or contour cultivation is practiced.

b. Superior level of management; suitable rotations are followed and fertilizer is applied according to soil tests.

c. Based upon a rating of 100 for the most productive soil in the state.

The Monana County, Iowa, soil survey report included a table on soil use besides yield estimates. No attempt was made to put these together into any form of an index. Table 4 is an extraction of this table.

Table 4. Principal soil uses and estimated proportionate extent of soil in each use. (44, p. 4)

Soil	Corn	Oats	Wheat	Soy-beans	Hay	Pas-ture	Native timber	Miscel-laneous
				Percent				
Albaton (0-1%)[a]	50	10	10	10	5	5	5	5
Ida silt loam (7-14%)	45	20	(b)	(b)	15	20	(b)	(b)
Luton clay (0-1%)	30	50	25	15	2	3	(b)	20
Shelby loam (8-14%)	40	20	(b)	(b)	10	15	5	10

a. Refers to slope.

b. Little or none of soil in this use.

Aandahl, who has done extensive research on the relationship of yields to soil types, converted crop yields which were associated with the individual soils into physical productivity ratings. (2) Table 5 presents an extraction from one of his tables.

The use of this type of data is extremely useful to the appraiser in estimating typical conditions to be used in estimating market value. A knowledge of the individual soils on a piece of property, their adaptability to certain crops and the yield that can be expected under defined input levels aids in formulating a cropping

system and usual yields to be used in the calculation of net returns to land.

Table 5. Productivity ratings of the soils of Tama County, Iowa. (2, p. 77)

Soil	Crop productivity index					
	Corn (100= 50 bu.)	Oats (100= 50 bu.)	Clover & timothy (100= 2 tons)	Alfalfa (100= 4 tons)	Soy beans (100= 25 bu.)	Pasture (100=100 cow-acre-days
Muscatine	120	100	90	100	100	130
Tama silt loam	100	90	85	95	80	120
Roy silt loam	90	70	100	85	80	140
Shelby loam	50	40	30	60	15	50
Buckner sandy loam	30	40	20	20	30	20

This only presents part of the picture, however. Physical yield comparisons may have little meaning in areas of diverse crops of different gross and net returns. It is when crops, yields, prices and costs are added together that individual soil productivities are additive and comparable. These are features of economic productivity indices.

Economic Productivity Ratings

Economic productivity ratings are for the most part an extension of the physical productivity ratings previously discussed. They have the advantage, however, in that they retain the important characteristics while adding income expectancies. Typifying this system is the work done in Nebraska by Ottoson, Aandahl and Kristjanson. (29)

Although this system was worked out specifically for tax assessment it has general application.

The major thesis of the Nebraska study is that soil productivity differences are the principal reason for differences in land values. To show this, it is necessary to separate the economic productivities of the soil from differences of management and then to test these established soil productivities in the market place. The effects of buildings and location were also considered when making the final estimate of market value.

The procedures outlined for the determination of productivity ratings are as follows:

1. Classify the soils. Soil survey reports are the major source for this information and air photos on which the soils are mapped are almost a necessity.
2. Estimate the typical soil management system for each soil. To do this information is collected concerning the crops which are grown on each soil, crop rotations and methods used. This is a field operation.
3. Estimate crop yields for the typical farm management system on each soil. The typical farm management system has reference to a defined level of input relationships such as fertilizers, sprays, cultural practices, etc. Information is collected from various agricultural statistics and from farmers in the field. Long time average yields are most desirable.

4. Estimate an economic rating for each soil. Gross income is first estimated by applying expected average prices to the yield estimates for each soil. Net income is next estimated by subtracting crop production costs from the gross income. Either the rental share method or the owner-operator method can be used in estimating costs; the method which is typical is used. Differences in expenses associated with soil types are reflected. By multiplying the net income of each crop by its corresponding percent distribution on each soil and summing the representative crop returns on each soil a composite net return is arrived at which represents each soil. The soils can then be rated against each other by assigning a value of 100 to the highest net return and then rate the balance of soils as a percentage of the highest one. This procedure is illustrated in Tables 6, 7, and 8.

Table 6. Estimated percentages of different crops grown on six soils, Saunders County. (29, p. 16)

Soils	Percent of:					
	Corn	Wheat	Oats	Soybeans	Clover, alfalfa and grasses	
Judson	56	12	16	2	10	4
Marshall (3-5%)	52	12	16	4	8	8
Sharpsburg (3-5%)	52	12	16	-	12	8
Sharpsburg (6-11%)	50	12	16	-	14	8
Knox (6-11% eroded	46	12	16	-	16	8
Pawnee-Nuckolls (6-11%) eroded	44	12	16	-	20	8

Table 7. Total crop production and gross value per 100 acres of six common soils, Saunders County. (29, p. 19)

Soils	Production of:						
	Corn	Wheat	Oats	Soy beans	Clover	Alfalfa	Gross value
	Bu.	Bu.	Bu.	Bu.	Tons	Tons	$
Judson	2800	240	640	48	20.0	12.0	4889
Marshall (3-5%)	2288	160	480	76	12.8	13.2	4328
Sharpsburg (3-5%)	2204	144	448	72	6.4	12.6	3736
Sharpsburg (6-11%)	1768	192	416	--	16.0	16.0	3229
Knox (6-11%) eroded	1104	96	288	--	9.6	4.6	1934
Pawnee-Nuckolls (6-11%) eroded	440	72	128	--	8.0	4.8	937

Table 8. Computation of net income per acre of six common soils, Saunders County. (29, p. 19)

Soils	Gross value	Expenses	Net income	Crop economic rating
Judson	$48.89	$13.56	$35.33	100
Marshall (3-5%)	43.28	13.21	30.07	85
Sharpsburg (3-5%)	37.36	12.62	24.74	70
Sharpsburg (6-11%)	32.29	12.58	19.71	56
Knox (6-11%) eroded	19.34	10.90	8.44	24
Pawnee-Nuckolls (6-11%) eroded	9.37	10.16	-.79	-2

For some soils a pasture economic rating is calculated in a similar manner. A balance point between crop and pasture usuage is determined; this determines whether highest and best use is for crops or pasture and hence whether the soil is rated by the crop or pasture rating.

The average economic rating for a tract of land can be calculated as illustrated in Table 9.

Table 9. Computation of average economic rating for a 160 acre farm. (29, p. 25)

Soil	Use	Acres	Economic rating	Product (acres x rating)
Barney	Pasture	2	17	34
Marshall (9%) eroded	Crop	39	57	2223
Marshall (9%)	Crop	48	68	3264
Marshall (4%)	Crop	39	81	3159
Marshall (2%)	Crop	3	87	261
Judson-Wabash (1%)	Crop	29	100	2900
Total		160		11841

Average economic rating = 11,841 ÷ 160 acres = 74

The economic rating of each tract of land represents its income producing ability in comparison with other tracts. These can then be compared with market value by simple regression techniques. (29)

It would appear that the procedure used by Nebraska in calculating economic productivity ratings could be adopted to Oregon conditions. The major problems present themselves in terms of the complexity of crops and soils found in many areas of Oregon. Within a limited area it is not unusual to find five or six soil series and 20 or 30 crops; within the area of a county there may be over 100 crops grown on a single soil series. These are the problems around which the procedures used by Nebraska are adapted to Oregon conditions in the following chapters.

CHAPTER IV

Framework for Computing Productivity Indices

The major assumption considered in this problem is that each soil class, due to its innate qualitites as a factor of production, has different productive capacities than other soil classes. This is not a new assumption but really a very old one. In fact, it is a tested and proven assumption. It is easily recognized that the market price for different qualities of land reflect different capacities of the soil to produce income. The relevant question is, how well does the market reflect productive capacity of individual soils, or, for that matter, the composite of soils forming a land unit? As has been pointed out earlier, under conditions of perfect competition we could rely upon the market to reflect marginal productivities. However, as was also pointed out, market conditions are far from perfect and particularly in regards to the land market. Even if the market were perfectly competitive, it may not reflect the individual productive capacities of the individual soil units; land is transacted as a productive unit and includes other than land values. Thus, it can be seen that in order to test the assumption that the productive capacity of different soils are different and to measure the relative amount of difference it is necessary to look at the individual soil units.

There are two measures which have been established for determining the productive capacity of the individual soil units. Both

of these are crop measures. The first measures the crop yields associated with the individual soil units. The second measures the net returns to the individual soil units from the crops which they support. Under certain conditions either measure might be adequate but under conditions of diverse soils and crops both methods are necessary to get a reliable estimate. The first method is used to determine the relative position of the individual soils by the comparative crop yields associated with each soil. However, crop net returns may be a better measure when production costs are significantly different or when the crops grown on the individual soils are not the same. Where the same crops are grown in the same proportions yields may give about as good a measure and would be more easily obtained. However, it is well known that all soils are not adaptable to the same crops and that, the same crop is not grown year after year on the same piece of land or field. Crop rotations or sequences and market opportunities must be considered. It is necessary to consider the composite of crops normally grown on a particular soil to adequately represent that soil. The tools necessary to do this are crop distributions and net returns. Net returns are additive and the distributions furnish the adequate weights.

Net returns, for purposes of this study, refer to the residual returns imputed to the soil after all other costs of production and distribution to factors have been paid. The assumption is that the market is more perfect in the pricing of these other factors than it is in pricing soils. This assumption may not be entirely correct but

the composite net returns to the individual soils calculated under this assumption can be compared with relative confidence since all are under the same assumption. The availability of information to do otherwise is lacking so there is really no other choice.

The yields and inputs should be representative of the average farmer in each situation; in appraisal work the "typical" is stressed. This method does not grant special favors to the farmer who lacks initiative and management ability nor does it penalize the outstanding operator. It more nearly represents the majority considering a normal distribution.

The yields which should be used are the average so as not to reflect the variability associated with any one year. This average should not, however, be taken over such a long period of time so as not to include technological change in terms of improved varieties, the use of fertilizers and chemicals and cultural practices.

The price to use is sometimes difficult to determine in the calculation of net returns. The use to which the final data are to be put often determines the price. Considering the objectives of this study previously outlined, it would seem that there may be a conflict between the use of long term averages or normal periods and more recent prices. More recent prices were finally decided upon due to the following reasons: one, there are alternative methods for capatizing future incomes if it is desirable to estimate earnings value which use more recent price data; two, productivity indices themselves are not income levels but rather relative

measures of productivity; and three, for other than appraisal purposes more recent prices may be more useful. Farm product prices are so variable, however, that the use of any one year's price may be highly misleading. Under these considerations it would appear logical that an average of prices received over the past five or more years, depending upon the nature of the variations, adjusted to present price indicators would be the best estimate to use for product prices. Factor prices are much less variable; hence, the use of those prices prevailing on the market at the time may be the most realistic to use.

It is under the framework outlined in this chapter that the productivity calculations have been made.

CHAPTER V

Characteristics of the Area from Which the Sample Was Drawn

Description of the Sampling Area

In order for a procedure to prove useful to the whole it should be workable in its most difficult parts. Marion County represents just such a part in terms of soils and crops. Techniques developed for characterizing Marion County soils in terms of physical and economic productivity should be adaptable to other Oregon counties. This is not the only reason Marion County was chosen. Marion County is one of the most important counties agriculturally in Oregon based upon the value of all farm products sold. (42) The crops and soils of Marion County are also similar to those of other Willamette Valley counties; hence, it is in this area that the most benefit could be derived. It is very desirable to have recent air photos available on which the soils have been designated. At the time this project was initiated Marion County was in the process of being remapped and it was anticipated this would be completed by the time field work began. For these and other reasons Marion County was selected as the data source.

The eastern tail of Marion County is mountainous and does not lend itself to the production of farm crops. The portion of the county used in this study lies west of a north-south line running four miles east of the Willamette meridian; this is approximately one-half mile west of Silver Falls. This area will be referred to

as western Marion County.

Western Marion County includes an area of over 405,000 acres. Approximately 6,500 of these acres are urban and were not included in the survey. A small portion of this total is occupied by public and state institutions, which may or may not be engaged in farming, and these, also, were not included. Of the balance there are approximately 17,000 acres classified as rough and broken. This leaves a little over 375,000 acres in the area which was surveyed.

Tables 1, 2, 3 and 4 present statistics regarding Marion County farms. Marion County is characterized by a large number of different sized farms producing a large variety of crops, many of which are high valued. These tables are presented to illustrate the importance of Marion County agriculture and to furnish information which was considered prior to drawing a sample of survey farms.

Table 1. Number of farms and total acres in farms by farm size (acres) in Marion County, 1959. (42)

Farm size	No. of farms
All farms	3,788
Under 10 acres	552
10-49 acres	1,511
50-99 acres	691
100-179 acres	508
180-259 acres	209
260-499 acres	232
500-999 acres	72
1,000 acres and over	13

Table 2. Number of farms in Marion County by economic class, 1959. (42)

Value of farm products sold	Number
Commercial farms[a]	
$40,000 or more	206
20,000 - 39,999	282
10,000 - 19,999	386
5,000 - 9,999	490
2,500 - 4,999	576
50 - 2,499	115
Total	2,055
Other farms	1,762
$50 - 2,499 (part-time)[b]	1,275
50 - 2,499 (part-retirement)[c]	480
Abnormal[d]	7

a. Each place operated as a unit of 10 or more acres from which the sale of agricultural products totaled $50 or more, as well as each place operated as a unit less than 10 acres from which the sale of agricultural products totaled $250 or more, was counted as a farm.

b. Operator under 65 years of age, and working off farm 100 or more days or with income from other sources greater than farm products sold.

c. Operator 65 years old or older.

d. Public and private institutional farms, community enterprises, experiment station farms, etc.

Table 3. Number of farms by farm type in Marion County, 1959. (42)

Field-crop farms other than vegetable and fruit and nut	227	
Cash grain		130
Other		97
Vegetable farms	270	
Fruit and nut farms	412	
Poultry farms	138	
Dairy farms	190	
Livestock farms other than poultry and dairy	214	
General farms	553	
Miscellaneous and unclassified farms	1,813	

Table 4. Number of farms and total acres of selected crops grown in Marion County, 1959. (42)

Crop	Number of farms	Total acres
Grain crops		
Fall wheat	867	14,897
Spring wheat	304	3,474
Oats (fall and spring)	905	17,734
Barley	984	25,805
Field corn (grain)	414	6,884
Seed crops		
Red clover seed	175	2,093
Crimson clover	207	3,586
Hairy vetch seed	34	967
Other vetch seed	113	2,154
Austrian winter peas	30	816

(continued)

Table 4, continued.

Crop	Number of farms	Total acres
Seed crops (continued)		
Common or perennial ryegrass	157	7,612
Fesque seed	373	17,121
Bentgrass seed	200	14,451
Marion bluegrass	33	1,092
Forage crops		
Alfalfa hay, alone or mixed	243	2,774
Clover hay, alone or mixed	594	8,074
Vetch or pea hay, alone or mixed	225	2,453
Grain hay	267	2,475
Wild hay	145	1,748
Other hay	180	1,948
Grass or legume silage	130	2,663
Corn silage	157	2,308
Specialty field crops		
Irish potatoes	151	282
Hops	67	3,588
Mint	83	4,509
Vegetable crops		
Snap beans (bush and pole)	207	3,666
Sweet corn	203	4,126
Dry onions	75	894
Green peas	8	73
Tomatoes	53	74
Broccoli	34	634
Cabbage	17	36
Carrots	40	388
Other vegetables	--	864
Small fruit crops		
Strawberries	569	4,063
Tree fruits, nuts and grapes		No. of trees
Apples	758	20,481
Peaches	181	25,011
Pears	790	24,991
Cherries	1,094	96,449
Prunes	622	90,526
Apricots	42	1,081
Grapes	386	--
Walnuts	1,152	47,397
Filberts and hazel nuts	594	149,732
Total acres		8,278

Marion County Soils

The soils of western Marion County are classified into 32 soil series. Of these only 16 are important in terms of total acreage of all crops grown in the county. About 90 percent of the total sampling area is accounted for by the 16 soils selected. Also, all of the major crops can be found growing on one or another of these 16 soils. Table 5 presents these 16 soils in terms of their total and cultivated acreage and percent tiled and irrigated

These 32 soils found in western Marion County can be conveniently grouped according to the four physiographic features: (1) the upland or hill soils, (2) the terrace or bench soils, (3) the floodplain or bottom soils, and (4) the Lake Labish or muck soils. The upland, terrace and floodplain soils can each be subdivided according to parent material and drainage. Table 6 shows the relationship of this subdivision. Parentheses enclose the 16 major soils listed in Table 5. The four dominant hill soils can be grouped conveniently into two groups: the Jory-Aiken group and the Polk-Sublimity group. The 16 important series are briefly described in Appendix A.

Table 5. Estimated total and cultivated acres of selected soil series in Marion County, 1958.[a]

Soil series	Total acres	Total cultivated acres	Percent[b] irrigated	Percent[b] tiled
Riverbottom				
Chehalis	22,000	18,500	50[c]	0[c,d]
Newberg	15,000	11,000	50	0
Wapato	11,000	6,000	20	20
Terrace soils				
Willamette	20,000	17,000	25	33
Woodburn	60,000	48,000	20	50
Amity	57,000	48,000	15	65
Concord	11,000	9,000	5	60
Dayton	11,000	9,000	5	10
Salem	6,000	4,500	35	75
Sifton	3,500	2,500	50	10
Clackamas	10,000	7,500	35	30
Hill soils				
Jory	32,000	21,000	0	0
Aiken	18,000	12,000	0	0
Polk	40,000	26,000	5	0
Sublimity	25,000	16,500	5	0
Muck soils				
Labish	2,000	1,950	60	

a. Based upon estimates arrived at from survey data obtained in this study.

b. Percent of cultivated acres.

c. Nearest 5 percent.

d. A field was indicated as being tiled regardless of the amount of tile in it; this often represented the tiling of less well drained inclusions of another soil which was not listed unless it occupied approximately 10 percent or more of the field area.

Table 6. Relationship of Marion County soils to parent material and natural drainage class.

Parent material and selected soil characteristics	Natural Drainage Class				
	Good or excessively	Moderately good	Imperfect	Poor	Very Poor
A. Hill Soils from Colluvium or Residuum					
1. Basalt material					
a. Firm subsoil	(Jory)[a]				
b. Friable subsoil	(Aiken)				
2. Tuff material	(Polk):(Sublimity) ---->				
3. Sandstone and shale material					
a. Reddish color	Willakenzie				
b. Brown color	Steiwer --------->:	<--------- Hazelair			
B. Terrace Soils from Glacial Alluvium or Outwash					
1. Mixed gravelly material, high terrace					
a. Reddish color	Salkum				
b. Brown color	Pringle --------->:	<--------- Santiam		Gilkey	
2. Mixed gravelly material, low terrace					
a. Brown color	(Salem)--------->:	<--------- (Clackamas)		Courtney	
b. Almost black color	(Sifton)				
3. Mixed silty material					
a. Without claypan	(Willamette)	(Woodburn)	(Amity)	(Concord)	
b. With claypan			Holcomb	(Dayton)	
c. Overlying upland residuum	Silverton				
C. Bottom Soils from Recent Alluvium					
1. Local upland material	Abiqua	McAlpin --------->:	<------- Waldo		
2. Mixed material					
a. Gravelly	Camas				
b. Silty	(Chehalis)	Maytown --------->:	<------- (Wapato)		Reed
D. Lake Labish Bog Soils					Muck

a. The parentheses are used to indicate the soils which were selected for productivity determination.

Marion County Climate

Closely associated with the soil and one of the major determinants of crop selection is climate. The amount of moisture received, its distribution throughout the season and the amount of variation in quantity and distribution are important determinants in choosing which crops to grow, what to expect in terms of yield, how often a failure can be expected, what supplementary irrigation is necessary, etc.. Likewise, the normal monthly, seasonal and annual temperatures, the length of the growing season, the maximum and minimum temperatures and the expected frequencies of these are important determinants in the selection of crops and related farm management decisions. Appendix B summarizes some important climatological data which relates to Marion County agriculture.

The climate of western Marion County is characterized by marked seasonal precipitation fluctuations, moderate seasonal temperature variations, a long growing season and a virtual absence of catastrophic weather phenomena. The winters are wet and cool; the summers are dry and warm. The average frost-free period is about 200 days. Destructive winds and torrential rains are uncommon. Temperature extremes above 100° F. and below 0° F. are rare.

The mean annual precipitation increases from west to east and south to north. Salem, which is located in the southwest section of Marion County, has an average of about eight inches less precipitation than Oregon City which lies just across the northern border and 36 inches less than Silver Creek Falls which lies just

across the border in eastern Marion County. Part of this difference is caused by changes in elevation. Mehama, which has approximately the same longitude as Silver Creek Falls but is about 700 feet lower in elevation, has a mean annual precipitation nearly 6 inches less.

Over 40 percent of the precipitation falls during the winter months. December and January average more than 20 rainy days each year. Most of the precipitation is rain but some snow falls nearly every year; snow seldom lasts over a few days.

About 25 percent of the annual precipitation falls in each of the spring and falls seasons. Less than 10 percent falls in the summer. July and August, the driest months, average only three days of rain per year.

The rains in western Marion County are gentle rains. Nearly all of the rains fall at intensities less than one inch per 24 hour period; 75 percent fall at intensities less than one-half inch per 24 hour period. An average of about six thunder showers are recorded at Salem each year. Heavy fog is recorded for an average of 38 days per year.

The wettest months are the coolest months. Salem's mean January temperature is about 30° F. lower than its mean July temperature. Continued winter cold spells and summer hot spells are practically unknown. Salem averages about 60 days per year with minimum daily temperatures of 32° F. or lower and less than one-half day per year with minimum daily temperatures below 0° F. Only about 16 days

per year have maximum temperatures above 90° F.

The summer diurnal temperature fluctuations are twice the winter diurnal fluctuations. The mean July maximum and minimum at Salem are about 82 and 53° F., respectively, while the equivalent mean January temperatures are 45 and 32° F. The summer nights are cooled by an evening westerly breeze.

The average dates of the first and last frosts at Salem are April 14 and October 28, making a frost-free period of 197 days. First frosts in the fall have been recorded as early as September 12 and as late as December 4. Last frosts in the spring have been recorded as early as February 12 and as late as May 23. (30)

CHAPTER VI

Sampling Procedures

Selection of Soils and Crops

The soils selected to be studied relative to their productivities are the 16 soils appearing in Table 5, Chapter V. All of these soils were not analyzed individually, however. Since Jory and Aiken, Polk and Sublimity and Salem and Sifton soils are closely associated groups they were added together and appear as Aiken, Polk and gravelly, respectively.[a]

Consultants in the Departments of Agricultural Economics, Soils, Farm Crops and Horticulture and the Marion County Extension Service cooperated in determining the crops which were likely to be associated with each of the soils selected. Agricultural census data and reports published by the Oregon Crop and Livestock Reporting Service also proved useful. The soil-crop combinations appearing in Table 1 were the ones selected for study in developing the soil productivity ratings.

The next problem was in determining the number of crop enterprise records necessary to give statistical reliability to the results. In cooperation with the Experiment Station statistician it was decided that three enterprise records were sufficient on each soil-crop combination selected provided there were a total of at least 25

a. It was found necessary in later phases of data processing to include Clackamas in the Salem-Sifton group .

Table 1. Number of soil-crop enterprise records which were desired to be collected in the complete farm survey, Marion County, Oregon, 1958.

Crop \ Soil series	Willamette	Woodburn	Amity	Concord	Dayton	Newberg	Chehalis	Wapato	Salem, Sifton	Clackamas	F4, F5	Aiken	Other Hill	Labish	Total required
Wheat, fall	8	8	8	8	-	8	8	8	8	8	3	8	8	-	91
spring	8	8	8	8	8	8	8	8	8	8	3	8	8	-	99
Oats, fall	3	8	8	8	3	3	3	3	3	3	3	8	8	-	64
spring	3	3	3	3	3	3	3	3	3	3	3	3	3	-	39
Barley, spring	8	8	8	8	8	8	8	8	8	8	3	8	8	-	99
Oats and vetch	3	3	8	3	3	-	-	-	3	3	3	8	8	-	45
Corn, field	3	3	3	-	-	-	-	-	-	-	-	-	-	-	9
Red clover	3	3	3	3	-	-	-	-	-	-	-	-	-	-	12
Alfalfa	3	3	3	-	-	-	3	-	-	-	-	-	-	-	12
Pasture, irrigated	3	3	3	-	3	-	3	3	3	3	-	-	-	-	24
dry	3	3	3	3	3	-	3	-	3	3	3	8	8	-	43
Ryegrass, perennial	-	-	-	-	-	-	-	-	-	-	-	8	8	-	16
common	-	-	-	8	8	-	-	-	-	-	-	-	-	-	16
Bentgrass	-	-	-	-	-	-	-	-	-	-	-	8	8	-	16
Alta fescue	3	3	3	-	-	-	-	-	-	-	-	8	8	-	25
Chewings fescue	3	3	3	-	-	3	3	-	-	-	-	8	8	-	31
Strawberries	8	8	8	-	-	8	8	3	3	-	-	8	8	-	62
Evergreen blackberries	8	8	8	8	-	-	-	-	8	8	-	8	-	-	56
Boysen & loganberries	8	8	3	-	-	3	3	-	8	-	-	-	-	-	33
Filberts	8	8	3	-	-	8	8	-	8	3	-	8	-	-	54
Walnuts	8	8	3	-	-	8	8	-	8	3	-	8	-	-	54
Prunes	8	8	3	-	-	-	-	-	-	-	-	8	8	-	35
Cherries	8	8	3	-	-	-	-	-	-	-	-	8	8	-	35
Beans, pole	8	8	3	-	-	8	8	-	8	3	-	-	-	-	46
Sweet corn	8	8	8	-	-	8	8	3	8	8	-	-	-	-	59
Carrots	-	-	-	-	-	8	-	-	3	-	-	-	-	-	11
Hops	8	8	-	-	-	8	8	-	-	-	-	-	-	-	32
Mint	-	-	-	-	-	8	8	8	-	-	-	-	-	-	24
Onions	-	-	-	-	-	-	-	-	-	-	-	-	-	10	10
TOTAL	134	139	106	60	39	100	101	47	93	64	21	131	107	10	1152

enterprise records collected on each soil. The Labish soil was an exception because there was only one principal crop produced on it. It was decided that 10 total enterprise records would be sufficient from this soil. Analysis on the basis of three soil-crop enterprise records would not permit individual crop comparisons in regard to soils. If it were desirable to make individual crop comparisons across soils then on these soils it would be necessary to have at least eight enterprise records for each soil-crop combination. As a result of these requirements and the purposes of the study the decision was made that for the important soil-crop combinations eight enterprise records would be the goal and for the less important soil-crop combinations three enterprise records would be sufficient.

Further, it was decided that more than three enterprise records from any one farmer covering any soil-crop combinations would bias the data in terms of that farmer.

A sample farm survey was taken in the Mt. Angel Soil Conservation District in the fall of 1957 which proved useful in the final selection of soil-crop combinations. It was useful, also, in determining the number of records required per soil-crop combination.

Besides information about soils in relation to selected crops it was desirable to gain information about the distribution and extent of the soils themselves. Since the last soil survey, which was published in 1927, a number of changes had taken place, not only in the techniques of soil survey but also in the soil classes themselves.

Selection of Farms to be Surveyed

In consideration of the soil-crop combinations, the total number of crop enterprise records required per soil and the desire for greater information about the soils themselves, a modified random point sampling method was chosen. On the basis of a millimeter grid system 1,000 random points were selected in western Marion County. The old 1927 survey map was used as a base from which to work. These 1,000 points were later traced to recent soil survey data to estimate the total acres of each soil series in the county. These 1,000 points did not give sufficient random points on some of the soils. Additional random points were selected in the corresponding geographic areas until the desired number were obtained.

The random points thus selected were then located on farms and farmers' names were obtained from records in the Marion County Agricultural Stabilization and Conservation Office. Farm boundaries were traced onto air photos which had soil survey data transcribed thereon where soil survey photo maps were available. Soil survey air photos were available for all of the county except the river bottom area north of Salem and the terrace region lying outside the Mt. Angel SCS District approximately north of Brooks. It was necessary for these two areas to make a soils determination on the farm at the time the visit was made or just prior to this time. Mr. James Pomerening, a soil survey graduate student who had done considerable soil survey work in this northern area, did most of the farm survey work where a soils determination was necessary.

The nature of the data collected during the farm survey visits can be seen by leafing through the survey schedule which appears as Exhibit A. As the enterprise records were collected a running total was maintained in accordance with Table 1. An effort was made to select soil-crop enterprise records in such a manner as to get a representative sample over each total soil area.

At the completion of the 1958 farm survey 419 farmers had furnished information about the soils and crops on the farms they operated. Seventy of these 419 complete schedules were collected in 1957 in the Mt. Angel SCS District in the preliminary survey. Included in the complete farm schedules were 868 enterprise records covering the soil-crop combinations previously discussed. Assuming these 419 farms were all commercial, as defined by the 1959 Census of Agriculture, this represents 20 percent of the total commercial farms. They account for 11 percent of the total farms. See Table 2, Chapter V. There was a total of 71,611 acres in the farms surveyed. This represents about 19 percent of the total farm area of 375,000 acres. Of the total area sampled, 55,461 acres were classified as being in cultivated crops which is about 72 percent of the total acreage. The census lists about 76 percent of the farm acreage as being cultivated which is fair correlation. The total cultivated acres sampled is about 20 percent of the total area in farm crops listed in the 1959 Agricultural Census. Thus it can be concluded that the survey included about 15 percent of the total commercial farms in the county and about 19 percent of the total farm area.

CHAPTER VII

Distribution of Crops on Soils

It is necessary to have yield and crop distribution estimates in order to allocate the use of the soil to the various crops when calculating physical productivity. The same is true for economic productivity except net returns are substituted for yields. In fact, the allocation of crops to individual soils may be more important than yields or net returns. This becomes particularly true when there are a large number of crops which can be grown on individual soils. In this situation the yields and net returns of a particular crop may not differ greatly when grown on several different soils. Any significant difference in relative productivity then relies more upon the distribution of the total set of crops occupying each soil than upon the individual yields or net returns. This section presents the crop distribution pattern on the selected soils as determined in this study.

Crop distribution patterns are presented in Table 1. These were determined through an analysis of total land use of the 419 farms visited. Only those fields which contained approximately 90 percent of one soil series were used. It was assumed that the 10 percent or less occupied by another soil series did not affect greatly the use of a field.

An adjustment was necessary in the Mt. Angel SCS District land use patterns before they could be added to the balance of the data;

Table 1. Percentage distribution of crops on selected soil series in Marion County, Oregon, 1958.[a]

Soils / Crops	Riverbottom soils			Fine-textured terrace soils				Terrace gravelly soils	Peat	Hill soils	
	Chehalis	Newberg	Wapato	Willamette	Woodburn	Amity	Dayton		Labish	Aiken	Polk
	Percent										
Fall wheat	8.7	2.6	3.1	15.0	16.6	12.3	--	4.9	--	4.7	1.6
Spring wheat	--	1.5	1.2	3.0	1.0	.9	--	2.3	--	1.4	--
Fall oats	--	--	1.9	3.8	6.1	9.0	--	--	--	3.9	2.9
Spring oats	--	2.6	8.2	2.9	2.3	6.7	5.0	7.8	--	5.3	4.3
Spring barley	17.9	13.8	31.3	18.6	13.9	16.6	2.5	12.8	--	1.9	--
Field corn	3.9	1.7	--	6.0	2.7	1.7	--	4.5	--	--	--
Other grain	2.3	.8	.6	--	1.5	5.7	1.1	3.6	--	1.3	2.1
Red clover for seed	2.9	3.3	--	5.5	4.7	2.8	--	2.0	--	--	--
Crimson clover seed	2.0	1.3	--	3.9	3.3	2.8	--	3.6	--	--	1.1
Oats and vetch	3.8	--	--	6.9	5.8	5.4	--	--	--	1.2	--
Other legume seed	--	.8	5.1	2.8	3.6	1.6	.4	--	--	.4	.5
Common ryegrass	--	--	7.0	--	--	--	35.8	--	--	--	--
Highland bentgrass	--	--	--	--	--	--	7.0	--	--	1.8	36.4
Chewings fesque	--	--	--	--	2.2	6.7	--	4.5	--	7.1	27.7
Creeping red fesque	--	--	--	--	--	--	--	--	--	15.5	--
Alta fesque	--	--	--	--	--	1.1	--	--	--	--	--
Other grass seed	2.7	3.6	1.2	--	1.8	2.1	9.4	1.2	--	5.1	2.9
Corn silage	--	--	--	--	1.2	--	--	--	--	--	--
Alfalfa forage	3.1	3.9	1.9	1.0	1.8	1.5	--	--	--	--	--
Other cult. forage	2.6	5.7	34.4	6.1	7.6	8.1	24.0	21.8	--	26.6	8.6
Strawberries	3.3	7.0	--	5.7	4.3	1.6	--	--	--	--	1.5
Evergreen blackberries	--	--	--	.5	.9	.5	--	2.1	--	--	--
Boysen & loganberries	--	--	--	1.1	--	--	--	--	--	--	--
Other small fruit	.9	.9	--	.8	1.0	.4	--	1.6	--	.7	.3
Sweet cherries	--	--	--	2.6	--	--	--	--	--	1.4	--
Prunes	--	--	--	--	--	--	--	--	--	3.9	--
Walnuts	--	3.3	--	1.2	--	--	--	--	--	8.2	--
Filberts	2.9	2.6	--	1.1	1.1	--	--	--	--	2.4	--
Other tree fruits	1.7	2.5	--	2.9	1.1	.3	--	1.7	--	.2	.8
Pole beans	6.0	6.5	--	2.0	1.1	.9	--	10.6	--	--	--
Sweet corn	7.1	3.1	--	2.9	4.8	1.7	--	12.5	--	--	--
Carrots	--	4.1	--	--	--	--	--	--	--	--	--
Onions	--	--	--	--	--	--	--	--	96.8	--	--
Other vegetables	3.8	3.4	.5	.4	1.5	1.5	.6	.4	--	--	.4
Mint	12.1	16.3	--	--	--	--	--	--	3.2	--	--
Sugar beet seed	1.8	--	--	1.5	--	1.1	--	--	--	--	--
Hops	7.7	4.0	--	--	7.0	2.8	--	--	--	--	--
Other specialty	.2	1.5	.8	1.2	.9	.6	--	--	--	--	--
Fallow	2.4	3.1	2.4	.6	1.0	1.9	2.5	2.1	--	7.0	8.6
Soil bank and other	.3	.1	--	--	.2	.5	11.7	--	--	--	.3
Total percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total cultivated acres[b]	4,556	2,968	845	1,697	6,887	6,840	1,656	3,140	161	4,147	7,863
Total acres[b]	5,128	3,776	1,231	1,875	8,326	7,301	1,702	4,195	164	6,569	11,946

a. Distribution percentages were calculated on the basis of cultivated land.

b. The acres here referred to are those which entered into the percentage distribution determinations.

the sampling rate was somewhat greater here. According to the number of random points falling within this area and in consideration of sampling percentages in the surrounding areas the total land use data were reduced by three-sevenths. This was done so as not to bias the total distribution pattern towards this area.

It was determined that over 100 different crops were grown on some of the soils. A large number of these were not important to the soil or to the county. Therefore, only those crops occupying at least one percent of the cropland were itemized. Those crops occupying less than one percent were grouped and are listed as "other" under their respective crop grouping. On all soils, those crops occupying over one percent accounted for over 85 percent of the total soil use.

The crop distribution for only the cultivated portion of the total soil series is presented. This is the relevant portion. The total cultivated acres and the total of all acres surveyed in respect to each soil series are presented. The non-cultivated portion included the farmstead, waste and unaccounted land including roads, fencelines, heavy brush not pastured and non-cultivated pastures such as woodland pasture. Pastures which were at one time cultivated but since have grown up into native pasture are counted as being cultivated.

It will be noted that the gravelly terrace soils are not itemized separately. An attempt was made to do this but it was determined that both the total number of farms and the total land area

surveyed were not extensive enough to make individual estimates. The distribution presented represents the total gravelly area. It was observed by those making the farm survey that farmers show little crop preference in relation to Salem, Sifton and Clackamas soils. Clackamas seemed to be as desirable for the production of pole beans, sweet corn or other intensive crops as the well-drained Salem or Sifton soils. A well designed surface drainage system or tile drain tends to equalize the productivities of these soils. The soils are so intermixed in this area that it is difficult to find a field of a pure soil series. The difference seems to come in the area margins where larger bodies of Clackamas were found; these margins were used primarily for pasture. It was observed that Clackamas generally was used less intensively than Salem or Sifton.

The definition of productivity used refers to the crops which were being produced on a given soil and not in terms of crop potential. For this reason the same soil series located in different geographic areas may not have the same productivity rating. This difference is due, primarily, to the distribution of crops in the different areas and not to yields on comparative crops. To illustrate this Tables 2 and 3 are presented. Table 2 compares the distribution of Chehalis and Newberg, respectively, in three geographic areas -- the North Santiam River area, the Keizer-Mission Bottom area and the area lying north of an east-west line extending from Gervais. This difference can probably be attributed to two major reasons: (1) a change in market opportunities and (2) a hold-over of older

Table 2. Percentage distribution of crops on Chehalis and Newberg soil series in three geographic areas in Marion County, Oregon, 1958.

Crop	Chehalis			Newberg		
	North Santiam	Mission Bottom	North Marion	North Santiam	Mission Bottom	North Marion
	Percent					
Fall wheat	.2	14.7	12.3	1.1	4.3	6.2
Spring wheat	1.5	--	--	4.2	3.0	--
Fall oats	--	--	3.2	--	--	--
Spring oats	--	--	2.3	--	--	3.6
Spring barley	17.4	18.6	20.4	12.8	16.2	13.5
Field corn	1.9	2.2	13.8	--	--	8.9
Other grain	2.1	1.1	--	.1	.5	3.7
Red clover seed	3.8	2.8	2.3	--	5.3	8.3
Crimson clover seed	.1	4.5	--	2.0	1.0	--
Oats and vetch	--	3.5	14.2	1.8	--	--
Other legume seed	--	--	--	--	--	--
Total grass seed	.3	4.3	4.4	--	6.1	8.5
Alfalfa forage	1.3	3.1	7.2	4.9	1.5	6.0
Other forage	3.2	.7	5.9	2.1	.9	23.5
Strawberries	1.7	5.8	--	4.7	14.5	--
Other small fruit	.8	1.2	--	1.0	1.5	--
Sweet cherries	--	1.3	--	--	3.0	--
Walnuts	--	--	--	--	9.4	--
Filberts	3.2	3.8	--	--	4.9	--
Other tree fruits	.4	2.5	--	.4	4.3	--
Pole beans	10.4	3.1	--	11.1	1.0	--
Sweet corn	6.9	7.8	--	4.5	2.1	1.8
Carrots	--	--	--	8.7	--	--
Other vegetables	4.4	5.2	--	3.1	4.8	2.0
Mint	31.5	--	--	34.7	1.5	--
Sugar beet seed	2.4	2.2	--	.6	1.0	1.5
Hops	7.1	6.3	11.7	--	8.9	5.3
Other specialty	--	3.5	--	--	1.1	1.5
Fallow	.9	1.8	--	2.2	3.2	5.7
Other	--	--	2.3	--	--	--
Total percent	100.0	100.0	100.0	100.0	100.0	100.0
Cultivated acres	1,555	1,809	1,028	1,352	982	563
Total acres	1,670	2,048	1,175	1,634	1,232	835

production patterns. Table 3 compares the Willamette soil series in the Howell Prairie and Mt. Angel SCS District areas. The noticeable difference is in the distribution of grains and small fruits. Much of the Willamette soils in the Mt. Angel SCS District is located around Woodburn. Many of the farms in this area are small and specialize in small fruit production.

Any measure of productivity must account for these geographic influences or else the use of the productivities for assessment or other appraisal work will result in values which do not approach market values.

Table 3. Percentage distribution of crops on Willamette soil series in two geographic areas in Marion County, Oregon, 1958.

Crop	Howell Prairie	Mt. Angel SCS District
	Percent	
Fall wheat	14.5	8.1
Spring wheat	--	3.9
Fall oats	5.5	1.4
Spring oats	3.6	3.9
Spring barley	22.5	8.9
Field corn	9.2	.9
Other grain	--	--
Red clover seed	6.4	3.1
Crimson clover seed	1.8	--
Oats and Vetch seed	5.1	6.3
Austrian peas	--	3.9
Other legume seed	2.6	5.0
Total grass seed	--	--
Alfalfa forage	1.0	1.9
Other Cult. forage	4.5	13.7
Strawberries	5.1	11.4
Evergreen blackberries	--	2.8
Boysenberries and Loganberries	--	7.0
Blackcap berries	--	2.0
Other small fruits	--	1.3
Sweet cherries	1.8	1.1
Pears	2.3	--
Walnuts	.8	3.0
Filberts	.8	3.6
Other tree fruits	1.9	1.6
Pole beans	2.2	1.7
Sweet corn	4.1	1.5
Other vegetables	--	1.8
Sugarbeet seed	.6	--
Other specialty	.5	.2
Fallow	3.2	--
Total percent	100.0	100.0
Cultivated acres surveyed	1,062	643
Total acres surveyed	1,178	706

CHAPTER VIII

Physical Productivity Considerations

When considering soil productivities it is desirable to have long time yield records so that the yields used to reflect the productivity of an individual soil are not influenced by year-to-year climatic fluctuations. On the other hand, the period of time should not be so long that technological changes are nullified. In most instances, however, these data are not available so less reliable estimates must be made. The method used in this study relied upon the judgment of farmers surveyed to estimate the yield to be used in determining soil productivities.

Each farmer contacted in the farm survey was asked to estimate a "usual" yield for each crop grown in 1958. He was asked also for his 1958 yield. These yield estimates were then grouped by individual soils and a simple average calculated. Tables 1 and 2 present the results of this tabulation. In most instances, only yields for those crops which occupied over one percent of the cultivated soil area are presented. The number immediately following the individual yields represents the number of estimates making up that average. This gives an indication of the reliability of the individual yield. It should be remembered that prior to initiating the survey it was estimated that approximately eight observations were needed before the average usual yields estimated by the farmers surveyed would be very reliable in estimating individual soil yields or net returns.

Table 1. Average usual yield comparisons of major crops grown on selected soils, Marion County, Oregon, 1958.

Crop \ Soils	Unit of measure	Riverbottom soils			Fine-textured terrace soils				Gravelly terrace soils			Peat	Hill soils	
		Chehalis	Newberg	Wapato	Willamette	Woodburn	Amity	Dayton	Salem	Sifton	Clackamas	Labish	Aiken	Polk
Fall wheat	Cwt.	27.3,13[a]	26.3, 3	23.2, 3	26.5,19	27.7,54	25.6,45	--	20.8, 4	--	22.5, 2	--	18.3, 6	19.5, 6
Spring wheat	Cwt.	--	18.0, 1	25.3, 2	27.6, 4	22.3, 6	22.1, 8	--	22.5, 2	--	20.0, 1	--	17.0, 3	23.4, 2
Fall oats	Cwt.	21.3, 3	--	20.0, 1	22.4, 6	21.2,25	21.0,25	--	--	--	--	--	16.5, 7	16.7, 7
Spring oats	Cwt.	36.3, 3	25.0, 2	18.0, 5	22.2, 2	21.4,13	22.3,22	19.7, 3	11.2, 1	--	21.4, 2	--	15.0, 6	17.9, 7
Spring barley	Cwt.	30.1,12	29.2,12	25.2,15	25.8,22	27.2,38	25.6,49	23.1, 4	25.0, 2	13.4, 1	23.7, 2	--	21.0, 5	23.7, 4
Field corn	Cwt.	49.7, 6	56.0, 1	--	30.0, 3	33.5,14	36.8,10	--	--	--	--	--	--	--
Red clover seed[b]	Lbs.	200, 1	400, 1	--	140, 4	244,17	262,13	--	--	--	--	--	--	--
" " hay	Tons	2.0, 1	2.5, 1	--	2.2, 4	2.4,17	2.1,13	--	--	--	--	--	--	--
Crimson clover	Lbs.	488, 4	650, 1	--	617, 3	508,13	494, 9	--	--	--	--	--	--	500, 2
Oats and C. vetch	Lbs.	1860, 5	--	--	2080, 5	2274,17	2162,16	--	--	--	--	--	--	--
Common ryegrass	Lbs.	--	--	1133,.3	--	--	1138, 4	757, 7	--	--	--	--	--	--
Highland bentgrass	Lbs.	--	--	--	--	--	--	--	--	--	--	--	370, 1	365,16
Chewings fesque	Lbs.	--	--	--	--	487, 5	440, 8	--	--	457, 1	--	--	340, 5	420,21
Creeping red fesque	Lbs.	--	--	--	--	--	--	--	--	--	--	--	539, 4	375, 1
Alta fesque	Lbs.	--	--	--	--	--	712, 5	--	--	--	--	--	--	--
Corn silage	Tons	--	--	--	--	10.7, 3	11.5, 3	--	--	10.0, 1	10.0, 1	--	--	--
Alfalfa	Tons	4.9, 7	4.3, 4	3.5, 2	5.2, 2	4.7,13	4.7, 8	--	--	--	--	--	--	--
Other hay and pasture[c]														
Irrigated	Tons	9.9, 1	--	4.7, 4	4.4, 2	3.8, 3	4.0, 6	1.8, 2	2.0, 1	--	2.2, 2	--	--	--
Dry	Tons	4.0, 1	2.6, 4	2.2, 4	2.8, 5	2.5, 9	2.5,15	.6, 3	1.5, 1	3.0, 1	2.2, 3	--	2.0,13	2.0,11
Strawberries	Cwt.	80.0, 3	88.3, 6	--	93.2,10	80.7,25	87.1,14	--	--	--	--	--	--	73.5, 5
Evergreen blackberries	Cwt.	100.0, 1	--	--	115.7, 7	92.6,15	100.5,15	--	57.8, 2	--	--	--	--	--
Boysenberries	Cwt.	60.0, 1	--	--	73.1, 5	47.7,11	62.4, 5	--	--	--	--	--	35.0, 3	--
Loganberries	Cwt.	--	--	--	75.0, 2	43.8, 4	40.0, 1	--	--	--	--	--	--	--
Sweet cherries	Cwt.	83.4, 2	--	--	80.2, 6	61.7, 2	80.0, 2	--	--	--	--	--	53.7, 3	50.0, 1
Prunes	Cwt.	--	47.4, 1	--	--	113.3, 3	--	--	--	--	--	--	46.0, 8	--
Walnuts	Cwt.	11.8, 2	10.0, 3	--	18.3, 3	18.0, 4	12.5, 2	--	--	--	--	--	8.8, 6	8.5, 1
Filberts	Cwt.	14.8, 3	12.6, 2	--	10.7, 5	13.6, 6	11.5, 3	--	--	--	--	--	8.6, 5	--
Pole beans	Cwt.	208.0,10	207.0,10	--	185.0, 2	175.0, 4	178.3, 3	--	170.5, 4	195.0, 4	169.3, 7	--	--	--
Sweet corn	Cwt.	130.9,11	112.3, 7	--	105.0, 2	121.9, 8	110.0, 5	--	95.0, 2	--	95.8, 6	--	--	--
Carrots	Cwt.	--	608.3, 6	--	--	--	--	--	--	--	--	--	--	--
Onions	Cwt.	--	--	--	--	--	--	--	--	--	--	338.9,10	--	--
Mint	Lbs.	56.9,10	56.0, 3	--	--	--	--	--	--	--	--	--	--	--
Sugar beet seed	Lbs.	3000, 2	3000, 1	--	2000, 1	2250, 2	2667, 3	--	--	--	--	--	--	--
Fuggle hops	Cwt.	13.7, 8	13.0, 3	--	--	12.6, 8	11.5,10	--	--	--	--	--	--	--
Cluster hops	Cwt.	17.8, 3	20.0, 2	--	--	17.0, 4	--	--	--	--	--	--	--	--

a. The figure which follows the comma represents the number of farmers contributing to the yield estimates.

b. Some red clover yield estimates were not supported by hay yields; therefore, only those yields are included which were composed of a seed and a hay yield.

c. Yields for pasture and silage were converted to hay equivalents.

Table 2. Average 1958 yield comparisons of major crops grown on selected soils, Marion County, Oregon, 1958.

Crop[b] \ Soils	Unit of measure	Riverbottom soils			Fine-textured terrace soils				Gravelly terrace soils			Peat	Hill soils	
		Chehalis	Newberg	Wapato	Willamette	Woodburn	Amity	Dayton	Salem	Sifton	Clackamas	Labish	Aiken	Polk
Fall wheat	Cwt.	18.1,15[a]	20.8, 4	16.2, 3	20.5,19	18.1,55	17.2,47	--	15.2, 4	--	21.5, 2	--	14.5, 6	17.0, 6
Spring wheat	Cwt.	17.5, 2	14.4, 2	18.0, 1	17.4, 4	17.6, 7	11.6, 9	--	7.5, 2	--	--	--	9.0, 3	13.0, 3
Fall oats	Cwt.	16.5, 4	15.0, 1	15.0, 2	15.3, 8	13.0,24	13.3,26	--	--	--	--	--	15.0, 8	14.6, 8
Spring oats	Cwt.	26.3, 3	15.0, 2	11.5, 5	11.5, 4	15.8,15	15.6,23	10.0, 3	6.4, 1	--	13.9, 2	--	13.8, 8	12.6,10
Spring barley	Cwt.	19.1,14	20.3,13	16.0,16	21.0,21	18.5,41	16.8,50	14.0, 4	20.0, 2	13.4, 1	15.0, 2	--	15.9, 5	18.4, 5
Field corn	Cwt.	39.7, 6	56.0, 1	--	33.7, 5	30.6,12	38.0,10	--	--	--	36.4, 1	--	--	--
Red clover seed[b]	Lbs.	300, 1	375, 1	--	96, 5	193,17	248,13	--	--	--	--	--	--	--
" " hay	Tons	2.0, 1	3.0, 1	--	2.1, 5	2.1,17	2.0,13	--	--	--	--	--	--	--
Crimson clover	Lbs.	498, 4	500, 2	--	491, 4	265,15	300, 8	--	--	--	--	--	--	--
Oats and C. vetch	Lbs.	1656, 5	--	--	1636, 5	1820,18	1392,19	--	--	--	--	--	--	383, 3
Common ryegrass	Lbs.	--	--	800, 3	--	--	725, 4	700, 4	--	--	--	--	--	--
Highland bentgrass	Lbs.	--	--	--	--	--	--	--	--	--	--	--	295, 2	249,15
Chewings fesque	Lbs.	--	--	--	--	361, 5	275, 9	--	--	107, 1	--	----	209, 5	251,20
Creeping red fesque	Lbs.	--	--	--	--	--	--	--	--	--	--	--	364, 4	250, 1
Alta fesque	Lbs.	--	--	--	--	--	618, 5	--	--	--	--	--	--	--
Corn silage	Tons	--	--	--	--	10.8, 3	8.5, 4	8.3, 1	--	12.0, 1	10.0, 2	--	--	--
Alfalfa	Tons	4.6, 6	4.8, 5	3.5, 2	5.2, 3	4.7,14	4.2, 8	--	--	--	--	--	--	--
Other hay and pasture														
Irrigated	Tons	9.9, 1	--	--	5.1, 1	--	4.4, 8	1.8, 2	2.0, 1	--	2.2, 2	--	--	4.5, 2
Dry	Tons	3.0, 1	2.3, 6	2.3, 5	2.8, 5	2.0,12	2.3,15	.6, 3	1.5, 2	3.3, 1	1.4, 5	--	2.0,15	2.0,12
Strawberries	Cwt.	65.0, 2	71.6, 8	--	60.1,11	58.3,23	65.1,14	--	--	--	--	--	23.1, 3	52.1, 6
Evergreen blackberries	Cwt.	75.0, 2	--	--	103.5, 8	67.1,15	65.7,15	--	62.6, 2	--	--	--	--	--
Boysenberries	Cwt.	40.0, 1	--	--	70.2, 5	40.5,10	24.9, 6	--	--	--	--	--	17.3, 3	--
Loganberries	Cwt.	--	--	--	62.4, 3	28.4, 4	25.4, 2	--	--	--	--	--	--	--
Sweet cherries	Cwt.	58.4, 2	--	--	72.7, 5	26.6, 1	70.7, 3	--	--	--	--	--	61.3, 3	30.8, 1
Prunes	Cwt.	--	35.0, 1	--	--	25.6, 3	--	--	--	--	--	--	17.3, 7	--
Walnuts	Cwt.	17.4, 2	16.4, 2	--	9.4, 3	23.5, 4	6.7, 1	--	--	--	--	--	9.1, 6	8.5, 1
Filberts	Cwt.	13.9, 4	6.7, 1	--	10.0, 4	8.7, 6	8.8, 4	--	--	--	--	--	16.4, 5	--
Pole beans	Cwt.	200.8,11	196.2,10	--	205.0, 2	192.0, 5	166.2, 3	--	186.8, 5	204.0, 4	163.2, 6	--	--	--
Sweet corn	Cwt.	111.1,11	106.0, 7	--	108.4, 2	115.4, 7	110.0, 5	--	106.7, 2	--	91.4, 7	--	--	--
Carrots	Cwt.	--	486.6, 7	--	--	--	--	--	--	--	--		--	--
Onions	Cwt.	--	--	--	--	--	--	--	--	--	--	307.2,10	--	--
Mint	Lbs.	65.6,10	73.0, 9	36.0, 3	--	--	--	--	--	--	--	--	--	--
Sugar beet seed	Lbs.	2633, 3	1900, 2	--	3100, 2	2458, 2	2333, 3	--	--	--	--	--	--	--
Fuggle hops	Cwt.	10.0, 8	8.2, 3	--	--	10.1, 8	8.5,10	--	--	--	--	--	--	--
Cluster hops	Cwt.	18.2, 3	13.5, 2	--	--	15.0, 6	--	--	--	--	--	--	--	--

a. The figure which follows the comma represents the number of farmers contributing to the yield estimates.

b. Some yield estimates were not supported by hay yields; therefore, only those yields are included which were composed of a seed and hay yield.

Usual yields may not equal long time average yields. For usual and average yields to be equal the yield representing each soil-crop combination would need to be normally distributed over the years. This may not be the case; the usual yield may be above the average. Also, farmers are probably influenced in their estimates of usual yields by the experiences of the immediate past. This, also, may bias usual yield estimates, derived by the survey technique, above the average. Thus, it is conceivable that the usual yield estimates presented here are higher than average yields over the same period of time.

From 1952 to 1956 the average wheat yield for Marion County rose above its 20 year average yield by approximately five bushels per acre. The difference between usual and average yield is probably greater on the non-irrigated crops. Even if the usual yield is above the average yield this may not greatly affect the index of physical productivity since this is a relative concept. Economic productivity indices will be more adversely affected.

Coefficients of variation for the individual yield estimates are presented in Table 3. Only those crops were presented which had a large number of estimates representing the soil-crop combinations. In most instances, the coefficient of variation percentages are not over six percent. The larger amount of variation of crop yields on the gravelly soils was due, in part, to the differences in the productivities of the soils forming this grouping; the coefficients of variation were not greatly different from that found on other soils,

Table 3. Coefficient of variation percentages of usual crop yields on Marion County, Oregon, soils.[a]

Crop \ Soil	Cheha-lis	New-berg	Wapato	Will-amette	Wood-burn	Amity	Gravelly	Aiken	Polk
					Percent				
Fall wheat	7.9	--	--	4.3	2.8	3.2	--	--	--
Spring barley	6.0	7.9	5.5	3.8	3.5	3.1	12.8	11.6	10.0
Chewings fesque	--	--	--	--	12.3	3.0	--	12.0	3.9
Strawberries	--	4.5	--	1.4	4.7	5.7	--	--	13.4
Pole beans	5.4	3.3	--	5.9[b]		--	4.1	--	--
Sweet corn	3.7	6.6	--	--	5.9	4.1	8.8	--	--
Mint	3.8	4.6	--	--	--	--	--	--	--
Hops	5.3	--	--	--	6.0	4.3	--	--	--

a. Data for this table were taken from the individual observations which were combined to form Table 1.

b. The yield for pole beans was combined for Willamette and Woodburn prior to calculating the coefficient of variation.

however. The large amount of variation of strawberries grown on Polk is due, in part, to the differences in inputs; only about half of the strawberries were irrigated.

It is difficult to develop a physical productivity index which has meaning when the crops and soils are so varied. Nevertheless, an attempt was made and the results appear in Table 4. Since there was not a single cropping system or even a group of important crops which could be used as indicators of relative productivity a different system needed to be devised. The method arrived at compares soils which have the most likeness in terms of the crops which they support. For example, Chehalis and Newberg have a similar distribution of crops. Selection was on the basis of the distributions presented in the previous chapter. After the individual crops were compared, the relative crop productivities were weighted in terms of their importance to the soil, vis. their distribution percentages, to form the physical productivity of the soils. The weighted crop productivity then becomes the relative productivity of the soils being compared. These individual soil comparisons can then be reflected back to a standard. In this case, Chehalis was chosen as having a productivity of 100 and all other productivities were relative to it.

It can be observed that the productivities of Chehalis and Newberg are very near the same. Only in those cases where the number of observations are small was the difference large. Wapato, however, did not measure up to Chehalis or Newberg. Not only are the

Table 4. Physical productivity considerations of selected soils in Marion County, Oregon. Chehalis = 100.[a]

Crop	Soil	Newberg vs. Chehalis[b]	Wapato vs. Newberg	Willamette vs. Chehalis	Woodburn vs. Willamette	Amity vs. Woodburn	Dayton vs. Amity	Gravelly vs. Woodburn	Polk vs. Amity	Aiken vs. Polk
						Percent				
Fall wheat		96	88	97	104	90	--	77	76	94
Spring wheat		--	--	--	81	99	--	99	--	73
Fall oats		--	--	105	95	99	--	--	80	99
Spring oats		69	72	61	95	104	88	84	80	84
Spring barley		97	86	86	105	94	90	81	--	89
Field corn		113	--	60	112	110	--	--	--	--
Red clover seed		--	--	--	--	107	--	--	--	--
Red clover hay		--	--	--	--	88	--	--	--	--
Crimson clover		133	--	126	82	97	--	--	101	--
Oats and vetch		--	--	112	109	95	--	--	--	--
Common ryegrass		--	--	--	--	--	66	--	--	--
Highland bentgrass		--	--	--	--	--	--	--	--	--
Chewings fesque		--	--	--	--	90	--	--	95	81
Creeping red fesque		--	--	--	--	--	--	--	--	--
Alta fesque		--	--	--	--	--	--	--	--	--
Corn silage		--	--	--	--	107	--	--	--	--
Alfalfa forage		88	81	106	90	100	--	--	--	--
Other forage	irrigated	--	--	--	86	105	45	--	--	--
	dry	--	85	--	89	100	24	88	56	100
Strawberries		110	--	116	87	107	--	--	84	--
Evergreen blackberries		--	--	--	80	108	--	--	--	--
Boysen and loganberries		--	--	--	--	--	--	--	--	--
Sweet cherries		--	--	96	--	--	--	--	--	--
Prunes		--	--	--	--	--	--	--	--	--
Walnuts		85	--	155	98	--	--	--	--	--
Filberts		85	--	72	127	--	--	--	--	--
Pole beans		100	--	89	94	102	--	100	--	--
Sweet corn		86	--	80	116	89	--	78	--	--
Carrots		--	--	--	--	--	--	--	--	--
Mint		98	--	--	--	--	--	--	--	--
Sugar beet seed		--	--	--	--	118	--	--	--	--
Hops		95	--	--	--	91	--	--	--	--
Weighted productivity[c]		97	84	94	100	96	57	86	84	94
Productivity relative to Chehalis[d]		97	81	94	94	90	51	81	76	71

a. Based upon Tables 1, Ch. VII and 1, Ch. VI.

b. The soil on the top is being rated in terms of the ratio of its crop yields to the yields of the soil on the bottom.

c. The individual percentage estimates of relative crop productivity is weighted in terms of the distribution of soils on the soil being compared; see Table 1, Ch. VI.

d. Productivities in this row are all in relation to Chehalis; Chehalis was given a value of 100.

comparative yields lower but Wapato does not have the range of adaptability. A physical productivity index calculated in this manner does not measure this aspect; economic productivity will.

It was necessary to revert back to Chehalis to compute an index for Willamette. Willamette compares very favorably with Chehalis on most crops. There appears to be greater differences in the intensive crops than the extensive. Woodburn appears to be about the same as Willamette in productivity on comparative crops. Even Amity does not differ greatly in productivity over comparative crops from Woodburn and Willamette. The difference is, however, large enough to indicate the superior productive qualities of the better drained soils. Dayton falls way behind all three of the other fine-textured terrace soils.

There were not enough observations on the gravelly soils to consider them separately. As mentioned earlier, their use was not greatly different. The three coefficient of variation percentages presented in Table 3 would indicate that yields are not greatly different. Clackamas accounts for about as much total area as Salem and Sifton combined and it would seem that the coefficients of variation would be noticeably different if their productivities were wide apart. In overall productivity the gravelly soils appear to be inferior to their fine-textured counterparts. The overall productivity of the gravelly soils is probably greater than Wapato even though this tabulation does not indicate this.

The hill soils on the whole are considerably less productive than the terrace or the riverbottom soils. In all comparative yields, except crimson clover seed, Amity showed superior productive capacity over Polk. The two major hill soils are nearly the same, however, with Polk rising slightly over Aiken.

The closeness of these physical productivities to each other illustrates the observation made earlier that differences in productivity may be more dependent upon the soil's adaptability to high-income type crops than upon the level of yield of comparative crops.

In support of the physical productivity comparisons the mean usual yields of selected crops were tested by the use of analysis of variance techniques to determine if there were significant differences in yields of the same crop between soils. If there was an overall significant difference, due to the soils effect, then the individual soils were compared by keying out individual degrees of freedom. The same system of comparison was used, if possible, on all of the crops tested. The analysis of variance comparisons appear in Table 5.

It will be noted that only in the case of sweet corn did Chehalis show any significant difference to Newberg. Willamette was only significantly different from Woodburn in the case of strawberries and then only at the 10 percent level. Woodburn was only significantly different from Amity in the case of winter wheat. The fine-textured terrace soils were significantly different from the gravelly terrace soils in three out of the four crops tested.

Table 5. Statistical comparison of crop yields on soils by use of analysis of variance techniques.[a]

Source of variation	Degrees of freedom	Mean square	Level of significance
Winter wheat (X1,T1,T4,T2,Z,B2,B7)[b]			
Due to soils	6	163.38	.01
T1 vs. T4	1	31.78	N.S.[c]
T4 vs. T2	1	143.19	.05
B2 vs. B7	1	4.09	N.S.
X1 vs. T1 & T4	1	.84	N.S.
T1, T4 & T2 vs. Z	1	170.78	.05
Z vs. B2 & B7	1	27.45	N.S.
Within soils	141	33.40	
Spring barley (X1,X3,X4,T1,T4,T2,T3,Z)			
Due to soils	9	96.30	.01
X1 vs. X3	1	5.03	N.S.
X3 vs. X4	1	108.45	.10
T1 vs. T4	1	30.94	N.S.
T4 vs. T2	1	26.41	N.S.
B2 vs. B7	1	16.81	N.S.
X1 & X3 vs. T1 & T4	1	144.79	.05
T1,T4 & T2 vs. Z	1	94.93	.10
Z vs. B2 & B7	1	.15	N.S.
Within soils	160	33.46	
Spring oats (X4,T4,T2,T3,Y1,B2,B7)			
Due to soils	6	59.49	.05
T4 vs. T2	1	7.20	N.S.
T2 vs. Y1	1	18.56	N.S.
B2 vs. B7	1	6.73	N.S.
T4 & T2 vs. B2 & B7	1	99.21	.05
Within soils	53	24.69	
Red clover seed and hay (X1,X3,T1,T4,T2)			
Due to soils	3	153.73	N.S.
Within soils	41	1,023.01	
Chewings fesque (T4,T2,B2,B7)			
Due to soils	3	22,737.90	.10
Within soils	39	6,601.15	
Strawberries (X1,X3,T1,T4,T2,B2,B7)			
Due to soils	6	135,293.25	.01
X1 vs. X3	1	13,888.89	N.S.
T1 vs. T4	1	111,250.29	.10
T4 vs. T2	1	39,363.54	N.S.
B2 vs. B7	1	224,713.55	.01
X1 & X3 vs. T1 & T4	1	1,546.67	N.S.
T1,T4 & T2 vs. B2 & B7	1	439,217.42	.01
Within soils	59	31,473.93	
Pole beans (X1,X3,T1,T4,T2,Z)			
Due to soils	4	2,430.20	.05
X1 vs. X3	1	5.00	N.S.
T1 & T4 vs. T2	1	0.00	N.S.
X1 & X3 vs. T1,T4, & T2	1	5,280.17	.05
T1,T4 & T2 vs. Z	1	6.40	N.S.
Within soils	39	787.46	
Sweet corn (X1,X3,T1,T4,T2,Z)			
Due to soils	5	1,797.37	.01
X1 vs. X3	1	1,483.66	.05
T1 vs. T4	1	455.62	N.S.
T4 vs. T2	1	433.89	N.S.
X1 & X3 vs. T1 & T4	1	171.61	N.S.
T1,T4 & T2 vs. Z	1	3,641.73	.01
Within soils	36	354.74	

(continued)

Table 5, continued.

Source of variation	Degrees of freedom	Mean square	Level of significance
Fuggle hops (X1,X3,T4,T2)			
Due to soils	3	7.69	N.S.
Within soils	25	3.44	
Mint (X1,X3)			
Due to soils	1	1.22	N.S.
Within soils	16	51.05	

a. The data for this table came from the individual observations used to develop Table 1.

b. The symbols X1,X2,X4,T1,T4,T2,T3,Y1,Z,B2 and B7 stand for Chehalis, Newberg, Wapato, Willamette, Woodburn, Amity, Concord, Dayton, gravelly, Aiken and Polk soils respectively. The hypothesis tested is that the crop yield means of those soils compared are equal.

c. All "non-significant" notations are at the 10 percent level.

The hill soils showed a significant difference to fine-textured terrace soils on all crops tested.

The 1958 yield estimates presented in Table 2 are included only to illustrate what can happen during an individual year. Those crops which were dependent upon climatic conditions had yields considerably different from usual yields. The total amount of moisture during the year was not greatly different from the normal but the summer was hot and dry. Also, a virus hit the Willamette Valley in 1957 which caused severe small grain damage.

CHAPTER IX

Economic Productivity Considerations

This chapter brings to a climax the soil productivity considerations. Techniques will be applied in establishing economic productivity ratings for the selected soils of Marion County. Prior to the presentation of the soil ratings it will be necessary to consider the individual soil-crops in terms of costs and returns necessary in arriving at a "net" return. The fore part of this section will be devoted to a discussion of the individual crops in respect to the relevant soils. The last part will bring these together into aggregate economic productivity groupings for the various soils in determination of indices.

Framework for Determining Crop Costs and Returns

Before presenting individual crop discussions it is necessary to build a framework under which costs and returns were determined. Almost all of the data used in this study had as its origin the 419 schedules obtained in the farm survey as outlined in the sampling chapter. Besides the land use data presented in the last two chapters, information was collected relative to costs and returns of selected crops. This was obtained in two parts. The first part analyzed the productive operations and factor inputs necessary in producing the various crops; these were on a "usual" basis, the same as yields. This portion was in physical terms; vis. the number

of hours required to perform certain operations in terms of machinery and labor, the amount and kind of fertilizer applied, the amount and kind of chemical applied, etc. The second part was devoted to obtaining costs in relation to machinery operations, labor, fertilizer, chemicals, custom work, related investment costs in buildings, tiling, wells etc., and other miscellaneous items.

The data were processed in much the same form as they were collected. First, the physical inputs were listed and then a cost or price was applied. The physical data were kept separate for each individual enterprise record but the costs and prices applied to these physical units were generally aggregative over the whole, or relevant part, of the total data available. This was done in an attempt to remove some of that portion of the total variation not associated with the individual soils. Also, every schedule did not contain the complete cost information; for example, the information necessary to determine machinery operation costs may be missing. In these cases the costing and pricing information needed to come from the balance of the information available.

The costs of operating powered and non-powered farm machinery used in this study are presented in Appendix C. The data for the establishment of these costs were taken directly from the farm schedules. In most cases the observations were large enough to give reliable cost estimates. When the data were scarce in relation to certain machines its accuracy was checked with surrounding data. All in all, the costs arrived at should be quite representative of

actual farm situations. The different cost categories represent the farm machinery situation as it existed at the time the schedules were taken. There was no attempt made to account for inflationary price changes. In order to account for any cost differences as they may relate to the different soils, an attempt was made to compare operation costs of similar machines on different soils, or soil associations, but there were not sufficient observations in each category to do this. The per hour costs are probably not nearly as important as the number of physical inputs required in terms of hours of machinery operation or the number of operations required to properly prepare the seedbed etc. There may, however, be differences in the annual units of use of machinery, which would affect the per unit cost of operation, through the farm structure or size associated with the different soils. This difference may be arrived at through an analysis of the units of use of each farm machinery category on each soil or through the crops associated with each soil. The latter method was chosen because it fit the data processing procedures. Through this method the amount of annual use for each machine was determined as it related to crop categories: viz., grains and legume seeds, grass seeds, forage, small fruits, tree fruits, vegetables, hops and mint. The differences in cost due to annual use associated with these crop categories reflected back to the soils by means of the percentage distribution of these crop categories on the soils involved. The appendix carries a complete discussion of the methods used in arriving at machinery operating costs.

One of the most difficult costs to determine was for irrigation. This information came at the end of the survey schedule and as a result it was sometimes left out or only partially complete. The method finally arrived at for costing sprinkler irrigation was to use the individual farm estimates directly, as far as they were complete enough to do so and then to supplement them with aggregate estimates where necessary. The majority of the records were complete enough to furnish the complete information. That is, the same farmer who furnished the physical units of water used also furnished the costing information. This is a contrasting procedure to that used for powered and non-powered machinery, but the nature of the data was such that irrigation information could not be aggregated and still retain its direct relationship to actual farm situations. Part of the cost data were collected on a "per acre" basis and part on a "per hour" basis which further complicated aggregative procedures.

In order to supplement missing enterprise data in regards to irrigation costs a general set of cost relationships was established. The farm survey furnished most of the information but in addition electrical power companies were consulted and data from other sources were reviewed. This supplemental irrigation cost information appears in Appendix D. Methods and procedures used in arriving at these costs are discussed in detail there.

Farm building costs were divided into two general types: buildings directly related to enterprises and buildings indirectly related to enterprises. Transient labor housing or corn cribs are

examples of the first and machinery storage is an example of the second. Costs for housing farm machinery were averaged over each crop. This average cost was then charged against every enterprise crop regardless of the soil. The same method was used for hired labor housing and corn cribs except that a charge was made only where indicated.

Closely related to building costs are costs associated with pole bean, hop, and cane berry yards. These costs, too, were averaged and a standard charge made. The costs determined for buildings and these related items are presented in Appendix E.

For those soils which were less than well drained it was necessary to include a tiling cost where tiling was indicated. Only on Woodburn and Amity soils were survey cost estimates sufficient to give a reliable figure to use. Therefore, tiling recommendations were obtained from the Soil Conservation Services (SCS) in Marion County. Costs of installation for various sized tile were obtained from the County Agricultural Stabilization Conservation (ASC) office in Salem; their cost estimates were obtained from commercial sources. With these data available it was possible to establish per acre costs for tiling the different soils. These costs were for pattern tiling and thus did not reflect actual farm situations on the whole. Therefore, in order to bring these costs in line with actual farm situations they were reduced in accordance with findings in the farm survey. The number of observations was large enough on the Woodburn soil series to consider it as being fairly representative; therefore, it

was chosen as a base. For Woodburn soils the cost used was that determined in the survey. The tiling cost used for other soils was determined by multiplying the survey determined cost for Woodburn by the ratio of the current costs for recommended pattern tiling on Woodburn to that of other soils. The exception was Labish series where a large portion was drained with wood box tiles. The costs here were, for the most part, those determined in the farm survey. Tiling costs are presented in Appendix F. The methods and procedures used in arriving at final cost estimates for the individual soils are discussed in more detail there.

Fencing charges were applied only where pasture was involved. The schedules were not complete enough to furnish this information. It was necessary to obtain estimates from outside sources. Since the County ASC office has been charged with handling the government-share program for fencing they were the logical source. The Benton County, Oregon, ASC office furnished the basic cost information. Costs were related to field size. A tabulation of these costs are presented in Appendix G.

Farm insurance takes many different forms and thus it was necessary to handle each type a little differently. Machinery insurance, including autos and trucks, was included in the per unit operating costs of the various machines as explained in Appendix C. Crop insurance was included only where the farmer indicated he carried it. The rate used was based upon commercial rates for particular crops. Farm liability insurance costs were charged against each

farm surveyed according to commercial rates which were based upon total farm acreage. The cost was then allocated to the individual crops on an acre basis. Workmen's compensation insurance costs were charged against all hired labor on intensive type crops but only when indicated by the farmers surveyed on extensive type crops. The coverage will be apparent as each crop is presented. The rate used was that quoted by the State Industrial Accident Commission of Oregon. The State Industrial Accident Insurance was used on the basis that if the farmer did not carry it he was assuming part or all of the risk himself. A breakdown of the above insurance costs, except for machinery and buildings, appears in Appendix H.

Social Security was charged against all hired labor at the rate of three percent except in the case of hand harvesting of fruits and vegetables; in this case no Social Security charge was made. It was assumed that most of this type of labor did not come under Social Security coverage for one reason or another.

A number of farm operations were done on custom or piece-work bases. For some operations custom or piece-work was the normal procedure and for others it was only prevalent enough to establish a usual cost rate. These custom and piece-work rates are presented in Appendix I. Where custom or piece work operations were indicated these rates were used.

The prices used in establishing costs for labor, seeds and seedlings, fertilizers, pesticides, and miscellaneous materials are

presented in Appendix K. For the most part these represent 1958 prices and were taken directly from the survey schedules. Labor was divided into three classes: operator, family and hired. The costs for each of these three classes were summarized over crop groupings. Crops were grouped into six groups: grains, legumes and forages, grass seeds, vegetables, small fruits, tree fruits and specialty crops. In addition all hand work and other specific types of work were analyzed separately. Management was accounted for by increased operator wages and also by accounting for the additional time spent in this type of activity. When establishing prices for pesticides it was possible, and necessary for supplemental purposes, to establish some application rates; these are also presented.

Land taxes were not included as production costs because it was felt that the inclusion of existing land taxes may bias the results in terms of some soils. This would happen if the tax levies were not directly related to economic productivity. There was no tax levy made against crop investments such as orchards or other perennial crops.

In the case of perennial crops it was necessary to establish crop investments. This may involve compounding costs over several years or it may take only one year; walnuts and hops illustrate the two extremes. For these crops it was necessary to include a land charge and a tax charge. In order to remove as much bias as possible and also reflect farm conditions, the land values used as a basis

for determining land charges and taxes were those estimated by farmers in the survey. These land values are presented in Appendix J. Taxes were calculated on the basis of 1.6 percent of the land value; which approximates the 1958 levy in Marion County. A five percent interest rate was used in estimating land returns.

The prices received for products sold, in general, are five year averages over the period 1954-58 inclusive. If, however, this average price was too far out of line with present prices and future expectations then an adjustment was made. The prices arrived at, to be used in calculating gross returns, are presented in Appendix L. Peculiarities of the individual prices and detailed procedures are presented there.

It will be noted in Appendix L that the prices used for fruits and vegetables were cash market prices. This study did not attempt to study market returns of cooperative versus non-cooperative processing plants as they might affect land values. It was observed, however, that the increased returns from crops sold to cooperative processing plants do affect land values but the extent was not measured.

The difference between cooperative and non-cooperative processing plant prices may not be as large as it appears on the surface. In the first place, part of the total farmer return enters into a revolving fund; the present value of this portion of the total return would be a discounted value. Secondly, it was evident in both the farm and the processing plant survey that the grade

distribution of non-cooperative processing plants was higher than for cooperative processing plants; this was so for pole beans, sweet corn and strawberries. Thirdly, the market over the period of reference has been a general rising one. The effect of the reverse of this situation was not known.

All returns on capital investments - machinery, buildings, tiling, cash type expenditures and perennial crops - were deferred until the summary. Returns on investments were then made on the basis of opportunity interest rates. A standard of five percent was used on all investments except seasonal cash type expenditures which were charged at one percent; the basis for this one percent is an estimated three month production season with costs equally distributed and an eight percent interest rate.

The costs and returns summaries for the various crops are presented in terms of input categories rather than production operations. The data in the appendix and the individual crop discussions presented in this chapter should be complete enough, however, for anyone interested to reconstruct costs in a manner to fit his particular need.

In averaging the costs and investments appearing in the crop costs and returns summaries a weighting system was used. Each record was weighted in terms of the number of acres in the field on which the data were obtained. This was done in order to more nearly reflect average per acre costs and returns of the total soil area. The larger fields account for a larger percentage of the total

soil-crop acres.

All crop discussions will be on a "per acre" basis unless otherwise stated. The averages used in discussing crop inputs are simple averages.

Costs and Returns of Soil-Crop Combinations

Fall Wheat

Fall wheat costs and returns summaries appear in Table 1.

Fall wheat was produced on nearly all of the soils in Marion County. It is better adapted to the well drained soils but produced almost as heavily on the imperfectly drained soils if they had been artificially drained. Fall wheat was found growing on Concord and Dayton but to a limited extent. Favorable support prices have extended production to soils which otherwise would not have been used. Moisture conditions are favorable enough in the Willamette Valley that a fallow year is not necessary. Lack of moisture during the maturing stage may cause shrunken kernels. There were about 23,000 acres of fall and spring wheat in Marion County in 1958; most of this was fall wheat.

The cultural practices followed in producing fall wheat began with a plowing operation. The most common plow used was either a two or three bottom moldboard depending , in most cases, upon total farm acres tilled. Following this the ground was usually disked one to three times with the majority disking only once and spiketooth harrowed about the same number of times. The most common disk used

Table 1. Fall wheat costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Chehalis	New-berg	Wapato	Willa-mette	Wood-burn	Amity	Gravelly	Aiken	Polk
No. of records	9	3	3	6	19	17	6	5	5
					(dollars) (per acre)				
I. Weighted average costs									
A. Machinery									
1. Non-powered[b]	1.38	1.23	1.16	1.33	1.18	1.24	1.35	1.20	1.60
2. Powered[c]	3.40	2.51	3.58	4.93	2.85	3.41	3.88	5.66	5.40
3. Autos and trucks[d]	.32	--	.40	.25	.22	.20	.71	.28	.81
4. Interest @ 5%[e]	.96	.59	.87	1.10	.78	.88	1.03	1.28	1.35
Total	6.06	4.33	6.01	7.61	5.03	5.73	6.97	8.42	9.16
B. Improvements									
1. Machinery housing[f]	.58	.58	.58	.58	.58	.58	.58	.58	.58
2. Tiling[g]	--	--	1.44	--	.91	2.01	.21	--	--
3. Interest @ 5%[e]	.26	.26	1.78	.26	1.22	2.38	.49	.26	.26
Total	.84	.84	3.80	.84	2.71	4.97	1.28	.84	.84
C. Cash type expenses									
1. Materials									
a. Seed	4.38	4.48	4.30	4.57	4.11	6.62	4.54	4.23	4.09
b. Fertilizer	9.48	4.68	4.86	6.10	6.70	4.05	6.72	6.65	2.35
c. Pesticides	.46	--	.29	.41	.26	.25	--	1.31	.12
2. Labor[h]	2.83	3.20	3.12	4.67	2.56	3.42	4.20	5.76	6.73
3. Custom work[i]	2.35	10.45	2.73	3.40	3.47	2.26	.36	.15	1.09
4. Interest @ 1%[e]	.19	.23	.15	.19	.17	.16	.16	.18	.14
Total	19.69	23.04	15.45	19.34	17.27	16.76	15.98	18.28	14.52
D. Miscellaneous									
1. Farm liab. ins.[j]	.07	.03	.03	--	.01	.01	.01	--	.04
2. Social security[k]	.04	.16	.16	.17	.14	.17	.17	.12	.10
Total	.11	.19	.19	.17	.15	.18	.18	.12	.14
Grand total	26.70	28.40	25.45	27.96	25.16	27.64	24.41	27.66	24.66
II. Weighted average returns									
A. Yield (cwt.)	(27.7)	(28.9)	(23.7)	(29.6)	(27.5)	(26.4)	(21.7)	(16.3)	(18.9)
B. Price	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
Gross revenue	80.33	83.81	68.73	85.84	79.75	76.56	62.93	47.27	54.81
III. Residual return[l]	53.63	55.41	43.28	57.88	54.59	48.92	38.52	19.61	30.15

a. Averages were weighted in terms of the number of acres in each field.

b. Non-powered machinery costs included depreciation, taxes and repair.

c. Powered machinery costs include depreciation, taxes, insurance, repair, fuel, lubrication and work preparation.

d. Auto and truck costs include depreciation, taxes, insurance, license, repair, fuel and lubrication.

e. The return on investment includes all items in the section at the indicated rate.

f. Machinery housing costs include depreciation, taxes, insurance and repair.

g. Tiling costs include depreciation only.

h. Labor costs include operator, family and hired labor.

i. Custom work costs include all operations custom hired in producing the crop.

j. Farm liability insurance was assumed for all farms at a commercial rate.

k. Social security was charged at three percent of hired labor costs.

l. The residual return represents not only an imputed return to land but also a return to pay land taxes.

was either an eight or ten foot field disk. Many operators combine operations. Springtooth harrowing, field cultivating, dragging or rolling may be substituted for, or done in addition to, the other seedbed preparation operations. It is reasonable that light textured soils, such as Newberg, would not require as many tillage operations in order to prepare an adequate seedbed as would the heavier textured soils but there was no observable differences. The number of operations depended to a large extent upon the previous crop and moisture conditions.

Seeding was early in the fall when moisture conditions were favorable. The common drill sizes were eight and ten feet. A spike harrow was usually pulled behind the drill. An average of 110 pounds of seed was sown per acre; this varied between 80 and 120 pounds.

Almost without exception commercial fertilizers were applied. Most all of this was in the form of nitrogen (N); only a few producers added phosphorus (P_2O_5) or potash (K_2O). The average application of N was 46 pounds per acre; the rate was highest on Chehalis and Newberg soils with a combined average of 53 pounds and lowest on Wapato with 29 pounds. The application rate of N on the fine textured and gravelly terrace soils averaged 47 and 45 pounds, respectively. An average of 43 pounds of N was applied to Aiken soils. Only two out of the six producers on Polk soil applied N fertilizer; the rate was only 24 pounds.

Fifty-six percent of the operators in the survey applied 2, 4-D weed spray. Eighty percent sprayed on the riverbottom soils, 60

percent on the fine textured terrace soils, none on the gravelly terrace soils and 36 percent on the hill soils. Twenty-seven percent of the spraying was done on a custom basis.

Most all of the harvesting was done with self-propelled combines, although, there were still some pull types being used, particularly on the smaller farms. Most of the pull-type combines were six feet; the most common self-propelled combines were ten or twelve feet. Twenty-eight percent had their crop custom harvested. Most of the grain was hauled in 1.5 or 2-ton trucks; the average miles driven per acre was 3.5 miles. Where a pickup truck was used the average miles was eight. The average total hours of labor required per acre was 3.4.

Ninety-four percent of the Amity fields, 42 percent of the Woodburn fields, two out of the three Wapato fields and one out the two Clackamas fields were tiled.

Spring Wheat

Spring wheat costs and returns summaries appear in Table 2.

Spring wheat was produced on nearly all of the soils in Marion County but the total acres were far below those of fall wheat. Spring wheat accounted for only about ten percent of the total wheat grown. Spring wheat is adapted to about the same soil conditions as fall wheat. Due to unfavorable weather conditions which frequently occur in the spring resulting in late plantings, the available moisture throughout the growing season and other reasons, spring wheat yields are below those of fall wheat. It would appear that spring wheat

Table 2. Spring wheat costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Newberg	Wapato	Willa-mette	Wood-burn	Amity	Gravelly	Aiken	Polk
No. of records	3[b]	2	3	6	7	3	2	2
				(dollars)				
				(per acre)				
I. Weighted average costs								
A. Machinery								
1. Non-powered	2.13	1.81	1.47	1.01	1.79	1.31	1.60	3.27
2. Powered	3.62	5.21	4.02	2.17	3.93	3.52	3.90	6.12
3. Autos and trucks	.09	.80	.40	.13	.42	.05	.22	.46
4. Interest @ 5%	.78	1.57	1.01	.55	1.04	.78	1.07	2.11
Total	6.62	9.39	6.90	3.86	7.18	5.67	6.79	11.96
B. Improvements								
1. Machinery housing	.58	.58	.58	.58	.58	.58	.58	.58
2. Tiling	--	--	--	.25	.89	--	--	--
3. Interest @ 5%	.26	.26	.26	.53	1.19	.26	.26	.26
Total	.84	.84	.84	1.36	2.66	.84	.84	.84
C. Cash type expenses								
1. Materials								
a. Seed	4.33	4.63	4.60	4.80	4.58	4.92	4.20	3.86
b. Fertilizer	4.21	6.28	3.93	5.98	6.21	4.19	6.62	10.14
c. Chemicals	--	.61	.38	.09	.15	--	.61	.47
2. Labor	6.38	4.72	4.66	4.61	4.79	4.01	3.44	5.74
3. Custom work	5.07	.28	2.82	5.42	3.99	3.44	2.10	--
4. Interest @ 1%	.20	.17	.16	.21	.20	.17	.17	.20
Total	20.19	16.69	16.56	21.11	19.93	16.73	17.14	20.42
D. Miscellaneous								
1. Farm liab. ins.	.28	.07	.14	.35	.23	.29	.17	.11
2. Social security	.04	.05	.01	--	.02	.01	.04	.04
Total	.32	.12	.15	.35	.25	.30	.21	.15
Grand total	27.97	27.04	24.45	26.68	30.02	23.54	24.97	33.37
II. Weighted average returns								
A. Yield (cwt.)	(22.1)	(25.3)	(24.2)	(21.4)	(23.3)	(22.3)	(18.0)	(22.2)
B. Price	2.75	2.75	2.75	2.75	2.75	2.75	2.75	2.75
Gross revenue	60.78	69.58	66.55	58.85	64.08	61.32	49.50	61.05
III. Residual returns	32.81	42.54	42.10	32.17	34.06	37.78	24.53	27.68

a. For a complete description of individual items see Table 1.

b. There was only one Newberg record; in order to give greater reliability two Chehalis records were included. Grain yield differences were not significant between Chehalis and Newberg.

was planted generally to fill government wheat acreage allotments where a spring grain crop was needed in the cropping system or where conditions were not favorable for the production of fall wheat.

The cultural practice were similar to those of fall wheat except that the seedbed was more difficult to prepare in the spring. On the average there was one more disking and one more harrowing required.

Eighty-five percent fertilized with nitrogen at a level of 44 pounds per acre. This is only slightly under the level for fall wheat. Fifty-nine percent sprayed for weeds. The normal seeding rate was 110 to 120 pounds per acre.

Tiling was less extensive than for fall wheat on both Woodburn and Amity soils.

Fall and Spring Oats

Costs and returns summaries for fall and spring oats appear in Tables 3 and 4, respectively.

There were about 23,000 acres of spring and fall oats produced in Marion County in 1958. About 47 percent of the total acreage was fall oats. Like wheat, oats can be found on nearly all of the Marion County soils. The percentage distribution of fall oats was highest on the well drained terrace soils. As moisture conditions increased, due to poor drainage or higher rainfall, the percentage distribution of spring oats in relation to fall oats increased. On soils such as Concord or Dayton, where drainage was a real problem, spring oats

Table 3. Fall oat costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Wapato	Willamette	Woodburn	Amity	Aiken	Polk
No. of records	1	2	9	9	7	6
			(dollars)			
			(per acre)			
I. Weighted average costs						
A. Machinery						
1. Non-powered	1.27	.74	1.44	1.11	1.35	1.06
2. Powered	3.43	1.54	4.70	3.58	4.80	4.95
3. Autos and trucks	.60	--	.24	.24	.22	.60
4. Interest @ 5%	1.08	.32	1.26	.87	1.15	1.28
Total	6.38	2.60	7.65	5.81	7.53	7.89
B. Improvements						
1. Machinery housing	.58	.58	.58	.58	.58	.58
2. Tiling	--	--	.78	1.44	--	--
3. Interest @ 5%	.26	.26	1.09	1.78	.26	.26
Total	.84	.84	2.45	3.80	.84	.84
C. Cash type expenses						
1. Materials						
a. Seed	3.00	3.13	2.97	2.99	3.12	2.94
b. Fertilizer	5.17	--	4.13	4.17	6.64	3.75
c. Chemicals	.41	--	.25	.18	.27	--
2. Labor	3.41	2.80	3.88	4.08	5.27	4.34
3. Custom work	--	7.04	2.05	1.75	1.37	1.44
4. Interest @ 1%	.12	.13	.13	.13	.17	.12
Total	12.11	13.10	13.41	13.31	16.84	12.60
D. Miscellaneous						
1. Farm liab. ins.	.05	.36	.14	.18	.15	.11
2. Social security	--	--	.02	.01	.01	.01
Total	.05	.36	.16	.19	.16	.12
Grand total	19.38	16.90	23.67	23.11	25.37	21.45
II. Weighted average returns						
A. Yield (cwt.)	(20.0)	(16.9)	(24.5)	(18.3)	(16.4)	(16.1)
B. Price	2.17	2.17	2.17	2.17	2.17	2.17
Gross revenue	43.40	36.67	53.16	39.71	35.59	34.94
III. Residual returns	24.02	19.77	29.49	16.63	10.22	13.49

a. For a complete description of individual items see Table 1.

Table 4. Spring oat costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Newberg	Wapato	Willa-mette	Wood-burn	Amity	Dayton	Gravelly	Aiken	Polk
No. of records	2	2	3	7	7	3	5	5	3
					(dollars)				
					(per acre)				
I. Weighted average costs									
A. Machinery									
1. Non-powered	2.11	1.46	1.45	1.18	1.71	2.06	1.39	1.44	1.38
2. Powered	4.12	3.55	4.90	3.19	3.70	5.39	5.18	4.27	5.34
3. Autos and trucks	.36	.13	.36	.08	.33	.20	.48	.14	.21
4. Interest @ 5%	1.18	.95	1.31	.70	1.02	1.18	1.13	1.04	1.18
Total	7.77	6.09	8.02	5.15	6.76	8.83	8.18	6.89	8.11
B. Improvements									
1. Machinery housing	.58	.58	.58	.58	.58	.58	.58	.58	.58
2. Tiling	--	.31	--	--	.52	--	--	--	--
3. Interest @ 5%	.26	.58	.26	.26	.80	.26	.26	.26	.26
Total	.84	1.47	.84	.84	1.90	.84	.84	.84	.84
C. Cash type expenses									
1. Materials									
a. Seed	3.10	3.10	3.17	3.18	3.32	3.10	2.74	3.10	3.08
b. Fertilizer	6.57	4.14	1.59	3.85	5.84	5.69	3.43	4.88	4.98
c. Chemicals	.53	--	.05	--	.42	--	--	.22	.59
2. Labor	4.14	3.62	5.50	2.96	3.72	5.75	5.31	5.06	5.72
3. Custom work	--	.43	2.22	4.45	1.13	.39	.89	--	1.45
4. Interest @ 1%	.15	.11	.13	.14	.14	.15	.12	.13	.16
Total	14.49	11.40	12.66	14.58	14.57	15.08	12.49	13.39	15.98
D. Miscellaneous									
1. Farm liab. ins.	.08	.11	.17	.25	.08	.16	.18	.14	.08
2. Social security	.05	--	.01	--	.02	--	.01	.03	--
Total	.13	.11	.18	.25	.10	.16	.19	.17	.08
Grand total	23.23	19.07	21.70	20.82	23.33	24.91	21.70	21.29	25.01
II. Weighted average returns									
A. Yield (cwt.)	(24.0)	(15.8)	(14.7)	(17.8)	(25.6)	(19.3)	(14.0)	(15.4)	(14.3)
B. Price	2.24	2.24	2.24	2.24	2.24	2.24	2.24	2.24	2.24
Gross revenue	53.76	35.39	32.93	39.87	57.34	43.23	31.36	34.50	32.03
III. Residual return	30.53	16.32	11.23	19.05	34.01	18.32	9.66	13.21	7.02

a. For a complete description of individual items see Table 1.

was the principal grain produced. Overall, oats showed greater tolerance to excessive moisture conditions than the other grain crops.

The cultural practices followed in producing fall and spring oats were no different than for fall and spring wheat, respectively.

The average pounds of seed sown per acre for fall and spring oats was 100. Sixty percent of those producing fall oats and 78 percent of those producing spring oats fertilized using an average of 37 and 35 pounds N per acre, respectively. There were not sufficient observations on each soil to measure soil difference. Forty-three percent sprayed for weeds; the percentage was slightly higher for fall than spring oats.

Sixty-seven percent of the Amity fall oat fields were tiled while on the same soil only 28 percent of the spring oat fields were tiled. This same trend was observed on Woodburn oat fields with 38 and 0 percent tiling for fall and spring oats, respectively. This substantiates the observation that spring oats are more tolerant to poor drainage conditions than fall oats.

Spring Barley

Spring barley costs and returns summaries appear in Table 5.

According to total cultivated soil acres and distribution percentages determined in this study, barley occupied the largest total acreage of any crop produced in the county. The same is true for most of the individual terrace and riverbottom soils except those which were poorly drained. Barley is not as tolerable to poor drainage conditions as oats but is more tolerable than wheat. The larger

Table 5. Spring barley costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Chehalis	Newberg	Wapato	Willamette	Woodburn	Amity	Dayton	Gravelly	Aiken
No. of records	11	9	9	10	15	19	3	5	5
				(dollars per acre)					
I. Weighted average costs									
A. Machinery									
1. Non-powered	1.48	1.67	1.84	1.92	1.75	1.67	1.74	1.40	1.36
2. Powered	3.18	3.90	4.77	4.82	4.37	5.53	4.37	4.22	2.96
3. Autos and trucks	.22	.31	.41	.38	.11	.57	.64	.81	.10
4. Interest @ 5%	.92	1.05	1.08	1.25	.98	1.41	1.17	1.14	.75
Total	5.80	6.94	8.10	8.37	7.20	9.18	7.92	7.57	5.15
B. Improvements									
1. Machinery housing	.58	.58	.58	.58	.58	.58	.58	.58	.58
2. Tiling	--	--	.06	--	.49	1.19	--	.33	--
3. Interest @ 5%	.26	.26	.33	.26	.78	1.51	.26	.61	.26
Total	.84	.84	.97	.84	1.85	3.28	.84	1.52	.84
C. Cash type expenses									
1. Materials									
a. Seed	3.78	4.46	4.32	3.90	3.47	3.46	3.55	3.47	3.32
b. Fertilizer	4.97	5.23	4.78	4.49	4.67	6.63	13.31	3.91	7.32
c. Chemicals	.49	.48	.18	.70	.35	.21	.46	.65	--
2. Labor	3.18	3.25	5.65	4.00	5.31	5.35	4.88	5.17	3.57
3. Custom work	4.19	1.90	5.39	2.24	3.67	2.36	1.36	.68	6.35
4. Interest @ 1%	.17	.15	.20	.15	.17	.18	.23	.14	.20
Total	16.78	15.47	20.52	15.49	17.64	18.19	23.80	14.02	20.76
D. Miscellaneous									
1. Farm liab. ins.	.10	.10	.18	.16	.20	.17	.14	.17	.20
2. Social security	.05	.03	.03	.01	--	.04	--	.02	.01
Total	.15	.13	.21	.17	.20	.21	.14	.19	.21
Grand total	23.57	23.38	29.80	24.87	26.89	30.86	32.70	23.30	26.96
II. Weighted average returns									
A. Yield (cwt.)	(28.9)	(30.1)	(27.6)	(26.8)	(26.7)	(24.4)	(20.5)	(22.2)	(19.9)
B. Price	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
Gross revenue	65.02	67.72	62.10	60.30	60.08	54.90	46.12	49.95	44.78
III. Residual return	41.48	44.34	32.30	35.43	33.19	24.04	13.42	26.65	17.82

a. For a complete description of individual items see Table 1.

number of observations on barley enables one to see the effect of drainage conditions upon net returns.

The cultural practices were similar to those described for all wheat. However, there were sufficient barley observations to indicate differences which existed between the cultural practices on spring and fall small grains. Seedbed preparation operations began with plowing. Almost all of the operators surveyed followed the plow with field disk; the average number of diskings was 2.5. The soil was then harrowed with a spike or springtooth harrow equally as many times or other tillage operations were substituted. A large percentage of operators pulled a harrow behind the disk. There was no observable difference in the number of operations required to prepare an adequate seedbed on the different soils although reason would indicate fewer operations would be required on the fine textured soils.

Forty-six percent drilled with ten foot drills while 36 percent used eight foot. Seeding rates fluctuated between 100 and 120 pounds per acre with the average using a little under 110 pounds. Eighty-two percent applied fertilizer at an average rate of 40 pounds per acre. There was some indication that the fertilizer application rate was higher on the riverbottom soils and lower on the hill and gravelly soils than on the fine-textured terrace soils. Sixty-two and 64 percent of the fields were sprayed for weeds on the riverbottom and fine-textured terrace soils, respectively; none of the Aiken fields were sprayed. Thirty-two percent of the producers

employed commercial sprayers.

Twenty-three percent of the fields were harvested by pull-type combines; most of these were 5-7 feet. The self-propelled combines were generally 12 feet. About 40 percent of the fields were harvested by custom operators.

One of the nine fields of Wapato was tiled and one ditched. Twenty and 63 percent of the Woodburn and Amity fields were tiled, respectively. None of the Dayton fields were tiled and only one of the two Clackamas fields were tiled.

The average total labor used, over all soils, was 3.9 hours per acre.

Field Corn for Grain

Grain field corn costs and returns summaries are presented in Table 6.

There were about 4,500 acres of field corn grown in Marion County in 1958. These were located on the well drained river-bottom soils and the imperfectly or better drained terrace soils. Corn can, however, be produced on the more poorly drained soils because its growing season comes at a time when the amount of rainfall is low and these soils are relatively dry.

The practices followed in establishing a seedbed were very similar to those of barley. In addition to the seedbed preparation operations on barley, many operations rolled or leveled their land once or twice.

Seeding was usually accomplished with a two-row planter. The

Table 6. Field corn costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Chehalis	Willamette	Woodburn	Amity
No. of records	3	4	7	3
		(dollars) (per acre)		
I. Weighted average costs				
A. Machinery				
1. Non-powered	2.90	3.20	3.02	2.81
2. Powered	7.28	7.42	6.05	6.08
3. Autos and trucks	1.10	.67	1.09	.94
4. Irrigation[b]	8.80	2.57	1.48	2.85
5. Interest @ 5%	4.89	2.49	1.77	2.18
Total	24.97	16.35	13.41	14.86
B. Improvements				
1. Machinery housing	1.05	1.05	1.05	1.05
2. Corn crib	.44	.44	.91	1.50
3. Tiling	--	--	1.17	2.04
4. Interest @ 5%	.84	.91	2.39	3.69
Total	2.33	2.50	5.52	8.28
C. Cash type expenses				
1. Materials				
a. Seed	1.56	1.64	2.07	1.66
b. Fertilizer	12.62	11.39	7.54	11.16
c. Chemicals	1.93	.97	2.24	1.06
2. Labor	13.03	14.78	12.08	13.46
3. Custom work	19.66	18.62	17.58	16.32
4. Interest @ 1%	.49	.47	.41	.44
Total	49.29	47.87	41.92	44.10
D. Miscellaneous				
1. Farm liab. ins.	.07	.13	.13	.22
2. Social security	.14	.10	.05	.04
Total	.21	.23	.18	.26
Grand total	76.80	66.95	61.03	67.50
II. Weighted average returns				
A. Yield (cwt.)	(48.8)	(31.6)	(35.0)	(38.2)
B. Price	2.60	2.60	2.60	2.60
Gross revenue	126.87	82.28	91.00	99.38
III. Residual returns	50.07	15.33	29.97	31.88

a. For a complete description of individual items not footnoted here see Table 1.

b. Irrigation costs include depreciation, taxes, power and repair; for this crop depreciation on the well is also included here.

standard seeding rate was 10 pounds per acre. About two-thirds used a pre-emergence weed spray. All operators except two used commercial fertilizer and one of these two applied manure. The average application was 45 pounds N, 32 pounds P_2O_5 and nine pounds K_2O per acre.

The average number of cultivations was three; all except two of the cultivators were two row.

All of the fields on Chehalis and Newberg soils, half of the fields on Willamette, one-third of the fields on Amity and Woodburn, and the one Clackamas field were irrigated.

Harvesting methods were so varied and information so scarce that, in general, commercial cost rates were used. Six of the 19 operators picked and shelled in the field. Half had their corn dried commercially and the other half used corn cribs. Those that hauled their corn in 1.5 or 2-ton trucks drove an average of eight miles per acre. In addition, some producers indicated they used their pickup trucks in support of the corn crop.

Several of the producers indicated they cover cropped.

On those fields that were irrigated, 13.6 total hours of labor were used per acre; 11.3 hours per acre used on non-irrigated fields.

Red Clover Seed

Red clover seed costs and returns summaries are presented in Table 7.

Most of the red clover seed grown in the Willamette Valley was of the medium type and thus, was generally considered a biennial.

Table 7. Red clover seed costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Chehalis	Willamette	Woodburn	Amity
No. of records	3[b]	4	11	7
		(dollars per acre)		
I. Weighted average costs				
A. Machinery				
1. Non-powered	.60	1.92	1.59	1.67
2. Powered	2.73	5.68	2.89	6.20
3. Autos and trucks	.23	1.29	.32	.19
4. Interest @ 5%	.76	1.83	.81	1.62
Total	4.32	10.72	5.61	9.70
B. Improvements				
1. Machinery housing	.61	.61	.61	.61
2. Tiling	--	--	.77	1.36
3. Interest @ 5%	.32	.32	1.13	1.75
Total	.93	.93	2.51	3.72
C. Cash type expenses				
1. Materials				
a. Seed	4.73	3.50	3.28	3.69
b. Fertilizer	3.44	7.42	2.25	1.85
c. Chemicals	3.82	--	.28	.33
d. Other incl. sacks	1.93	.68	1.03	1.35
2. Labor	2.07	5.71	5.07	6.95
3. Custom work[c]	17.62	11.05	22.27	20.77
4. Interest @ 1%	.34	.28	.34	.35
Total	33.95	28.64	34.52	35.29
D. Miscellaneous				
1. Farm liab. ins.	.08	.14	.15	.17
2. Workmen's comp. ins.	.03	.10	.13	.18
3. Social security	.01	.03	.05	.06
Total	.12	.28	.33	.41
Grand total	39.32	40.57	42.97	49.12
II. Weighted average returns				
A. Hay yield (tons)	(0.8)	(1.6)[d]	(2.5)[d]	(2.2)[d]
Price	22.00	22.00	22.00	22.00
Revenue	17.60	35.20	55.00	48.40
B. Seed yield (lbs.)	(386)	(136)	(206)	(269)
Price	.32	.32	.32	.32
Revenue	123.52	43.52	65.95	86.08
Gross revenue	141.12	78.72	120.92	134.48
III. Residual returns	101.80	38.15	77.95	85.36

a. For a complete description of individual items see Table 1.

b. These three records represent two on Chehalis and one on Newberg. The two Chehalis records reported no hay yield.

c. Custom work includes baling and seed cleaning for all producers.

d. One producer on each of these soils sold his hay standing by the acre. In these cases the estimated yield was reduced to bring the value per ton to $22.00.

The usual practice was to sow red clover with either spring or fall grain. Under this procedure, a grain crop was harvested the first year and red clover seed the second. It was assumed in this study that the grain crop paid for the seedbed preparation and returned a payment to the land for its use. If the grain stubble and young clover were harvested the first year it was assumed that the hay value was worth just the cost of removal.

Twenty-nine percent of the red clover producers fertilized. An average of 36 pounds P_2O_5 per acre was applied. One operator applied 60 pounds K_2O per acre. About half applied gypsum; 42 percent of this was borated. Only 28 percent sprayed or dusted.

Harvesting methods varied from producer to producer. Most producers harvested both a forage crop and a seed crop but there were some who elected to harvest a seed crop only. Those who did not harvest a forage crop were hoping for an increase in seed harvest and possibly to reduce harvest costs by not having to swath prior to combining. Most producers using the seed-only-harvest method clipped the clover early in the spring to reduce weed infestations. Forage was harvested usually as hay but some producers preferred silage. When hay was harvested operations consisted of mowing and raking or swathing. Three operators used hay crushers. The hay was then baled and hauled. Custom baling was assumed for all hay. When silage was harvested a custom rate was assumed in accordance with Appendix I.

Seed harvest varied also. Most producers swathed prior to

combining but some producers combined the crop while standing. A chemical defoilant was sometimes used in conjunction with this last method. Most of the combines used were self-propelled.

An average of 5.5 hours of labor was expended per acre.

Crimson Clover Seed

Crimson clover seed costs and returns summaries are presented in Table 8.

There were approximately 3,000 acres of crimson clover grown in Marion County which is just a little under the total red clover seed acreage. Crimson clover can be found growing on all of the well drained soils and to a more limited extent on the imperfectly drained ones.

Crimson clover is considered a winter annual and thus the seedbed preparation operations were very similar to fall wheat except that most all producers rolled their fields in addition to theother tillage operations. Seeding methods were varied; two producers seeded with commercial fertilizer spreaders, four broadcast and ten used grain drills. The grain drills probably had small seed attachments. About half of the producers followed the seeding operation with a roller. The average seeding rate per acre was 16 pounds. Eight of the 17 operators fertilized applying an average of 17 pounds N, 53 pounds P_2O_5 and 2 pounds K_2O per acre. Four producers applied borated gypsum at an average rate of 150 pounds. Four producers sprayed; two of these sprays were IPC and two were defoliants.

Table 8. Crimson clover seed costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Newberg	Willamette	Woodburn	Amity	Polk
No. of records	2	1	5	3	2
			(dollars)		
I. Weighted average costs			(per acre)		
A. Machinery					
1. Non-powered	1.67	.96	1.36	1.68	1.75
2. Powered	6.86	3.94	6.37	4.49	5.83
3. Autos and trucks	.59	.36	.22	.31	.22
4. Interest @ 5%	1.41	1.10	1.64	1.25	1.55
Total	10.53	6.36	9.59	7.73	9.35
B. Improvements					
1. Machinery housing	.53	.53	.53	.53	.53
2. Tiling	--	--	.35	2.04	--
3. Interest @ 5%	.30	.30	.67	2.45	.30
Total	.83	.83	1.55	5.02	.83
C. Cash type expenses					
1. Materials					
a. Seed	4.89	3.38	4.16	3.96	6.28
b. Fertilizer	7.23	--	.91	6.09	4.91
c. Chemicals	--	--	3.75	--	--
d. Other (sacks, etc.)	3.48	2.50	2.34	2.86	2.50
2. Labor	7.61	2.43	4.15	4.87	4.50
3. Custom work	31.50	15.00	17.68	19.82	18.00
4. Interest @ 1%	1.01	.47	.66	.75	.73
Total	55.72	23.78	33.65	38.35	36.92
D. Miscellaneous					
1. Farm liab. ins.	.28	.19	.19	.17	.10
2. Social security	.33	--	--	--	--
3. Workmen's comp. ins.	.11	--	.01	--	--
Total	.72	.19	.20	.17	.10
Grand total	67.80	31.16	44.99	51.27	47.20
II. Weighted average returns					
A. Yield (lbs.)	(695)	(500)	(468)	(571)	(500)
B. Price	.21	.21	.21	.21	.21
Gross revenue	145.95	105.00	98.28	119.91	105.00
III. Residual returns	78.15	73.84	53.29	68.64	57.80

a. For a complete description of the individual items see Table 1.

The normal harvesting operations included mowing and swathing and threshing; both pull and self-propelled combines were used. The seed was then cleaned. Many operators had their seed tested and inspected at the time of cleaning.

An average of slightly over four hours of labor was used per acre.

Tiling was indicated on all of the Amity fields and half of the Woodburn fields.

Oats and Common Vetch

Oats and vetch costs and returns summaries are presented in Table 9.

There were about 6,000 acres of oats and vetch produced in Marion County in 1958. Over 90 percent of these were of the common variety; hence, cost and returns are in terms of common vetch. Oats and vetch can be found growing on the same soils as fall oats.

The cultural practices followed in producing oats and vetch are the same as for fall oats. The average seeding rate was 70 pounds of oats and 30 pounds of vetch per acre. Only 17 percent applied fertilizer and the level of application was not very high. Three of the 23 operators dusted with DDT.

Twelve of the 23 operators mowed and swathed prior to threshing; two of these used self-propelled windrowers. After threshing the seed was cleaned and tested. The average percentages of oats, vetch and screenings were 48, 30 and 22, respectively.

Two out of five and four out of nine of the fields on Amity and

Table 9. Oat and common vetch costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Chehalis	Willamette	Woodburn	Amity
No. of records	3[b]	4	9	5
		(dollars) (per acre)		
I. Weighted average costs				
A. Machinery				
1. Non-powered	1.48	1.49	.74	1.37
2. Powered	4.29	2.59	2.34	3.50
3. Autos and trucks	.60	.22	.11	.14
4. Interest @ 5%	1.13	.69	.51	.87
Total	7.50	4.99	3.70	5.88
B. Improvements				
1. Machinery housing	.58	.58	.58	.58
2. Tiling	--	--	.77	1.50
3. Interest @ 5%	.26	.26	1.07	1.85
Total	.84	.84	2.42	3.93
C. Cash type expenses				
1. Materials				
a. Seed	4.14	4.02	4.65	4.43
b. Fertilizer	3.85	.97	1.78	--
c. Chemicals	--	--	.31	--
2. Labor	4.38	3.92	2.75	3.36
3. Custom work	1.49	6.62	9.04	1.72
4. Other[c]	9.71	8.20	9.04	10.25
5. Interest @ 1%	.24	.24	.28	.19
Total	23.81	23.97	27.85	19.95
D. Miscellaneous				
1. Farm liab. ins.	.09	.26	.33	.22
2. Social security	--	.01	--	--
Total	.09	.27	.33	.22
Grand total	32.24	30.07	34.33	29.98
II. Weighted average returns				
A. Yield (cwt.)	(23.7)	(20.0)	(22.0)	(25.0)
B. Price	3.08	3.08	3.08	3.08
Gross revenue	73.00	61.60	67.76	77.00
III. Residual returns	40.76	31.53	33.43	47.02

a. For a complete description of the individual items see Table 1.

b. There was only one Chehalis record; to give more reliability to the Chehalis estimate a Newberg and a Wapato record were added. In this case the Wapato record showed the greatest net return.

c. The "other" in this case refers, in the main, to cleaning, testing and sacks.

Woodburn soils were tiled, respectively.

The amount of labor required per acre would be just slightly higher than for the grains.

Common Ryegrass Seed

Common ryegrass seed costs and returns summaries are presented in Table 10.

Ryegrass was produced primarily on imperfectly and poorly drained soils. Major production in Marion County was located south of Turner and in the Ankeny Bottom area on Dayton and Reed soils. There were approximately 3500 acres of common ryegrass produced in Marion County in 1958.

Cropping systems varied from farm to farm. The common systems indicated were: one, continuous ryegrass with a fallow year between harvests; two, continuous ryegrass with a seed crop every year; and three, alternating oats and ryegrass. Four of the five ryegrass producers surveyed who were farming Dayton soils used the fallow system for a seed crop every other year. On the other hand, all four of the producers surveyed on the Reed soils alternated oats with ryegrass. This seems contrary to reason since Reed soils are considered less well drained than Dayton soils. The one producer on Wapato also alternated grain with ryegrass for a crop each year. In addition, many producers obtained pasture by grazing sheep after the crop had been harvested.

The seedbed preparation operations are the same for ryegrass as for spring grains except that the fields were usually rolled; there

Table 10. Common ryegrass seed costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Wapato	Dayton	Reed
No. of records	1	5	4
		(dollars)	
I. Weighted average costs		(per acre)	
A. Machinery			
1. Non-powered	2.21	1.85	1.61
2. Powered	4.48	5.59	4.32
3. Autos and trucks	.12	.69	.55
4. Interest @ 5%	1.14	1.21	1.05
Total	7.95	9.34	7.53
B. Improvements			
1. Machinery housing	.37	.37	.37
2. Fencing	--	.61	.34
3. Interest @ 5%	.18	.39	.28
Total	.55	1.37	.99
C. Cash type expenses			
1. Materials			
a. Seed	1.12	1.59	2.22
b. Fertilizer	9.00	9.88	8.35
c. Chemicals	2.03	.30	.07
d. Other incl. sacks	2.00	2.28	2.64
2. Labor	8.26	5.63	6.46
3. Custom work	7.76	6.58	9.23
4. Interest @ 1%	.30	.26	.29
Total	30.47	26.52	29.29
D. Miscellaneous			
1. Farm liab. ins.	.10	.08	.11
2. Social security	--	.05	.05
3. Workmen's comp. ins.	--	.13	.14
4. Crop insurance	.10	.12	.14
Total	.20	.38	.43
Grand total	39.17	37.61	38.24
II. Weighted average returns			
A. Seed (lbs.)	(800)	(911)	(1099)
Price	.06	.06	.06
Revenue	48.00	54.66	70.34
B. Pasture (TDN)	--	(149.5)	(42.4)
Price	--	.02	.02
Revenue	--	2.99	.85
Gross revenue	48.00	57.65	71.19
III. Residual returns	8.85	20.06	32.97
Average residual return	8.85	10.69	25.06

a. For a complete description of the individual items see Table 1.

may have been an additional tillage operation since a number of producers springtooth harrowed. Ryegrass was usually seeded with the grain crop where production was alternated. A large percent of the tractors used were diesel powered wheel type.

Most of the plows were three bottom moldboard. Almost without exception the soil was harrowed and/or rolled after seeding.

The average seeding rate was 20 pounds per acre. All of the producers fertilized. The average fertilizer application per acre was 63 pounds N and 8 pounds P_2O_5. Four out of ten sprayed with 2, 4-D.

Harvesting operations included mowing and swathing, threshing and hauling. Two used self-propelled swathers and three used pull-type combines. Three of the 10 producers had their crop custom hauled; the balance used 1.5 and 2-ton trucks. The average miles driven per acre by those who hauled their own seed was 4.7 In addition, an average of three miles per acre was charged against pickup trucks.

None of the fields on which the ryegrass crop was grown was tiled but nearly all operators plowed drainage ditches to remove surface water.

Three out of the five Dayton fields were grazed with the sheep; the average TDN harvested was 279 pounds per acre.

The average residual return represents that portion of the total which, considering several fields, can be expected each year. Since all did not fallow, this does not equal one-half of the total

residual; data were collected only on those fields which were harvested the year of the survey.

Highland Bentgrass Seed

The Highland bentgrass costs and returns summary is presented in Table 11.

There were over 16,000 acres of Highland bentgrass grown in Marion County in 1958. These were located mainly in the Sublimity-Silverton hills.

Highland bentgrass is so well adapted to the hill soils that producers wishing to produce other grass seeds have a difficult time getting rid of it. Many of the producers contacted in this survey indicated there was no cost of establishment because the bentgrass had crowded out other crops. However, there was indication that in order to have a high yielding stand proper establishment was necessary. For this reason, and also due to lack of direct survey information, a standard procedure was estimated for establishing a stand of bentgrass. Seedbed preparation included plowing, disking twice, harrowing twice, field cultivating three times and rolling twice. The field cultivations were for weed control purposes. The bentgrass was seeded during the fall. Six pounds of seed and 3.12 hours of labor per acre were also budgeted. A 15 year production period was assumed. This resulted in a crop investment of $26.74 per acre excluding any land or land tax costs.

The annual production operations, in general, consist of burning, spraying, fertilizing and harvesting. During the late summer,

Table 11. Highland bentgrass costs and returns summary as related to Marion County, Oregon, soils.

Item[a]	Polk
No. of records	13
	(dollars)
I. Weighted average costs	(per acre)
A. Machinery	
1. Non-powered	.86
2. Powered	4.15
3. Autos and trucks	.44
4. Interest @ 5%	.95
Total	6.40
B. Improvements	
1. Machinery housing	.47
2. Interest @ 5%	.22
Total	.69
C. Cash type expenses	
1. Materials	
a. Fertilizer	12.69
b. Chemicals	4.61
c. Other incl. sacks	2.70
2. Labor	3.70
3. Custom work	16.35
4. Farm share utilities	.10
5. Interest @ 1%	.40
Total	40.55
D. Miscellaneous	
1. Farm liab. ins.	.09
2. Social security	.03
3. Workmen's comp. ins.	.09
4. Crop insurance	.14
Total	.35
E. Crop investment	
1. Depreciation	1.78
2. Interest @ 5%	.67
Total	2.45
Grand total	50.44
II. Weighted average returns	
A. Yield (lbs)	(354)
B. Price	.20
Gross revenue	70.90
III. Residual returns	20.46

a. For a complete description of the individual items see Table 1.

after the crop was harvested, the old dead grass was burned. This was usually a joint operation of several farmers who could have stand-by spray equipment available in case the fire got out of control. The average burning labor required was .36 hours per acre. Most of the producers sprayed twice - once with chloro IPC and once with 2, 4-D. All producers fertilized once and 38 percent twice. The average application was 86 pounds N and 19 pounds P_2O_5 per acre.

Only two out of the 13 producers swathed their bentgrass prior to combining it. The most common combine size was 12 feet. Some producers sacked the uncleaned bentgrass seed in the field while others bulk handled it. The average clean-out was 65 percent. A standard cleaning and testing and inspection charge was made for all producers.

The average total labor required was 2.9 hours per acre. The average miles driven for 1.5 and 2-ton trucks was three per acre. In addition, most producers indicated they drove their pickup truck or auto another three miles per acre.

Chewings Fesque Seed

Chewings fesque seed costs and returns summaries are presented in Table 12.

Chewings fesque and Highland bentgrass were the most important grass seeds produced in Marion County. There were over 9,000 acres of chewings fesque in 1958.

Although chewings fesque can be found growing on the terrace soils in the county it is primarily produced in the hills. It

Table 12. Chewings fesque seed costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Woodburn	Amith	Gravelly	Aiken	Polk
No. of records	4	5	1	6	10
			(dollars)		
			(per acre)		
I. Weighted average costs					
A. Machinery					
1. Non-powered	.56	.81	.88	1.39	.89
2. Powered	1.60	3.51	4.60	3.34	3.60
3. Autos and trucks	.09	.30	.28	.40	1.05
4. Interest @ 5%	.39	.76	.95	.85	.90
Total	2.64	5.38	6.71	5.98	6.44
B. Improvements					
1. Machinery housing	.57	.57	.57	.57	.57
2. Tiling	1.65	2.13	--	--	--
3. Interest @ 5%	1.98	2.45	.23	.23	.23
Total	4.20	5.15	.80	.80	.80
C. Cash type expenses					
1. Materials					
a. Fertilizer	18.08	20.54	18.05	18.64	14.71
b. Chemicals	4.92	5.60	4.12	6.04	4.56
c. Other incl. sacks	1.14	1.12	1.06	.86	1.08
2. Labor	2.26	3.27	2.82	3.60	4.34
3. Custom work	35.58	24.56	24.51	17.91	23.38
4. Farm share utilities	--	--	--	.08	.16
5. Interest @ 1%	.62	.55	.51	.47	.48
Total	62.60	55.64	51.07	47.60	48.71
D. Miscellaneous					
1. Farm liab. ins.	.06	.06	.12	.10	.08
2. Social security	--	.04	.08	.03	.04
3. Workmen's comp. ins.	--	.12	.25	.10	.11
4. Crop insurance	.28	.22	.23	.17	.22
Total	.34	.44	.68	.40	.45
E. Crop investment					
1. Depreciation	3.13	2.53	25.00	3.57	2.98
2. Interest @ 5%	.63	.51	5.00	.71	.59
Total	3.76	3.04	30.00	4.28	3.57
Grand total	73.54	69.65	89.26	59.06	57.85[b]
II. Weighted average returns					
A. Yield (lbs.)	(558)	(444)	(457)	(235)	(396)
B. Price	.25	.25	.25	.25	.25
Gross revenue	139.41	110.98	114.25	83.78	99.10
III. Residual returns	65.87	41.33	24.99	24.72	41.25

a. For a complete description of the individual items see Table 1.

b. There were two rental costs included in the total costs; hence, the grand total cost does not add up to the sum of its components.

probably made its inroads on the terrace soils when seed prices were much higher than when this survey was made.

A good seedbed is necessary in establishing chewings fesque. There was sufficient information to calculate individual producer costs. The typical seedbed operations were plowing, disking three to four times, spike and/or springtooth harrowing four to eight times and rolling or floating. Seeding was accomplished with grain-type drills. The typical seeding rates were 10-15 pounds per acre. Most producers fertilized the young crop with N and/or P_2O_5 and indicated they sprayed with 2, 4-D. On the terrace soils many operators seeded their chewings fesque with a grain nurse crop. In this case there was no seedbed preparation charge made. Land and tax charges were made where there was no grain crop for the year required to establish the chewings fesque crop. An eight year life which was based upon survey data, was used in calculating depreciation. Half-life was assumed for investment purposes.

The growing and harvesting operations were very similar to those of Highland bentgrass. The old dead grass was burned after harvest; some producers indicated the straw was first bucked off the field or baled. Most producers sprayed twice - once with IPC and once with 2, 4-D. All except a few fertilized twice applying an average of 103 pounds N and 28 pounds P_2O_5 per acre; the average on the terrace soils was 121 pounds N and 15 pounds P_2O_5 and on the hill soils 91 pounds N and 34 pounds P_2O_5.

About half of the producers swathed prior to combining. Normally,

a self-propelled swather was used. Several of the producers on the fine-textured terrace soils applied a defoilant and then combined the crop in a standing position. Producers harvesting with 12-foot combines averaged 1.4 acres per hour. Acres per hour varied somewhat depending, to some extent, upon whether or not the crop was first swathed. Custom rates were charged for the cleaning and testing of the seed. The average clean-out was 56 percent clean seed.

The average hours of labor per acre required to grow and harvest the crop was 2.7. The average 1.5 or 2-ton truck miles was 2.4 per acre; in addition, about half of the producers indicated they drove their pickup truck or auto an average of two miles per acre.

Four out of five of the Amity fields and all of the Woodburn fields were tiled.

The crop investment cost for gravelly soils was a result of one producer's estimate; there were probably land clearing costs involved. The reason why the grand total costs on Polk does not equal the sum of the individual costs is due to the inclusion of two rental payments which were averaged in at this point.

Red Fesque Seed

The red fesque costs and returns summary is presented in Table 13.

Red fesque was not grown so extensively as chewings fesque. At the time the survey was taken Pennlawn and Illahee strains were just beginning to be recognized by growers; it was too early to establish production estimates. The red fesque here is probably

Table 13. Red fesque and alta fesque seed costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Red fesque Aiken	Alta fesque Amity
No. of records	3	3
	(dollars)	
I. Weighted average costs	(per acre)	
A. Machinery		
1. Non-powered	.90	.80
2. Powered	3.43	4.26
3. Autos and trucks	.36	.58
4. Interest @ 5%	.80	.84
Total	5.49	6.49
B. Improvements		
1. Machinery housing	.57	.57
2. Tiling	--	1.50
3. Fencing	--	.44
4. Interest @ 5%	.23	1.96
Total	.80	4.47
C. Cash type expenses		
1. Materials		
a. Fertilizer	11.50	14.09
b. Chemicals	5.00	6.61
c. Other incl. sacks	1.64	3.48
2. Labor	3.78	4.88
3. Custom work	33.42	15.61
4. Farm share utilities	.11	--
5. Interest @ 1%	.56	.45
Total	56.01	45.12
D. Miscellaneous		
1. Farm liab. ins.	.09	.07
2. Workmen's comp. ins.	.21	.04
3. Social security	.07	.01
4. Crop insurance	.33	.18
Total	.70	.31
E. Crop investment		
1. Depreciation	5.37	4.81
2. Interest @ 5%	1.34	1.24
Total	6.71	6.22
Grand total	69.71	62.61
II. Weighted average returns		
A. Seed yield (lbs.)	(636)	(748)
Price	.26	.125
Revenue	165.41	93.46
B. Pasture (TDN)	--	(293)
Price	--	.020
Revenue	--	5.86
Gross revenue	165.41	99.32
III. Residual returns	95.70	36.71

a. For a complete description of the individual items see Table 1.

the common strain.

Costs of establishment for red fesque are very similar to chewings fesque; in fact, chewings fesque is a variety of red fesque. The average cost per acre, including a land charge and taxes, was $56.63. A ten year life was estimated by the three producers furnishing establishment costs.

The normal production operations were very similar to those of chewings fesque. All three of the producers surveyed sprayed with IPC and 2, 4-D. All three of the producers fertilized once; two fertilized twice. The average fertilizer application per acre was 74 pounds N and 27 pounds P_2O_5.

Two of the three producers indicated they swathed prior to combining. The same seed clean-out was assumed as was determined for chewings fesque. The average 1.5 or 2-ton truck miles driven per acre was 2.2.

The average total labor was 3.2.

Alta Fesque Seed

The alta fesque seed costs and returns summary is presented in Table 13.

The information concerning alta fesque production was very limited. Only one of the survey records indicated establishment costs. On this record the cost amounted to $49.80 per acre including a land and tax charge; this is comparable to similar operations on other grass seeds.

Burning, spraying and harvesting operations were the same as for Highland bentgrass and chewings fesque.

In addition to the seed crop one of the three producers indicated that he also received 1,218 TDN's pasture per acre.

Corn Silage

Silage corn costs and returns summaries are presented in Table 14.

The cultural practices followed in producing silage corn, except for harvest operations, are the same as for field corn. All four of the producers surveyed fertilized. Two producers added commercial fertilizer at an average rate of 60 pounds N and 12 pounds P_2O_5 per acre; one added commercial fertilizer and manure; and one indicated he applied 22 tons of manure. All four producers sprayed - one with pre-emerge and three with 2, 4-D. None of these producers irrigated.

Because of lack of harvest input costs from survey data a rate determined in connection with a forage harvesting study conducted by the Department of Agricultural Economics in 1957 was used. (35, p. 46-49)

The large custom costs include harvest operations as explained above.

Alfalfa

Alfalfa costs and returns summaries are presented in Table 15.

According to determinations made in this study there were between 2,500 and 3,000 acres of alfalfa grown in Marion County in 1958..

Table 14. Corn silage costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Amity	Woodburn
No. of records	2	2
	(dollars) (per acre)	
I. Weighted average costs		
A. Machinery		
1. Non-powered	2.32	1.43
2. Powered	3.71	4.49
3. Autos and trucks	.18	.28
4. Interest @ 5%	.83	.86
Total	7.04	7.05
B. Improvements		
1. Machinery housing	1.05	1.05
2. Tiling	.34	--
3. Interest @ 5%	.91	.55
Total	2.30	1.60
C. Cash type expenses		
1. Materials		
a. Seed	2.83	1.72
b. Fertilizer	9.83	14.72
c. Chemicals	.45	.13
2. Labor	6.43	7.94
3. Custom work	26.88	30.70
4. Interest @ 1%	.46	.55
Total	46.88	55.75
D. Miscellaneous		
1. Farm liab. ins.	.26	.17
2. Social security	--	.10
3. Workmen's comp. ins.	--	.32
Total	.26	.59
Grand total	56.48	64.99
II. Weighted average returns		
A. Yield (tons)	(11.4)	(10.6)
B. Price	8.00	8.00
Gross revenue	91.20	84.80
III. Residual returns	34.72	19.81

a. For a complete description of the individual items see Table 1.

Table 15. Alfalfa costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Chehalis	Newberg	Wapato	Willamette	Woodburn	Amity
No. of records	1	3	1	2	8	3
			(dollars) (per acre)			
I. Weighted average costs						
A. Machinery						
1. Non-powered	3.51	3.40	6.24	4.32	7.01	5.19
2. Powered	2.54	2.63	2.68	2.68	3.93	4.94
3. Autos and trucks	3.00	3.24	--	1.22	2.92	1.86
4. Irrigation	12.88	--	--	6.53	--	3.06
5. Interest @ 5%	3.73	.84	1.53	2.59	1.75	2.28
Total	25.66	10.11	10.45	17.34	15.61	17.33
B. Improvements						
1. Machinery housing	1.51	1.51	1.43	1.51	1.51	1.51
2. Tiling	--	--	2.04	--	1.14	.72
3. Well	.28	--	--	--	--	.19
4. Fencing	--	--	--	--	.27	--
5. Interest @ 5%	1.07	.82	2.94	.82	2.10	1.76
Total	2.86	2.33	6.44	2.33	5.02	4.18
C. Cash type expenses						
1. Fertilizer	7.80	2.07	6.00	5.52	7.08	3.91
2. Labor	21.58	10.32	4.34	9.29	13.42	14.38
3. Custom work	22.50	19.84	32.50	52.87	26.71	28.45
4. Farm share utilities	.71	.71	.71	.71	.71	.71
5. Interest @ 1%	.53	.34	.44	.48	.48	.48
Total	53.12	33.28	43.99	68.87	48.40	47.93
D. Miscellaneous						
1. Farm liab. ins.	.22	.12	.13	.29	.09	.18
2. Social security	.20	.12	--	.04	.17	.18
3. Workmen's comp. ins.	.59	.34	--	.12	.49	.48
Total	1.01	.58	.13	.45	.75	.84
E. Crop investment						
1. Depreciation	--	7.20	11.02	12.35	10.93	10.77
2. Interest @ 5%	--	1.09	1.65	1.88	1.64	1.62
Total	--	8.29	12.67	14.23	12.57	12.39
Grand total	82.65	54.59	73.68	103.22	82.36	82.67
II. Weighted average returns						
A. Yield, hay equiv. (tons)	(5.00)	(4.55)	(5.00)	(5.19)	(5.24)	(5.25)
B. Price	26.00	26.00	26.00	26.00	26.00	26.00
Gross revenue	130.00	118.30	130.00	134.94	136.24	136.50
III. Residual returns	47.35	63.71	56.32	31.72	53.88	53.83

a. For a complete description of individual items see Table 1.

The seedbed preparation operations were about the same as for grain except that there were required additional tillage operations such as harrowing and rolling. Most producers seeded with a grain drill. Seeding rates per acre fluctuated between 10 and 15 pounds. Only two out of the 13 producers who gave establishment cost information indicated they irrigated the new seedlings. Five of the 13 producers surveyed fertilized with P_2O_5, four added boron, three added gypsum, and ten added lime. The average fertilizer application rates per acre were 45 pounds P_2O_5, 30 pounds boron, 150 pounds gypsum and 2.3 tons lime. The average establishment costs, excluding land associated costs, were $30 per acre. Excluding the year required to get the alfalfa established it was estimated to have a productive life of six years.

Annual production costs are associated with fertilizing, irrigating and harvesting. Fifty-eight percent of the producers fertilized with P_2O_5 at an average rate of 47 pounds per acre. Thirty-two percent irrigated; which represents one out of one on Chehalis; none on Newberg, Wapato or Amity; one out of two on Willamette and four out of eight on Woodburn.

Most of the producers harvested three or more times; six of the 19 producers indicated four cuttings. Three producers harvested one cutting as silage and one sold his crop standing. In order to dry their hay many of the producers raked twice, three used hay conditioners. A standard charge was used for harvesting silage which was determined from outside sources due to the lack of survey

cost information. (35, p. 46-49) A commercial rate was charged for all baling. Most of the producers hauled their hay by truck; loading was generally done by hand. In addition to the cost associated with miles driven, a $2 per hour truck charge was made for time spent in the field. The $2 rate was determined from outside sources.

The average total labor used on non-irrigated fields was 9.7 hours per acre and on irrigated fields 12.9.

Tiling was indicated on the one Wapato field, one of the three Amity fields and four of the eight Woodburn fields.

Grass and Clover Forage

Grass and clover forage costs and returns summaries are presented in Table 16.

The determination of costs and returns of forages representative of the various soils was a most difficult problem and one which was not entirely solved. It would have been desirable to separate the hay and silage from the pasture, the irrigated fields from the non-irrigated fields, the legumes from the grasses and the annuals from the perennials but this was not possible. It was found that a given field may be harvested as hay, silage and pasture and that all combinations of grasses and legumes entered into the seed mixture. Therefore, after much deliberation it was decided that with the information available concerning costs and returns and crop distribution, the best that could be done was to separate the irrigated from the non-irrigated crops for costs and returns

Table 16. Grass and clover forage costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Wapato		Willamette		Woodburn		Amity		Dayton		Gravelly		Aiken	Polk
	Dry	Irrigated	Dry	Irrigated	Dry	Irrigated	Dry	Irrigated	Dry	Irrigated	Dry	Irrigated	Dry	Dry
No. of records	4	4	1	2	2	3	5	4	3	2	4	2	14	4
							(dollars per acre)							
I. Weighted average costs														
A. Machinery														
1. Non-powered	.04	.59	.12	.49	1.66	.14	.31	.31	--	.12	.07	.58	.46	.56
2. Powered	.10	1.76	.40	.46	2.76	.15	.45	.58	--	.05	.13	.50	.22	.29
3. Autos and trucks	.17	.14	.24	.22	.14	.24	.06	.08	--	.26	.01	.71	.10	.04
4. Irrigation	--	7.02	--	21.05	--	18.64	--	16.34	--	17.68	--	--	--	--
5. Interest @ 5%	.04	2.11	.12	4.85	.67	5.69	.14	6.52	--	5.25	.03	.17	.11	.11
Total	.37	11.62	.88	27.07	5.23	24.87	.96	23.83	--	23.36	.24	1.96	.89	1.00
B. Improvements														
1. Machinery housing	.15	.07	.23	.43	.23	--	.06	.22	--	--	.04	.60	.06	.09
2. Tiling	--	.10	--	--	--	1.07	.76	1.80	--	--	--	--	--	--
3. Well	--	.05	--	1.23	--	.62	--	1.49	--	2.64	--	1.00	--	--
4. Fencing	1.13	1.44	--	2.07	--	1.33	1.01	2.63	.80	1.64	1.38	2.35	1.54	1.13
5. Interest @ 5%	.45	.64	.11	2.03	.11	2.22	1.16	4.51	.27	.71	.45	1.09	.50	.40
Total	1.73	2.31	.34	5.76	.34	5.24	2.99	10.65	1.07	4.99	1.87	5.04	2.10	1.62
C. Cash type expenses														
1. Fertilizer	1.35	8.32	4.30	6.14	1.68	6.83	.49	6.51	--	--	--	3.44	3.49	4.45
2. Labor	.17	5.83	1.87	11.38	6.07	7.19	1.05	7.31	--	2.93	.27	5.88	.86	1.77
3. Custom work	1.32	3.94	30.60	9.29	9.15	2.71	3.14	3.49	--	2.05	1.80	3.60	1.13	2.52
4. Farm share utilities	.01	.01	.52	.06	.20	.18	.05	.21	--	--	.01	.08	.07	--
5. Interest @ 1%	.03	.18	.37	.26	.17	.17	.05	.18	--	.05	.02	.13	.06	.09
Total	2.88	18.28	37.66	27.13	17.27	17.08	4.78	17.69	--	5.03	2.10	13.13	5.61	8.83
D. Miscellaneous														
1. Farm liab. ins.	.08	.18	.12	.18	.50	.10	.16	.24	.05	.17	.22	.17	.13	.23
2. Social security	--	--	--	.01	--	--	.01	--	--	--	--	.02	--	--
3. Workmen's comp. ins.	.01	.01	--	.04	--	--	.03	--	--	--	--	.06	.01	--
4. Crop insurance	.07	.04	.32	.14	.19	--	.07	.07	--	--	.02	.08	.02	.03
Total	.15	.23	.44	.38	.69	.10	.27	.32	.05	.17	.24	.33	.16	.26
E. Crop investment														
1. Depreciation	4.13	2.13	6.26	4.77	6.07	4.86	3.57	5.44	--	2.90	.86	1.96	2.31	1.17
2. Interest @ 5%	1.03	.53	1.57	1.19	1.52	1.21	.89	1.36	--	.73	.15	.49	.57	.29
Total	5.17	2.66	7.83	5.96	7.59	6.08	4.46	6.79	--	3.63	1.01	2.45	2.88	1.46
Grand total	10.30	35.10	47.15	66.30	31.12	53.37	13.46	59.28	1.12	37.18	5.46	22.91	11.64	13.17
II. Weighted average returns														
A. Yield, hay equiv. (tons)	(1.83)	(1.73)	(3.33)	(3.58)	(1.85)	(3.65)	(1.67)	(3.12	(.49)	(1.77)	(2.20)	(2.04)	(1.57)	(1.13)
B. Price	21.00	22.00	22.00	22.00	21.80	22.00	21.00	22.00	21.00	21.00	21.00	21.00	21.00	21.00
Gross revenue	38.43	38.06	73.26	78.76	40.33	80.30	35.07	68.64	10.29	37.17	46.20	42.84	32.97	23.73
III. Residual returns	28.13	2.96	26.11	12.46	9.21	26.93	21.61	9.36	9.17	--	40.74	19.93	21.33	10.56
Weighted average returns	17.50		13.37		27.58		18.41		8.05		36.81		21.33	10.56

a. For a complete description of individual items see Table 1.

determinations and then to average the net of these two, as they would relate to individual soils, in relation to the acres of each in the survey. The assumption behind this method being that the survey accurately reflected the percentages of the soils in hay and pastures and irrigated and non-irrigated crops.

There was such a variety of combinations entering into the final averages that no attempt will be made to discuss separate input categories; such an attempt would be meaningless. The same general calculating procedures were used as on other crops previously discussed.

Of the four non-irrigated Wapato fields two were straight pasture and two combined hay with pasture; three of the four irrigated fields was pasture and one was a combination of hay and pasture. The non-irrigated Willamette field was oats and peas cut for silage; of the two irrigated fields one was pastured and the others combined hay and pasture. Two of the five Amity fields were pastured, one combined hay and pasture and two were harvested for hay only; three of the irrigated fields were pastured and the other one was harvested for hay and pasture. Both of the non-irrigated Woodburn fields were harvested for hay only; the three irrigated fields were harvested as pasture. All of the Dayton fields were harvested as pasture; the non-irrigated fields were native grasses. Three of the four non-irrigated gravelly soils fields were native grasses harvested as pasture; the other one was harvested as hay. Both of the irrigated gravelly soils fields were sub-irrigated; one was harvested as hay

and pasture and the other was just pastured. Two of the 14 Aiken fields were harvested as hay, two combined hay and pasture and the balance were pastured. Three of the four Polk fields were pastured and the other one was harvested as hay and pasture.

Where hay and pasture were both harvested from a field the hay was generally harvested first. Some of the pure pastures were clipped to remove old dead grasses and weeds; also, some were harrowed to distribute the manure piles.

Silage and pasture yields were converted into hay equivalent on the basis of the estimated TDN's in each.

Strawberries

Strawberry costs and returns summaries are presented in Table 17.

There were over 4,000 acres of strawberries produced in Marion County in 1958. These were grown mainly on the well to moderately well-drained riverbottom and fine-textured terrace soils. There was indication, however, that Amity, an imperfectly drained soil, would produce equally as well as its better drained associates if it were tiled. Very few strawberries were found growing on the gravelly soils. There were several hundred acres produced in the Silverton Hills area north-west of Silver Creek Falls.

The initial investment in strawberries is rather high. For this reason many of the commercial processors loaned money to farmers through contractural arrangements whereby the producer sold only to the processor who held his contract; the loan was retired over the productive life of the strawberries which was normally three years.

Table 17. Strawberry costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Newberg	Willamette	Woodburn	Amity	Polk
No. of records	7	7	15	7	6
			(dollars)		
I. Weighted average costs			(per acre)		
A. Machinery					
1. Non-powered	5.17	4.18	4.68	3.47	4.21
2. Powered	9.99	7.78	7.79	12.96	8.78
3. Autos and trucks	9.53	10.88	9.10	19.33	15.30
4. Irrigation	10.62	8.26	9.79	14.67	23.05
5. Interest @ 5%	5.40	5.60	5.47	8.54	9.86
Total	40.71	36.70	36.83	58.97	61.20
B. Improvements					
1. Machinery housing	2.28	2.28	2.28	2.28	2.28
2. Tiling	--	--	.59	.55	--
3. Well	.09	.17	.83	.74	2.54
4. Carts and carriers	1.50	1.50	1.50	1.50	1.50
5. Interest @ 5%	1.38	1.43	2.76	2.50	3.47
Total	5.25	5.38	7.96	7.57	9.79
C. Cash type expenses					
1. Materials					
a. Fertilizer	25.14	19.84	19.50	24.00	23.64
b. Chemicals	21.53	8.38	15.83	14.67	10.59
2. Labor					
a. Harvest	370.88	490.64	397.50	421.58	386.74
b. All other	48.04	80.63	87.73	95.44	116.67
3. Custom work	12.06	6.17	1.36	9.23	1.06
4. Farm share utilities	1.65	1.65	1.65	1.65	1.65
5. Interest @ 1%	4.79	6.07	5.23	5.67	5.40
Total	484.09	613.38	528.80	572.24	545.75
D. Miscellaneous					
1. Farm liab. ins.	.15	.36	.28	.37	.17
2. Social security	1.92	2.30	2.86	2.12	2.26
3. Workmen's comp. ins.	10.63	13.70	14.09	12.97	11.87
Total	12.70	16.36	17.23	15.46	14.30
E. Crop investment					
1. Depreciation	82.92	94.39	97.25	83.12	82.51
2. Interest @ 5%	6.22	7.06	7.30	6.22	7.39
Total	89.14	101.45	104.55	89.34	89.90
Grand total	631.89	773.27	695.37	743.58	720.94
II. Weighted average returns					
A. Yield (cwt.)	(76.5)	(101.1)	(81.9)	(86.9)	(79.7)
B. Price	12.54	12.54	12.54	12.54	12.54
Gross revenue	958.94	1268.58	1027.75	1090.02	999.95
III. Residual returns	327.05	495.31	332.38	346.44	279.01

a. For a complete description of individual items see Table 1.

The availability of contracts was a major determinant of the total acres of strawberries produced.

The seedbed for strawberries was prepared in much the same way as for other crops previously mentioned which required a smooth, well tilled seedbed. About half of the producers fertilized with a regular ten foot spreader prior to planting; the balance side-dressed shortly after planting in connection with cultivating. Many did both. The average total fertilizer application per acre was 47 pounds N, 135 pounds P_2O_5 and 45 pounds K_2O. The level of N was very near the same on the riverbottom, terrace and hill soils; P_2O_5 was highest on the terrace soils with an average of 148 pounds and lowest on the hill soils with an average of 112 pounds. The level of K_2O was near 55 pounds on the riverbottom and terrace soils but dropped to eight pounds on the hill soils. About half of the producers added aldrin or heptachlor to their fertilizer or applied it separately as a soil sterilant.

The young strawberry plants were planted with a one or two-row strawberry planter; for lack of a better cost estimate this machine was charged at a rental rate of $2 per acre. The average labor required to plant the strawberries was 11.5 hours per acre. Several producers had their strawberries planted on a custom basis. The average planting rate was 7,000 and 9,000 plants on irrigated and non-irrigated acres, respectively.

The young strawberry plants were next cultivated and irrigated where irrigation was practiced. The average number of cultivations

were five; this varied widely on all soils from two to ten. Eighty-six percent of the riverbottom plantings, 73 percent of the terrace plantings and 33 percent of the hill plantings were irrigated; the average number of irrigations was 3.5. In addition to the machine cultivations, most producers reported hand hoeing and weeding; the average was 54 hours per acre but this varied from none to 200.

The average total labor required per acre to establish the strawberries, excluding planting, hoeing and weeding and irrigation labor, was 14 hours.

The establishment period began with the seedbed preparation and ended with the last operation performed during the first fall.

The average total cost per acre for establishing strawberries, excluding a return to the land and land taxes, was $232 on the riverbottom soils, $270 on the terrace soils and $276 on the hill soils. Most producers reported that it took one year to establish strawberries. A few growers indicated a fallow year in addition to the year required for the young plants to develop. The average productive life was estimated at three years on the riverbottom and terrace soils and 3.7 years on the hill soils.

After the crop was established, the first operation after harvest was topping; most producers used a tractor mower but some used beaters, rotary mowers or shredders and one burned the tops with a propane burner. During the interval between harvests, the riverbottom producers averaged rotovating two times, cultivating four times, spraying two times, irrigating four times, and weeding and

hoeing 18 hours. The terrace producers averaged cultivating seven times, spraying and/or dusting three times, for the 76 percent that irrigated, irrigating three times and hoeing and weeding 54 hours. The hill producers averaged cultivating and/or rototilling eight times, spraying and/or dusting three times, for the 50 percent that irrigated, irrigating four times and hoeing and weeding 65 hours. Twenty-one percent of the producers indicated they cut the plants back with a trimmer disk.

Fertilizer was applied by side dressing it during cultivations or through the irrigation water. The average fertilizer application per acre of N, P_2O_5 and K_2O was 41 pounds, 135 pounds and 71 pounds on the riverbottom soils; 46 pounds, 88 pounds and 60 pounds on the terrace soils; and 60 pounds, 115 pounds and 43 pounds on the hill soils, respectively. A summary of the chemicals applied can be found in Appendix J.

The harvest operation was by far the most expensive; costs were nearly proportionate to the yields. Even though there was some indication that the picking cost rate varied with the yield and price received, a flat average was used over all soils. Picking costs did not seem to vary with the soils. Individual producer records were not complete enough in all cases to calculate the cost of picker supervision and yard help; therefore, on the basis of the data available a cost of $.60 per cwt. was determined and used as a standard estimate. Twenty-five percent indicated they hauled pickers. The average miles driven excluding the hauling of pickers

per cwt. of crop harvested was 1.8 for pickup trucks and .9 for 1.5 or 2-ton trucks. The average hauling time, exclusive of hauling pickers, was 8.7, 8.5 and 14.4 hours for the riverbottom, terrace and the hill soils, respectively. This averaged .12 hours per mile for 1.5 and 2-ton trucks, .08 for pickups and .06 for automobiles.

A standard charge per acre was made for carts and carriers.

Two out of seven of the Amity soils and six out of 15 of the Woodburn soils were tiled.

Evergreen Blackberries

Evergreen blackberry costs and returns summaries appear in Table 18.

Even though the total acres of blackberries was small in relation to the county and individual soils, crop costs and returns summaries are presented. It was felt that the information gathered and the importance of this crop to individual farms warranted this inclusion.

There were two investments made in establishing blackberries - the crop was planted and nurtured during the first season and a yard was constructed. Of the 23 survey records collected, only seven had itemized establishment costs; these were on Amity and Woodburn soils. Remarks will be directed toward these seven.

The seedbed was prepared the same as for other crops previously mentioned. Four of the seven fertilized prior to planting applying an average of 45 pounds N, 25 pounds P_2O_5 and 8 pounds K_2O per acre. There were no chemicals applied. Planting was accomplished by hand

Table 18. Evergreen blackberry cost and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Willamette	Woodburn	Amity	Gravelly
No. of records	6	7	7	3
		(dollars)		
I. Weighted average costs		(per acre)		
A. Machinery				
1. Non-powered	6.64	9.70	3.05	8.27
2. Powered	21.71	8.96	9.95	12.68
3. Autos and trucks	12.01	8.30	4.96	10.71
4. Irrigation	8.95	13.80	5.63	8.76
5. Interest @ 5%	7.47	7.67	3.01	5.74
Total	56.78	48.43	26.60	46.16
B. Improvements				
1. Machinery housing	4.39	4.39	4.39	4.39
2. Tiling	--	1.38	1.14	--
3. Well	.46	1.73	.63	--
4. Blackberry yard	16.50	16.50	16.50	16.50
5. Carts and carriers	4.00	4.00	4.00	4.00
6. Interest @ 5%	5.73	8.79	7.18	5.35
Total	31.08	36.79	33.84	30.24
C. Cash type expenses				
1. Materials				
a. Fertilizer	22.28	30.33	12.72	17.75
b. Chemicals	11.78	11.53	10.07	6.66
c. Other, cover crop seed	1.48	--	2.93	--
2. Labor				
a. Harvest	423.27	356.86	279.45	272.28
b. All other	190.38	91.87	114.18	101.20
3. Custom work	2.00	2.98	.59	--
4. Farm share utilities	2.70	1.62	2.06	1.50
5. Interest @ 1%	6.32	4.77	4.08	3.86
Total	660.21	499.99	426.08	403.25
D. Miscellaneous				
1. Farm liab. ins.	.47	.16	.36	.33
2. Social security	1.42	2.86	2.15	2.24
3. Workmen's comp. ins.	9.81	13.21	10.12	10.11
Total	11.70	16.23	12.63	12.68
E. Crop investment costs				
1. Depreciation	13.20	14.45	11.32	12.59
2. Interest @ 5%	3.30	3.62	2.85	3.15
Total	16.50	18.07	14.17	15.74
Grand total	776.27	619.51	513.32	508.07
II. Weighted average returns				
A. Yield (cwt.)	(112.9)	(93.7)	(74.7)	(69.1)
B. Price	9.10	9.10	9.10	9.10
Gross revenue	1027.39	852.67	679.77	628.81
III. Residual returns	251.12	233.16	166.45	120.74

a. For a complete description of individual items see Table 1.

and averaged 16.5 hours per acre. The number of plants varied between 300 and 500 and averaged 435 per acre. The new plants were cultivated an average of four times and in addition, eight hours were spent hoeing and weeding. Labor, other than planting and hoeing and weeding, averaged 19 hours per acre.

The average total cost excluding land charges and land taxes was $103 per acre. The average productive life was estimated at ten years. These average costs and productive life estimates were used as a basis for calculating crop depreciation and investments in all cases where individual estimates were not available.

An average cost for erecting an acre of blackberry yard was determined to be $66. This was based upon 200 posts at $35 each, $25 for wire, $1 for staples and $30 for labor. Yard investments varied considerably due to variations in field size, new and used wire, etc. The average length of life was estimated at 15 years.

Yard repair averaged $8 per year which consisted of replacing posts, tightening wire, etc.

The yard costs established by the above procedures were applied to all blackberry records regardless of soil.

The usual annual production operations consisted of grape hoeing both directions; disking, rotovating or cultivating 5 to 20 times with an average of 10; fertilizing with a short commercial spreader or by hand; spraying or dusting one to four times; irrigating where practiced; hand hoeing; and cutting, training and pinning or tying the canes back. The average per acre fertilizer

application was 5.5 pounds N, 64 pounds P_2O_5 and 44 pounds K_2O for the 80 percent fertilized. Chemicals were applied as indicated in Appendix J. Sixty-two percent irrigated an average of 3.5 times. The average hand labor was 82 hours per acre.

The picking operation was by far the most expensive; a standard rate per cwt. was used for all producers. Supervisory and yard help averaged $.22 per cwt.; this average was used whenever the survey data were not complete in this regard. The average trucking miles per acre was 75 for 1.5 to 2-ton trucks or 117 for pickups when used. The average trucking labor was 11.6 hours per acre.

A standard charge was made for carts and carriers.

Forty-two percent cover cropped which consisted of drilling, in the case of grains or hand seeding, in the case of crimson clover.

The average total hours labor, excluding vine hand work, hoeing and weeding, irrigating, harvesting and hauling, was 28 per acre.

Sixty-two percent of the Amity fields and 43 percent of the Woodburn fields were tiled.

Boysenberries and Loganberries

Boysenberry and loganberry costs and returns summaries appear in Table 19.

The practices followed in producing boysenberries and loganberries are so near the same that they will be grouped for the purposes of this study. These two crops, even when combined, are less extensive than Evergreen blackberries. They were found growing on the same soils, although there was indication that Evergreen

Table 19. Boysenberry and loganberry costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Willamette		Amity		Woodburn	
	Boysens	Logans	Boysens	Logans	Boysens	Logans
No. of records	3	2	4	2	3	1
			(dollars) (per acre)			
I. Weighted average costs						
A. Machinery						
1. Non-powered	1.63	3.49	1.63	2.07	4.27	2.88
2. Powered	6.67	9.01	3.86	10.15	10.21	19.49
3. Autos and trucks	4.30	4.56	5.37	3.73	5.34	2.82
4. Irrigation	--	12.23	5.66	--	3.48	24.32
5. Interest @ 5%	1.67	5.13	2.19	1.82	3.62	11.29
Total	14.27	34.42	18.71	17.77	26.92	60.80
B. Improvements						
1. Machinery housing	4.39	4.39	4.39	4.39	4.39	4.39
2. Tiling	--	--	1.81	2.04	.86	--
3. Well	--	1.14	2.03	--	.12	2.56
4. Berry yard	22.00	22.00	22.00	22.00	22.00	22.00
5. Carts and carriers	4.00	4.00	4.00	4.00	4.00	4.00
6. Interest @ 5%	5.75	6.72	9.83	7.90	6.70	7.83
Total	36.14	38.25	44.06	40.33	38.07	40.78
C. Cash type expenses						
1. Materials						
a. Fertilizer	18.15	29.63	10.62	14.51	5.33	--
b. Chemicals	.75	4.24	1.74	10.31	--	3.20
c. Other	.44	--	--	6.12	3.52	--
2. Labor						
a. Harvest	233.09	278.98	212.29	230.83	214.18	139.28
b. All other	93.27	136.70	93.29	109.68	116.94	97.09
3. Custom work	5.67	--	10.54	--	6.67	--
4. Farm share utilities	3.57	3.57	3.57	3.57	3.57	3.57
5. Interest @ 1%	3.55	4.53	3.32	3.75	3.59	2.43
Total	358.49	457.65	335.37	378.77	362.45	245.57
D. Miscellaneous						
1. Farm liab. ins.	.50	.50	.34	.24	.32	.50
2. Social security	2.48	3.28	1.37	2.66	1.63	1.59
3. Workmen's comp. ins.	10.37	13.41	6.72	10.83	7.76	--
Total	13.35	17.19	8.43	13.73	9.71	2.09
E. Crop investment costs						
1. Depreciation	28.17	28.17	28.62	31.13	24.16	28.67
2. Interest @ 5%	4.25	4.25	4.32	4.69	3.63	4.30
Total	32.42	32.42	32.94	35.82	27.79	32.97
Grand total	454.67	579.93	439.51	486.42	464.94	382.21
II. Weighted average returns						
A. Yield (cwt.)	(56.7)	(79.5)	(50.2)	(63.3)	(52.2)	(35.3)
B. Price	11.30	11.30	11.30	11.30	11.30	11.30
Gross revenue	640.71	898.35	567.26	715.29	589.86	398.89
III. Residual returns	186.04	318.42	127.75	228.87	124.92	16.68
Average returns	275.09		164.52		111.39	

a. For a complete description of the individual items see Table 1.

blackberries were more tolerant to poor drainage conditions.

The establishment procedures were very similar to those of Evergreen blackberries. An average of 20 hours per acre was utilized in planting the new seedlings according to the five complete records in this regard. About 600 plants were planted per acre. Only one of the five fertilized and none irrigated.

Based upon these five records, plus supplementary information from the Evergreen blackberry records, the average cost for establishing young boysenberries or loganberries, exclusive of land charges and land taxes, was $140. This cost per acre was applied to all records as a standard. The average productive life was estimated at six years.

The estimated average cost for erecting an acre of yard was $142; this represented $87.50 for posts, $17 for wire, $1.50 for staples, and $36 for labor. Average life was estimated at ten years. Yard repairs were estimated at $8.

Annual production operations again were similar to those of blackberries. On the average they were grape-hoed both directions, disked, cultivated and/or rotovated an average of seven times, hand hoed or weeded 13 hours and 68 hours were spent in cutting, training and pinning back the canes. Eighty percent fertilized with commercial fertilizer or farm manure. The eight that applied commercial fertilizer averaged 43 pounds N, 64 pounds P_2O_5 and 45 pounds K_2O per acre. The average application per acre for the four applied farm manure was 12 ton. Sixty-seven percent indicated

they applied pesticides; application rates can be found in Appendix J. Only six of the 15 indicated they irrigated.

Standard picking rates were used in accordance with Appendix J. Supervisory and yard help averaged $.52 per cwt.; this was used as a standard where no rates were indicated. The average hauling time was 7.6 hours per acre.

There were only two that indicated they cover cropped.

The average total labor requirement per acre, excluding hand labor, irrigation labor and harvest labor, was 18 hours.

The average residual for boysenberries and loganberries combined was weighted in terms of the number of acres of each crop in the survey.

Sweet Cherries

Sweet cherry cost and returns summaries appear in Table 20.

There were over 1,100 acres of sweet cherries in Marion County. About 40 percent of these were produced in the hills; the balance were located on the fine-textured terrace soils and, to a lesser extent, the riverbottom soils.

The data in the survey were not complete enough to estimate orchard investment costs. Therefore, it was necessary to revert to older departmental studies for an estimate. Since there was not an estimate available for sweet cherries, one was developed from the cost of establishing filberts. (20, p. 38) It was assumed that establishment costs, except tree costs, were the same for cherries as for filberts and that the yearly costs associated

Table 20. Sweet cherry and prune costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Sweet cherries			Prunes	
	Chehalis	Willamette	Aiken	Woodburn	Aiken
No. of records	3[b]	4	4	3	5
			(dollars) (per acre)		
I. Weighted average costs					
A. Machinery					
1. Non-powered	5.12	6.80	5.61	3.70	1.84
2. Powered	7.00	8.67	12.68	10.90	3.92
3. Autos and trucks	5.76	4.90	10.16	3.20	1.23
4. Interest @ 5%	3.07	3.60	5.18	2.80	1.13
Total	20.95	23.97	33.63	20.60	8.12
B. Improvements					
1. Machinery housing	5.02	5.02	5.02	1.46	1.46
2. Yard equipment[c]	6.08	6.08	6.08	--	--
3. Interest @ 5%	4.65	4.65	4.65	.89	.89
Total	15.75	15.75	15.75	2.35	2.35
C. Cash type costs					
1. Materials					
a. Fertilizer	8.62	22.16	21.56	6.84	9.45
b. Chemicals and bees	34.16	25.75	46.83	.70	3.17
c. Miscellaneous	2.24	1.11	.87	3.93	1.64
2. Labor					
a. Harvest	206.45	323.34	229.64	89.99	39.52
b. Other[d]	37.74	46.15	37.06	42.15	17.04
3. Custom work	--	2.07	.92	11.07	6.23
4. Interest @ 1%	2.89	4.21	3.37	1.55	.77
Total	292.10	424.78	340.24	156.23	77.81
D. Miscellaneous					
1. Farm liab. ins.	.15	.35	.44	.21	.14
2. Social security	.98	.31	.43	.90	.64
3. Workmen's comp. ins.	5.75	5.40	4.43	3.57	2.22
Total	6.88	6.06	5.30	4.68	3.00
E. Crop investment costs					
1. Depreciation	25.14	46.90	38.00	46.00	14.28
2. Interest @ 5%	12.62	23.45	18.85	23.00	7.08
Total	37.76	70.34	56.85	69.00	21.36
Grand total	373.44	540.90	451.77	252.86	112.64
II. Weighted average returns					
A. Yield (cwt.)	(46.6)	(74.5)	(52.5)	(116.0)	(42.8)
B. Price	17.50	17.50	17.50	3.23	3.23
Gross revenue	815.50	1303.75	918.75	374.68	138.24
III. Residual returns	442.06	762.85	466.98	121.82	25.60

a. For a complete description of individual items see Table 1.

b. Includes two Chehalis records and one Newberg record; the orchard on Newberg was old enough to be considered depreciated out.

c. Yard equipment consisted of ladders, picking pails, etc.

d. Other labor refers to tillage, pruning and brush removal, hauling and other miscellaneous.

with nurturing the cherry orchard to bearing age were also the same. The first year's cost amounted to $159 per acre and each successive year's cost was $50, excluding land charges and land taxes. Land charges and land taxes were then added to these costs and the total was compounded at 5 percent until an estimated bearing age of eight years was reached. This amounted to $940 on Willamette soil and $760 on Aiken soil. An estimated life of 20 years was used in determing depreciation; investment was based upon half-life.

There are several problems associated with this method of estimating orchard investment costs. Some may argue that producers replace their worn out trees and thus the orchard does not depreciate. This may be so, but the replacement cost should approximate depreciation rates. Others will point out that orchards are still appreciating in value at eight years, which is also very true but the investment must be retired and the depreciation method coincides with loan procedures.

The 20 years life used in estimating depreciation is short of the productive life which was determined from the survey data and other sources. It was felt that the use of a 20 year life allowed a margin of safety for uncertainty. Also, after the trees reach an age where they are no longer productive, they have a negative value in accordance with removal costs; a reserve would need to be put away during the late producing years to accomplish this.

Considering a productive orchard, the annual cultural practices

consisted of disking, harrowing or dragging an average of five times, fertilizing once, spraying and/or dusting six or eight times, pruning and brush removal and perhaps seeding a cover crop. The average fertilizer application per acre was 83 pounds N, 50 pounds P_2O_5 and 20 pounds K_2O on Willamette and 110 pounds N, 111 pounds P_2O_5 and 43 pounds K_2O on Aiken. Spraying was in accordance with Appendix J. An average of 11.5 hours per acre was spent in pruning and brush removal. Only two out of the eight indicated they cover cropped. Three of the eight paid an average of $7.50 per acre for bees.

As with other fruits, the harvest operation was the most expensive. A flat rate was used in determining picking costs. Supervisory and yard help averaged $.35 per cwt. An average of eight hours per acre was spent in hauling activities.

The average amount of labor per acre utilized in tillage operations, applying pesticides and other miscellaneous activities not itemized was 14.

Prunes

Prune costs and returns summaries appear in Table 20.

The same orchard investment was assumed for prunes as was used for sweet cherries. There were three cases in which the orchards were so old that no investment charge was made. Most of the orchards in the study were past their prime.

Tillage operations were the same as for sweet cherries except that there was additional land preparation for harvest operations which consisted of floating two to four times. Two of the three

producers on Woodburn and three of the five on Aiken fertilized with the average applications per acre being 43 pounds N, 22 pounds P_2O_5 and 3 pounds K_2O. One of the producers on Aiken added 1.5 tons of lime. There was an average of two chemical applications. See Appendix J for chemicals used. None of the producers on Woodburn and four of the five on Aiken cover cropped; the common cover crop was crimson clover. An average of 11 hours was spent in pruning and brush removal.

Harvest operations consisted of shaking, picking and hauling. Two of the eight producers used mechanical shakers. There seemed to be a standard custom rate for shaking, picking and hauling. Two of the eight producers used mechanical shakers. There seemed to be a standard custom rate for shaking of about $.25 per cwt. Picking was charged on a piece work basis. Three of the producers reported custom hauling; for two records the data were missing and custom rates were used.

The average amount of labor per acre utilized in tillage operations, applying pesticides, and miscellaneous activities not itemized was ten.

Filberts

Filbert costs and returns summaries appear in Table 21.

There were over 2,200 acres of filberts produced in Marion County in 1958 which illustrates its importance to Marion County farmers. Although there were a few orchards located on Amity soil the majority were produced on the better drained fine-textured

Table 21. Filbert costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Chehalis	Newberg	Willamette	Woodburn	Aiken
No. of records	2	2	4	3	5
			(dollars)		
I. Weighted average costs			(per acre)		
A. Machinery					
1. Non-powered	4.60	3.17	2.89	2.16	2.43
2. Powered	10.10	8.08	4.92	7.36	6.23
3. Autos and trucks	2.09	.76	.75	1.13	2.80
4. Interest @ 5%	3.67	2.45	1.45	1.81	1.86
Total	20.46	14.46	10.01	12.46	13.32
B. Improvements					
1. Machinery housing	1.63	1.63	1.63	1.63	1.63
2. Pruning equipment	.40	.40	.40	.40	.40
3. Interest @ 5%	1.03	1.03	1.03	1.03	1.03
Total	3.06	3.06	3.06	3.06	3.06
C. Cash type expenses					
1. Materials					
a. Fertilizer	11.91	4.48	--	1.57	5.13
b. Chemicals	23.26	7.79	10.39	15.33	6.04
c. Other[b]	3.31	1.19	1.90	3.49	1.65
2. Labor					
a. Harvest[c]	71.57	64.18	63.08	70.63	40.68
b. All other	27.30	23.76	21.51	21.01	25.72
3. Custom, incl. drying	21.25	22.91	15.94	17.01	9.82
4. Farm share utilities	.45	.45	.45	.45	.45
5. Interest @ 1%	1.59	1.25	1.13	1.30	.90
Total	160.64	126.01	114.40	130.79	90.39
D. Miscellaneous					
1. Farm liab. ins.	.06	.18	.18	.37	.34
2. Social security	.95	.56	.19	.36	--
3. Workmen's comp. ins.	3.84	2.55	1.40	1.94	.50
Total	4.85	3.29	1.77	2.67	.84
E. Crop investment					
1. Depreciation	32.45	32.20	30.95	30.40	26.35
2. Interest @ 5%	16.20	16.05	15.45	15.20	13.20
Total	48.65	48.25	46.40	45.60	39.55
Grand total	237.66	195.07	175.64	194.58	147.16
II. Weighted average returns					
A. Yield (cwt.)	(15.7)	(14.28)	(13.62)	(14.0)	(7.98)
B. Price	19.60	19.60	19.60	19.60	19.60
Gross revenue	308.00	279.97	267.00	274.40	156.51
III. Residual return	70.34	84.90	91.36	79.82	9.35

a. For a complete description of individual items see Table 1.

b. Other materials include cover crop seed and harvest sacks.

c. Harvest labor includes picking and yard work.

terrace soils, the well-drained riverbottom soils and the hill soils.

The cost of establishing filberts were determined, like cherries, from an earlier study made by the Department of Agricultural Economics, Oregon State College. (20, p. 38) According to this study, the first year's cost amounted to $165 per acre; the yearly cost thereafter until a production age of six years was reached was $58. To these costs were added land charges and land taxes according to the various soils concerned and the total costs were compounded to establish the total investment at age six years. This amounted to $649, $642, $619, $608 and $527 on Chehalis, Newberg, Willamette, Woodburn and Aiken soils, respectively. For depreciation purposes, a 20 year life was assumed; investment was determined on a half-life basis.

Considering an established orchard, the average tillage operations consisted of disking 6.5 times on the riverbottom soils, 5 times on the terrace soils and 3.5 times on the hill soils; harrowing 2 times on the riverbottom soils, 3 times on the terrace soils and 3.5 times on the hill soils and floating and/or rolling 5 times on the riverbottom soils and 3 times on the terrace and hill soils. Only about half of the producers fertilized applying an average of 81 pounds N per acre; one applied 4 tons chicken manure per acre. All except two producers indicated they dusted or sprayed; those which did averaged 2.5 applications. Chemicals applied were in accordance with Appendix J. An average of 11 hours per acre was

spent in pruning, suckering and brush removal. About half cover cropped.

Picking costs were determined on a standard piece work basis. Yard work, consisting of supervising, raking, weighing, loading, etc., averaged $.50 per cwt. An average of 1.8 hours per acre was spent in hauling activities. Drying costs were determined on a custom basis. Picking and drying costs were determined on a green weight basis. Green weight was 117 percent of dry weight according to survey estimates and other sources; this estimate was based upon usual conditions and does not represent 1958.

An average of eight hours labor per acre was spent in tillage, pesticide application and other miscellaneous activities not itemized above.

Walnuts

Walnut costs and returns summaries appear in Table 22.

There were probably a few more acres of walnuts produced in Marion County than filberts; this is due mainly to the large acreage of one producer. In general, walnuts were found on the same soils as filberts; in many places, they were even on the same farm.

Costs for establishing walnuts, like cherries and filberts, were not available from the survey data; therefore it was necessary to revert to an earlier walnut publication. (21, p. 38) Based on these earlier data a cost of $137 per acre to prepare the seedbed, plant the trees and nurture them through the first year is estimated. Each year thereafter the cost is estimated at $43. To these

Table 22. Walnut costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Newberg	Willamette	Aiken
No. of records	3[b]	3	5
		(dollars) (per acre)	
I. Weighted average costs			
A. Machinery			
1. Non-powered	2.64	4.09	1.83
2. Powered	6.94	5.03	3.80
3. Autos and trucks	1.10	3.26	.59
4. Interest @ 5%	1.76	2.27	1.24
Total	12.64	14.65	7.46
B. Improvements			
1. Machinery housing	.91	.91	.91
2. Tiling	--	--	--
3. Pruning equipment	.40	.40	.40
4. Interest @ 5%	.61	.61	.61
Total	1.92	1.92	1.92
C. Cash type costs			
1. Materials			
a. Fertilizer	11.43	3.99	--
b. Chemicals	4.04	5.05	1.23
c. Other	3.39	6.07	2.70
2. Labor			
a. Harvest	45.69	46.18	22.70
b. All other	18.94	17.15	15.36
3. Custom incl. drying	25.45	24.53	13.29
4. Farm share utilities	.45	.45	.45
5. Interest @ 1%	1.09	1.04	.56
Total	110.48	104.46	56.29
D. Miscellaneous			
1. Farm liab. ins.	.22	.34	.17
2. Social security	.24	--	.19
3. Workmen's comp. ins.	1.32	.59	.88
Total	1.78	.93	1.24
E. Crop investment			
1. Depreciation	46.30	44.00	7.79
2. Interest @ 5%	34.68	32.85	5.82
Total	80.98	76.85	13.61
Grand total	207.80	198.81	80.52
II. Weighted average returns			
A. Yield (cwt.)	(13.22)	(12.74)	(6.52)
B. Price	19.00	19.00	19.00
Gross revenue	251.18	242.11	123.88
III. Residual returns	43.38	43.30	43.36

a. For a complete description of individual items see Table 1.

costs were added land charges and tax costs. A walnut orchard was considered to reach bearing age in 12 years. Thus, these costs were compounded over this period. The orchard investment per acre calculated after this method amounted to $1,382 for Newberg, $1,314 for Willamette, $1,282 for Woodburn, and $1,047 for Aiken. Depreciation was calculated on the basis of a 30 year life and investment was determined on a half-life basis.

Considering an established orchard, the average tillage operations consisted of disking 5 times, harrowing 4 times and floating or rolling 3.5 times. Thirty-eight percent of the producers fertilized applying an average of 70 pounds N; one added boron. Thirty-eight percent sprayed or dusted. Chemical applications are in accordance with Appendix J. Fifty-four percent cover cropped with grain and/or legume. One producer on Chehalis maintained a sod crop. An average of eight hours per acre was spent in pruning and brush removal.

Even though there was some variation in picking rates, a standard rate was used. Supervision and yard work averaged $.40 per cwt. An average of 1.7 hours per acre was spent in hauling activities. Four producers reported custom hauling. Drying was charged at a standard custom rate. Picking and drying rates were on a green weight basis. Green weight was determined to be 154 percent of dry weight considering usual conditions.

An average of eight hours per acre was spent in tillage, pesticide operations and miscellaneous activities not itemized above.

Pole Beans

Pole bean costs and returns summaries appear in Table 23.

Pole beans and sweet corn were by far the most important vegetable crops produced in Marion County. There were over 3,500 acres of beans and these were mostly of the pole type. Pole bean production was concentrated on the riverbottom soils along the North Santiam River and the gravelly terrace soils in the same region. Pole bean yards were found, however, scattered over the better-drained fine-textured terrace soils and the Keiser-Mission Bottom riverbottom soils.

Seedbed preparations were very similar to those of other crops. Cover cropping was practiced by about 85 percent of the producers, and was disked under prior to plowing. The average number of diskings was 3.5 on Chehalis, 3 on Newberg, 4.5 on the fine-textured soils and 3 on the gravelly soils. Most all producers followed the disking with a spike or springtooth harrow. The average number of harrowings in relation to individual soils was 2.5 on Chehalis, 3 on Newberg, 2 on the fine-textured terrace soils and 3 on the gravelly soils. Following the harrowing a large percentage either rolled or floated and some did both; the average number of times for this operation was about 2.

Pole beans were seeded according to specifications of the processing plant with whom the producer held a contract. The processing plant directed the variety to plant, planting time, the amount of fertilizer to apply in many cases, the pesticides to use, etc.

Table 23. Pole bean costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Chehalis	Newberg	Willamette	Woodburn	Amity	Gravelly
No. of records	7	6	2	3	2	15
			(dollars)			
I. Weighted average costs			(per acre)			
A. Machinery						
1. Non-powered	9.38	7.56	8.60	8.09	8.59	7.73
2. Powered	16.35	14.57	11.81	15.71	12.82	18.68
3. Autos and trucks	20.62	12.47	5.38	9.24	13.52	13.11
4. Irrigation	16.70	18.17	13.27	22.66	15.07	18.95
5. Interest @ 5%	9.19	7.26	8.26	12.05	9.46	9.07
Total	72.24	60.03	47.32	67.75	59.46	67.54
B. Improvements						
1. Machinery housing	5.50	5.50	5.50	5.50	5.50	5.50
2. Hired labor housing	7.44	1.17	--	--	--	10.78
3. Tiling	--	--	--	--	1.21	.08
4. Well	.26	.08	.91	1.90	1.11	.07
5. Bean yard	16.72	16.72	16.72	16.72	16.72	16.72
6. Interest @ 5%	6.41	5.50	6.19	6.96	7.51	6.67
Total	36.33	28.97	29.32	31.08	32.05	39.82
C. Cash type expenses						
1. Materials						
a. Fertilizer	46.48	45.61	29.93	39.59	49.01	43.64
b. Chemicals	16.30	15.09	11.26	11.56	13.25	16.54
c. Seed	13.70	10.40	12.85	13.02	14.36	12.94
d. Other[b]	30.48	30.48	30.48	30.48	30.48	30.48
2. Labor						
a. Hand	20.00	20.00	20.00	20.00	20.00	20.00
b. Yard	45.63	45.63	45.63	45.63	45.63	41.65
c. Harvest	616.07	615.23	602.27	619.53	521.51	556.13
d. Other	47.79	35.91	25.15	29.02	28.29	41.27
3. Custom work	3.71	6.57	6.89	7.29	5.21	6.42
4. Farm share utilities	1.68	1.68	1.68	1.68	1.68	1.68
5. Interest @ 1%	8.42	8.26	7.86	8.18	7.30	7.71
Total	850.26	834.86	794.00	825.98	736.72	778.46
D. Miscellaneous						
1. Farm liab. ins.	.33	.16	.14	.23	.19	.27
2. Social security	2.65	2.92	2.69	2.43	2.48	2.28
3. Workmen's comp. ins.	19.04	19.85	18.86	17.84	16.44	17.01
Total	22.02	22.93	21.69	20.50	19.11	19.56
Grand total	980.85	946.79	892.33	945.31	847.34	905.38
II. Weighted average returns						
A. Yield (cwt.)	(198.7)	(198.9)	(192.0)	(196.7)	(166.1)	(179.3)
B. Price	6.25	6.25	6.25	6.25	6.25	6.25
Gross revenue	1241.88	1243.12	1200.00	1229.38	1038.12	1120.62
III. Residual returns	261.03	296.33	307.67	284.07	190.78	215.24

a. For a complete description of individual items see Table 1.

b. Other cash expenses include the bottom cord, twining string, sacks and buckets.

Most seeders were 1 and 2-row. The average seeding rate per acre was 27 pounds. Most producers fertilized with a regular 10-foot spreader prior to planting; those that did not side dressed at planting time and many did both. Almost all producers sprayed with pre-emergence weed spray.

As soon as the beans were up the yard was erected. There were several types of bean yards used. Some producers preferred the permanent type in which the end posts and top wire remain intact; the top wire was raised between production seasons for tillage operations. Some preferred the semi-permanent yard in which only the end posts remain intact. Others completely removed posts and wire each year. Although it was not tested, it is doubtful if there was much difference in the costs associated with these three methods. Since the data were not complete enough to establish yard construction costs in relation to the individual records, a standard cost was estimated, based upon the survey data and assuming a semi-permanent yard. According to these calculations the per acre yard investment amounted to $18 for 30 each end and anchor posts, $36 for 300 pounds of top wire, $18 for 450 supporting stakes and $45 for labor. These figures were based upon a 10 acre square field. It was estimated that the posts would last 6 years, the wire 20 years and the stakes 4 years.

Yard construction consisted of rolling out and stretching the top wire, scattering and driving the support stakes, rolling out the bottom wire or string, stapling these to the support stakes and

putting on the vine string. Either wire or paper cord was used to anchor the twining string at the bottom. Paper cord seemed to be the most popular so it was assumed for all producers. An average of 32 pounds of paper cord was required per acre. An average of 3.5 hours per acre was required to roll out and tighten the top wire, 5.6 hours to scatter and drive the stakes with the use of a stakepress, and 4.2 hours to put on the bottom cord. Staples were charged at $1.50 per acre. The vine string was either put on with a mechanical stringer or by hand on a per pound of string piece work basis. Since there were not too many mechanical stringers in use, hand stringing was assumed for all. An average of 23 pounds of vine string was required per acre.

The cultural practices followed in nurturing the crop until harvest consisted of cultivating; hand hoeing, weeding and training; irrigating; fertilizing and controlling pests. Part of the producers had shop-made cultivator tractors and the other part used small factory tractors. The average number of cultivations was 4 on Chehalis fields, 3 on Newberg, 4 on the fine-textured terrace soils and 3 on the gravelly soils. The data were incomplete in some cases in regard to hand weeding, hoeing and training. After visiting with processing plant representatives and specialists at Oregon State College it was determined that this operation was becoming less time-consuming due to weed sprays, better cultural practices and proper timing of operations. On the basis of recommendations, survey tabulations and non-published data, a flat rate of $20 per acre was

used. Irrigations were frequent but light in comparison to other crops. Producers on Chehalis, Newberg and the fine-textured terrace soils irrigated an average of 7 times while producers on gravelly soils averaged 8 times. Fertilizer was applied during the growing season by side-dressing it or through the water in addition to that which was applied at seeding time. The average total rates per acre were 201 pounds N, 177 pounds P_2O_5 and 57 pounds K_2O on the riverbottom soils; 164 pounds N, 144 pounds P_2O_5 and 50 pounds K_2O on the fine-textured terrace soils; and 157 pounds N, 183 pounds P_2O_5 and 65 pounds K_2O on the gravelly soils. Many producers applied N in the form of calcium cyanimid. It was assumed this also helped control weeds and acted as a soil sterilant besides increasing the pH. Pesticides were applied in accordance with Appendix J. Most of these were applied as dusts; some operators used custom facilities in their dusting operations.

Harvesting was accomplished by hand labor and depended upon the availability of transient labor and /or labor from city centers. Most producers either furnished transient labor housing or ran busses to insure sufficient labor. There was indication that some producers did neither of these and still obtained labor. The location of the bean yard in respect to city centers and transient labor centers dictated the practices necessary to obtain sufficient labor. Picking was on a piece work basis. Average costs for picking supervision and yard help, viz., weighers, checkers, loaders, etc., was estimated on the basis of $.30 per cwt.; this was

calculated on the basis of survey data and checked with unpublished data available in the Department of Agricultural Economics. Beans were picked in buckets and sacks and loaded into tote boxes which were furnished by the processing plant. An average of .4 truck miles and .04 hours labor was used per cwt. in hauling beans. In addition, 110 miles per acre was charged against the family auto or pickup truck during the whole season.

After the beans were harvested the yard was taken down and in most cases a cover crop planted. An average of 5 hours per acre was required to remove the vines, 3.2 hours to remove the top wire, and 5 hours to pull and remove the support stakes.

Prior to planting the cover crop the field was disked an average of 2 times. Common cover crops were rye and crimson clover. Rye was seeded at about 100 pounds per acre and crimson clover at about 15 pounds.

The average labor spent in preparing the seedbed, planting the beans and nurturing them to maturity, putting in the cover crop and in other unaccounted activities amounted to 19 hours per acre on the riverbottom soils, 13 hours on the fine-textured terrace soils and 18 hours on the gravelly soils. This does not include yard construction or removal labor, harvest and hauling labor, hand hoeing and weeding labor and irrigation labor.

For a more complete discussion of cultural practices and recommended inputs see Bibliography 14.

Sweet Corn

Sweet corn cost and returns summaries appear in Table 24.

There were about 4,000 acres of sweet corn produced in Marion County in 1958. These acres were scattered over nearly all of the soils in the survey. The principal production areas, however, were located on the imperfectly or better-drained fine-textured and gravelly terrace soils and on the well-drained riverbottom soils. Sweet corn seemed to be moderately tolerant to poor drainage conditions; two producers reported good yields on Dayton and Reed soils. Like pole beans and strawberries, sweet corn was primarily a contract crop; without a contract a market could not be assured. The processer who held the contract dictated many of the production operations.

Up until harvest time the production of sweet corn was not greatly different from field corn. The seedbed was prepared the same as for field corn and other spring crops. The normal operations were to plow, disk 3 times, harrow 3 times, and roll and/or float 1 to 3 times. To these may be added field cultivating, chiseling or some other operation. There was no measurable difference in the number or kind of operations as related to the several soils.

Sweet corn was planted almost exclusively with 2-row planters. The standard seeding rate was 10 pounds per acre but there was some fluctuation. Fertilizer was applied prior to planting with a regular commercial spreader and/or side dressed at the time of planting.

Table 24. Sweet corn costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Chehalis	Newberg	Willamette	Woodburn	Amity	Gravelly
No. of records	8	6	2	6	3	9
			(dollars) (per acre)			
I. Weighted average costs						
A. Machinery						
1. Non-powered	3.09	3.62	3.06	3.27	2.98	3.60
2. Powered	6.29	7.38	4.78	4.82	6.31	5.94
3. Autos and trucks	3.34	.94	.89	1.23	2.17	1.91
4. Irrigation	6.77	10.32	6.85	12.89	7.74	11.02
5. Interest @ 5%	3.45	5.17	3.53	4.85	3.88	3.05
Total	22.94	27.43	19.11	27.06	23.08	25.52
B. Improvements						
1. Machinery housing	2.15	2.15	2.15	2.15	2.15	2.15
2. Tiling	--	--	--	.53	--	1.21
3. Interest @ 5%	.91	.91	.91	1.47	.91	2.19
Total	3.06	3.06	3.06	4.15	3.06	5.55
C. Cash type costs						
1. Materials						
a. Seed	7.92	4.65	3.85	3.36	3.13	4.27
b. Fertilizer	25.88	21.31	22.39	21.53	21.39	28.67
c. Chemicals	2.49	2.01	--	2.13	3.17	4.01
2. Labor	18.71	23.12	10.59	18.43	13.80	15.69
3. Custom work incl. harvest	23.31	27.09	26.52	35.21	25.08	20.68
4. Farm share utilities	.35	.35	.35	.35	.35	.35
5. Interest @ 1%	.78	.79	.64	.81	.65	.74
Total	78.44	79.32	64.34	81.82	67.57	74.41
D. Miscellaneous						
1. Farm liab. ins.	.22	.27	.07	.13	.16	.14
2. Social security	.22	.20	.22	.25	.17	.16
3. Workmen's comp. ins.	.64	.60	.66	.76	.52	.47
Total	1.08	1.07	.95	1.14	.85	.77
Grand total	105.52	110.88	87.46	114.17	94.56	106.25
II. Weighted average returns						
A. Yield (cwt.)	(128.2)	(105.9)	(107.5)	(130.9)	(109.3)	(103.4)
B. Price	1.26	1.26	1.26	1.26	1.26	1.26
Gross revenue	161.52	133.49	135.45	164.97	137.76	130.28
III. Residual returns	56.00	22.61	47.99	50.80	43.20	24.03

a. For a complete description of individual items see Table 1.

In addition to this, fertilizer was applied during the maturing stages of the corn stalks by side dressing it and/or applying it through the irrigation water. The average total fertilizer application per acre was as follows: 91 pounds N, 83 pounds P_2O_5 and 29 pounds K_2O on the riverbottom soils; 75 pounds N, 82 pounds P_2O_5 and 36 pounds K_2O on the fine-textured terrace soils; and 110 pounds N, 106 pounds P_2O_5 and 35 pounds K_2O on the gravelly terrace soils. Forty-one percent sprayed with pre-emerge weed spray and 2 sprayed with 2, 4-D. Twenty-five percent treated their soil with a soil sterilant; most of this was aldrin but 2 applied toxaphene. There was only one producer who sprayed with DDT. Throughout the growing season the riverbottom producers averaged cultivating 2.6 times and irrigating 3.6 times. These operations averaged 2 and 3.6 on the fine-textured terrace soils and 3.2 and 4.3, respectively, on the gravelly terrace soils. In addition to machine cultivations some of the producers indicated hand hoeing.

Since a large percentage of the producers had their crop custom harvested and, also, due to the lack of other costing information custom harvesting was assumed for all. About half of the producers had their corn custom hauled.

Forty-one percent of the producers indicated there was a cover crop chargable to sweet corn.

In addition to irrigation and harvest hauling labor an average of 10.1, 7.4 and 8.1 hours per acre was utilized on the riverbottom, fine-textured terrace and gravelly terrace soils, respectively.

Considering all vehicles an average of 13 miles per acre was driven for other than harvest purposes.

None of the Amity fields, 2 of the 6 Woodburn fields and 5 of the 7 Clackamas fields were tiled.

Carrots

The carrot costs and returns summary appears in Table 25.

Even though there were less than 400 acres of carrots produced in Marion County its concentration to a limited area on one soil warrants its inclusion in this study. Carrot production was concentrated along the North Santiam River on Newberg soil. The total production was directed, to a large extent, by the availability of a processing plant contract since most carrots were grown for processing.

The seedbed was prepared the same as for other vegetable crops previously mentioned and, hence, will not be restated here. Prior to planting, all producers surveyed fertilized with a 10-foot commercial spreader. All but one producer indicated they applied aldrin as a soil sterilant; aldrin was usually added to the fertilizer. Planting was accomplished with a 4-row seeder. Seeding rates varied between 1.5 and 5 pounds per acre with an average of 3.

Throughout the growing season the carrots were cultivated 3 or 4 times, sprayed for weeds 1 to 3 times with an average of 2 and irrigated an average of 6.5 times. In addition to the machine cultivations and weed sprays all but two producers indicated hand hoeing and weeding; the average hours per acre for those who did

Table 25. Carrot costs and returns summary as related to Marion County, Oregon, soils.

Item[a]	Newberg
No. of records	9
	(dollars)
I. Weighted average costs	(per acre)
A. Machinery	
1. Non-powered	3.70
2. Powered	8.21
3. Autos and trucks	5.03
4. Irrigation	13.08
5. Interest @ 5%	4.87
Total	34.89
B. Improvements	
1. Machinery housing	5.30
2. Well	.07
3. Interest @ 5%	2.27
Total	7.64
C. Cash type expenses	
1. Materials	
a. Fertilizers	30.15
b. Chemicals	21.06
c. Other	5.09
2. Labor	54.12
3. Custom work	
a. Harvest	91.01
b. Hauling	66.24
4. Farm share utilities	.16
5. Interest @ 1%	2.68
Total	270.50
D. Miscellaneous	
1. Farm liab. ins.	.21
2. Social security	.86
3. Workmen's comp. ins.	2.46
Total	3.52
Grand total	316.55
II. Weighted average returns	
A. Yield (cwt.)	(618.9)
B. Price	.95
Gross revenue	587.95
III. Residual returns	271.40

a. For a complete description of individual items see Table 1.

was 33. The weed sprays were either stove oil or cleaning solvent or both; the average total application was 93 gallons per acre. Single applications varied between 40 and 60 gallons. In addition to the fertilization at or just prior to seeding there were additional side dressings and water applications. The average total fertilizer applied per acre was 66 pounds N, 104 pounds P_2O_5 and 50 pounds K_2O; in addition, one-third applied borax and one manured.

Harvest operations consisted of beating off the tops, digging and hauling. Since there were relatively few producers contacted harvest machinery operation costs were considered unreliable and a custom rate was assumed for all producers. About half of the producers had their carrots custom hauled.

One-third of the producers indicated a cover crop should be charged against the carrot enterprise.

The average total labor utilized, exclusive of irrigation and hand labor, was 13.5 hours per acre for the five that had their carrots custom hauled and 23.4 for the four that hauled their own. Those producers who hauled their own crops drove their 1.5 or 2-ton trucks an average of 123 miles per acre. There were approximately 10 miles driven per acre in various farm vehicles in other than harvest activities.

Onions

The onion costs and returns summary appears in Table 26.

Onion production was restricted to Lake Labish muck and peat soils; these are the most valuable agricultural soils in the entire

Table 26. Onion costs and returns summary as related to Marion County, Oregon, soils.

Item[a]	Labish
No. of records	9
	(dollars) (per acre)
I. Weighted average costs	
A. Machinery	
1. Non-powered	13.83
2. Powered	22.54
3. Autos and trucks	15.17
4. Irrigation	11.17
5. Interest @ 5%	10.96
Total	73.68
B. Improvements	
1. Onion and machinery housing	42.70
2. Tiling	6.60
3. Tote boxes	23.39
4. Interest @ 5%	25.43
Total	98.12
C. Cash type costs	
1. Materials	
a. Fertilizer	38.40
b. Chemicals	15.66
c. Other	8.94
2. Labor	139.08
3. Custom work	10.54
4. Farm share utilities	.74
5. Interest @ 1%	2.13
Total	215.49
D. Miscellaneous	
1. Farm liab. ins.	.41
2. Social security	.64
3. Workmen's comp. ins.	6.68
4. Crop insurance	3.35
Total	11.08
Grand total	398.37
II. Weighted average returns	
A. Yield (cwt.)	(353.1)
B. Price	1.90
Gross revenue	670.89
III. Residual returns	272.52

a. For a complete description of the individual items see Table 1.

county. There were about 900 acres of onions produced; these were of the Oregon Yellow Globe Danver variety. Onions are so well adapted to these muck and peat soils that few other crops were grown on them.

Seedbed preparations started early in the year and continued over a relatively long period. These operations consisted of plowing once, disking 2 to 4 times, and harrowing, rolling, floating and/or leveling an average of 10 times with a range of from 6 to 17.

All of the producers surveyed fertilized with a regular commercial spreader prior to planting. In addition, there were probably other fertilizer applications made early in the production season either by banding it or applying it through the irrigation water. The average total fertilizer application per acre was 67 pounds N, 125 pounds P_2O_5 and 200 pounds K_2O; other minor elements were indicated. Seeding was accomplished with a 4 to 8-row planter. The average seeding rate per acre was 3.1 pounds. At the same time the seed was planted, a formaldehyde solution was trickled into the plant rows to control smut. Approximately two gallons of formaldehyde was used per acre.

Six of the nine producers sprayed with a pre-emergence weed spray; the usual chemical used for this was Randox. In addition to chemical control an average of 57 hours per acre was spent in hand weeding and hoeing. Other cultural practices consisted of cultivating an average of 4 times, dusting 6 to 10 times with DDT and for the five of the nine that irrigated, irrigating an average

of six times. Irrigation varied greatly; the amount of water applied seemed to depend a great deal upon the location of the onion field in respect to the lake bed. The lake bed is naturally sub-irrigated.

Harvest operations began with pulling the onions and placing them in windrows. A 4-row pulling machine was used for this operation.. The onions were then left to cure. Frequently it was necessary to turn the onions during the curing stage. The pulling machine was used to turn the onions. The onions were then loaded onto 1.5 or 2-ton trucks by a pickup machine and hauled to the storage shed. Most operators loaded their onions into tote boxes for hauling and storage purposes. Some, however, were still using a more permanent type of storage bin. A warehouse tractor was used to move the boxes in and out of the warehouse. The hauling-in operation required two or three trucks. Operators usually hired the use of additional trucks or exchanged with neighbors. The onions were stored until a sale could be negotiated. The storage shed was ventilated by electric fans in most cases. Hauling-out took place through the fall and winter months.

Not many years prior to initiating this study onion producers also topped their onions prior to selling them but this operation has been assumed by the purchaser.

Onions were mostly sold through onion brokerage firms.

Following harvest operations, the onion fields were leveled two or three times and in about half of the cases planted to a cover crop. Rye was the most popular cover crop but crimson clover was also used.

All of the Labish soil was tiled. Part of this was with wood box tile and part with regular clay tile. This aspect is discussed in considerable detail in Appendix G.

Mint

Mint costs and returns summaries appear in Table 27.

There were about 4,500 acres of mint produced in Marion County in 1958. The principle production area was located in the southwest corner on Chehalis and Newberg soils. The mint produced in this area was pepermint.

Mint is propagated by stolons. As with crops previously mentioned, the first requirement in establishing a mint crop was to prepare a good seedbed. After the seedbed was properly prepared the new stolons were planted. Planting was accomplished either by dropping the stolons into cultivator rows by hand, which was the most popular method in the past, or by a planting machine. Planting by machine is a more recent method requiring a planting machine, a tractor and about four men. One producer indicated he scattered the stolons with a manure spreader. The stolons were obtained from a vigorous, healthy mint stand. The standard method for purchasing the stolons was to purchase them by the field or portion of a field. For example, a producer wishing to establish a mint field goes to a mint producer who has a healthy stand of mint and purchases stolons from him by the acre or field. The average cost per acre for stolons was about $15. The average total cost for establishing a mint field, which includes stolons and planting, was near $60

Table 27. Mint costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Chehalis	Newberg
No. of records	8	8
	(dollars) (per acre)	
I. Weighted average costs		
A. Machinery		
1. Non-powered	3.03	2.06
2. Powered	3.36	2.76
3. Autos and trucks	1.44	1.44
4. Irrigation	14.69	15.37
5. Interest @ 5%	3.66	3.56
Total	26.18	25.19
B. Improvements		
1. Machinery housing	1.05	1.05
2. Well	.58	.43
3. Interest @ 5%	.74	.72
Total	2.37	2.20
C. Cash type expenses		
1. Materials		
a. Fertilizer	35.10	37.12
b. Chemicals and other	4.29	7.82
2. Labor		
a. Hand	15.34	8.62
b. Other	19.32	28.47
3. Custom	.45	.29
4. Harvest	59.89	57.85
5. Farm share of utilities	.41	.26
6. Interest @ 1%	1.35	1.40
Total	136.15	141.83
D. Miscellaneous		
1. Farm liab. ins.	.16	.15
2. Social security	.65	.43
3. Workmen's comp. ins.	1.95	1.28
Total	2.76	1.86
E. Crop investment		
1. Depreciation	10.00	10.00
2. Interest @ 5%	1.50	1.50
Total	11.50	11.50
Grand total	178.96	182.58
II. Weighted average returns		
A. Yield (lbs.)	(59.9)	(57.8)
B. Price	5.00	5.00
Gross revenue	299.50	289.00
III. Residual returns	120.54	106.42

a. For a complete description of individual items see Table 1.

per acre. The machine method would probably cost a little less than this. Once established a mint field will last indefinitely if properly cared for and if not affected by pecticides. However, due to market uncertainty and the ever present hazard of insects and disease a six year life was assumed. This conforms with estimates made by specialists working with mint. A half-life investment was assumed.

Even though mint propagates itself each year the seedbed was prepared in much the same manner as for other crops. Fields were plowed late in the fall with a regular two or three-bottom moldboard plow. As soon as the soil could be worked in the spring, producers followed with tillage impliments. Most producers either disked or springtooth harrowed 1 to 3 times. All producers spiketooth harrowed several times; the number seemed to depend to some degree upon the number of diskings or springtooth harrowings and upon the soil. Producers on Chehalis spiketooth harrowed an average of 4 times while those on Newberg averaged only 3. In addition, about two-thirds rotary hoed. Again, producers on Chehalis went over their field more times than producers on Newberg; the average being 4 and 2, respectively. This is not necessarily evidence that Chehalis soils need more tillage than Newberg soils because many of these operations were for weed control purposes; weeds were controlled by tillage until the plants were several inches tall.

Fertilizer was applied with regular commercial spreaders and through the irrigation water; about 40 percent made two applications

with spreaders. The average total fertilizer applied per acre was 175 pounds N and 61 pounds P_2O_5. Only two of the 16 producers applied K_2O. Two applied lime.

Chemicals were applied to control weeds and insects. Almost all producers sprayed with a pre-emergence weed spray; either dinitro amine or diuron was used -- two producers used both. One producer sprayed for perennial grasses with dalapon. Troublesome insects were controlled by applying wettable DDT through the irrigation water or dusting it. Not all applied DDT and those that did applied it only once.

Hand hoeing and weeding was used to control weeds in addition to the tillage operations and chemical weed sprays; an average of 13 hours per acre was required. Some operators used geese for this purpose.

Mint had a high consumption of water. The average number of applications were only 5.3 but these were of long duration.

Harvest operations consisted of mowing, raking and chopping; hauling to the still; distilling of the mint oil; and returning the waste to the fields. Since there was a standard custom rate established for these operations it was assumed for all producers.

The average total labor required, exclusive of hand hoeing and weeding, irrigating and harvesting, was seven hours per acre.

Sugar Beet Seed

Sugar beet seed costs and returns summaries appear in Table 28.

Sugar beet seed was not produced extensively on any one soil

Table 28. Sugar beet seed costs and returns summaries as related to Marion County, Oregon, soils.

Item[a]	Chehalis	Willamette	Amity	Sifton
No. of records	1	2[b]	2	1
		(dollars) (per acre)		
I. Weighted average costs				
A. Machinery				
1. Non-powered		3.24	3.47	1.83
2. Powered		4.82	8.33	5.81
3. Autos and trucks		1.85	1.30	2.18
4. Irrigation		22.98	21.70	13.86
5. Interest @ 5%		6.60	8.71	4.61
Total		39.49	43.51	28.29
B. Improvements				
1. Machinery housing		2.58	2.58	2.58
2. Tiling		.89	2.04	2.04
3. Well		.93	--	3.00
4. Interest @ 5%		3.32	3.65	3.65
Total		7.72	8.27	11.27
C. Cash type costs				
1. Materials				
a. Fertilizer		33.26	23.34	49.15
b. Chemicals		7.16	--	5.06
c. Seed		1.73	1.29	1.80
2. Labor		23.33	29.56	26.70
3. Custom work				
a. Harvest		46.99	38.85	42.12
b. Seed cleaning		18.83	18.75	19.52
c. Other		17.31	24.21	30.20
4. Ins. and social security		.20	.95	.11
5. Interest @ 1%		1.49	1.37	1.75
Total		150.30	138.32	176.41
Grand total	187.30	197.51	190.10	215.89
II. Weighted average returns				
A. Yield (lbs.)	(3000)	(2512)	(2500)	(2603)
B. Price	.15	.15	.15	.15
Gross revenue	450.00	376.80	375.00	390.45
III. Residual returns	262.70	179.29	184.90	174.56
Average yearly residual	131.35	89.64	92.45	87.28

a. For a complete description of individual items see Table 1.

b. The two records represented here as Willamette soil include one Woodburn record.

but was found scattered over the better drained terrace and river-bottom soils.

Sugar beet seed is a biennual crop, usually requiring two years for a harvest.

The standard practices followed by the limited number of sugar beet seed producers in this survey were to plow during the first spring, fallow during the summer, plant in late summer, nurture the crop over the winter, spring and early summer and harvest during the late summer of the second year. There was indication, however, that some producers were able to harvest another crop the year the sugar beets were planted. A fallow, however, seemed to be preferred.

The seedbed was prepared in much the same manner as for other field crops. Due to the fallow year additional field cultivations were performed. Three of the five producers interviewed fertilized prior to planting. Seeding was accomplished with 2 or 4-row planters which were either rented or furnished by the company holding the seed contract. The average seeding rate was 12 pounds per acre.

The practices followed in nurturing the crop from planting to harvest included cultivating an average of 4 times, hand hoeing an average of 3 hours, spraying with IPC, dusting with DDT and irrigating an average of 6 times including fertilizer applications. The average total fertilizer applied per acre was 241 pounds N plus about 30 pounds actual boron. Not all producers indicated they sprayed, dusted, or hoed.

Harvest operations included cutting and windrowing, combining, hauling and cleaning the seed. Custom rates were used for all of these operations except hauling. An average of 10 miles per acre was charged against the crop for the use of 1.5 or 2-ton trucks and about the same for other farm vehicles.

The average labor required per acre, exclusive of irrigation, handwork and harvest, amounted to nine hours.

The Woodburn field and both the Amity fields were tiled.

The Chehalis cost figure presented was estimated by the producer and was not built up by budget procedures as were the other estimates.

The total residual returns were divided as if the net had been evenly distributed over the two year period.

Hops

Hop costs and returns summaries appear in Table 29.

There were approximately 3,500 acres of hops produced in Marion County in 1958. These were mostly of the Fuggles variety but there were also some clusters produced. The discussion which follows will have reference to Fuggles. Hops were found growing principally on the riverbottom and better drained terrace soils, although, there were large acreages on Amity. All of the Amity and Woodburn fields used for hop production were tiled which illustrates the need for good drainage conditions.

In establishing the hop yard there were two related investments made. First, there was an investment made in establishing the hops

Table 29. Hop costs and returns as related to Marion County, Oregon, soils.

Item[a]	Chehalis	Newberg	Woodburn	Amity
No. of records	7	3	8	5
		(dollars) (per acre)		
I. Weighted average costs				
A. Machinery				
1. Non-powered	5.47	5.14	6.21	4.55
2. Powered	14.03	7.99	11.29	8.70
3. Autos and trucks	4.74	4.74	4.74	4.74
4. Irrigation incl. well	9.38	11.67	5.94	10.35
5. Interest @ 5%	5.26	5.44	4.16	6.73
Total	38.88	34.98	32.25	35.07
B. Improvements				
1. Machinery housing	2.23	2.23	2.23	2.23
2. Tiling	--	--	1.33	2.04
3. Interest @5%	.76	.76	2.17	2.91
Total	2.99	2.99	5.73	7.18
C. Cash type expenses				
1. Materials				
a. Fertilizer	24.09	29.06	32.92	34.39
b. Chemicals	14.28	4.18	6.44	2.72
c. Other[b]	40.20	38.48	38.15	37.16
2. Labor				
a. Hand	65.00	65.00	65.00	65.00
b. Other	28.69	22.29	24.85	19.46
3. Custom work	2.02	4.87	1.96	2.10
4. Harvesting	240.37	225.60	215.12	199.16
5. Storage and inspection	4.43	4.16	3.97	3.67
6. Farm share utilities	.44	--	.23	.05
7. Interest @ 1%	1.79	1.68	1.73	1.65
Total	421.31	395.32	390.37	365.36
D. Miscellaneous				
1. Farm liab. ins.	.13	.07	.09	.16
2. Social security	2.42	2.40	2.59	2.25
3. Workmen's comp. ins.	7.24	7.19	7.78	6.75
Total	9.79	9.66	10.46	9.16
E. Crop and yard investments				
1. Crop depreciation	11.39	11.39	10.48	10.36
2. Yard dep. and repair	35.00	35.00	35.00	35.00
3. Interest @ 5%	10.32	10.32	10.04	10.01
Total	56.71	56.71	55.52	55.37
Grand total	529.68	499.66	494.33	472.14
II. Weighted average returns				
A. Yield (cwt.)	(13.6)	(12.8)	(12.2)	(11.3)
B. Price	43.42	43.42	43.42	43.42
Gross revenue	592.14	555.78	529.96	490.65
III. Residual returns	62.46	56.12	35.63	18.51

a. For a complete description of individual items see Table 1.

b. Other materials include vine string, pegs and burlap.

themselves and second, the cost of erecting the trellis. The annual cost of production information was rather complete but the information relative to the establishment of the hop yard was somewhat sketchy. Therefore, a standard estimate was built up in reference to the information available. There were eight records with establishment cost information.

The first requirement in establishing hops, like with other crops, was a good seedbed. Typical operations necessary to do this consisted of plowing once, disking twice, harrowing twice, and rolling once. The fields were then fertilized with N, P_2O_5 and K_2O at the per acre rates approximating 24, 80 and 80 pounds, respectively.

Following seedbed preparations the field was staked off and the plants planted. These were hand operations requiring approximately 5 and 25 hours per acre, respectively. The average number of plants required per acre was 700. Usually the new crop was then irrigated once, cultivated eight times and perhaps hand hoed.

The above establishment costs totaled $100.36 per acre excluding the costs for tile on Amity and Woodburn soils, trellising, land charges and land taxes. It took one year to establish the crop and it was estimated to have an expected productive life of 12 years. This latter figure corresponds to the estimated life of the trellis providing it was allowed to depreciate. Like with other perennial crops, a half-life was assumed.

The component per acre costs arrived at for the construction of the trellis were: 55 support posts at $1.75 each, eight anchor

posts at $2.00 each, $100.00 for cross wire, $30.00 for hand labor and $30.00 for machine use for a total of $276.00. Annual repair was estimated at 3 hours man labor, 1.5 hours machine work and 3 posts for a total of $11.85. As referred to earlier, the average life of the trellis was estimated to be about 12 years. These were all high-wire trellises.

In reference to an established crop, the annual tillage operations usually began with plowing in the early spring. This was generally accomplished with a hop or sloper plow but common moldboard plows were also used. Following the plow most producers disked 2 or more times with an average of 4. Only about half followed the disk with a harrow. In addition to these initial operations the field was cultivated an average of 15 times; regular field-type cultivators were generally used but included under this heading were diggers, drags, hoeing machines and rollers. All impliments of necessity were about five feet wide. Since the plantings were square tillage opperations were both directions.

Fertilizing usually began in late winter with hand applications of calcium cyanamid. Following this there was usually a general application of a fertilizer mix applied with a 5-foot spreader. Other fertilizer applications included additional hand and spreader applications, anhydrous ammonia applications and water applications. It was not unusual for a producer to make four or five total applications of fertilizer. The per acre average total rate was 104 pounds N, 89 pounds P_2O_5 and 62 pounds K_2O. In addition

there were four producers who applied manure and two who applied lime.

Soon after plowing and disking the yards were strung with coir yarn. This was fastened from the trellis wires to pegs driven by each plant. An average of 140 pounds of string and 680 pegs per acre was required. As the hops matured the other hand operations required included training and retraining, stripping and suckering, arching and tieing and hoeing. A common figure quoted for this total hand work was $65.00 per acre. This common custom rate was used as a standard cost for all producers.

All but two producers indicated they irrigated. In these two cases the yields were noticeably lower. The average number of applications was only three but these were of long duration.

All producers either sprayed or dusted an average of 2.3 times; a few more sprayed than dusted. The common chemicals applied are listed in Appendix J.

Harvest operations included picking, drying, baling and hauling. There were two common methods of picking. In one case the picking machine was stationary and the vines were cut and hauled to the picker. In the other case the picking machine was portable and went into the fields, thus saving the hauling operation. Since there were many who harvested on a custom basis a custom rate was assumed for all producers including hauling the hop bales to market or storage. It cost an average of $2.00 per bale (200 pounds) for string and burlap. In addition there was an inspection fee of $.35

per bale and generally a storage fee of $.30 per bale.

Following harvest operations the vines were disposed of and usually a cover crop planted. Prior to planting the cover crop the field was disked or cultivated; four of the producers subsoiled. Common cover crops were small grains, vetch and crimson clover.

During the winter it was usually necessary to do some replanting. The average number of replants required per acre was eight.

Total annual labor per acre, excluding trellis repair, harvest, hand labor and irrigation labor, averaged 16 hours. An average of 19 miles for large trucks and 58 miles for pickups was charged against each acre of hops.

Economic Productivity Ratings

It is now possible to bring together the information presented in the last two chapters and the economic results of the soil-crop combinations presented in this chapter into single economic productivity ratings for each soil. The productivity ratings for the county as a whole appear in Tables 30, 31, 32, and 33. The aggregation method used in adding together the net returns for the individual crops was the same as that presented in the physical productivity section; i.e., the net returns of the individual crops were weighted in terms of their distribution on the soils being considered. The aggregate net returns for each soil was obtained by

Table 30. Economic productivity ratings of the riverbottom soils in Marion County -- Chehalis = 100.

Soil	Chehalis		Newberg		Wapato	
Crop	Distribution	Net returns	Distribution	Net returns	Distribution	Net returns
	%	$	%	$	%	$
Fall wheat	8.7	56.65	2.6	55.41	3.1	43.28
Spring wheat	--	--	1.5	32.81	1.2	42.54
Fall oats	--	--	--	--	1.9	24.02
Spring oats	--	--	2.6	30.53	8.2	16.32
Spring barley	17.9	41.48	13.8	44.34	31.3	32.30
Field corn	3.9	50.07[a]	1.7	50.07[a]	--	--
Red clover seed	2.9	101.80[a]	3.3	101.80[a]	--	--
Crimson clover seed	2.0	78.15[b]	1.3	78.15	--	--
Oats and vetch	3.8	40.76[a]	--	--	--	--
Common ryegrass	--	--	--	--	7.0	8.85
Alfalfa forage	3.1	130.00	3.9	118.30	1.9	130.00
Other cultivated forage	2.6	24.51[c]	5.7	24.51[c]	34.4	17.50
Strawberries	3.3	327.05[b]	7.0	327.05	--	--
Walnuts	--	--	3.3	43.38	--	--
Filberts	2.9	70.34	2.6	84.90	--	--
Pole beans	6.0	261.03	6.5	296.33	--	--
Sweet corn	7.1	56.00	3.1	22.61	--	--
Carrots	--	--	4.1	271.40	--	--
Mint	12.1	120.54	16.3	106.42	--	--
Sugar beet seed	1.8	90.29[d]	--	--	--	--
Hops	7.7	62.46	4.0	56.12	--	--
Fallow	2.4	0.00	3.1	0.00	2.0	0.00
	88.2		86.4		91.0	
Aggregate net returns		89.02		112.61		25.13
Productivity rating	100.0		126.5		28.2	

a. This is a combined net return for Chehalis and Newberg soils.

b. The same net return was used for Chehalis as was developed for Newberg.

c. This is a combined net return for Willamette and Woodburn soils.

d. This is a combined net return for Willamette, Amity and Sifton.

Table 31. Economic productivity ratings of the terrace soils in Marion County -- Chehalis = 100.

Crop / Soil	Willamette		Woodburn		Amity		Dayton		Gravelly	
	Distribution	Net returns	Distribution	Net returns	Distribution	Net returns	Distribution	Net returns	Distribution	Net returns
	%	$	%	$	%	$	%	$	%	$
Fall wheat	15.0	57.88	16.6	54.59	12.3	48.92	--	--	4.9	38.52
Spring wheat	3.0	42.10	1.0	32.17	0.9	34.06	--	--	2.3	37.78
Fall oats	3.8	19.77	6.1	29.49	9.0	16.63	--	--	--	--
Spring oats	2.9	11.23	2.3	19.05	6.7	34.01	5.0	18.32	7.8	9.66
Spring barley	18.6	35.43	13.9	33.19	16.6	24.04	2.5	13.42	12.8	26.65
Field corn	6.0	16.35	2.7	13.41	1.7	14.86	--	--	4.5	14.00[a]
Red clover seed	5.5	38.15	4.7	77.95	2.8	85.36	--	--	--	--
Crimson clover seed	3.9	73.84	3.3	68.64	2.8	53.29	--	--	3.6	61.00[a]
Oats and vetch	6.9	31.53	5.8	33.43	5.4	47.02	--	--	--	--
Common ryegrass	--	--	--	--	--	--	35.8	10.69	--	--
Chewings fesque	--	--	2.2	65.87	6.7	41.33	--	--	4.5	24.99
Alta fesque	--	--	--	--	1.1	36.71	--	--	--	--
Corn silage	--	--	--	--	1.2	31.54[b]	--	--	--	--
Alfalfa forage	1.0	134.94	1.8	136.24	1.5	136.50	--	--	--	--
Other cultivated forage	6.1	13.37	7.6	27.58	8.1	18.41	24.0	8.05	21.8	36.81
Strawberries	5.7	495.31	4.3	332.38	1.6	346.44	--	--	--	--
Evergreen blackberries	0.5	251.12	0.9	233.16	0.5	166.45	--	--	2.1	120.74
Boysen and loganberries	1.1	275.09	--	--	--	--	--	--	--	--
Sweet cherries	2.6	762.85	--	--	--	--	--	--	--	--
Walnuts	1.2	43.30	--	--	--	--	--	--	--	--
Filberts	1.1	91.36	1.1	79.82	--	--	--	--	--	--
Pole beans	2.0	307.67	1.1	284.07	0.9	190.78	--	--	10.6	215.24
Sweet corn	2.9	47.99	4.8	50.80	1.7	43.20	--	--	12.5	24.03
Sugar beet seed	1.5	89.64	--	--	1.1	92.45	--	--	--	--
Hops	--	--	7.0	35.63	2.8	18.51	--	--	--	--
Fallow	0.6	0.00	1.0	0.00	1.9	0.00	2.5	0.00	2.0	0.00
	91.9		88.1		87.3		69.8		89.4	
Aggregate net returns		98.67		63.29		43.77		10.04		52.85
Productivity rating	110.8		71.1		49.2		11.3		59.4	

a. There was no estimate for crimson clover on the gravelly soils; this net return represents the combined net return for Woodburn and Amity.

b. The net return for Amity is a combined net for Woodburn and Amity.

Table 32. Economic productivity ratings of the hill soils in Marion County - Chehalis = 100.

Crop	Soils: Aiken Distribution %	Aiken Net returns $	Polk Distribution %	Polk Net returns $
Fall wheat	4.7	19.61	1.6	30.15
Spring wheat	1.4	24.53	--	--
Fall oats	3.9	10.22	2.9	13.50
Spring oats	5.3	13.21	4.3	7.02
Spring barley	1.9	17.82	--	--
Crimson clover seed	--	--	1.1	57.80
Highland bentgrass	1.8	20.46[a]	36.4	20.46
Chewings fesque	7.1	24.72	27.7	41.25
C. red fesque	15.5	95.70	--	--
Cultivated forage	26.6	21.33	8.6	10.56
Strawberries	--	--	1.5	279.01
Sweet cherries	1.4	466.98	--	--
Prunes	3.9	25.60	--	--
Walnuts	8.2	43.36	--	--
Filberts	2.4	9.35	--	--
Fallow	7.0	0.00	8.6	0.00
	91.1		92.7	
Aggregate net returns		40.23		27.81
Productivity rating	45.2		31.2	

a. The same net return was assumed for Aiken as was established for Polk.

Table 33. Economic productivity rating for Labish soil, Marion County - Chehalis = 100.

Soil	Labish	
Crop	Distribution	Net returns
	%	$
Onions	96.8	272.52
Productivity rating	306.1	

dividing the sum of the products by the total percent of the soil area accounted for by the crops presented. This assumes that the returns to the crops not presented would average about the same as the crops presented. The economic rating for each soil was obtained by comparing the aggregate net returns on each soil with the return on Chehalis. This was the same comparison which was made in developing the physical productivity ratings.

As was pointed out in the Chapter VII, the soil rating established for the county may not represent any individual area of the county and thus not fulfil its objective. This is illustrated in regards to Chehalis, Newberg and Willamette soils in Tables 34, 35 and 36, respectively. It will be observed that for both Chehalis and Newberg soils the North Santiam riverbottom area was used more intensively and thus had the highest aggregate net returns. The North Marion County riverbottom area was not used any more intensively than were the terrace soils in the same area and thus rate more nearly like Woodburn and Amity. The same thing can be seen by comparing Willamette in the Howell Prairie area with Willamette in the Mt. Angel SCS District. In this case the high returns associated with the berry crops influenced greatly the productivity rating.

Before leaving the economic productivity section something needs to be said about the reliability of the individual ratings established. Emphasis was upon developing techniques; Marion County served as the guinea pig. There are lessons to be learned not only

Table 34. Comparative economic productivity ratings of Chehalis soil in three geographic area of Marion County - Chehalis = 100.[b]

Area	North Santiam River		Keiser-Mission Bottom		North Marion County	
Crop	Distribution	Net returns	Distribution	Net returns	Distribution	Net returns
	%	$	%	$	%	$
Fall wheat	0.2	56.53	14.7	56.53	12.3	56.53
Spring wheat	1.5	32.81[a]	--	--	--	--
Spring oats	--	--	--	--	2.3	30.53
Spring barley	17.4	41.48	18.6	41.48	20.4	41.48
Field corn	1.9	50.07	2.2	50.07	13.8	50.07
Red clover seed	3.8	101.80	2.8	101.80	2.3	101.80
Crimson clover seed	0.1	78.15	4.5	78.15	--	--
Oats and vetch	--	--	3.5	40.76	14.2	40.76
Alfalfa forage	1.3	130.00	3.1	130.00	7.2	130.00
Other cultivated forage	3.2	24.51	0.7	24.51	5.9	24.51
Strawberries	1.7	327.05	5.8	327.05	--	--
Sweet cherries	--	--	1.3	442.06	--	--
Filberts	3.2	70.34	3.8	70.34	--	--
Pole beans	10.4	261.03	3.1	261.03	--	--
Sweet corn	6.9	56.00	7.8	56.00	--	--
Mint	31.5	120.54	--	--	--	--
Sugar beet seed	2.4	90.29	2.2	90.29	---	---
Hops	7.1	62.46	6.3	62.46	11.7	62.46
Fallow	0.9	0.00	1.8	0.00	--	--
	93.5		82.2		90.1	
Aggregate net returns		105.44		91.11		54.68
Productivity rating	118.4		102.3		61.4	

a. The net return for spring wheat on Chehalis is taken from the Newberg net return.

b. The Chehalis aggregate return here referred to is the one for the whole county.

Table 35. Comparative economic productivity ratings of Newberg soil in three geographic areas of Marion County - Chehalis = 100.

Area	North Santiam River		Keiser-Mission Bottom		North Marion County	
Crop	Distribution	Net returns	Distribution	Net returns	Distribution	Net returns
	%	$	%	$	%	$
Fall wheat	1.1	55.41	4.3	55.41	6.2	55.41
Spring wheat	4.2	32.81	3.0	32.81	--	--
Spring oats	--	--	--	--	3.6	30.53
Spring barley	12.8	44.34	16.2	44.34	13.5	44.34
Field corn	--	--	--	--	8.9	50.07
Red clover seed	--	--	5.3	101.80	8.3	101.80
Crimson clover seed	2.0	78.15	1.0	78.15	--	--
Oats and vetch	1.8	40.76	--	--	--	--
Alfalfa forage	4.9	118.30	1.5	118.30	6.0	118.30
Other cultivated forage	2.1	24.51	.9	24.51	23.5	24.51
Strawberries	4.7	327.05	14.5	327.05	--	--
Sweet cherries	--	--	3.0	442.06	--	--
Walnuts	--	--	9.4	43.38	--	--
Filberts	--	--	4.9	84.90	--	--
Pole beans	11.1	296.33	1.0	296.33	--	--
Sweet corn	4.5	22.61	2.1	22.61	1.8	22.61
Carrots	8.7	271.40	--	--	--	--
Mint	34.7	106.42	1.5	106.42	--	--
Sugar beet seed	.6	90.29	1.0	90.29	1.5	90.29
Hops	--	--	8.9	56.12	5.3	56.12
Fallow	2.2	0.00	3.2	0.00	5.7	0.00
Aggregate net return		132.73		120.6		48.66
Productivity rating	149.1		135.5		54.7	

Table 36. Comparative economic productivity ratins of Williamette soil in two geographic areas of Marion County - Chehalis = 100.

Area	Howell Prairie		Mt. Angel SCS District	
Crop	Distribution	Net returns	Distribution	Net returns
	%	$	%	$
Fall wheat	14.5	57.88	8.1	57.88
Spring wheat	--	--	3.9	42.10
Fall oats	5.5	19.77	1.4	19.77
Spring oats	3.6	11.23	3.9	11.23
Spring barley	22.5	35.43	8.9	35.43
Field corn	9.2	16.35	0.9	16.35
Red clover seed	6.4	38.15	3.1	38.15
Crimson clover seed	1.8	73.84	--	--
Oats and vetch seed	5.1	31.53	6.3	31.53
Alfalfa forage	1.0	134.94	1.9	134.94
Other cultivated forage	4.5	13.37	13.7	13.37
Strawberries	5.1	495.31	11.4	495.31
Evergreen blackberries	--	--	2.8	251.12
Boysen and loganberries	--	--	7.0	275.09
Sweet cherries	1.8	762.85	--	--
Walnuts	0.8	43.30	3.0	43.30
Filberts	0.8	91.36	3.6	91.36
Pole beans	2.2	307.67	1.7	307.67
Sweet corn	4.1	47.99	1.5	47.99
Sugar beet seed	0.6	89.64	--	--
Fallow	3.2	0.00	--	--
	92.7		83.1	
Aggregate net returns		82.02		133.81
Productivity rating	92.1		105.3	

from the successes but also the failures of the study. The techniques will be appraised in the following chapter but some of the limitations of the methods used will be pointed out here; a few have already been mentioned in regard to crop yields and distributions.

The soil-crop yields were extremely shallow and in many cases cannot be relied upon as being representative. In the first place, there were not always enough observations to give reliable estimates. It was for this reason that the number of observations were always indicated. Secondly, the usual yields were arrived at from farmers' estimates. According to official data published by the Oregon Crop and Livestock Reporting Service the average usual yields estimated by the farmers participating in this study are above, by a considerable amount, the average yield for the past 10 or more years. This would not be serious if the net returns derived from an acre of each crop were approximately the same but this was not the case. For example, an error of similar magnitude on strawberries and barley would not result in the same amount of change in their gross or net returns.

Not only were yields and, hence, gross revenue subject to error due to the lack of observations but so also were enterprise costs. In many cases the observations were so few as to render the individual estimates unreliable.

These errors were not unexpected. The survey technique dictated that where individual soil-crop combinations were not to be compared

that three observations would be sufficient. The assumption underlying this procedure was that the net returns of crops to individual soils were similar. This was not the case and, hence, the errors were not compensating in all cases.

For the above reasons, and perhaps others, some of the individual net returns are not to be interpreted as being representative of soil-crop economic productivity. Also, the overall soil ratings are, perhaps, not in the correct relationship with one another in all cases. This should not be interpreted as meaning the ratings and the individual crop costs and returns data are wholly in error and have no value. Rather than being exact measures of productivity they are indicators of productivity which, in some cases, need further study.

CHAPTER X

Summary and Conclusions

Summary

This study was dedicated to the development of techniques for characterizing Oregon soils for agricultural purposes in terms of physical and economic productivities. Physical productivity was defined in terms of crop yields associated with individual soils. It was measured by comparing yields of a single crop or group of crops produced on one soil with those of another. Physical productivity indices were used to rate one soil against another. Economic productivity was defined in terms of net returns to the soil from a single crop or group of crops. It was measured by comparing the net returns of the single crop or group of crops of one soil with those of another. Economic productivity indices were used to rate one soil against another.

Physical and economic productivity ratings find their greatest use among tax assessors, real estate agents and farm loan agencies. Farmers are the focal point of all three of these agencies and thus, they too find relevant areas of use. Behind the productivity indices are input-output data relating to soil-crop combinations which have many uses including farm management decisions, resource allocation and aiding technical advisors to agriculture.

Marion County, Oregon,was selected as the source of data for testing and developing techniques which may be useful to Oregon as

a whole. Marion County was important agriculturally, had a complex of soils and crops and recent air photo soils maps were available.

Information concerning soils and crops was collected by a farm survey. The number of records necessary on each soil to properly characterize it was determined on the basis of three enterprise records for each soil-crop combination where it was not desirable to test individual crop productivity differences as related to individual soils and eight or more enterprise records where it was desirable to test differences. The crops for which enterprise information was to be obtained were determined from interviews and meetings with county agents and soil and crop specialists plus agricultural census and crop production data. The crops which were most important to the county relative to individual soils were the ones which were selected for more complete information. Crop enterprise information was further limited in terms of the number of soils in the survey. Ten of the most important soil series or highly related soil associations were selected. Further, it was decided that any one farmer should not furnish more than three enterprise records. On the basis of the above considerations the sample size was chosen.

The sampling method used was a random point system. It was designed to give random points over the entire county in order to estimate the distribution of individual soils and also to furnish a sufficient number of farms to give the desired number of soil-crop enterprise records. The county ASC office in Salem furnished

information which related the random points to farms and farmers.

There were three sets of data obtained in the farm survey; one, land use data relating soils to crops and crop yields; two, physical input data on selected soil-crop combinations; and three, general costing and pricing data necessary in extending the physical yields and inputs in calculating net returns. Crop yields were for 1958 and "usual". Usual yields were interpreted to mean those which occurred most frequently. The interviewer selected the soil-crop combinations for which enterprise cost of production information was obtained on the basis of the sample desired.

At the completion of the farm survey 419 farmers had been interviewed and records had been collected. The 419 farms accounted for about 19 percent of the total area in farms in Marion County. The 686 enterprise records covered 30 crops.

The farm survey records furnished information for four general tabulations of which the latter three were essential for the calculation of economic productivity; one, a tabulation was made of the distribution of soils in the county by geographic area including the portion of each soil cultivated, irrigated and tiled; two, a tabulation was made of the distribution of crops on soils; three, a tabulation was made of crop yields as they related to individual soil series; and four, tabulations were made of physical inputs and output costs as related soil-crop combinations contained on the enterprise records.

It was determined that the soils selected to be rated in terms

of productivities accounted for about 90 percent of the land area in Marion County and included all of the major crops.

Essential to both physical and economic productivity indices are crop distributions as related to the individual soils. Crop distribution became the weighting factor when aggregating crop yields or net returns on individual soils to determine the soil's productivity index. Crop distributions were determined by tabulating the total acres of each crop found on each soil and then converting these into percentages of the total cultivated acres. Only those crops which occupied at least one percent of the total soil area were thought important enough to include when determining soil productivities; these accounted for over 85 percent of the total cultivated acres on all soils studied.

It was concluded after studying crop yields and net returns that the distribution of crops on the various soils was often the most important criterian of the level of productivity. For many crops yields and net returns were very near the same level over the soils on which these crops were produced. Productivity differences then became dependant upon the intensiveness or extensiveness of the crops produced on the several soils. In Marion County there was a broad selection of crops available for farmers to choose from. The choice which the farmers made in respect to land use relative to intensive or extensive crops caused the productivity of some soils to rise above others. There was indication that some soils were not being used as intensively as their characteristics would warrant.

Distribution of crops on soils over the county may be very misleading in regard to geographic locations of the same soil series. This was probably due to differences in market opportunity, the continuance of existing cropping patterns, the availability of irrigation water, etc. For this reason distribution patterns were calculated for three soils in different geographic locations. On all three soils the geographic location affected greatly the cropping patterns.

Due to the multiplicity and irregularity of crops relating to the individual soils it was not possible to rate the soils in terms of the yields from a few selected crops. The method arrived at compared soils whose crops were most nearly the same. These single soil comparisons were then transferred back in terms of one soil chosen as a base. The individual comparisons were treated as if they accounted for 100 percent of the soil area. The assumption behind this method being that those crops compared would account appropriately for those having no base for comparison. The physical productivities calculated after this manner are presented in Table 1.

Table 1. Physical productivities of selected soils or soil associations. Marion County, Oregon, 1958. Chehalis = 100.

Soil[a]	Physical Productivity Index
Chehalis	100
Newberg	97
Wapato	81
Willamette	94
Woodburn	94
Amity	90
Dayton	51
Gravelly	81
Polk	76
Aiken	71

a. There were no means for comparing Labish.

Statistical comparisons of crop yields as they related to the several soil series revealed that yield differences, in general, were significant only where there were wide separations between soils due to drainage, elevation, precipitation, texture or other such reasons. The physical productivities did not measure the differences due to the range of crops and thus the most important element was overlooked.

Economic productivities were calculated in much the same manner as were physical productivities except that net returns were substituted for yields. In the calculation of economic productivities the ratings of individual soils were separate from all other soils. The aggregate net return of a crop depended entirely upon the individual net returns and their corresponding distribution percentages. Again it was assumed that those crops accounting for less than one

percent of the soil area would not greatly change the final rating by their inclusion.

Input costs used in calculating total costs and investments were based upon conditions as they existed when the farm survey was taken except that usual operations were asked for. Prices received were based on a 1954-58 adjusted average.

The soil productivities and productivity indices appear in Table 2.

Table 2. Economic productivities and productivity indices of selected soils or soil associations in Marion County, Oregon, 1958. Chehalis = 100.

Soil	Economic Productivity[a]	Economic Productivity Index
	$	
Chehalis	89.02	100
Newberg	112.61	126
Wapato	25.13	28
Willamette	98.67	111
Woodburn	63.29	71
Amity	43.77	49
Dayton	10.04	11
Gravelly	52.85	59
Labish	272.52	306
Aiken	40.23	45
Polk	27.81	31

a. The aggregate returns here presented include land taxes. This should not affect the index provided taxes were proportionate to economic productivity.

In order to illustrate the importance of the location factor in rating soils by their productivity separate productivities were calculated for Chehalis, Newberg and Willamette soil series in

different geographic areas. The results appear in Tables 3 and 4.

Table 3. Affects of geographic location on the productivity indices of Chehalis and Newberg soils.

Soils	Total County	North Santiam River	Keiser-Mission Bottom	North Marion County
Chehalis	100.0	118.4	102.3	61.4
Newberg	125.6	149.1	135.5	54.7

Table 4. Affects of geographic location on the productivity index of Willamette soil

Soil	Total County	Howell Prairie	Mt. Angel SCS District
Willamette	110.8	92.1	150.3

Conclusions

There are several areas of improvement and limitation which should be pointed out in regards to the techniques and procedures used in deriving the physical and economic productivities in this project. In the first place, the yield data were not complete enough in regards to the individual soil-crop combinations. In many cases there were only two or three observations available from which to estimate soil-crop yields. The assumption was made prior to gathering the data that sampling errors associated with yields from the individual soil-crop combinations, when only three observations were made, would be reduced in the aggregation process. This assumption was

partially in error because the distribution of crops on soils did not give the same weighting to each of the soil-crops. In the calculation of economic productivities this assumption error was compounded due to the large differences in gross returns to the soil-crop combinations. The conclusion can logically be drawn that eight or more yield observations per soil-crop combination would have returned more reliable results. Eight observations were the number considered necessary when individual soil-crop combinations were to be compared statistically.

Second, average usual yields arrived at through the survey method were above, by a considerable degree, the official average yield reported by the Oregon Crop and Livestock Reporting Service. (31) This bias would not be serious providing it was approximately the same on all crops and if the crops were equally distributed on the individual soils. These two conditions were not fulfilled, however. The biases were expanded when yields were converted into gross returns. This can be seen easily by considering gross returns which ranged between $30 and $600 per acre on the same soil series and crop distribution percentages which ranged between one and 30 percent.

Since official yields are not available for the separate soils it would seem necessary to rely upon farmers to differentiate yields between soils.

Perhaps this could be accomplished by using farmer estimated yields relative to individual soil-crop combinations to differentiate

the official average crop yields between the several soils. An alternative to this plan would be to work through an informed group consisting of leading farmers, county agents, processing plant field men, etc.

Third, the conclusion is drawn that individual soil-crop net returns could be made more representative if, in addition to conclusions one and two above, the crop cost of production estimates were built from a general set of data without reference to individual soils, rather than being developed for each soil-crop combination. The method used in this study resulted in relatively large total numbers of enterprise records for most crops but when distributed to the individual soils the number of observations are few. It was observed that for most production operations there were greater differences associated with management than with soils. There are, however, certain areas of costs which are associated with soils which should be accounted for. Tiling cost is an example of a soil associated cost. The use of this method would result in the collection of basic information concerning each crop which could be expanded by budget techniques to individual soil-crop combinations. There are some costs associated with certain crop yields which would change from one soil-crop combination to the same crop on another soil which would also need to be accounted for. This general budget method would reduce the collection of data greatly and also result in greater reliability in the net returns estimates.

The fourth, and probably the most important, conclusion made

is that soil productivities measured after the manner used in this study did not measure productive potential. The productivity ratings presented in this report measured only existent cropping patterns and practices. Present cropping patterns are tied to existent crop contracts, community and historical influences, lack of knowledge, present tax structure, government programs and the like. Perhaps a more realistic measure of soil productivity would measure productive potential disregarding many of these patterns and practices. The measurement of productive potential would involve market predictions and the budgeting of land use relative to a selected set of crops used in the rating process.

The suggested procedure for obtaining information for each soil relative to the intensity of land use, cropping patterns which would maintain fertility, differentiated yields relative to soils, costs peculiar to specific crops etc. would be to work through a group or groups of selected farmers, county agents, processing plant field men, extension specialists etc. After this basic data had been gathered budget techniques could be used in determining the relative productivity of the individual soils.

If soil productivities are to be developed which represent present production patterns then it would seem that the number of crops entering into the process might be further reduced. This reduction could take place within areas of similar crops. For example, in reference to this study, fall wheat and spring barley may be used to represent all of the grain crops, chewings fesque and

Highland bentgrass all of the grass seed crops, etc. where these crops were prominent. The conclusion is that only the most important crops, in terms of distribution, need enter into the soil rating process. Each of these crops would be used to represent the category of crops to which they belonged. In connection with the other conclusions this method would further reduce the data gathering and processing time and would not greatly change the results. This procedure would reduce the influence of crops which were of minor importance relative to the total soil area under condition of market expansion resulting in high price.

The last observation to be made concerns cropping patterns associated with geographic location. This has already been referred to but needs further stressing. When productivities are calculated to represent present conditions then more attention must be given to the geographic differences of crop production on individual soils at the series level. In this case, the same soil series in different geographic locations needs to be considered separately as if it were a different soil.

Farm Survey Schedule

OREGON STATE COLLEGE
CORVALLIS, OREGON

Department of Agricultural Economics — Department of Soils

MARION COUNTY SOIL PRODUCTIVITY STUDY -- 1958

Soil series(1 _____ Sample number _____

Corrected to(2 _____ Enumerator _____

Operator _____ Address _____ Date _____

Age _____ Operational organization(3 _____

Owner _____ Address _____

Farm numbers(4	_____	_____	_____
Owned or rented	_____	_____	_____
Cropland(5	_____	_____	_____
Orchard	_____	_____	_____
Native pasture(6	_____	_____	_____
Farmstead	_____	_____	_____
Other(7	_____	_____	_____
Total acres	_____	_____	_____
Years farmed	_____	_____	_____

1) Refers to the series which was chosen in the sample.
2) Refers to the series found if different from the sample point.
3) Single operator, father and son, partnership, etc.
4) Refers to ACP number on all properties operated if available.
5) Land that is or has been cultivated and seeded or similarly improved.
6) Land which has not been cultivated but is suitable for grazing purposes; does not include woods or other lands not suitable for grazing purposes.
7) Fencelines, roadways, ponds, woodland, and all other land which does not enter into one of the above categories.

Interviewer's comments: _____

CROPPING HISTORY(1

Farm no.	Field no.	Soil(2	Acres	1958 crop or use	Previous crops or use(3 1957	1956	1955	1954	Yield per acre	usual yield	Irri-gated	Tiled

1) List the complete use for all areas of the farm including non-cropland. Field sketch should show all areas of farm by soil and field number.
2) List soils in order of importance. Include only those soils accounting for more than 10 percent of the field.
3) Include the 1957 and 1958 use for all fields; include 1958-54 use for crops where enterprise records are taken.

Range of Yields for Enterprise Crop Records

Crop	High	Frequency	Low	Frequency	Crop	High	Frequency	Low	Frequency

Notes and comments:

ANNUAL CROP ENTERPRISE RECORD

Soil_____

Crop_____Variety_____Acres_____Previous crop_____Field no._____

Cropping plan or rotation_____

Preparation of Seedbed

Operation[1]	Date	Machine size	Power equipment[2]	No. times over	Time once over	Acres per hour	Total hours	Hours labor required[4] Operator	Family[3]	Hired	Notes

Seeding and Growing Crop

Harvesting Crop

Cover Crop

1) Record all operations, including custom work. The details of custom work will come elsewhere.
2) In "Notes" column indicate the number of miles trucks were driven.
3) In "Notes" column indicate ages, sex, etc., in relation to family labor.
4) Include in labor required time spent in supervising, directing custom operations, etc.

Number of miles driven in support of crop: Auto_____Truck_____Pickup_____

Seed, Fertilizer, Chemicals, Etc.

Materials used	Amount Unit	Per acre	Total	Cost Per unit	Total
Seed					
Fertilizer (1					
Chemicals (2					
Water (3					
Other (4					

1) Include manure. Report fertilizer analysis rather than brand names.
2) Sprays, dusts, etc., for control of weeds, disease, insects, etc.
3) Use only where water is purchased; pumping water will be taken care of elsewhere.
4) Include sacks, wire, string, stakes, etc., which are applied directly to crop.

Custom or Piece Work Hired

Operation	Unit	No. of units	Cost per unit	Total cost	Usual custom work hired

Additional Operator or Family Time(1

Nature of work	by whom	Time required

1) Include time spent in arranging for workers and custom operations, obtaining materials, attending crop meetings, keeping records, etc.

Labor Expense

Operator		Family		Hired	
Operation	$ Rate	Operation	$ Rate	Operation	$ Rate

Disposition of Crop(1

Method of disposition	Grade	Unit	No.of units	Prices received at farm 1958	1957	1956	1955	1954	Total received 1958

1) Include home consumption

COST OF ESTABLISHING PERENNIAL CROP

Soil_____ Crop_____ Field no._____ Acres_____ Date_____

Operations	Machine size	Power equip.	Total hours	Hours labor	Rate labor	Total cost	Notes
1. Land preparation(1							
2. Seedbed prep.							
3. Planting							
4. Planting to bear(2							
5. Per Acre Cost up to Bearing							

6. Materials used	Unit	Units per acre	Cost per unit	Cost per acre	Notes
Fert., etc.					
Seed or plants					

7. Total cost per acre to bearing(3 _____
8. Less revenue during growing period(4 _____
9. Total net cost to bearing _____
10. Years of productive life _____
11. ANNUAL DEPRECIATION cost for stand _____

12. If purchased, price per acre paid _____
13. Less value of bare land _____
14. Value of stand _____
15. Remaining life at purchase _____
16. ANNUAL DEPRECIATION cost for stand _____

17. Years needed to establish stand and bring to bearing age_____

1) Leveling or other land work needed for this crop.
2) May be performed over a period of more than one year.
3) If farmer has cost of establishing stand already computed get this figure under "Notes" in this column but ask enough about component costs to permit evaluation.
4) Value of anything harvested before full bearing is reached.

GRAZING RECORD

Soil_____ Crop_____ Field no._____

Type of pasture_____

Grazing situation_____

Period grazed[1]	No. of days	Type of animal[2]	No. of head	% of[3] full feed	Ave. wt. gain	% of[4] feed util.	Notes[5]

Rental received and basis for payment_____

Customary rental in the community for this type of pasture situation_____

Costs incurred in producing and pasturing this feed_____

Fencing involved on this field: Type_____ Length_____
Original cost_____ Year built_____ Annual repairs_____

1) Give dates.
2) Species, age, type, cow, steer, etc.
3) If under 100%, list other feeds fed under "Notes."
4) Percent of feed available which was utilized.
5) List any other information which may aid in determining pasture productive capacity.

POWERED MACHINERY AND EQUIPMENT[1]

	Tractors		Trucks		Autos	Other	
Type and size							
Make and model							
Year new							
Year acquired							
Price paid							
Years of life from now							
Annual use: 1958							
Usual							
Rate of fuel consumption							
Price of fuel (net)							
Cost of oil and grease used							
Licenses							
Insurance							
Repairs, including tires, batteries, etc.[2]							
Work preparation time							

1) Only list those items which were used for the production of crops listed on enterprise records. All self-powered items are to be included here.
2) List by item and frequency. Include all labor and parts. 1958 or usual are acceptable.

NON-POWERED MACHINERY[1]

Machine	Type or model & size	Year new	Year acq.	Price paid	Life from now	Usual ann. cost	Acres ann. use
Plow							
Disc							
Harrow, spike							
Harrow, spring							
Roller							
Drill							
Fertilizer spreader							
Manure spreader							
Mower							
Rake							
Cultivator							
Trailer							
Wagon							
Other							
Shop equipment							

1) Include all items used directly on enterprise record crops and items of a general nature such as welding equipment and small tools which are used in support of crop.

IRRIGATION EQUIPMENT

Item[1]	Size	Date acq.	Amount invest.	Est.[2] life	Ann.[3] repairs	Other costs	Notes

1) Record details in "Notes."
2) From now.
3) Include in annual repair replacements of risers, etc.

Type of power_____
Annual hours of use_____
Power costs: Total_____ Per hour of operation_____
Water delivered per hour of operation_____

IMPROVEMENT COSTS[1]

Item	Orig. invest.	Life from now[2]	Ann. depr.	Age[3]	1958 repairs	Usual repairs[4]	Percent chargeable to enterprise crops / /			Notes
Irrigation: Well					XXX					
Other					XXX					
Drainage: Tile[5]					XXX					
					XXX					
					XXX					
Bldgs. directly related to enterprise crops[6]	Rep.[7] cost									
						XXX				
						XXX				
Bldgs. & other impros. indirectly related to enterprise crops[8]										
						XXX				
						XXX				
						XXX				

1) Refers only to improvements related to production of enterprise crops.
2) Farmer's estimate of total useful life, past and future.
3) Present age from time of construction.
4) Farmer's estimate of usual annual repair.
5) Get data by field for enterprise fields.
6) Crop storage buildings, hop driers, etc.
7) Estimated cost of replacing building with one of comparable utility.
8) Machinery storage sheds, etc.

MISCELLANEOUS EXPENSES

Item	Annual cost	Chargeable to enterprise crops						Notes
		%	$	%	$	%	$	
Rent for land								
Fire insurance premiums								
Property taxes								
Telephone								
Workmen's compensation								
Social security								
Organization dues								
Other								

LAND VALUES

Item	Field	Soil	Value
1. What is land comparable to the fields used for enterprise records selling for without buildings?			
2. Over a long period of years, what do you think would be the true agricultural value of (a key soil on the farm)?			
3. If (the soil indicated under no. 2) is worth that much, what value would you put on other soils?			

4. Do you have a water right? What field? Costs? Values?

CROP CONTRACTS

1. Crops contracted? _____ _____ _____ _____
2. Acres of crops contracted? _____ _____ _____ _____
3. Who is contract with? _____ _____ _____ _____
4. Length of contract? _____ _____ _____ _____
5. Where do you deliver? _____ _____ _____ _____
6. Number of miles hauled? _____ _____ _____ _____
7. How does a new producer gain in a contract? _____
8. How binding is contract on farmer? _____
9. How binding is contract on the buyer? _____
10. Could these crops be sold to other firms without a contract? _____
11. What assistance does the processor furnish the farmer with the contract? _____
12. Are there farmers who desire contracts but cannot get them? (Indicate what crops.) _____
13. Can contracts be bought and sold? _____ If so, for how much? _____
    If not, is there a value which may represent their worth? _____
14. What are the advantages of a contract? _____
15. For what crops does farmer desire contracts? _____ _____ _____
16. Has he tried to obtain contracts for these? _____ _____ _____
17. Why not obtained? _____
18. What would a contract be worth to you per acre? _____

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APPENDIX A

Marion County Soils

Jory and Aiken Series

The Jory and Aiken series consist of well drained, reddish brown, fine textured soils developed in deep residuum and side-slope colluvium from basic volcanic rocks. They occur on sloping to steep uplands and in Marion County are mapped mainly in the Salem Hills. Jory and Aiken soils are similar in appearance, but Jory soils have a firmer subsoil than the Aiken soils.

The surface soils of both series are dark reddish brown silty clay loams. They have granular structures and are friable.

The subsoils of both series are dark reddish brown clays, and both have blocky structures. The subsoil is firm for the Jory soils and friable for the Aiken soils. Depth to weathered basalt is greater than 60 inches for the Jory soils and between 20 and 60 inches for the Aiken soils.

There are about 32,000 acres of Jory soils and 11,000 acres of Aiken soils in the Salem Hills. There are also approximately 7,000 acres of Aiken soils in the Waldo Hills. About two-thirds of the Aiken and Jory soils are cultivated.

Aiken and Jory soils are used principally for grass seed and small grain production.

Steep slopes and the associated erosion hazard are the chief limitation for cultivation. Stoniness and shallowness to bedrock

also limit crop production on some of the Aiken soils. Water becomes limiting in the summer and irrigation water is scarce. The soils are strongly acid.

Polk and Sublimity Series

The Polk and Sublimity series consist of well drained, fine textured soils developed in residuum and side slope colluvium from basic tuff. They occur on gently to strongly sloping foothills of the Cascade Mountains and in Marion County are mapped in the uplands between Sublimity and Silverton. Polk soils are dark reddish brown and occupy the tops of the hills and ridges, while the Sublimity soils are dark brown and occupy the lower footslopes.

The surface soil of the Polk soils is dark reddish brown silty clay loam. It has granular structure and is friable. The subsoil is dark reddish brown silty clay. It has blocky structure and is firm. Depth to weathered tuff varies from 36 inches to more than 60 inches.

The surface soil of Sublimity soils is very dark brown silty= clay loam. It has a granular structure and is friable. The subsoil is dark brown silty clay. It has blocky structure and is firm. Depth to weathered tuff varies from less than 20 inches to 60 inches.

There are about 40,000 acres of Polk soils and 25,000 acres of Sublimity soils in Marion County. About two-thirds of the acreage is cultivated for each series. The cultivated soils are used principally for grass seed and small grain production.

These soils have the same limitations in relation to land use

as the Jory and Aiken soils. Most have an erosion hazard, and some are shallow and stony. They are strongly acid.

Salem Series

The Salem series consists of well drained, dark brown, moderately fine textured soils developed from old gravelly alluvium. They occur on almost level terraces and in Marion County are mapped mainly in the Stayton Basin. They are associated with soils of the Sifton, Clackamas, and Courtney series, all of which are gravelly.

The surface soil of the Salem series is a grayish brown gravelly clay loam. It has weak blocky structure and is friable. The subsoil is a brown gravelly clay loam. It has a blocky structure and is friable. Depth to loose, porous gravel and sand varies between 36 and 60 inches.

There are about 6,000 acres of Salem soils in Marion County. They are used for the production of a variety of vegetables and berries, small grain and forages.

Salem soils become droughty during the summers and need to be irrigated when used for shallow rooted crops. The soils are moderately acid.

Sifton Series

The Sifton series consists of very well drained, very dark brown, light textured soils developed from old gravelly alluvium. They occur in association with Salem soils on nearly level terraces and in Marion County are mapped mainly in the Stayton Basin.

The surface soil of Sifton soils is nearly black when moist and

has a gravelly fine sandy loam texture. It is loose and very friable. Depth to stratified loose sand and gravels varies between 10 and 36 inches.

Marion County has about 3,500 acres of Sifton soils. They are used for the production of the same variety of crops as the Salem soils.

Droughtiness is the major limitation to plant growth for Sifton soils. The soils are moderately acid.

Clackamas Series

The Clackamas series consists of imperfectly drained, dark brown, medium textured soils developed from old gravelly alluvium. They occur on nearly level terraces in association with soils of the well drained Salem and Sifton series and the poorly drained Courtney series, and in Marion County are mapped mainly in the Stayton Basin.

The surface of the Clackamas soils is very dark brown, gravelly silt loam. It has moderate blocky structure and is friable. The subsoil is a dark brown gravelly clay. It is compact and massive and is firm. Depth to loose sand and gravel is over 60 inches.

There are about 12,000 acres of Clackamas soils in Marion County. Clackamas soils are used principally for small grain, forage, and pasture production,but they are also used for a variety of vegetable and berry crops.

The choice of crops grown on Clackamas soils is limited by restricted drainage. The soils become droughty in the summer. Cultivation and seedbed preparation is affected by the gravelly condition

of these soils. The soils are moderately acid.

Willamette Series

The Willamette series consists of well drained, very dark brown, medium textured soils developed from old silty alluvium. They occur on nearly level to gently sloping terraces and in Marion County are mapped mainly on the bench land north of the Salem and Waldo Hills. They are associated with the moderately well drained Woodburn, imperfectly drained Amity, and poorly drained Concord and Dayton soils.

The surface of the Willamette soils is very dark brown, silt loam. It has a weak blocky structure and is friable. The subsoil is dark brown, silty clay loam. It has moderate blocky structure and is firm.

There are about 20,000 acres of Willamette soils in Marion County. The soils are adapted to nearly all crops grown in the area.

Some of the Willamette soils are located on moderately sloping to steep terrace escarpments and are subject to an erosion hazard. Willamette soils are slightly to moderately acid.

Woodburn Series

The Woodburn series consists of moderately well drained, dark brown, medium textured soils developed in old silty alluvium. They occur on nearly level to gently sloping terraces, and in Marion County are mapped mainly on the bench land north of the Salem and Waldo Hills. They are associated with well drained Willamette, imperfectly drained Amity, and poorly drained Concord and Dayton series.

The surface soil of Woodburn soils is very dark brown, silt loam. It has moderate granular structure and is friable. The subsoil is dark brown, silty clay loam. It has blocky structure and is firm. Woodburn soils have a firm massive layer between 30 and 50 inches that restricts root growth and water permeability.

There are about 60,000 acres of Woodburn soils in Marion County. With proper management they are adapted to most of the crops grown in the area.

Crop growth is limited on these soils by the restricted drainage in the subsoil. Some of the soils occur on strongly sloping terrace escarpments and are subject to an erosion hazard. The soils are slightly to moderately acid.

Amity Series

The Amity series consists of imperfectly drained, dark grayish brown medium textured soils developed from old silty alluvium. They occur on nearly level to gently sloping terraces and in Marion County are mapped on the bench land in all parts of the county.

The surface soil is dark brown, silt loam. It has moderate blocky structure and is friable. The subsoil is dark grayish brown, silty clay loam, mottled with gray and yellowish brown. It has a blocky structure and is friable.

There are about 57,000 acres of Amity soils in Marion County. They are used principally for grain and forage production, but when artificially drained they are adapted to many other crops grown in the area.

Restricted drainage is the most limiting factor for plant growth in these soils. Some of the soils occur on moderately sloping topography and are subject to an erosion hazard. The soils are moderately acid.

Concord Series

The Concord series consists of poorly drained, dark grayish brown, medium textured soils developed from old silty alluvium. They occur on nearly level terraces and in Marion County are mapped mainly on flat areas of the bench land north of the Salem and Waldo Hills.

The surface soil is dark grayish brown, silt loam. It has a weak blocky structure and is friable. The subsoil is grayish brown, silty clay loam, mottled with gray and yellowish brown. It has a blocky structure and is friable.

There are about 11,000 acres of Concord soils in Marion County. Most of it is used for pasture, hay, and small grain production.

The major limiting factor for choice of crops is poor drainage. The soils are moderately to strongly acid.

Dayton

The Dayton series consists of poorly drained, grayish brown, medium textured soils with a claypan, and are developed from old silty alluvium. They occur on nearly level terraces and in Marion County are mapped mainly in Ankeny Bottom, in the western portion of the Stayton Basin, and in association with Concord soils in French Prairie.

The surface soil is grayish brown, silt loam. It has weak blocky structure and is friable. The subsoil is dark grayish brown clay. It has moderate prismatic structure and is firm and very sticky.

There are about 11,000 acres of Dayton soils in Marion County. It is used mainly for ryegrass seed, pasture, and small grain production.

Poor drainage is the major limiting factor for selection of crops. These soils are strongly acid.

Chehalis Series

The Chehalis series consists of well drained, dark grayish brown, medium textured soils developed from recent alluvium. They occur on nearly level floodplains and in Marion County are mapped mainly along the Santiam and Willamette Rivers. They are associated with the well drained, sandy soils of the Newberg series and the poorly drained, medium textured soils of the Wapato series.

The surface soil is dark grayish brown, silt loam to clay loam. It has granular structure and is friable. The subsoil is dark brown, clay loam. It has a fine blocky structure and is friable.

There are about 22,000 acres of Chehalis soils in Marion County. They are suited for the production of most of the crops grown in the area.

Some areas of Chehalis soils are subject to a flooding hazard. Chehalis soils are moderately acid.

Newberg Series

The Newberg series consists of well drained, brown, light textured soils developed from recent alluvium. They occur on nearly level floodplains, and in Marion County are mapped mainly along the Santiam and Willamette Rivers in association with soils of the Chehalis and Wapato series.

The surface soil is brown, fine sandy loam. It has weak granular structure and is friable. The subsoil is yellowish brown, fine sandy loam. It has a weak granular structure and is very friable.

There are about 15,000 acres of Newberg soils in Marion County. They are used for the production of most of the crops grown in the area.

Droughtiness is the most serious limiting factor to crop growth for these soils. Some areas of Newberg soils are subject to an overflow hazard. These soils are moderately acid.

Wapato Series

The Wapato series consists of poorly drained, very dark grayish brown, moderately-heavy textured soils developed from recent alluvium. They occur on nearly level to slightly depressional floodplains, and in Marion County are mapped along all of the rivers and creeks except those within the hill land.

The surface soil is very dark grayish brown, silty clay loam. It has a blocky structure and is firm and sticky. The subsoil is dark brown, silty clay loam mottled with gray and yellowish brown. It has blocky structure and is firm and sticky.

There are about 11,000 acres of Wapato soils in Marion County. They are used principally for forage and small grain productions, although when drained and irrigated they are adapted to a variety of crops.

Poor drainage is the most serious limiting factor for choice of crops on these soils. These soils are moderately acid.

Muck Soils

The muck areas have very poorly drained, black soils developed from decayed plant remains and alluvial mineral material. They occur on level and depressional old lake plains and floodplains, and in Marion County are mapped mainly in Lake Labish. The muck soils are associated with soils of the poorly drained Wapato series.

The surface soil is black and contains from 40 to 85 percent organic matter. It is loose when dry and soft when wet. The subsoil is primarily black, but contains some yellowish brown undecomposed plant remains.

There are about 2,000 acres of muck in Marion County. Most of it is used for growing onions.

Very poor drainage is the first limiting factor for plant growth on these soils. They are subject to a wind erosion hazard when dry. These soils are moderately acid and are low in potassium.

APPENDIX B

Table 1. Normal monthly, seasonal and annual precipitation at several weather stations in or near Marion County, Oregon. (43)

Month	Precipitation					
	Salem[a]	Oregon City[b]	Stayton[c]	Silverton[d]	Silver Creek Falls[e]	Mehama[f]
	Inches					
December	6.6	7.7	8.9	7.6	11.7	11.1
January	7.0	8.9	9.1	9.4	10.5	11.6
February	5.2	6.1	5.6	5.6	8.6	8.6
Winter	18.8	22.7	23.6	22.6	20.8	20.3
March	4.3	5.3	6.1	5.5	9.1	8.5
April	2.2	2.8	3.6	3.0	5.7	4.1
May	2.1	2.5	2.9	2.6	4.6	4.2
Spring	8.6	10.6	12.6	11.1	19.4	16.8
June	1.6	2.0	3.1	2.7	3.9	3.7
July	.4	.6	.4	.4	.8	.7
August	.5	1.0	.6	.6	1.1	.9
Summer	2.5	3.6	4.1	3.7	5.8	5.3
September	1.5	2.2	1.9	1.8	3.2	2.6
October	4.3	4.6	5.1	5.8	8.1	7.8
November	5.9	6.3	5.6	6.2	10.7	8.1
Fall	11.7	13.1	12.6	13.8	22.0	18.5
Year	41.6	50.0	52.9	51.2	78.0	71.9
Mean snowfall	6.1	--	--	--	13.5	15.6

a. Elevation 195 feet. 1941-1959 monthly means.
b. Elevation 167 feet. 1948-1959 monthly means.
c. Elevation 465 feet. 1951-1959 monthly means.
d. Elevation 870 feet. 1950-1959 monthly means.
e. Elevation 1,340 feet. 1941-1959 monthly means.
f. Elevation 640 feet. 1949-1959 monthly means.

Table 2. Frequency distribution of precipitation by monthly normals for the years 1941-1959, Salem and Silver Creek Falls, Oregon. (43)

Month	Inches Precipitation							
	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-7.0	Over 7.1
	Years							
Salem:								
January	1	-	2	1	3	2	3	7
February	-	-	2	3	5	5	3	1
March	-	3	3	3	4	3	2	1
April	3	8	5	2	-	1	-	-
May	3	7	4	2	3	-	-	-
June	6	6	5	2	-	-	-	-
July	18	1	-	-	-	-	-	-
August	16	2	1	-	-	-	-	-
September	8	5	5	1	-	-	-	-
October	1	4	5	2	1	-	2	4
November	1	1	2	2	1	3	3	6
December	-	-	2	1	3	2	4	7
Silver Creek Falls:								
January	-	1	-	-	-	2	2	14
February	-	-	1	1	1	1	1	14
March	-	-	-	1	1	2	2	13
April	-	2	1	2	5	1	2	6
May	1	2	2	4	2	3	1	4
June	2	2	3	4	3	1	2	2
July	11	8	-	-	-	-	-	-
August	11	4	3	1	-	-	-	-
September	4	-	6	3	3	1	2	-
October	-	2	-	2	1	4	2	8
November	-	-	1	2	-	2	-	14
December	-	-	-	1	-	1	1	16

Table 3. Normal monthly, seasonal and annual temperature at several weather stations in or near Marion County, Oregon. (43)

Month	Temperature				
	Salem[a]	Oregon[b] City	Stayton[c]	Silverton[d]	Silver Creek[e] Falls
	Degrees Fahrenheit				
December	41	42	42	40	39
January	38	39	41	39	37
February	43	43	43	41	40
Winter	41	41	42	40	39
March	45	45	45	43	41
April	50	52	50	49	49
May	57	58	56	55	52
Spring	51	52	50	49	46
June	61	63	60	59	56
July	67	68	66	65	62
August	66	66	65	65	61
Summer	65	66	64	63	60
September	62	63	62	62	57
October	54	54	54	53	49
November	45	46	44	44	42
Fall	54	54	53	53	50
Year	52	53	52	51	49

a. Elevation 195 feet. 1941-1959 monthly averages.

b. Elevation 167 feet. 1948-1959 monthly averages.

c. Elevation 465 feet. 1951-1959 monthly averages.

d. Elevation 870 feet. 1950-1959 monthly averages.

e. Elevation 1,340 feet. 1941-1959 monthly averages.

Table 4. Frequencies for the last freezing date, the earliest freezing date, length of growing season, yearly maximum temperature and yearly minimum temperature at Salem and Silver Creek Falls, Oregon, 1941-1959. (43)

Identification	Number of years	
	Salem	Silver Creek Falls
Last freezing date:		
Before April 1	3	-
April 1-15	3	-
April 16-30	10	2
May 1-15	3	6
May 16-31	-	5
After June 1	-	5
	19	18[a]
First freezing date:		
Before September 15	-	5
September 16-30	-	11
October 1-15	2	2
October 16-31	7	-
After November 1	10	1
	19	19
Length of growing season:		
Under 100 days	-	5
101-120 days	-	4
121-140 days	-	4
141-160 days	1	4
161-180 days	3	-
181-200 days	9	1
201-220 days	2	-
221-240 days	3	-
Over 240 days	1	-
	19	18[a]
Yearly maximum temperature:		
Below 90 degrees F.	1	2
91-95 degrees F.	3	6
96-100 degrees F.	7	10
Over 100 degrees F.	8	-
	19	18[b]
Yearly minimum temperature:		
Below 0 degrees F.	1	2
1-5 degrees F.	1	4
6-10 degrees F.	2	4
11-15 degrees F.	3	4
16-20 degrees F.	9	3
Over 20 degrees F.	3	1
	19	18[c]

a. Data for the year 1950 is missing.

b. Data for the year 1949 is missing.

c. Data for the year 1952 is missing.

APPENDIX C

Cost of Operating Powered and Non-powered Farm Machinery

The collection of farm machinery costs was secondary to the major purpose of this study. However, in order to have machinery operation costs for enterprise cost analysis, relevant information was collected during the farm interview. This was then categorized and tabulated to reflect machinery costs per unit of use. This section discusses the assumptions, methods and items included in arriving at these costs.

No attempt was made in this study to reflect inflationary changes in the purchase price of machinery; rather, it was desirable to present costs in relation to actual farm situations. If prices had been adjusted to 1958 dollars then the machinery valuations would be larger than the actual farm investment. However, so that dollar valuation changes would not be too large and it keep machine groupings in a smiliar technological framework, only machines new after 1947 were used in this tabulation. Deviations from this will be noted.

For most machinery groups there was a large number of farmer quotations and estimates which could be used in arriving at total costs; this is particularly true for the more common machines. For the less common, where the information was lacking for a reliable estimate, the more common machines were used as a basis of adjustment. Also, other machinery studies, published and unpublished, were used .

as guides and checks. Tractor horsepower was determined from the Nebraska tests for field type tractors; the horsepower used was "rated" drawbar horsepower. (41)

The following comments will be directed toward the tabulation of machinery operation costs presented at the end of the discussion.

Purchase Price

The prices paid for farm machinery were based on data from the farm survey schedule. There were however, adjustments which needed to be made. Since the methods used for making these adjustments varies with the various categories of machines, they will be discussed separately.

The purchase price in relation to size of gasoline powered wheel tractors closely fit a linear line. Therefore, a simple linear regression equation was determined and the prices used are a result of this fitting. Although the goodness of fit was not determined the graphic comparison was impressive. The only sizes which were affected to any extent by this procedure were the 5-7 H.P. and the 40-43 H.P. groups. Size 5-7 H.P. was adjusted downward and size 40-43 H.P. upward. In both cases there were only a small number of observations. Attachments were probably included in the purchase price of size 5-7 H.P. tractors.

The diesel powered wheel tractors were all rather new and also were purchased new. The number of price quotations here were much smaller than for gasoline powered wheel tractors. A linear price-size relationship was again assumed. Except for size 20-23 H.P.

there were only minor changes.

Gasoline powered crawler tractors presented a different price pattern than any of the other tractor data. Different sized tractors grouped themselves by different makes and ages; i.e., size 12-15 H.P. were all small John Deeres, size 16-19 H.P. were Oliver Cletracs, size 20-23 H.P. were Caterpiller 22's, and sizes 24-27 H.P. and 28-31 H.P. were Case 300's and 400's respectively. The prices used here were the average for each size grouping. Although the prices paid do not follow a linear pattern, the total costs approach it due to variable costs.

Only slight adjustments were made in the purchase prices used for diesel powered crawler tractors. The cause for the large price jump which occurs between sizes 24-27 H.P. and 28-31 H.P. were not determined. There was a large number of size 24-27 H.P. tractors but only a few size 28-31 H.P. tractors. The prices quoted for the 28-31 H.P. tractors were very close together.

The purchase prices used for autos and trucks are averages of prices paid for vehicles which were relatively new when purchased. The exception to this is school buses which were nearly worn out when purchased; these are used to haul hand labor from the cities and then for only a short time each year.

No adjustments were made in the prices paid for pull and self-propelled type combines and swathers.

The warehouse tractor lifts used for handling onion storage boxes generally were purchased used and most farmers surveyed did not know when they were new; thus, only the year purchased is

indicated. The prices paid varied greatly.

The pole bean cultivator tractors were farm-shop constructed. The year purchased also represents the year constructed.

The price paid for all non-powered machinery was the average price paid for new items; items purchased used were excluded. It was thought that this would give greater reliability to the estimates. Only minor adjustments were made where it was apparent that a price was not in proper perspective to prices of related items or sizes. Individual machines will not be singled out for discussion.

Length of Life

The length of life of a machine is an important item in determining fixed costs. The length of life estimates arrived at in this study were based upon farmer estimates obtained in the farm survey. Adjustments were made to obtain uniform patterns. Where the number of machines were small the estimate obtained was checked with similar items in this study and information from secondary sources.

For all powered machines it was assumed that the length of life was a function of yearly use and not machine size. There was no acceptable means of testing this assumption but there were no observable differences relating to size.

For non-powered machines it was assumed that length of life was a function of use and size.

Depreciation

The straight line method was used to calculate depreciation.

It was assumed that the machines were used the year they were purchased. The depreciation years were those remaining at the time of purchase. There was no salvage value assumed; it would have been a somewhat arbitrary figure and also would not change appreciably the per unit cost. This method gives a higher depreciation charge but is partially offset by the resulting decreased investment as used in this study.

Present Investment for Tax and Interest Purposes

A half-life situation was assumed for all farm machinery for tax and interest purposes; that is, the machine was assumed to be half used up. This does not present average conditions on the whole where the use of machinery is on the increase; however, for individual machines it more nearly represents an average cost over the life of the machine. For buses, fork lifts and pole bean cultivator tractors, half of the remaining life at the time of purchase or construction was used.

Interest

Interest returns on machinery investments were not allocated to individual machines as a part of the operating costs but were aggregated in terms of the total machinery investment and presented in the enterprise cost summaries. Nevertheless, an interest column is included for those who wish to use the data for other purposes. Interest was determined on the basis of five percent. The "limited cost" column does not include an interest return.

Property Tax

The valuation used for tax purposes for machinery in Marion County was 20 percent of the estimated market value. It was assumed in this study that the depreciated present investment approached market value. The average rural tax levy was determined to be 81 mills.

Insurance

The insurance cost used was on the basis of survey averages. For many items this was too small to consider.

Housing

No estimate was obtained for housing costs applied directly to individual items of machinery; buildings used for machine storage were allocated directly against the enterprises. Therefore, this cost was also left out of the "limited cost" column. However, in order to have an estimate for farm machinery housing, the Department of Agricultural Engineering at Oregon State College was consulted and an estimate was arrived at. Table 4 reports these yearly cost estimates.

Fuel

Fuel costs were based upon estimates made by the farmers surveyed. Slight adjustments were sometimes made when the number of observations was small. In some categories it was possible to assume a linear relationship of fuel consumption and machine size. This was done for gasoline and diesel-powered wheel tractors.

For farm sprayers no estimate was obtained in the survey for fuel costs. Therefore, for the larger sprayers an estimate was made

from secondary sources. Prices for fuel are reported Table 6, Appendix J.

Lubrication

Lubrication per hour was assumed to vary only with machine size. On a per hour or a per mile basis this may vary only a small amount. Oil cost is the main contributor of lubrication cost and within certain size categories the quantity of oil required may change but little. No lubrication costs were allocated against non-powered machinery. This was done due to lack of reliable estimates and because, for most machines, the cost is rather negligible.

Repair

Of all the items of cost, repair was the most difficult to determine. The estimates obtained in the survey were extremely variable as can be expected. The repair costs reported in the survey schedule were on the basis of 1958 repairs or usual repairs. For most categories the number of machines was large enough that the estimate used in this tabulation is felt to be fairly reliable on the basis of a half-life situation. For those categories where the number of observations were small, the repair cost was estimated on the basis of similar machines in the study and/or from secondary sources. It is believed that the final estimate approaches reality.

For powered machinery, repair costs were assumed to be a function of hours or miles of use and for non-powered machinery a function of acres of use. That is, repair costs were assumed constant per unit of use.

For wheel-type tractors there was no calculated difference between repair costs for different sized tractors. At first one might draw the conclusion that this is not logical, but for the following reasons this may be quite realistic:

1. The major contributor of repair costs is labor and this may not be greatly different for different sized tractors.
2. As machine use increases the cost per hour for repairs probably decreases. The larger tractors on the average are used more hours per year.
3. Major overhaul jobs were not counted as repair where the length of life of the tractor was greatly affected, but were included as an investment item to be depreciated. This type of repair is probably more characteristic of the larger tractors and it is here the major cost differences appear.

For many of the non-powered machines repair also appears as a constant over all sizes. For example, a constant repair of 25 cents per acre was used for all moldboard plows. A constant repair cost which is not related to size should approach reality since, in this example, the same number of furrows need to be turned per acre regardless of the number of plow bottoms; for plows the major factor of repair cost is the sharpening or replacement of the shares. The same type of reasoning can be used for other machines.

Work Preparation

Before a machine is taken into the field there are certain preparatory operations which must be made; vis., fueling, lubricating,

etc. Farmers were asked to estimate the time spent each machine work day in preparing powered machinery for work. This time was converted to dollars on the basis of a labor charge of $1.20 per hour. It was assumed that the time spent in preparing non-powered machinery for work was negligible or included with the powered machinery.

Machinery Use

The amount of yearly use given to a machine greatly affects the per unit cost of operation. For this reason an attempt was made to measure the units of use of the several machines in such a manner as would reflect the farm structure in the areas representing different types of cropping systems. Since there was no attempt in this study to analyze farm structure in and of itself the size of the farm, the size of the enterprise, or the composition of the crops was not looked at in terms of machine use. However, the farm structure as it would relate to enterprise production costs in respect to soil productivity is important here. In order to get at this aspect of machinery costs two different tabulations were made. First, machine use was calculated in terms of individual soils and second, in terms of crop groupings. Because machinery use is more closely associated with the crops than the soils and to give uniformity of cost comparisons the latter method was settled upon. The reasoning behind this method was that any differences in costs associated with individual crops would be expanded by the percentage distribution of crops on soils. This then would represent the cost differential associated with the farm structure in relation to soils.

Because crops tend to group themselves in terms of their intensiveness or extensiveness individual crop computations were made. Also, there would not be sufficient observations on an individual basis for comparative purposes. For these reasons similar crops were grouped into categories for comparative purposes.

An analyzation of this data revealed that for the most part the amount of use given a machine is not closely associated with the intensiveness or extensiveness of the farming system. The amount of machinery use within the several crop categories was fairly uniform for individual machines. For the most part, large variations occurred only where there were not sufficient observations for a reliable estimate. This leads one to the conclusion that farmers, on the average, purchase the size and kind of machinery which they can use most economically. Where the operation is more intensive the amount of work done per unit of land is increased which results in about the same number of total hours or acres as on extensive operations.

Even though, on the whole, there were no large differences in machine use, yet there are a few machines which did show differences which were felt to be significant. These may be seen when comparing sprayers and commercial fertilizer spreaders. The many small differences which showed up were not considered great enough to change per unit of use machinery costs. Only where the differences were large enough to reach across the machinery use span used in developing per unit costs were differences in costs made. Powered machinery costs appear in Table 1. Non-powered machinery costs appear in Table 2. Machinery use comparisons appear in Table 3.

Table 1. Cost per hour of operating powered farm machinery.

Annual Use	Year New	Year Purch.	Purch. Price	Years Life	Per Unit of Use: Invest.	Dep.	Int.	Tax	Hous.	Fuel	Lub.	Repair	Prep.	Total Cost	Limited Cost[a]
(Hours)					I. Tractors										
(100)					A. Gasoline wheel tractors[b]										
					5-7 H.P.										
0-2	51	53	687	17	:2.79:	.31	.14	.05	.04	.19	.04	.08	.04	.89	: .71:
2-4	51	53	687	16	:1.28:	.16	.06	.02	.02	.19	.04	.08	.04	.61	: .53:
					8-11 H.P.; 1 plow										
2-4	51	53	993	16	:1.92:	.24	.10	.03	.02	.24	.04	.08	.04	.79	: .67:
4-6	51	53	993	15	:1.05:	.15	.05	.02	.01	.24	.04	.08	.04	.63	: .57:
					12-15 H.P.; 1-2 plow										
2-4	51	53	1298	16	:2.48:	.31	.12	.04	.03	.30	.04	.08	.04	.96	: .81:
4-6	51	53	1298	15	:1.40:	.20	.07	.02	.02	.30	.04	.08	.04	.77	: .68:
					16-19 H.P.; 2 plow										
4-6	51	53	1604	15	:1.75:	.25	.09	.03	.02	.36	.04	.08	.04	.91	: .80:
6-8	51	53	1604	14	:1.14:	.19	.06	.02	.01	.36	.04	.08	.04	.80	: .73:
					20-23 H.P.; 2-3 plow										
4-6	51	53	1909	15	:2.03:	.29	.10	.03	.02	.43	.04	.08	.04	1.03	: .91:
6-8	51	53	1909	14	:1.38:	.23	.07	.02	.01	.43	.04	.08	.04	.92	: .84:
					24-27 H.P.; 3 plow										
4-6	51	53	2215	15	:2.38:	.34	.12	.04	.02	.48	.05	.08	.04	1.17	:1.03:
6-8	51	53	2215	14	:1.56:	.26	.08	.03	.02	.48	.05	.08	.04	1.04	: .94:
					28-31 H.P.; 3-4 plow										
4-6	51	53	2520	15	:2.73:	.39	.14	.04	.02	.55	.05	.08	.04	1.31	:1.15:
6-8	51	53	2520	14	:1.80:	.30	.09	.03	.02	.55	.05	.08	.04	1.16	:1.05:
					32-35 H.P.; 4 plow										
4-6	51	53	2826	15	:3.01:	.43	.15	.05	.02	.61	.05	.08	.04	1.43	:1.26:
6-8	51	53	2826	14	:2.04:	.34	.10	.03	.02	.61	.05	.08	.04	1.27	:1.15:
					36-39 H.P.; 4-5 plow										
4-6	51	53	3131	15	:3.36:	.48	.17	.05	.02	.65	.05	.08	.04	1.54	:1.35:
6-8	51	53	3131	14	:2.22:	.37	.11	.04	.02	.65	.05	.08	.04	1.36	:1.23:
					40-43 H.P.; 5 plow										
4-6	51	53	3437	15	:3.71:	.53	.19	.06	.03	.72	.05	.08	.04	1.70	:1.48:
6-8	51	53	3437	14	:2.46:	.41	.12	.04	.02	.72	.05	.08	.04	1.48	:1.34:
(100)					B. Diesel wheel tractors										
					20-23 H.P.; 2-3 plow										
6-8	55	55	3000	14	:2.17:	.31	.11	.04	.01	.28	.05	.12	.04	.96	: .84:
8-10	55	55	3000	13	:1.69:	.26	.08	.03	.01	.28	.05	.12	.04	.87	: .78:
					24-27 H.P.; 3 plow										
6-8	55	55	3400	14	:2.45:	.35	.12	.04	.02	.32	.05	.12	.04	1.06	: .92:
8-10	55	55	3400	13	:1.88:	.29	.09	.03	.01	.32	.05	.12	.04	.95	: .85:
					28-31 H.P.; 3-4 plow										
6-8	55	55	3800	14	:2.73:	.39	.14	.04	.02	.36	.06	.12	.04	1.17	:1.01:
8-10	55	55	3800	13	:2.08:	.32	.10	.04	.01	.36	.06	.12	.04	1.05	: .94:
					32-35 H.P.; 4 plow										
6-8	55	55	4200	14	:3.01:	.43	.15	.05	.02	.40	.06	.12	.04	1.27	:1.10:
8-10	55	55	4200	13	:2.34:	.36	.12	.04	.01	.40	.06	.12	.04	1.15	:1.02:
					36-39 H.P.; 4-5 plow										
6-8	55	55	4600	14	:3.29:	.47	.16	.04	.02	.44	.07	.12	.04	1.37	:1.19:
8-10	55	55	4600	13	:2.54:	.39	.13	.04	.01	.44	.07	.12	.04	1.24	:1.10:
					40-43 H.P.; 5 plow										
6-8	55	55	5000	14	:3.57:	.51	.18	.06	.02	.48	.07	.12	.04	1.48	:1.28:
8-10	55	55	5000	13	:3.01:	.43	.15	.05	.01	.48	.07	.12	.04	1.35	:1.19:
					44-47 H.P.; 5-6 plow										
6-8	55	55	5400	14	:3.85:	.55	.19	.06	.02	.52	.07	.12	.04	1.57	:1.36:
8-10	55	55	5400	13	:2.99:	.46	.15	.05	.01	.52	.07	.12	.04	1.42	:1.26:

Table,1, continued.

Annual Use	Year New	Year Purch.	Purch.Price	Years Life	Invest.	Dept.	Int.	Tax	Hous.	Fuel	Lub.	Repair	Prep.	Total Cost	Limited Cost
						Per Hour of Use									
(Hours) (100)						C. Gasoline crawler tractors									
						12-15 H.P.; 2 plow									
2-4	51	53	2167	17	:4.08:	.48	.20	.07	.02	.32	.06	.11	.05	1.31	:1.09:
4-6	51	53	2167	16	:2.48:	.31	.12	.04	.01	.32	.06	.11	.05	1.02	: .98:
						16-19 H.P.; 2 plow									
2-4	50	51	2159	17	:3.82:	.45	.19	.06	.02	.36	.06	.12	.05	1.31	:1.10:
4-6	50	51	2159	16	:2.32:	.29	.12	.04	.01	.36	.06	.12	.05	1.05	: .92:
6-8	50	51	2159	15	:1.65:	.22	.08	.03	.01	.36	.06	.12	.05	.93	: .84:
						20-23 H.P.; 3-4 plow									
2-4	37	42	1628	17	:3.82:	.45	.19	.06	.02	.53	.07	.13	.05	1.50	:1.29:
4-6	37	42	1628	16	:2.40:	.30	.12	.04	.01	.53	.07	.13	.05	1.25	:1.12:
6-8	37	42	1628	15	:1.72:	.23	.09	.03	.01	.53	.07	.13	.05	1.14	:1.04:
						24-27 H.P.; 3-4 plow									
4-6	57	57	2700	16	:2.72:	.34	.14	.04	.02	.42	.07	.14	.05	1.22	:1.06:
6-8	57	57	2700	15	:1.95:	.26	.10	.03	.01	.42	.07	.14	.05	1.08	: .97:
						28-31 H.P.; 3-4 plow									
4-6	57	57	4300	16	:4.32:	.54	.22	.07	.02	.61	.07	.15	.05	1.73	:1.49:
6-8	57	57	4300	15	:3.08:	.41	.15	.05	.01	.61	.07	.15	.05	1.50	:1.34:
(100)						D. Diesel crawler tractors									
						16-19 H.P.; 2 plow									
4-6	47	48	2800	19	:2.94:	.31	.15	.05	.01	.32	.06	.12	.06	1.08	: .92:
6-8	47	48	2800	18	:2.16:	.24	.11	.03	.01	.32	.06	.12	.06	.95	: .83:
						20-23 H.P.; 3-4 plow									
4-6	48	50	3300	19	:4.75:	.39	.24	.08	.01	.32	.06	.13	.06	1.19	:1.04:
6-8	48	50	3300	18	:4.50:	.29	.22	.07	.01	.32	.06	.13	.06	1.16	: .93:
						24-27 H.P.; 3-4 plow									
4-6	50	51	3800	19	:3.99:	.42	.20	.06	.02	.32	.06	.14	.06	1.28	:1.10:
6-8	50	51	3800	18	:2.88:	.32	.14	.05	.01	.32	.06	.14	.06	1.10	:1.04:
						28-31 H.P.; 3-4 plow									
4-6	55	55	6300	19	:6.27:	.66	.31	.10	.02	.43	.07	.15	.06	1.80	:1.47:
6-8	55	55	6300	18	:4.50:	.50	.22	.07	.01	.43	.07	.15	.06	1.51	:1.28:
						32-35 H.P.; 4-6 plow									
4-6	56	56	6700	19	:6.74:	.71	.34	.11	.02	.43	.07	.16	.06	4.52	:1.54:
6-8	56	56	6700	18	:4.77:	.53	.24	.08	.02	.43	.07	.16	.06	1.59	:1.33:
						36-39 H.P.; 4-6 plow									
4-6	57	57	7000	19	:7.03:	.74	.35	.11	.02	.44	.08	.17	.06	1.97	:1.60:
6-8	57	57	7000	18	:5.04:	.56	.25	.08	.02	.44	.08	.17	.06	1.66	:1.39:
						48-55 H.P.; 6-8 plow									
4-6	53	53	7900	19	:7.88:	.83	.39	.13	.03	.58	.10	.20	.06	2.32	:1.90:
6-8	53	53	7900	18	:5.67:	.63	.28	.09	.02	.58	.10	.20	.06	1.96	:1.66:
						E. Specialized									
(1)						1. Pole bean cultivator tractors (shop made)										
85	--	51	700	12	:4.08:	.68	.20	.07	.04	.14	.04	.27	.03	1.47	:1.23:
(1)						2. Roto-tiller garden tractors									
20	--	--	241	15	:2.00:	.25	.12	.03	.08	.10	.03	.15	.01	1.02	: .76:
(1)						3. Warehouse tractor lifts - Onion									
104	--	53	1745	11	:8.90:	1.47	.45	.14	.08	.17	.05	.46	.04	2.88	:2.35:

Table 1, continued.

Annual Use	Year New	Year Purch.	Purch. Price	Years Life	Invest.	Per Unit of Use: Dep.	Int.	Lisc.	Ins.	Hous.	Fuel	Lub.	Repair	Total Cost	Limited Cost
(Miles)						II. Farm vehicles									
(1000)						A. Automobiles									
6-8	54	55	2478	12	:.192:	.032	.010	.001	.007	.002	.019	.003	.006	.080	:.068:
8-10	54	55	2478	11	:.154:	.028	.008	.001	.006	.002	.019	.003	.006	.073	:.063:
10-12	54	55	2478	10	:.125:	.025	.006	.001	.005	.001	.019	.003	.006	.066	:.059:
(1000)						B. Trucks									
						1/2 - 3/4 ton									
4-6	54	54	1900	16	:.192:	.024	.100	.002	.010	.004	.021	.003	.007	.081	:.067:
6-8	54	54	1900	14	:.133:	.019	.007	.002	.007	.003	.021	.003	.007	.069	:.059:
8-10	54	54	1900	13	:.104:	.016	.005	.001	.005	.002	.021	.003	.007	.060	:.053:
						1 ton									
2-4	52	52	2100	18	:.351:	.039	.018	.006	.016	.007	.026	.004	.012	.128	:.103:
4-6	52	52	2100	16	:.208:	.026	.026	.003	.010	.004	.026	.004	.012	.095	:.081:
6-8	52	52	2100	14	:.147:	.021	.007	.003	.007	.003	.026	.004	.012	.083	:.073:
						1 1/2 tons									
2-4	50	50	2600	18	:.432:	.048	.022	.009	.016	.008	.033	.005	.013	.154	:.124:
4-6	50	50	2600	16	:.256:	.032	.013	.006	.010	.005	.033	.005	.013	.117	:.099:
6-8	50	50	2600	14	:.189:	.027	.009	.003	.007	.004	.033	.005	.013	.101	:.088:
						2 tons									
2-4	53	53	3000	18	:.504:	.056	.025	.011	.016	.008	.036	.005	.014	.171	:.138:
4-6	53	53	3000	16	:.304:	.038	.015	.006	.010	.005	.036	.005	.014	.129	:.109:
6-8	53	53	3000	14	:.217:	.031	.011	.005	.007	.004	.036	.005	.014	.113	:.098:
(1000)			(Remaining)			C. Busses									
0-2	--	57	825	5	:.275:	.110	.014	.008	.016	--	.047	.005	.041	.241	:.227:
2-4	--	57	825	5	:.137:	.055	.007	.004	.008	--	.047	.005	.041	.187	:.160:

Table 1, continued.

Annual Use	Year New	Year Purch.	Purch. Price	Years Life	Per Unit of Use: Invest.	Dep.	Int.	Tax	Hous.	Fuel	Lub.	Repair	Prep.	Total Cost	Limited Cost
(Hours)															
(10)					III. Combines										
					A. Pulltype										
					5-7 feet										
10-15	49	51	1222	14	:5.67:	.81	.28	.09	.17	.30	.08	.07	.10	1.90	:1.45:
15-20	49	51	1222	13	:4.10:	.63	.20	.07	.12	.30	.08	.07	.10	1.57	:1.25:
					8-9 feet										
10-15	50	50	2100	14	:8.40:	1.20	.42	.14	.23	.35	.08	.07	.12	2.61	:1.96:
15-20	50	50	2100	13	:5.98:	.92	.30	.10	.16	.35	.08	.07	.12	2.10	:1.64:
					B. Self-propelled										
					9 feet										
15-20	55	56	4810	13	:14.89:	2.29	.74	.24	.17	.45	.09	.07	.11	4.19	:3.28:
20-25	55	56	4810	12	:11.64:	1.94	.58	.19	.13	.45	.09	.07	.11	3.59	:2.88:
25-30	55	56	4810	11	: 9.62:	1.75	.48	.16	.11	.45	.09	.07	.11	3.25	:2.66:
					10 feet										
15-20	54	55	5000	13	:15.47:	2.38	.77	.25	.18	.52	.10	.08	.11	4.42	:3.47:
20-25	54	55	5000	12	:12.12:	2.02	.61	.20	.14	.52	.10	.08	.11	3.81	:3.06:
25-30	54	55	5000	11	:10.01:	1.82	.50	.16	.12	.52	.10	.08	.11	3.44	:2.82:
					12 feet										
15-20	53	54	5447	13	:16.84:	2.59	.84	.27	.21	.67	.11	.09	.11	4.92	:3.87:
20-25	53	54	5447	12	:13.20:	2.20	.66	.21	.16	.67	.11	.09	.11	4.24	:3.42:
25-30	53	54	5447	11	:10.89:	1.98	.54	.18	.13	.67	.11	.09	.11	3.84	:3.17:
					14 feet										
15-20	55	55	8065	13	:24.96:	3.84	1.25	.40	.23	.74	.12	.10	.11	6.82	:5.34:
20-25	55	55	8065	12	:19.56:	3.26	.98	.32	.18	.74	.12	.10	.11	5.84	:4.68:
25-30	55	55	8065	11	:16.12:	2.93	.81	.26	.15	.74	.12	.10	.11	5.25	:4.29:
(10)					IV. Swathers										
10-15	57	57	2962	10	:11.85:	2.37	.59	.19	.10	.35	.07	.26	.06	4.00	:3.31:
15-20	57	57	2962	10	: 8.45:	1.69	.42	.14	.07	.35	.07	.26	.06	3.07	:2.58:
					V. Corn topper-sprayer										
140	58	58	3000	11	:10.00:	1.75	.50	.16	.17	.32	.03	.18	.13	3.30	:2.63:
(Acres)					VI. Farm sprayers										
(100)					A. Small trailer type[d]										
1-2	54	54	356	15	:1.20:	.16	.06	.02	.03	.06	c	.10	--	.43	: .34:
2-3	54	54	356	14	: .70:	.10	.04	.01	.02	.06	c	.10	--	.33	: .27:
4-5	54	54	356	12	: .24:	.04	.01	.004	.01	.06	c	.10	--	.22	: .20:
(100)					B. Medium trailer type[e]										
1-2	52	52	735	14	:2.48:	.33	.12	.04	.04	.09	c	.10	--	.72	: .56:
2-3	52	52	735	14	:1.47:	.21	.07	.02	.02	.09	c	.10	--	.51	: .42:
3-4	52	52	735	13	:1.04:	.16	.05	.02	.02	.09	c	.10	--	.44	: .37:
4-5	52	52	735	12	: .84:	.14	.04	.01	.01	.09	c	.10	--	.39	: .34:
(100)					C. Large trailer type[f]										
2-3	52	52	2700	15	:5.40:	.72	.27	.09	.05	.12	c	.10	--	1.35	:1.03:
3-4	52	52	2700	14	:3.85:	.55	.19	.06	.03	.12	c	.10	--	1.05	: .83:
4-5	52	52	2700	13	:2.99:	.46	.15	.05	.03	.12	c	.10	--	.91	: .73:

a. The limited cost column includes all items included in the total cost column except interest on investment and housing. In this study interest and housing were considered separately.

b. It was assumed that there was no appreciable difference between the cost of operation of general purpose and standard type wheel tractors. For gasoline tractors the difference in original purchase price was 100-200 dollars depending on size.

c. The colons are used to set off the columns considered in the enterprise analysis relative to machinery operations costs.

d. The rate of field performance is approximately 5 acres per hour.

e. The rate of field performance is approximately 6 acres per hour.

f. Lubrication included with fuel.

Table 2. Cost per hour of operating non-powered farm machinery.

Acres Per Hour	Annual Use (Acres) (10)	Year New	Year Purch.	Purch. Price	Years Life	Per Acre of Use: Invest.	Dep.	Int.	Tax	Hous.	Repair	Total Cost	Limited Cost[a]
						I. Plows							
						A. Moldboard, one way							
						Two 14 inch							
.8	5-10	52	52	205	16	:1.36:[b]	.17	.07	.02	.09	.25	.60	: .44:[b]
.8	10-15	52	52	205	15	: .82:	.11	.04	.01	.05	.25	.46	: .37:
						Two 16 inch							
1.1	5-10	52	52	276	16	:1.84:	.23	.09	.03	.09	.25	.69	: .51:
1.1	10-15	52	52	276	15	:1.12:	.15	.06	.02	.05	.25	.53	: .42:
						Three 14 inch							
1.3	10-15	52	52	356	16	:1.42:	.18	.06	.02	.08	.25	.59	: .45:
1.3	15-20	52	52	356	15	:1.05:	.14	.05	.02	.06	.25	.52	: .41:
						Three 16 inch							
1.5	10-15	52	52	376	16	:1.52:	.19	.08	.02	.08	.25	.62	: .46:
1.5	15-20	52	52	376	15	:1.05:	.14	.05	.02	.06	.25	.52	: .41:
						Four 16 inch							
1.9	15-20	54	54	700	16	:2.00:	.25	.10	.03	.10	.25	.73	: .53:
1.9	20-30	54	54	700	15	:1.42:	.19	.07	.02	.07	.25	.60	: .46:
						Five 16 inch							
2.5	20-30	55	55	825	15	:1.65:	.22	.08	.03	.09	.25	.67	: .50:
2.5	30-50	55	55	825	14	:1.05:	.15	.05	.06	.06	.25	.53	: .42:
	(10)					B. Moldboard, two way							
						One 14 inch							
.4	0-5	52	53	215	17	:4.32:	.54	.22	.07	.12	.25	1.20	: .86:
						Two 14 inch							
.8	0-5	50	50	535	17	:10.71:	1.26	.54	.17	.19	.25	2.41	:1.68:
.8	5-10	50	50	535	16	: 5.12:	.45	.26	.08	.09	.25	1.13	: .78:
	(10)					C. Disk							
						2 disk							
.07	5-10	55	55	319	16	:2.16:	.27	.11	.03	.09	.25	.75	: .55:
						3 disk							
1.1	10-15	53	53	380	16	:1.52:	.19	.08	.02	.08	.25	.62	: .46:
1.1	15-20	53	53	380	15	:1.05:	.14	105	102	106	125	152	: .42:
						4 disk							
1.5	15-20	52	52	406	16	:1.20:	.15	.16	.02	.10	.25	.58	: .42:
1.5	20-30	52	52	406	15	: .82:	.11	.04	.01	.07	.25	.48	: .37:
	(10)					II. Disks, field and covercrop							
						5-6 feet							
1.9	0-10	51	51	263	17	:2.64:	.31	.13	.04	.12	.06	.66	: .41:
1.9	10-20	51	51	263	16	: .88:	.11	.04	.01	.04	.06	.26	: .18:
1.9	20-30	51	51	263	15	: .52:	.07	.03	.01	.02	.06	.19	: .14:
						7-8 feet							
2.5	10-20	51	51	335	16	:1.12:	.14	.06	.02	.05	.06	.33	: .22:
2.5	20-30	51	51	335	15	: .68:	.09	.03	.01	.03	.06	.22	: .16:
						9-10 feet							
3.4	20-30	53	53	513	16	:1.04:	.13	.05	.02	.04	.06	.30	: .21:
3.4	30-40	53	53	513	15	: .75:	.10	.04	.01	.03	.06	.24	: .17:
						12 feet							
4.5	20-30	56	56	650	16	:1.28:	.16	.06	.02	.06	.06	.36	: .24:
4.5	30-40	56	56	650	15	: .90:	.12	.04	.01	.04	.06	.27	: .19:
						III. Harrows							
						A. Spiketooth							
						2 section							
3.0	10-20	52	52	85	18	: .27:	.03	.01	.00	.01	.02	.11	: .05:
3.0	20-30	52	52	85	17	: .20:	.03	.01	.00	.01	.02	.07	: .04:

Table 2, continued.

Acres Per Hour	Annual Use	Year New	Year Purch.	Purch. Price	Years Life	Invest.	Per Acre of Use Dep.	Int.	Tax	Hous.	Repair	Total Cost	Limited Cost
	acres (10)			III. Harrows									
						A. Spiketooth							
						3 section							
4.0	10-20-	52	52	115	18	: .36:	.04	.02	.01	.02	.02	.11	: .07:
4.0	20-30	52	52	115	17	: .24:	.03	.00	.02	.02	.02	.09	: .05:
4.0	30-40	52	52	115	16	: .16:	.02	.01	.00	.01	.02	.07	: .04:
						4 section							
5.0	20-30	52	52	145	17	: .32:	.04	.02	.00	.02	.02	.09	: .06:
5.0	30-40	52	52	145	16	: .24:	.03	.01	.00	.01	.02	.07	: .05:
	(10)					B. Springtooth							
						6 feet							
2.2	0-10	52	52	80	20	: .80:	.08	.04	.01	.04	.03	.20	: .16:
2.2	20-30	52	52	80	17	: .17:	.02	.01	.00	.07	.03	.07	: .05:
2.2	30-40	52	52	80	16	: .11:	.01	.01	.00	.04	.03	.06	: .05:
						8 feet							
2.8	10-20	52	52	115	18	: .39:	.04	.02	.01	.01	.03	.10	: .08:
2.8	20-30	52	52	115	17	: .23:	.03	.01	.00	.01	.03	.08	: .06:
						10 feet							
3.4	10-20	52	52	150	18	: .50:	.06	.02	.01	.02	.03	.14	: .09:
3.4	20-30	52	52	150	17	: .30:	.04	.02	.00	.02	.03	.11	: .07:
						12 feet							
4.0	10-20	52	52	185	18	: .62:	.07	.03	.01	.02	.03	.16	: .11:
4.0	20-30	52	52	185	17	: .37	.04	.02	.01	.02	.03	.12	: .09:
	(100)			IV. Rollers									
						5-6 feet							
2.2	1-2	53	53	168	18	: .54:	.06	.03	.01	.02	.03	.15	: .10:
2.2	2-3	53	53	168	16	: .32:	.04	.02	.01	.01	.03	.11	: .08:
						8 feet							
3.0	1-2	51	51	203	18	: .72:	.08	.04	.01	.03	.03	.19	: .12:
3.0	2-3	51	51	203	16	: .40:	.05	.02	.01	.02	.03	.13	: .09:
						10 feet							
3.6	1-2	53	53	269	20	:1.90	.09	.10	.03	.04	.03	.29	: .15:
3.6	2-3	53	53	269	18	: .54:	.06	.03	.01	.02	.03	.15	: .10:
3.6	3-4	53	53	269	16	: .40:	.05	.02	.01	.02	.03	.13	: .09:
						12 feet							
4.2	2-3	54	54	325	18	: .63:	.07	.03	.01	.03	.03	.16	: .11:
4.2	3-4	54	54	325	16	: .48:	.06	.02	.01	.02	.03	.14	: .10:
	(100)			V. Levels, floats, drags (wood)									
						8 feet							
2.0	0-1	56	56	30	10	: .30:	.06	.02	--	.06	.02	.16	: .08:
						10 feet							
3.0	1-2	56	56	35	8	: .12:	.03	.01	--	.02	.02	.08	: .05:
						12 feet							
4.0	1-2	56	56	40	8	: .13:	.03	.01	--	.02	.02	.08	: .05:
	(100)			VI. Subsoilers									
						1 prong							
1.7	0-1	55	56	85	17	: .85:	.10	.04	.01	.04	.06	.25	: .17:
1.7	1-2	55	56	85	15	: .30:	.04	.02	.00	.01	.06	.13	: .10:
						2 prong							
1.5	0-1	53	53	450	17	:4.50:	.53	.22	.07	.05	.06	.93	: .66:
1.5	1-2	53	53	450	15	:1.50:	.20	.08	.02	.02	.06	.38	: .28:
	(100)			VII. Field cultivators and chisels									
						6 feet							
2.0	1-2	53	53	165	14	: .56:	.08	.03	.01	.04	.10	.26	: .19:
2.0	2-3	53	53	165	13	: .32:	.05	.02	.01	.03	.10	.21	: .16:

Table 2, continued.

Acres Per Hour	Annual Use	Year New	Year Purch.	Purch. Price	Year Life	Invest.	Per Acre of Use Dep.	Int.	Tax	Hous.	Repair	Total Cost	Limited Cost
	acres												
						8 feet							
2.7	1-2	52	52	267	14	: .91:	.13	.05	.01	.06	.10	.35	: .24:
						10 feet							
3.4	2-3	53	53	340	14	: .70:	.10	.04	.01	.06	.10	.31	: .21:
						12 feet							
4.1	3-4	55	55	475	13	: .65:	.10	.03	.01	.05	.10	.29	: .21:
	(100)			VIII. Rotary hoes									
						8 feet							
1.8	1-2	53	53	227	16	: .72:	.09	.04	.01	.05	.20	.39	: .30:
1.8	2-3	53	53	227	15	: .45:	.06	.02	.01	.03	.20	.32	: .27:
	(100)			IX. Rod weeders									
						12 feet							
4.0	1-2	50	50	220	20	: .73:	.07	.04	.01	.05	.02	.20	: .10:
	(10)			X. Row cultivators									
						1 row (also pole bean)							
.9	5-10	52	52	130	15	: .90:	.12	.04	.02	.04	.15	.37	: .28:
						2 row							
1.5	5-10	52	52	184	15	:1.20:	.16	.06	.02	.08	.15	.47	: .33:
1.5	10-15	52	52	184	14	: .77:	.11	.04	.01	.05	.15	.35	: .27:
	(100)			XI. Rotovators									
						1 row							
.8	0-1	56	56	375	13	:3.77:	.58	.19	.06	.03	.50	1.36	:1.14:
1.5	1-2	56	56	880	10	:2.95:	.59	.15	.05	.04	.75	1.58	:1.39:
	(10)			XII. Planters									
				A. Grain drills									
						6 feet							
1.9	5-10	51	51	293	19	:2.00:	.21	.10	.03	.06	.07	.47	: .31:
						8 feet							
2.6	5-10	51	51	443	19	:2.94:	.31	.15	.05	.08	.07	1.18	: .43:
						10 feet							
3.3	10-15	51	51	539	18	:2.16:	.24	.11	.04	.07	.07	.53	: .35:
3.3	15-20	51	51	539	17	:1.53:	.18	.08	.02	.05	.07	.40	: .27:
						12 feet							
3.8	10-15	51	51	631	18	:2.52:	.28	.13	.04	.09	.07	.61	: .37:
3.8	15-20	51	51	631	17	:1.78:	.21	.09	.03	.06	.07	.46	: .31:
	(10)			B. Corn and bean planters									
						1 row							
.8	0-5	52	52	148	17	:2.98:	.35	.15	.05	.12	.12	.79	: .52:
						2 row							
1.4	0-5	52	52	206	17	:4.08	.48	.20	.07	.25	.12	1.12	: .67:
1.4	5-10	52	52	206	16	:1.36:	.17	.07	.02	.08	.12	.46	: .31:
						3 row							
2.2	5-10	50	50	405	17	:2.72:	.32	.14	.04	.13	.12	.75	: .48:
						4 row							
3.0	15-20	55	55	650	15	:1.88:	.25	.09	.03	.07	.12	.56	: .50:
	(100)			XIII. Fertilizer spreaders									
				A. Commercial fertilizer									
						6 feet							
2.0	0-1	53	53	231	15	:2.32:	.31	.12	.04	.08	.02	.57	: .37:

Table 2, continued.

Acres Per Hour	Annual Use	Year New	Year Purch.	Purch. Price	Years Life	Per Acre of Use Invest.	Dep.	Int.	Tax	Hous.	Repair	Total Cost	Limited Cost
	acres												
						8 feet							
2.7	0-1	53	53	250	15	:2.48:	.33	.12	.04	.09	.02	.60	: .39:
2.7	1-2	53	53	250	14	: .84:	.12	.04	.01	.03	.02	.22	: .15:
						10 feet							
3.4	0-1	53	53	278	15	:2.78:	.37	.14	.05	.12	.02	.70	: .44:
3.4	1-2	53	53	278	14	: .91:	.13	.05	.01	.04	.02	.25	: .16:
3.4	2-3	53	53	278	13	: .58:	.09	.03	.01	.02	.02	.17	: .12:
						12 feet							
4.1	1-2	55	55	317	14	:1.05:	.15	.05	.02	.06	.02	.30	: .19:
4.1	2-3	55	55	317	13	: .65:	.10	.03	.01	.03	.02	.19	: .13:
	(10)				B.	Manure (average size)							
.5	5	48	48	345	17	:3.48:	.41	.17	.06	.23	.10	.97	: .57:
.5	10	48	48	345	15	:1.72:	.23	.09	.03	.12	.10	.57	: .36:
(Field)	(100)			XIV.	Sprayers, tractor mounted								
4	0-1	53	53	156	13	:1.56:	.24	.08	.03	.02	.10	.47	: .37:
4	1-2	53	53	156	13	: .52:	.08	.03	.01	.01	.10	.23	: .19:
4	2-3	53	53	156	12	: .30:	.05	.02	.00	.01	.10	.18	: .15:
(Field)	(100)			XV.	Dusters (average size)								
5	0-1	52	52	353	15	:3.76:	.47	.19	.06	.12	.07	.91	: .60:
5	1-2	52	52	353	15	:1.28:	.16	.06	.02	.04	.07	.35	: .25:
	(10)			XVI.	General farm equipment								
					A.	Tractor mowers, 5-7 feet							
1.8	5-10	51	51	300	13	:2.02:	.31	.10	.03	.04	.36	.84	: .70:
					B.	Side delivery rakes							
2.4	10-15	53	53	421	12	:1.68:	.28	.08	.03	.10	.12	.61	: .43:
					C.	Wagons (average size)							
--	10	53	53	160	18	:1.62:	.18	.08	.03	.19	.06	.54	: .27:
					D.	Trailers (average size)							
--	5	53	53	160	18	:3.24:	.36	.16	.05	.31	.06	.94	: .47:
--	10	53	53	160	18	:1.62:	.18	.08	.03	.15	.06	.50	: .27:
					E.	Tractor lifts or loaders							
--	2	57	57	580	12	:14.52:	2.42	.73	.24	.15	.25	3.79	:2.91:
	(1)			XVII.	Specialized machinery								
					A.	Pole beans							
						Stake driver							
.4	24	56	56	202	17	:4.21:	.49	.21	.07	.10	.12	.99	: .68:
						Stake puller							
--	22	56	57	55	8	:3.52:	.36	.18	.06	.10	--	.70	: .52:
						Stringer							
.4	35	57	57	310	12	:4.43	.75	.22	.07	.04	.76	1.84	:1.58:
					B.	Hops							
						Plow							
1.6	100	46	48	242	14	:1.43:	.19	.07	.02	.16	.38	.82	: .59:
						Stringing cart							
--	80	48	48	264	20	:1.70:	.17	.08	.03	.06	.14	.48	: .34:
					C.	Onions							
						Planter							
1.2	26	52	53	295	14	:6.12:	.87	.31	.10	.42	.53	2.23	:1.50:

Table 2, continued.

Acres Per Hour	Annual Use	Year New	Year Purch.	Purch. Price	Years Life	Invest.	Per Acre of Use Dep.	Int.	Tax	Hous.	Repair	Total Cost	Limited Cost
	acres												
						Puller							
1.0	30	51	51	384	15	:6.37:	.85	.32	.10	.30	1.11	2.68	:2.06:
						Pickup machine							
.4	22	48	49	908	16	:22.00:	2.75	1.10	.35	.58	2.63	7.41	:5.73:
						D. Cane berries							
						Grape hoe							
--	--	--	--	--	--	:1.80:	--	--	--	--	--	--	: .28:
						E. Forages							
						Hay crusher							
--	100	57	57	840	10	:4.20:	--	--	--	--	--	--	: .91:

a. The limited cost column includes all items included in the total cost column except interest on investment and housing. In this study interestand housing costs were considered separately.

b. The colons are used to set off the columns considered in the enterprise cost analysis relative to machinery operation costs.

Table 3. Annual farm machinery use comparisons as related to grouped enterprises.

Farm Machines	Crop Groupings: Grains and legume seeds	Grass seeds	Forages	Small fruits	Tree fruits and nuts	Vege-tables	Hops	Mint
I. Tractors				(100 hours)				
A. Gasoline wheel								
5-7 H.P.	2-4	---	---	-2	---	2-4	---	---
8-11 H.P.	2-4	2-4	2-4	2-4	2-4	4-6	---	---
12-15 H.P.	4-6	2-4	4-6	4-6	2-4	4-6	4-6	2-4
16-19 H.P.	4-6	4-6	6-8	6-8	4-6	6-8	6-8	4-6
20-23 H.P.	4-6	4-6	4-6	6-8	4-6	6-8	6-8	4-6
24-27 H.P.	4-6	4-6	6-8	4-6	4-6	6-8	4-6	4-6
28-31 H.P.	4-6	4-6	4-6	4-6	4-6	6-8	6-8	4-6
32-35 H.P.	4-6	4-6	4-6	4-6	---	6-8	---	---
36-39 H.P.	4-6	---	4-6	---	---	6-8	---	---
40-43 H.P.	4-6	6-8	---	---	---	---	---	---
B. Diesel wheel								
20-23 H.P.	8-10	---	---	---	---	---	---	---
24-27 H.P.	8-10	8-10	---	---	---	---	8-10	---
28-31 H.P.	8-10	8-10	---	---	4-6	---	6-8	6-8
32-35 H.P.	6-8	6-8	---	---	---	8-10	---	---
36-39 H.P.	6-8	---	---	---	---	---	---	---
40-43 H.P.	---	---	---	---	---	---	---	---
44-47 H.P.	---	---	---	---	---	---	---	---
C. Gasline crawler								
12-15 H.P.	4-6	4-6	---	---	---	2-4	---	---
16-19 H.P.	4-6	4-6	---	2-4	2-4	2-4	6-8	---
20-23 H.P.	4-6	---	---	---	---	2-4	---	---
24-27 H.P.	6-8	---	---	---	---	4-6	---	---
28-31 H.P.	6-8	---	---	---	---	---	---	---
D. Diesel crawler								
16-19 H.P.	4-6	---	4-6	---	4-6	4-6	6-8	---
20-23 H.P.	6-8	---	---	---	---	---	---	---
24-27 H.P.	6-8	6-8	---	---	4-6	6-8	6-8	---
28-31 H.P.	6-8	---	---	---	4-6	6-8	---	---
32-35 H.P.	6-8	---	---	---	---	---	6-8	---
36-39 H.P.	6-8	---	---	---	---	6-8	---	---
40-43 H.P.	---	---	---	---	---	---	---	---
44-47 H.P.	---	---	---	---	---	---	---	---
48-55 H.P.	6-8	---	4-6	---	4-6	6-8	6-8	---
II. Autos, Trucks, Buses				(100 miles)				
A. Automobiles	100-120	100-120	100-120	100-120	100-120	100-120	100-120	100-120
B. Trucks								
1/2-3/4 Ton	60-80	60-80	---	60-80	60-80	80-100	80-100	60-80
1 Ton	40-60	40-60	---	40-60	20-40	40-60	---	---
1 1/2 Ton	20-40	20-40	20-40	40-60	20-40	40-60	60-80	20-40
2 Ton	20-40	20-40	20-40	40-60	20-40	40-60	60-80	20-40
C. Bus	---	---	---	-20	---	20-40	---	---
III. Combines				(10 hours)				
A. Pull type								
5-7 ft.	10-15	15-20	---	---	---	---	---	---
8-9 ft.	10-15	15-20	---	---	---	---	---	---
B. Self-propelled								
9 ft.	15-20	25-30	---	---	---	---	---	---
10 ft.	15-20	25-30	---	---	---	---	---	---
12 ft.	15-20	25-30	---	---	---	---	---	---
14 ft.	15-20	25-30	---	---	---	---	---	---
IV. Swathers	10-15	15-20	---	---	---	---	---	---
V. Plows				(10 acres)				
A. Moldboard, one way								
2 bottom	5-10	5-10	5-10	5-10	---	5-10	5-10	5-10
3 bottom	10-15	10-15	10-15	---	---	10-15	---	10-15
4 bottom	20-30	20-30	---	---	---	---	20-30	---
5 bottom	30-50	---	---	---	---	20-30	---	---
B. Moldboard, two way								
1 bottom	-5	---	---	-5	---	-5	---	---
2 bottom	5-10	5-10	5-10	5-10	---	5-10	5-10	5-10
C. Disk								
2 disk	5-10	5-10	5-10	5-10	5-10	5-10	5-10	5-10
3 disk	10-15	10-15	10-15	10-15	10-15	10-15	10-15	10-15
4 disk	20-30	20-30	20-30	20-30	20-30	20-30	20-30	20-30
VI. Disk, field & cover crop				(100 acres)				
5-6 ft.	10-20	10-20	10-20	20-30	-10	10-20	20-30	---

Table 3, continued.

Farm machines	Crop Groupings: Grains and legume seeds	Grass seeds	Forages	Small fruits	Tree fruits and Nuts	Vege-tables	Hops	Mint
VI. Disks, field & cover crop				(100 acres)				
5-6 ft.	1-2	1-2	1-2	2-3	-1	1-2	2-3	---
7-8 ft.	2-3	2-3	2-3	2-3	1-2	2-3	---	2-3
9-10 ft.	2-3	2-3	---	---	2-3	2-3	---	---
11-12 ft.	3-4	3-4	---	---	---	3-4	---	---
VII. Harrows				(100 acres)				
A. Spiketooth								
2 section	2-3	3-4	2-3	1-2	1-2	1-2	---	1-2
3 section	2-3	3-4	---	1-2	1-2	2-3	---	2-3
4 section	2-3	3-4	---	---	---	---	---	3-4
B. Springtooth								
5-6 ft.	-1	---	---	-1	---	---	3-4	---
7-8 ft.	2-3	---	1-2	---	1-2	2-3	---	1-2
9-10 ft.	2-3	2-3	---	---	---	2-3	---	2-3
11-12 ft.	2-3	---	---	---	---	2-3	---	2-3
VIII. Rollers				(100 acres)				
5-6 ft.	1-2	---	---	---	---	1-2	2-3	---
7-8 ft.	1-2	---	---	---	-1	2-3	---	1-2
9-10 ft.	2-3	3-4	---	---	-1	2-3	---	---
11-12 ft.	2-3	3-4	---	---	-1	3-4	---	---
IX. Subsoilers				(100 acres)				
1 prong	---	---	---	-1	---	1-2	-1	---
2 prong	---	---	---	---	---	1-2	1-2	---
X. Field cultivators & chisels				(100 acres)				
5-6 ft.	1-2	---	---	1-2	---	1-2	3-4	---
7-8 ft.	1-2	---	---	---	---	1-2	----	---
9-10 ft.	2-3	---	---	---	---	2-3	---	---
11-12 ft.	2-3	---	---	---	---	---	---	---
XI. Rotary hoe				(100 acres)				
8 ft.	2-3	---	---	---	---	---	1-2	---
XII. Row cultivators				(10 acres)				
1 row	---	---	---	5-10	---	5-10	---	---
2 row	5-10	---	---	5-10	---	10-15	---	---
XIII. Grain drills				(10 acres)				
5-6 ft.	5-10	---	5-10	5-10	5-10	---	5-10	---
7-8 ft.	5-10	---	5-10	---	5-10	5-10	---	---
9-10 ft.	10-20	20-30	---	---	10-15	10-15	---	---
11-12 ft.	15-20	---	---	---	10-15	---	---	---
XIV. Corn & bean planters				(10 acres)				
1 row	---	---	---	---	---	-5	---	---
2 row	5-10	---	---	---	---	-5	---	---
3 row	5-10	---	---	---	---	---	---	---
4 row	10-15	---	---	---	---	---	---	---
XV. Commercial fertilizer spreader				(100 acres)				
5-6 ft.	-1	---	---	-1	---	---	-1	---
7-8 ft.	1-2	---	1-2	-1	-1	-1	---	---
9-10 ft.	1-2	2-3	2-3	1-2	-1	1-2	1-2	1-2
11-12 ft.	1-2	2-3	2-3	1-2	1-2	2-3	---	---
XVI. Farm sprayers				(100 acres)				
Tractor Mtd.	1-2	2-3	---	1-2	---	-1	---	---
Small trail	2-3	4-5	---	1-2	---	1-2	1-2	---
Medium trail	3-4	4-5	---	3-4	---	2-3	1-2	1-2
Large trail	3-4	4-5	---	---	---	---	2-3	4-5
XVII. Rotovators				(100 acres)				
1 row	---	---	---	-1	---	---	---	---
4-6 ft.	---	---	---	1-2	---	1-2	---	---
XVIV. Farm trailers	5	---	---	(10 acres) ---	---	---	---	10

Table 4. Estimated cost of housing farm machinery.[a]

Item	Estimated Space Required	Cost per Year
	sq. ft.	$
I. Powered Machinery		
A. Wheel tractors		
7 H.P.	50	6.00
8-11 H.P.	60	7.20
12-15 H.P.	70	8.40
16-19 H.P.	80	9.60
20-23 H.P.	85	10.20
24-27 H.P.	90	10.80
28-31 H.P.	95	11.40
32-35 H.P.	100	12.00
36-39 H.P.	104	12.48
40-43 H.P.	108	12.96
44-47 H.P.	112	13.44
B. Crawler tractors		
12-15 H.P.	46	5.52
16-19 H.P.	51	6.12
20-23 H.P.	56	6.72
24-27 H.P.	66	7.92
28-31 H.P.	76	9.12
32-35 H.P.	86	10.32
36-39 H.P.	96	11.52
48-55 H.P.	108	12.96
C. Autos, trucks, buses		
automobile	126	15.12

a. The following estimates were used in arriving at a cost per square foot of storage space:

	Cost per Sq. Ft.
1. Depreciation ($1.25 per sq. ft. original cost, 20 years life)	$.062
2. Interest (half-life value, 6 percent)	.037
3. Taxes (half-life value, 20 percent taxable, 81 mills)	.002
4. Maintenance ($10 per year on a 30 x 50 ft. building)	.008
5. Insurance (half-life value, $.47 per hundred)	.003
6. Land ($500 per acre, 5 percent interest)	.005
Total annual cost per square foot	.12

Table 4, continued.

Item	Estimated Space Required	Cost per Year
	sq. ft.	$
trucks		
1/2-3/4 T.	150	18.00
1 T.	179	21.50
1.5 T.	208	24.96
2.0 T.	208	24.96
buses	---	---
D. Combines		
pull type		
5-7 ft.		21.60
8-9 ft.		28.80
self-propelled		
9 ft.		30.00
10 ft.		32.00
12 ft.		36.00
14 ft.		40.00
E. Swathers, S.P.		12.00
F. Warehouse tractor lifts	70	8.40
G. Pole bean cultivator tractors	30	3.60
H. Garden rototillers	14	1.68
II. Non-powered machinery		
A. Seedbed preparation		
1. Plows		
a. moldboard, one way		
2 bottom	55	6.60
3 bottom	84	10.08
4 bottom	140	16.80
5 bottom	187	22.44
b. moldboard, two way		
1 bottom	35	4.20
2 bottom	55	6.60
c. disk		
2 disk	55	6.60
3 disk	84	10.08
4 disk	140	16.80

Table 4, continued.

Item	Estimated Space Required	Cost per Year
	sq. ft.	$
2. Disks (cover crop and field)		
5-6 ft.	49	5.88
6-8 ft.	63	7.56
9-10 ft.	88	10.56
12 ft.	117	14.04
3. Harrows		
a. spike		
2 section	15	1.80
3 section	20	2.40
4 section	25	3.00
5 section	30	3.60
b. springtooth		
6 ft.	15	1.80
8 ft.	18	2.16
10 ft.	24	2.88
12 ft.	30	3.60
4. Levels, drags, floats (wood)		
8 ft.	26	3.12
10 ft.	28	3.36
12 ft.	30	3.60
5. Rollers		
5-6 ft.	30	3.60
8 ft.	38	4.56
10 ft.	46	5.52
12 ft.	54	6.48
6. Subsoiler		
1 prong	16	1.92
2 prong	20	2.40
7. Field cultivator		
6 ft.	56	6.72
8 ft.	80	9.60
10 ft.	108	14.40
12 ft.	140	16.80
8. Rod weeders		
12 ft.	68	8.12

Table 4, continued.

Item	Estimated Space Required sq. ft.	Cost per Year $
B. Planting		
1. Grain drills		
6 ft.	36	4.32
8 ft.	48	5.76
10 ft.	72	8.64
12 ft.	112	11.04
2. Corn and bean planters		
1 row	26	3.12
2 row	52	6.24
3 row	78	9.42
4 row	105	12.60
C. Fertilizer and chemical application equipment		
1. Commercial fertilizer spreaders		
6 ft.	32	3.84
8 ft.	38	4.56
10 ft.	50	6.00
12 ft.	70	8.40
2. Farm sprayers		
tractor mounted	10	1.20
small trailer	36	4.32
medium trailer	48	5.76
large trailer	100	12.00
3. Farm dusters	48	5.76
D. Crop cultivation equipment		
1. Row cultivators		
1 row	25	3.00
2 row	49	5.88
2. Rotovators		
1 row	12	1.44
4-6 ft.	49	5.88
3. Rotary hoes		
8 ft.	60	7.20
E. Crop harvest equipment		
1. Tractor mowers	25	3.00

Table 4, continued.

Item	Estimated Space Required	Cost per Year
	sq. ft.	$
2. Side rake	100	12.00
F. Misc. type equipment		
1. Wagon	80	9.60
2. Trailer	64	7.68
3. Tractor lift	25	3.00

APPENDIX D

Component Costs of Irrigating Farm Crops by the Sprinkler Method

Information was available on 75 of the farm schedules which could be and was used to estimate irrigation costs. This information was designed to give irrigation costs on an individual farm basis; the physical information collected was in terms of hours of water application and the cost section was designed to provide costs per hour of operation. No attempt was made to determine the number of inches of water applied or costs in relation to pump output. In this study the quantity of water applied is reflected only in terms of the number of irrigations and the time length of the settings. In addition to the information from the farm survey records, information was obtained from Soil Conservation Service technicians and electrical power company farm consultants.

The estimates used are not without relative checks. For each estimate made of component irrigation costs, due to missing survey data, there were several other comparative costs which were determined directly from the survey. Seldom was it necessary to estimate complete irrigation costs; usually only one or two of the component costs were missing

The size of an irrigation system may be determined in several ways; vis., lateral length, water output, total acres irrigated and pump size. Pump size was the only measure which would fit the survey data; hence, all costs are reported in relation to pump horse power.

Cost of Operating Sprinkler Irrigation Systems

The survey data was sorted and tabulated in terms of motor horse-power and annual use. The representative price paid for the various sized systems was determined by simple regression techniques. The equation thus determined was: $Y = 1122.85 + 132.96X$, where X equals the size of the system in terms of motor horse-power. Although the goodness of fit was not determined the graphic comparison was very impressive. The average year purchased on all of the horse-power groupings was between 1951 and 1953. In accordance with the method used in calculating the price, all systems are presented as being purchased in 1952. The price paid was assumed to be the same regardless of the annual use of the system.

The average length of life of the system was estimated by the farmers surveyed at 19 to 22 years almost without exception and regardless of size or use. For this reason a straight estimated life of 20 years was used.

Repair was an extremely variable item and seemed to follow no pattern. It was assumed, therefore, that repair varied only with the size of the system and a regression equation was used to estimate the repair function. The estimating equation was: $Y = .048 + .001X$ where X equals motor horse-power. The graphic comparison was not so impressive but the results are logical.

Due to the indeterminate nature of power costs as recorded in the survey schedules it was necessary to obtain estimates from outside sources. Costs per kilowatt hour were determined by averaging

the irrigation rates from two electrical power companies. It was assumed that one horse-power equals .746 kilowatts; this conversion was discussed with the power company consultants who supplied the power rates and it seemed satisfactory. Also, it was necessary to assume a three month irrigation season with power equally distributed per month and that minimum fees were equally distributed. Table 1 presents the results of this determination.

Table 1. Cost of electrical power for operating irrigation pumps by pump size and annual hours of use.

Annual	Motor Horse-power							
Use	5	7.5	10	15	20	25	30	40
(hours)				(dollars)				
400	.12	.16	---	---	---	---	---	---
6600	.08	.12	.16	.23	.31	.39	---	---
800	.06	.10	.13	.18	.25	.32	.38	.50
1000	---	---	.12	.16	.22	.27	.33	.43
1200	---	---	---	---	---	---	.29	.39

All other costs were determined in accordance with methods outlined in Appendix C for powered and non-powered farm machinery.

Table 2 presents the calculated costs per hour of operation of sprinkler irrigation systems as determined under the methods and assumptions described above. The annual use of category to use was determined on the individual farm survey record in relation to crops and acreage.

Table 2. Cost of operating sprinkler irrigation systems by pump size and annual hours of use.

Annual Use	Year Acqu.	Price Paid	Years Life	Per Hour of Use						Total Cost	Limited Cost[a]
				Invest.	Dep.	Int.	Tax	Power	Repair		
						5 H.P.					
400	52	1788	20	:2.91:[b]	.22	.15	.05	.10	.05	.57	: .42:
600	52	1788	20	:1.94:	.15	.10	.03	.08	.05	.41	: .31:
800	52	1788	20	:1.45:	.11	.07	.02	.06	.05	.31	: .24:
						7.5 H.P.					
400	52	2120	20	:3.44:	.26	.17	.06	.16	.06	.71	: .54:
600	52	2120	20	:2.30:	.18	.11	.04	.12	.06	.51	: .40:
800	52	2120	20	:1.72:	.13	.09	.03	.10	.06	.41	: .32:
						10 H.P.					
600	52	2452	20	:2.66:	.20	.13	.04	.16	.06	.59	: .46:
800	52	2452	20	:1.99:	.15	.10	.03	.12	.06	.46	: .36:
1000	52	2452	20	:1.59:	.12	.08	.03	.11	.06	.40	: .32:
						15 H.P.					
600	52	3117	20	:3.38:	.26	.17	.05	.24	.06	.78	: .61:
800	52	3117	20	:2.53:	.19	.13	.04	.19	.06	.61	: .48:
1000	52	3117	20	:2.03:	.16	.10	.03	.17	.06	.52	: .42:
						20 H.P.					
600	52	3782	20	:4.10:	.32	.20	.07	.31	.07	.97	: .77:
800	52	3782	20	:3.07:	.24	.15	.05	.25	.07	.76	: .61:
1000	52	3782	20	:2.46:	.19	.12	.04	.21	.07	.63	: .51:
						25 H.P.					
600	52	4447	20	:4.82:	.37	.24	.08	.39	.07	1.15	: .91:
800	52	4447	20	:3.61:	.28	.18	.06	.32	.07	.91	: .73:
1000	52	4447	20	:2.89:	.22	.14	.05	.28	.07	.76	: .62:
						30 H.P.					
800	52	5112	20	:4.15:	.32	.21	.07	.38	.08	1.06	: .85:
1000	52	5112	20	:3.32:	.26	.17	.05	.32	.08	.88	: .71:
1200+	52	5112	20	:2.77:	.21	.14	.04	.29	.08	.76	: .62:
						40 H.P.					
800	52	6441	20	:5.23:	.40	.26	.08	.50	.09	1.33	:1.07:
1000	52	6441	20	:4.19:	.32	.21	.07	.43	.09	1.12	: .91:
1200+	52	6441	20	:3.49:	.27	.17	.06	.39	.09	.98	: .81:

a. The limited cost column includes all items included in the total cost column except interest on investment and housing. In this study interest and housing costs were considered separately.

b. The colons are used to set off the columns considered in the enterprise cost analysis relative to machinery opperation costs.

Irrigation Well Costs

From the farm schedules data was obtained for estimating the average cost of irrigation wells. It was assumed that the cost of drilling wells on the river-bottom soils was the same regardless of the geographic location; the same for the fine textured terrace soils. The gravelly terrace soils were not generally irrigated from wells since there was water available from ditches and ponds. For this reason no estimate was made for the gravelly soils area; a charge per acre of $3.00 was made for the surface water. The assumption made above may not hold consistently, but it was remarkable the uniformity of the estimates when thus grouped. The substrata of the river-bottom soils along the North Santiam River and the Willamette River are somewhat different and it would be suspected that the wells along the Willamette River would be more expensive. However, a couple of reliable farm schedules were reviewed and it appeared that the costs were not greatly different. Table 3 presents the average costs for irrigation wells in Marion County. The average year drilled was 1952. Almost universally there was no estimate given for repair. Irrigation wells are not taxed directly.

Table 3. Irrigation well costs associated with pump size and soil groups.

Item	Pump size						
	5-7.5	10	15	20	25	30	40
	Riverbottom soils						
Year new	----	1954	1950	1950	----	----	----
Cost	----	$220	$280	$430	----	----	----
	Fine textured terrace soils						
Year new	1954	1954	1953	1951	1953	1951	1951
Cost	$800	$800	$1200	$1275	$1325	$1440	$1525

Present investment was calculated on the basis of half-life. Depreciation was calculated on the basis of three percent per year. Hours of annual use was the same as that of the irrigation system.

Area Covered per Setting in Relation to Geographic Location of the Well and Size of the Irrigation System

The average number of acres covered per setting as related to the size of the motor and location of the well in respect to terrace and riverbottom soils was difficult to determine. In the first place the survey data was not designed to give this information. However, in order to determine the number of hours of use to charge to an individual enterprise it was necessary to know the area covered per setting, the number of hours per setting and the number of times irrigated per season. It was thought that the area covered per setting, considering the same size motor, should be less on the terrace

soils, where the well drawdown is greater than on the riverbottom soils. After visiting with electrical power company farm representatives it was determined that this may not be so since the size of the nozzle may be larger on the riverbottom soils.[a] The data from the survey records confirm that the area covered per setting is nearly the same on the terrace and riverbottom soils.

The area covered is a function of the lateral length and the number of laterals. To have sufficient pressure at the end of a lateral length the number of forty-foot sprinklers should not exceed about 20; they may be less than this and usually are. Eighteen forty foot sprinklers cover about one acre per setting. This makes the total lateral length which a motor can support a function of design. However, all laterals need not be a specific length as 20 sprinklers is only a maximum. Thus, nearly any multiple of an acre is possible.

The drawdown in the different well locations may not vary so much as would be suspected. If the drawdown is not greatly different, then the total output would tend to be equalized on the riverbottom and terrace soils. Another equalizing feature is the type of pump generally used on wells in the different areas. Centrifugal pumps are used where the drawdown is only about 15 feet; where it is much over this the turbin pump is used. The centrifugal pump is considered

a. One power company farm consultant estimated the nozzle settings on riverbottom soils to be 4/10 inches per hour and on terrace soils to be 3/10 inches per hour.

to be less efficient than the turbin pump. (45 p. 30)

On the basis of the above reasoning, survey tabulations, and the advise of irrigation technicians Table 4 was developed.

Table 4. Average number of acres covered per setting in relation to pump size.

Pump Size (H.P.)							
5-7.5	10	15	20	25	30	40	50
			Riverbottom Soils				
.6	.8	1.2	1.4	1.8	2.1	2.7	3.4
			Gravelly Terrace Soils				
.5	.8	1.2	1.4	1.8	2.1	2.7	3.3
			Fine Textured Terrace Soils				
.4	.8	1.1	1.4	1.7	2.0	2.6	3.2

Seasonal Irrigation Requirements of Various Crops in Terms of Application Time.

From the survey data and secondary sources it was possible to estimate the average number of irrigations per season and the hours per setting on the crops concerned. (5) This data is summarized in Table 5.

Table 5. Number of irrigations per season and the length of time water was applied per setting.

Crop	Number of Irrigations	Hours per Setting	
		Riverbottom and Gravel Soils	Fine Textured Terrace Soils
Pole beans	8.0	3	4
Sweet corn	3.5	4	8
Carrots	6.0	4	-
Strawberries	3.0	4	6
Mint	6.0	10	-
Hops	3.0	8	10
Pasture	8.0	8	10

Labor Requirements for Moving Sprinkler Irrigation Equipment.

Table 6 presents the results of a number of survey tabulations which were made to determine the number of hours of man labor required to move irrigation equipment per acre each time a crop was irrigated. An attempt was first made to determine labor time in relation to irrigation settings which would have reflected any change associated with the size of the pump motor. This was not possible due to the lack of adequate information. Neither was it possible to reflect the size of the motor in the per acre tabulations. Therefore it was necessary to assume that the per hour labor requirements would be the same on the various sized systems.

Table 6. Number of labor hours required to move sprinkler irrigation equipment per acre per irrigation.

Crop	Hours per acre per irrigation
Pole beans	2.1
All corn	1.8[a]
Carrots	1.5
Strawberries	1.2
All cane berries	2.0
Hay & pasture	1.3[a]
Hops	1.6
Mint	1.7
Sugar beet seed	1.5

a. A recent study in Nebraska determined a labor requirement of 1.7 hours per irrigation per acre for corn and 1.2 hours for alfalfa. (40, p. 10)

APPENDIX B

Farm Building Investments and Annual Costs as Related to Specific Crops

During the farm interview farmers were asked to estimate the "replacement cost" of their present farm buildings. Also, data were obtained relative to age and repair, and the percentage allocation of these buildings to the crops for which costs and returns data were collected. On the basis of this information investment and annual costs were determined for each building category as related to individual crops.

Depreciation on machinery storage buildings was calculated on the basis of a 30 year life for buildings on concrete foundations and 20 years for pole construction buildings or buildings sitting on rocks and other less stable foundations.

Present investment was determined on the basis of annual depreciation and building age.

Taxes were calculated in accordance with Marion County rates for 1958.

Building insurance was estimated on the basis of $.50 per $100 of present value.

Costs representing depreciation, repair, taxes, and insurance and investment were summarized over individual crops without respect to soils.

The investments and annual costs for crop yards were calculated

slightly different from buildings. Instead of a depreciated present value a half-life value was assumed. There was no insurance or tax charge made. Repair included maintenance costs. In the case of pole beans a semi-permanent type yard was assumed for all growers. Therefore, the cost reported reflects the initial setting and bracing of the posts plus materials; it does not include the annual costs associated with putting up and taking down the balance of the yard.

Table 1. Farm building investments and annual costs as related to specific crops.

Item / Crop	Machine storage Invest.	Machine storage Cost	Crop yards Invest.	Crop yards Cost	Other Item	Other Invest.	Other Cost
	(dollars)		(dollars)			(dollars)	
Small grains[a]	5.25	.58					
Field corn	11.09	1.05			Corn crib	24.05	1.84
Red clover seed	6.36	.61					
Crimson clover seed	5.96	.53					
C. ryegrass	3.40	.37					
Fesques	4.68	.57					
H. bentgrass	4.31	.47					
Corn silage	11.09	1.05					
Irrigated hay[b]	16.38	1.51					
Non-irrigated hay[b]	2.22	.23					
All pasture	--	--					
Strawberries	17.84	2.28					
Evergreen blackberries	36.00	4.39	63.00	16.40			
Boysen & loganberries	36.00	4.39	71.00	22.00			
Sweet cherries	50.20	5.02			Ladders, pails, etc.	42.75	6.08[c]
Prunes	17.75	1.46					
Filberts	19.56	1.63					
Walnuts	11.25	.91					
Pole beans	44.29	5.50	61.87	16.72	Trans. labor housing	58.27	23.35
Sweet corn	18.15	2.15					
Carrots	44.10	3.96					
Onions	[d]	[d]			Crop & machine storage	345.00	42.87
					Tote & storage boxes	130.00	25.65
Mint	7.01	1.05					
Sugar beet seed	30.00	2.58					
Hops	15.17	2.23	138.00	35.00			

a. Includes oats and vetch.

b. Includes legume and grass hay and silage.

c. Repair cost and replacement cost are considered synonyms in this case.

d. Machinery storage is included in with crop storage since most buildings are double purpose.

Estimated farm cost for tiling Marion County, Oregon, soils as determined by farmer estimates and Soil Conservation Service recommendations, 1958.

Soil	Pattern Tiling Costs Based Upon SCS Recommendations					Estimated Tiling Costs Experienced by Farm Operators			
	Recommended lateral spacings[a]	Tile req. per acre	Cost per 1000 feet[b]	Total tiling cost per acre[c]	Ratio to Woodburn	Farm survey estimated cost[d]	Imputed farm cost using Woodburn as a base	Depreciation at 3%[e]	Present investment[f]
	feet	feet	$	$	%	$	$	$	$
Willamette	none[g]								
Woodburn	100	436	185	91	100	55	55	1.65	35
Amity	80	550	185	112	123	---	68	2.04	43
Concord	70[h]	621	185	125	137	---	75	2.25	47
Dayton	60[h]	721	185	143	157	---	86	2.58	54
Clackamas	80[i]	550	185	112	123	---	68	2.04	43
Wapato	80	550	185	112	123	---	68	2.04	43
Labish	55[j] clay	776	215[k]	167	---	74	93[m]	4.65[n]	46[p]
	wood	776	200[l]	155	---	86	78[m]	8.67	39[p]

See following page for footnotes.

Appendix F, continued.

a. The lateral spacings listed are for pattern tiling. They do not represent any one individual situation as drainage requirements differ within the soil series and also with the crop being produced. The spacings represent a typical situation for the individual soil as estimated by SCS technicians.

b. The Marion County ASC office obtained commercial estimates from four different firms to obtain installation costs, including the tile, for various sizes of tile. The average of these estimates is listed below:

Size of tile inches	Cost per 1000 feet, 1960 dollars
4	175
5	205
6	235
8	340
10	440
12	540

The estimate of $185 per 1000 feet was assumed on the basis of four and five inch tile; most lateral tile is four inch.

c. All but $10 of the total tiling cost per acre represents laterals. Ten dollars per acre was a standard estimated cost for mainline tile used in Marion County. The laterals in the Labish soil drain into a large open ditch located in the middle of the old lake bed; hence, there is no mainline tile.

d. The estimates obtained from farmers contacted in this survey were not sufficient to estimate farm costs on each soil. It was necessary to estimate tiling costs for the various soils on the basis of the few soils which had sufficient observations to give representative costs. For Amity soil there were 25 farmer estimates obtained and for Woodburn soil there were 26. Either of these soils could have been used as a base on which tiling costs for soils could rest; the Woodburn average was an arbitrary choice. These estimates are lower than the estimated cost for pattern tiling due to changes in tiling costs over the years and also to the fact that not all farmers pattern tile. Randum tiling was most prevalent. Pattern tiling is becoming more widely used however. It was not determinable from the survey records whether or not the farm costs were total costs or total costs minus ASC contributing payments. In most instances, according to those assisting in collecting the survey data, this cost is actual farm cost but there are probably some

Appendix F, continued

cost estimates within the average which are total.

e. A three percent depreciation is in accordance with farm estimates obtained in this survey. Three percent does not represent tiling on Labish soil as will be explained in a later footnote.

f. Eleven years was the average age of the systems on the farms surveyed. On the average, this would be expected to be near 15 years; however, where tiling is on the increase as it is in the Willamette Valley then the average age would be less than the median. This condition is expected to continue for some time.

g. Willamette soil series, as now defined, does not require any tiling according to SCS technicians. There are tile lines within this soil but these are probably intercepter lines designed to pick up water draining into wetter soils of a minor nature running through the Willamette soil. A field was designated as being of only one soil whenever there was not another soil within the same field which occupied over an estimated 10 percent. These same conditions exist for Salem, Sifton, Chehalis, Newberg, Aiken and Polk soils.

h. There was quite a range in the drainage conditions of Concord and Dayton soils. Their location in relation to other soils was very important here. In some areas there are no drainage outlets for these soils. When these soils occur in a pocket or drainage way in association with Amith, Woodburn, or Willamette soils they can be drained more easily. Concord in the Gervais area and Dayton in the Turner and Ankeny Bottom areas, for the most part, lend themselves to surface drainage only.

i. Clackamas soil is not an easy soil to drain and for this reason there was not a lot of tiling done; for the most part, it is surface drained with ditches. Water moves through the top soil readily but the substratum is rather impervious.

j. Of all the areas in Marion County being tiled Lake Labish Ditch is the most variable. The depth of the peat varies from the beginning to the end and from side to side. The subsidence is different from one end of the lake to the other. Also, there are springs in various parts of the lake bed. Because of these conditions there is both clay and wood box tiling used. At the head of the lake bed where the peat was shallower, many used clay tile because this could be placed on a more firm foundation. The wood tile seemed to be used where the tile was laid on top of peat or where springs cause the soil to be less stable.

Appendix F, continued.

Both of these types of tile have their advantages. The wood box tiles furnish greater stability when new and stay aligned for a longer period. The greatest problem of this tile is its length of life. Where it can be kept full of water its life is longer than where it is alternately full and empty. Wood tile was estimated to last from eight to twelve years. This type of tile is not removed when it is no longer effective but is left to work itself to the surface; the area looks like an old cemetery after it has been plowed.

Clay tile has not been used to a great extent in past years but was being used more extensively in accordance with SCS recommendations. Where it could be placed on a firm foundation it was estimated to last 20 or 30 years, but if not, it becomes out of line and must be relaid. In this latter case the tile can be reused but its effective life may not be any more than wood box tile. Also, where subsidence is high and this tile is used it may need to be lowered to become sufficiently effective.

The spacing of the lateral lines in the Labish soil varied with operators and moisture conditions. The SCS recommends a general spacing of 55 feet but many spaced closer than this while others accomplish the same in a little wider spacing. Depth was an important item here. Besides the lateral lines many farmers found it necessary to tile out wet spots that develop.

The estimates used here attempt to indicate average conditions.

k. Clay tile used on Labish soil was larger than that used on terrace soils. The estimate used here was for a combination of five and six inch tile.

l. Most of the wood boxes are constructed out of six and eight inch rough lumber. This gives a six inch inside diameter tile.

m. ASC contributes approximately half the cost of wood tile and a little less than half the cost of clay tile; for a combination of five and six inch tile this would be about nine and one-half cents a foot. The base here is the estimated total tiling cost per acre and not the farmer's share of the total.

n. Only three farm estimates were obtained for the length of life of clay tile drain in Labish soil; two of these were for 30 years and one for 12 years. After talking with SCS technicians and in regard to subsidence and unalignment, a 20 year estimated life was used; this is somewhat arbitrary.

o. Farmers estimated the length of life of wood box tile at approximately nine years; this seems to agree with SCS technicians' estimates.

p. For want of a better estimate the tile on Labish soil was considered to be half used up.

APPENDIX G

Fencing Costs as Related to Field Size

Since the farmers contacted in the farm survey were not able to give a reliable estimate of fencing costs an estimate was used. In the past the ASC has been an active participant in fencing costs in the Willamette Valley. The Benton County office at Corvallis, Oregon, quoted the following 50% share costs: woven wire $1.20 per rod; barbed wire $.90 per rod, or totals of $2.40 and $1.80, respectively. In order to have a standard estimate an average of these two figures was used; vis., $2.10 per rod. Present investment was figured at half the original cost, depreciation on the basis of a 20 years life and the straight line method of calculation and repair on the basis of three percent of original cost. A square field was assumed. Table 1 presents the results of this tabulation.

Table 1. Fencing costs as related to field size.

Field size	Side length	Total length	Total cost	Per acre			
				Construction Cost	Average investment	Yearly depreciation	Yearly repair
acre	rods	rods	$	$	$	$	$
5	28.3	113	237	47	24	2.35	1.41
10	40.0	160	336	33	17	1.65	.99
15	49.0	196	412	27	14	1.35	.81
20	56.4	226	474	23	12	1.15	.69
30	69.1	276	580	19	10	.95	..57
40	80.0	320	672	16	8	.80	.48
50	89.2	357	750	15	7	.75	.45
60	97.8	391	821	14	7	.70	.42
80	113.0	452	950	12	6	.60	.36
120	138.0	552	1,160	9	5	.45	.27
160	160.0	640	1,344	8	4	.40	.24
240	195.0	780	1,638	7	3	.35	.21
320	226.0	904	1,898	6	3	.30	.18
640	320.0	1,280	2,688	4	2	.20	.12

APPENDIX H

Farm Insurance

Farm Liability Insurance

Farm liability insurance provides legal protection to the farmer against the public. It does not cover employees. Table 1 presents the rates quoted by a large commercial insurance agency operating in the Willamette Valley; the coverage is as follows: bodily injury, $10,000 and $20,000; property damage, $5,000; medical care, $500.

Table 1. Farm liability insurance costs as related to farm size.

Farm size	Annual cost
acres	dollars
0-160	16.82
161-240	18.56
241-320	20.20
321-640	22.04
641-1000	23.78

Workmen's Compensation Insurance

Workmen's compensation insurance as provided by Oregon State Industrial Accident Commission provides legal protection to the workman plus protection against work loss, medical and hospital costs, etc. due to injuries on the job. The State Industrial

Accident insurance rates for 1959 were as follows:

First registration fee	$12.50
Annual registration fees thereafter	7.50
Per $100 payroll for the hand picking of fruits and the harvesting of vegetables where no machinery is involved	1.50
Per $100 payroll for general farm work	8.79

In addition to the above fees workmen must contribute $.02 per day. (32) (36)

Crop Insurance

Fire insurance for crops while still in the field was charged at the rate of $.20 per $100 of crop value at selling time. The only other crop insurance indicated in the survey schedules was for onions while in storage; this was charged at the rate of $.45 per $100 of value at selling time.

APPENDIX I

Custom and Piece Work Rates for Various Farm Operations by Crops[a]

Item	Cost	Unit
	$	
Grains		
Small grain:		
fertilizing	0.50[b]	acre
spraying excl. chemical	1.25	acre
spraying incl. chemical	2.25	acre
combining	5.00	acre
hauling	0.085	cwt.
combining-hauling	7.00	acre
Field corn:		
picking	8.00	acre
shelling	0.10	cwt.
picking-shelling (field)	12.00	acre
drying	0.25	cwt.
hauling	0.10	cwt.
Legume seeds		
Red clover:		
combining	6.00	acre
cleaning seed	0.02	lb.
inspection, testing, etc.	0.01	lb.
Crimson clover:		
defoliate incl. chemical	7.00	acre
cleaning seed	0.02	lb.
inspection, testing, etc.	0.01	lb.
Oats and vetch:		
combining	6.00	acre
cleaning seed	0.35	cwt.[c]
Grass seeds		
Common ryegrass:		
spraying	1.25	acre
combining	6.00	acre
hauling	0.112	cwt.
cleaning seed, dirt wt.	0.54	cwt.[d]
cleaning seed, clean wt.	0.68	cwt.
germination & purity tests	5.30	lot[e]
Highland bentgrass:		
spraying	1.25	acre
combining	7.00	acre

Item	Cost	Unit
	$	
cleaning seed, dirt wt.	0.030	lb.[f]
cleaning seed, clean wt.	0.045	lb.
germination & purity tests	9.00	lot[i]
Chewings & creeping red fesque:		
spraying	1.25	acre
defoliation, incl. chemical	7.00	acre
combining	7.00	acre
cleaning seed, dirt wt.	0.03	lb.[g]
cleaning seed, clean wt.	0.05	lb.
germination & purity tests	5.30	lot[i]
Forages		
Harvesting corn silage	2.37[h]	ton
Harvesting grass silage	3.06[h]	ton
Baling hay	4.50	ton
Hauling hay	2.00	ton
Small fruits		
Strawberries:		
planting	14.00	acre
picking	4.25	cwt.
Evergreen blackberries:		
picking	3.50	cwt.
Boysenberries:		
picking	3.50	cwt.
Loganberries :		
picking	3.00	cwt.
Tree fruits and nuts		
Sweet cherries:		
picking	4.00	cwt.
hauling	0.20	cwt.
Prunes:		
shaking	0.30	cwt.
picking	0.50	cwt.
hauling	0.15	cwt.
Filberts:		
picking	3.50	cwt.[i]
hauling	0.125	cwt.[i]
drying	1.00	cwt.[i]
Walnuts:		
picking	2.00	cwt.[j]
hauling	0.125	cwt.[j]
drying	1.60	cwt.[j]

Item	Cost	Unit
	$	
Vegetables		
Pole beans:		
stringing, twine	0.50	lb.
dusting, excl. chemical	1.75	acre
picking	2.75	cwt.
Sweet corn:		
picking	0.17	cwt.
hauling	0.10	cwt.
Carrots:		
digging	0.187	cwt.
hauling	0.10	cwt.
Onions:		
planting	5.00	acre
dusting, excl. chemical	1.50	acre
pulling	4.75	acre
trucking (field operation)	2.30	hour
Specialty crops		
Mint:		
harvest and distilling	1.00	lb.
Sugar beet seed:		
windrow	7.50	acre
combine	1.33	cwt.
cleaning	0.75	cwt.
Fuggle hops:		
fertilizing, pegging, stringing, training, suckering, hoeing, and like hand work	65.00	acre
harvesting	17.50	cwt.
hauling, inspection and storage	0.45	cwt.

a. Estimates are based upon farm survey tabulation obtained in this study unless otherwise stated.

b. The fertilizing rate here used refers to machinery rental for applying anhydrous ammonia.

c. The oats and vetch weight here is on a dirt basis. The average clean out for oats and vetch was as follows: 48 percent oats, 30 percent vetch, and 22 percent screenings (dirt).

d. The cleaning rate for common ryegrass quoted here is on a dirt weight basis. The seed cleanout is approximately 80 percent.

Footnotes for Appendix I, continued.

e. A "lot" refers to a quantity of seed which is grouped for testing purposes. It may represent the total farm, specific fields, or other groupings. The limit is 60,000 lbs. of seed; this would be approximately 150 acres.

f. The H. bentgrass weight is on a dirt basis. The seed cleanout is approximately 65 percent.

g. The fesque weight is on a dirt basis. The seed cleanout is approximately 60 percent.

h. The silage harvesting costs quoted were taken from a study made in 1957 by LeRoy F. Rogers, Dept. of Agricultural Economics, Oregon State College. Labor costs were added on the basis of $1.20 per hour. (35, p. 46-49)

i. Picking, hauling and drying costs for filberts are on the basis of green weight. The dry out is approximately 15 percent.

j. Picking, hauling and drying costs for walnuts are on the basis of green weight. The dry out is approximately 35 percent.

APPENDIX J

Prices Paid for Labor, Seeds and Seedlings, Fertilizers, Pesticides and Miscellaneous Materials

Table 1. Prices paid for various categories of farm labor by crop groupings and classified types of work, Marion County, Oregon, 1958.[a]

Crop groupings	Labor Rates per Hour		
	Operator	Family	Hired
General Work			
Grains, legumes and forages	$1.30	$1.05	$1.10
Grass seeds	1.50	1.25	1.15
Pole beans, sweet corn, carrots, and onions	1.50	1.05	1.10
Small fruits	1.30	1.00	1.10
Tree fruits	1.40	1.00	1.10
Mint, hops, sugar beet seed	1.50	1.00	1.10
Classified Work			
All hand work (hoeing, weeding, etc.)			1.00
Bookkeeping			1.00
Pole bean yard bosses			1.40
Small fruit yard bosses			1.25

a. Based upon farm survey estimates obtained in this study.

Table 2. Prices paid for seeds and seedlings, Marion County, Oregon, 1958.[a]

Item	Price Paid[b]	Planting Rate
Seeds		
Grains	($/cwt)	(lbs)
Fall wheat	4.10	100
Spring wheat	3.90	115
Fall oats	3.00	100
Spring oats	3.10	100
Spring barley	3.20	110
Field corn	19.00	10
Rye	3.30	100
Legumes	($/lb)	(lbs)
Alfalfa	0.630	14
Red clover	0.376	10
Crimson clover	0.262	15
Common vetch	0.060	30
Oats	0.030	70
Grasses	($/lb)	(lbs)
Common ryegrass	0.075	20
Bentgrass	0.300	4
Chewings fesque	0.350	10
Creeping red fesque	0.360	10
Alta fesque	0.150	10
Vegetables	($/lb)	(lbs)
Pole beans	0.37	27
Sweet corn	0.35	10
Carrots	1.97	3
Onions	2.75	3
Specialty	($/lb)	(lbs)
Sugar beet seed	0.150	12
Seedlings		
Small fruits	($/100 ea)	(100)
Strawberries	1.50	70[c]
E. blackberries	5.00	4.5
Boysenberries	10.00	6
Loganberries	10.00	6
Specialty	(ea)	(100)
Bullion hops	.03	7

a. Based upon farm survey estimates obtained in this study.

b. Prices are retail prices for cleaned and treated seed ready for planting.

c. This is the strawberry planting rate for irrigated fields. For dryland production the rate is 9,000 plants per acre..

Table 3. Prices paid for farm fertilizers, Marion County, Oregon, 1958.[a]

Analysis	Other Identification	Price[b]
($N-P_2O_5-K_2O$)		($/100 lbs)
Commercial		
22-0-0	Aqueous ammonia	11.00[c]
86-0-0	Anhydrous ammonia	10.50
45-0-0	Urea, Uran, Nu-green	6.30
33-0-0	Ammonium nitrate, Nitroprills	4.50
21-0-0	Ammonium Sulfate	3.20
21-0-0	Cyanmid	4.30
16-0-0	Calcium nitrate	3.30
0-20-0	Super phosphate	2.40
0-061	Murate of potash	3.40
0-0-21	Sul-po-mog	2.40
16-20-0	----	4.30
11-48-0	----	5.60
10-20-20	----	4.30
10-20-10	----	4.20
10-16-8	----	4.20
8-24, 26-8	----	4.30
6-20-20	----	4.20
4-36-8	----	4.20
0-16-20	----	3.90
---	Boron (46%)	4.50
---	Gypsum, land plaster	1.00
---	Gypsum with boron	1.50
---	Lime	0.30[d]
---	Onion mix[e]	3.50
Farm Manure		(ton)
0.5-0.25-0.5	Cow manure	2.50[f]

See following page for footnotes.

Table 3, continued.

a. Except where indicated the prices quoted here are averages taken from the farm survey schedules collected for this study.

b. Unless otherwise noted prices are in terms of the whole fertilizer mix including the filler.

c. Aqueous ammonia is sold on the basis of pounds of nitrogen.

d. ASC pays half of the total cost of lime; this is the farm share.

e. Several onion growers purchased an "onion mix" fertilizer. On the basis of what other onion producers applied, this probably represents a 5.5-10-20 mix plus minor elements.

f. The value of farm manure is difficult to estimate. The price here quoted was based upon prices for N, P_2O_5 and K_2O of 15, 10 and 5 cents per pound, respectively. This agrees with estimates used in other studies. (3, p. 230) (4, p. 12) According to a Purdue University study it costs, on the average, $1.20 per ton to move manure from the barn yard to the field. On this basis the value of the manure at the barn yard would be equal to: $2.50 - $1.20 - $1.30. It was estimated that 50 percent of the value of farm manure was used up the first year.

Table 4. Prices paid for pesticides with some application rates with reference to various farm crops, Marion County, Oregon, 1958.[a]

Crop	Chemical	Application Rate Range	Application Rate Typical	Price	Unit	Miscellaneous Information
Small grain:	2,4-D amine[b]	1-2	1.5	0.41	Pint	Controls broad-leaved weeds.
Red clover seed:	2% parathion[c]	--	40.0	0.14	Pound	
	5% DDT[c]	--	40.0	0.08	Pound	
Crimson clover:	Chloro IPC[b]	--	1.0	8.25	Gallon	Controls grass and grains.
Oats and vetch:	5% DDT[c]	--	20.0	0.08	Pound	
Common ryegrass:	2,4-D amine[b]	1-4	2.0	0.41	Pint	Controls broad-leaved weeds.
Highland bentgrass:	2,4-D amine[b]	2-4	2.0	0.41	Pint	Controls broad-leaved weeds.
	Chloro IPC[b]	2-3	2.5	2.06	Quart	Controls annual grasses.
Chewings fesque:	2,4-D amine[b]	1-2	1.5	0.41	Pint	Controls broad-leaved weeds.
	2,4-D ester[b]	1-2	1.5	0.51	Pint	Only amine or ester was applied.
	Chloro IPC[b]	2-3	2.5	2.06	Quart	
Strawberries:	Aldrin	--	5.0	2.50	Pound	Only Aldrin or Heptachlor was
	Heptachlor	--	5.0	2.83	Pound	applied. Soil sterilants applied to new plantings.
	Dinitro general[b]	--	1.5	1.83	Quart	Dormant weed spray for estab-
	plus IPC	--	6.0	2.06	Pound	lished strawberries.
	4% Malathion[c]	--	40.0	0.16	Pound	Applied every 2 or 3 weeks prior
	11% parathion[c]	--	40.0	0.11	Pound	to harvest. Any combination of
	plus 5% DDT[c]	--	40.0	0.08	Pound	these 3 may be applied.
	Zerum[c]	--	40.0	0.16	Pound	Applied prior to picking for
	5% Captan[c]	--	40.0	0.16	Pound	mildew. Either may be applied.
Evergreen blackberries:	Sulfur dust[c]	40-60	50.0	0.07	Pound	Applied 1-4 times per year.
	Lime sulfur[b]	10-20	16.0	0.30	Gallon	Applied 1-3 times per year.
	Karmex	--	3.0	3.50	Pound	
Sweet cherries:	Sulfur dust[c]	--	50.0	0.07	Pound	Applied 1-7 times per year.
	Lead arsenate[c]	--	50.0	0.11	Pound	Applied 1-5 times per year.
	5% DDT[c]	--	50.0	0.08	Pound	Applied 1-2 times per year.
Filberts:	40% lead arsenate[c]	--	40.0	0.17	Pound	Applied 1-3 times per year.
	5% DDT[c]	--	40.0	0.08	Pound	Applied 1-3 times per year.
Pole beans:	Dinitro amine[b]	2-6	4.0	1.38	Quart	Pre-emergence weed spray.
	4% Malathion[c]	--	40.0	0.16	Pound	Any of the following pole bean
	5% DDT[c]	--	40.0	0.08	Pound	dusts may be applied in any
	5% Methoxychlor[c]	--	40.0	0.13	Pound	combination. Two or more
	Kolo dust (sulfur)[c]	--	40.0	0.06	Pound	applications were made per year.
Sweet corn	Aldrin	--	2.0	2.50	Pound	Soil sterilant.
	Dinitro amine[b]	2-4	4.0	1.38	Quart	Pre-emergence weed spray.
	2,4-D amine[b]	--	1.5	0.41	Quart	Controls broad-leaved weeds.
	Toxaphene[b]	--	2.0	0.83	Pound	Not required every year.
Carrots	Aldrin	--	2.0	2.50	Pound	Soil sterilant.
	Cleaning solvent[b]	50-60	50.0	0.23	Gallon	Applied 1-2 times per year.
	Stove oil[b]	45-60	50.0	0.18	Gallon	Applied 1-3 times per year.
Onions	Formaldehyde	1.5-3	2.0	0.63	Gallon	Controls onion smut.
	CDAA (Randox)[b]	--	1.0	6.85	Gallon	Pre-emergence weed spray.
	10% DDT[c]	10-20	14.0	0.09	Pound	Applied 6-10 times per year.
Mint	Diuron	2-3	2.0	3.50	Pound	Pre-emergence weed spray.
	Dinitro amine[b]	2-4	3.0	1.12	Quart	Pre-emergence weed spray.
	50% DDT[c]	8-25	--	0.23	Pound	Applied in irrigation water.
Hops	20% Tepp[b]	1-2	1.0	2.00	Quart	
	1% Parathion[c]	--	30.0	0.11	Pound	Applied 1 or more times per year.
	5% DDT[c]	--	40.0	0.08	Pound	Applied 1 or more times per year.

a. The prices and rates quoted here are for the most part taken from the farm survey data. In no way are they considered to represent an adequate pesticide program.

b. Spray.

c. Dust.

Table 5. Prices paid for miscellaneous materials as related to specified crops, Marion County, Oregon, 1958.[a]

Crop	Item	Price	Unit	Miscellaneous information
Red clover:	Sacks	0.50	each	Holds 100 pounds
Crimson clover:	Sacks	0.50	each	Holds 100 pounds
Vetch:	Sacks	0.20	each	Holds 100 pounds
Common ryegrass	Sacks, field	0.05	each	Rental basis
and fesques:	Sacks, clean seed	0.25	each	Holds 100 pounds
H. bentgrass:	Sacks, clean seed	0.75	each	Holds 100 pounds
Pole beans:	Paper twine	0.22	pound	32 pounds per acre
	Cotton cord	0.70	pound	23 pounds per acre
	Staples	1.50	acre	
	Buckets	2.00	acre	Replacement
	Sacks	4.00	acre	Replacement
Sugar beet seed:	Sacks, clean seed	0.50	each	Holds 100-120 pounds

a. Data taken from the farm survey schedules collected for this study.

Table 6. Prices paid for fuels used in powered farm machinery.

Fuel	Price	Unit
	Cents	
Gasoline:		
Non-road use	21	gallon
Road use	29	gallon
Diesel	16	gallon

APPENDIX K

Land Values

Farmers were asked during the survey interview to estimate the sale value for individual soils. The average values thus obtained are presented in Table 1. These values were used only in establishing taxes and land returns used in estimating perennial crop investment costs.

Table 1. Estimated land values by soil series and geographic location.

Soil	Area	Mean value (per acre)	Number of estimates
Chehalis	North Santiam River	$569	17
	Keiser-Mission Bottom	531	8
	North Marion County	345	10
Newberg	North Santiam River	633	12
	Keiser-Mission Bottom	510	7
	North Marion County	338	4
Wapato	Keiser-Mission Bottom	217	3
	North Marion County	250	4
Willamette	Howell Prairie	445	16
	North Marion County	446	5
Woodburn	Howell Prairie	462	17
	North Marion County	358	29
Amity	North Marion County	302	38
Concord	North Marion County	150	12
Dayton	South Marion County	158	18
Salem-Sifton	South Marion Gravellies	350	10
Clackamas	South Marion Gravellies	330	11
Aiken-Jory	Ankeny Hills	161	15
Aiken	Silverton Hills	183	6
Polk-Sublimity	Silverton-Sublimity Hills	199	25
Labish	Lake Labish	2,250	8

APPENDIX L

Derivation of Prices Used in Calculating Gross Returns to Various Crops Produced in Marion County, Oregon, 1958

Crops	Oregon farm prices[a] 1958	Oregon farm prices[a] 54-58 Average	Oregon farm prices[a] 54-58 58	Marion County farm prices 1958[b]	Marion County farm prices 54-58 Average[c]	Prices used in this study
	$ (cwt)	$ (cwt)	Adjustment index (%)	$ (cwt)	$ (cwt)	$ (cwt)
Grain						
Fall wheat	3.02	3.36	111[d]	2.92	3.24	2.90[e]
Spring wheat	--	--	111[d]	2.76	3.06	2.75[e]
Fall oats	2.12	2.22	105[d]	2.07	2.17	2.17
Spring oats	--	--	105[d]	2.13	2.24	2.24
Spring barley	2.10	2.16	103	2.19	2.25	2.25
Field corn	2.57	2.92	114	2.60	2.96	2.60[e]
Screenings, O & V	--	--	--	1.50	--	1.50
Legume seed	lb.	lb.		lb.	lb.	lb.
Red clover	0.33	0.31[f]	094	0.34	0.32	0.32
Crimson clover	0.20	0.20	101	0.21	0.21	0.21
Common vetch	0.057	0.060	105	0.053	0.057	0.057
Grass seed[g]	lb.	lb.		lb.	lb.	lb.
Common ryegrass	0.078	0.059	076	[j]	--	0.059
Hyland bentgrass	0.225	0.380	165	0.204	0.337	0.200[h]
Chewings fesque	0.310	0.270	087	0.309	0.269	0.250[i]
Creeping red fesque	0.330	0.356	105	[j]	--	0.260[k]
Alta fesque	0.135	0.123	019	0.137	0.125	0.125
Hay	ton	ton		ton	ton	ton
Alfalfa	18.00	21.04	117[l]	23.00	26.00	26.00
Red clover	--	--	117[l]	19.00	22.00	22.00
Other	--	--	117[l]	18.00	21.00	21.00
Silage or green chop				ton		ton
Alfalfa	--	--	--	--	--	7.00[m]
Grass and clover	--	--	--	7.00	--	7.00[n]
Corn	--	--	--	8.00	--	8.00[o]
Pasture						ton
Irrigated TDN	--	--	--	--	--	0.022[p]
Dry TDN	--	--	--	--	--	0.020[p]
Vegetables	cwt.	cwt.		cwt.	cwt.	cwt.
Pole beans	6.20[q]	6.41	103	6.06[r]	6.25	6.25
Sweet corn	1.24[q]	1.33	107	1.18[s]	1.26	1.26
Carrots	1.31[t]	1.31	100	0.95[u]	0.95	0.95
Onions	3.50[v]	2.32	066	2.47		1.90[w]
Tree fruits	cwt.	cwt.		cwt.	cwt.	cwt.
Sweet cherries	15.55[x]	13.83	089	19.33	17.20	17.20
Prunes	4.86[x]	3.36	068	4.75	3.23	3.23
Filberts	19.00	19.30	101	19.40	19.60	19.60
Walnuts	19.00	19.00	100	19.00	19.00	19.00
Small fruits	cwt.	cwt.		cwt.	cwt.	cwt.
Strawberries	12.00[q]	13.20	110	11.40[y]	12.54	12.54
E. blackberries	5.50[q]	9.40	172	5.29	9.10	9.10
Boysenberries	8.20[q]	10.10	123	9.20	11.30	11.30
Loganberries	12.10[q]	11.10	092	12.30	11.30	11.30
Specialty	lb.	lb.		lb.	lb.	lb.
Peppermint	4.35	5.13	118	4.39	5.18	5.00
	cwt.	cwt.		cwt.	cwt.	cwt.
Fuggle hops	50.00	45.00	090	48.24	43.42	43.42
Cluster hops	--	--	--	45.67	41.10	41.10
				lb.		lb.
Sugar beet seed				0.15		0.15

See following page for footnotes.

Appendix L, continued.

a. Source: Oregon Crop and Livestock Reporting Service, Extension Service, Oregon State College, Corvallis, Oregon. (31)

b. Source: Farm survey data collected for this study.

c. In order to obtain an estimated average price for Marion County an index was computed which reflected the deviation of the 1958 price from the 1954-58 average price for Oregon. This index was then applied against the Marion County 1958 price.

d. The Oregon Farm Price reports did not distinguish between the fall and spring grains; hence, the same adjustment index was applied to all types. The price in this case includes both types.

e. In view of price trends, Commodity Credit Corporation stocks and in light of recent agricultural policy the 1954-58 average prices computed for Marion County seemed too high. Hence, prices more nearly reflecting 1958 conditions were used.

f. The 1954 price for red clover was not included in the average due to its extreme nature.

g. Grass seed specialists at Oregon State College were consulted before making price determinations for these grass seeds.

h. Due to the extreme nature of some of the prices included in the five-year average for H. bentgrass it was thought not to be a good price to use in establishing a productivity index. Therefore, an estimate was made in view of the 1957, 1958 and 1959 prices all of which were near to 20¢ per pound.

i. This price for chewings fesque is a little below the average farm price for 1954-58 which is due mainly to recent U. S. imports and import prices; the trend is toward such a price.

j. There were not sufficient quotations to estimate a price for Marion County.

k. Red creeping fesques are of more recent production than some of the other grass seeds and the price is not so well established. The 50¢ prices between 1950 and 1954, and more recently for some varieties, will indicate this. Hence, a price below the average was used.

l. The Oregon Crop and Livestock Reporting Service's quotations for hay include all hay; hence, the same index is used for alfalfa, red clover and other hay.

m. The price for alfalfa silage was made on the basis of TDN comparisons of hay and silage as follows:

	% TDN	lbs. TDN/ton
Alfalfa hay, all	50.3	1006
Alfalfa silage, not wilted	13.7	274

$\frac{274}{1006}$ = 27% .27 x $26.00/ton = $7.00/ton

n. The price for grass and clover silage was made on the basis of TDN comparisons of hay and silage as follows:

	% TDN	lbs. TDN/ton
Grass and clover hay	50.0	1000
Grass and clover silage, not wilted	16.2	324

$\frac{324}{1000}$ = 32% .32 x $22.00 = $7.00 per ton

o. The price of corn silage was based on the TDN value of clover hay as follows:

	% TDN	lbs. TDN/ton
Corn silage, all analysis	18.1	362

362 x $.022 = $7.96 per ton

The two farmer estimates obtained were $8.00 per ton each.

p. Pasture prices were based upon the TDN value of similiar quality hay.

q. Processing market prices.

r. The following grade percentages and prices were used in estimating the price of pole beans:

	Grade				
	1	2	3	4	5
Distribution*	26.6%	28.4%	27.7%	11.0%	5.6%
Price/cwt.**	$8.50	$7.50	$4.45	$3.25	$0.00

* Average grade distribution of farmers selling to cash canneries.
** Average cash market price of cash canneries as established by processing plant interviews.

s. The following grade distribution and prices were used in estimating the price of sweet corn:

Appendix L, continued.

	Grade		
	1	2	3
Distribution*	86%	10%	4%
Price/cwt.**	$1.25	$1.00	$0.00

* Average grade distribution of all farmers interviewed.
** Average cash market price according to farm and processing plant survey results.

t. Includes fresh and processing market prices.

u. The following grade distribution and prices were used in estimating the price of carrots:

	Grade			
	1	2	3	4
Distribution*	50.5%	40.5%	7.0%	2.0%
Price/cwt.**	$1.10	$0.90	$0.50	$0.00

* Average grade distribution of all farmers interviewed.
** Average cash market price according to farm and processing plant survey results.

v. Fresh market principally.

w. Due to the large disparity between the 1958 prices reported for Western Oregon and the prices obtained by farmer interviews a different method was used to estimate the price to be used in this study. Two large onion brokers were contacted and average farm prices were obtained for the years 1954-58. Both firms' average price for 1954-58 was near $1.90 per cwt. This is a little below that reported by the Oregon Crop and Livestock Reporting Service. However, the large 1958 price is considered to be out of line with other past prices. If this price is not included then a price of $1.90 seems more reasonable.

x. All methods of sale.

y. The following grade distribution and prices were used in establishing the price of strawberries:

Appendix L, continued.

	Grade	
	1	Cull
Distribution*	95%	5%
Price/cwt.**	$12.00	$0.00

* Average for non-coop processing plants according to farm and processing plant survey results.
** Average for non-coop processing plants.