Identification and Productivity of Western Oregon Soil Types

By

W. L. Powers
E. F. Torgerson
E. V. Dannen

FOREWORD

It is not wise, nor even possible, to grow all crops on any one soil. In fact, the difference in adaptability of a soil for crops is so great that on a given soil one crop may be a failure while another is a great success.

There is a scientific basis of and method for analysis of soils. Our soil scientists not only find ways to save and improve our soils; they also give valuable advice on what crops to grow or to avoid on known soils.

This bulletin presents both general and specific handling of western Oregon soil types, and on certain indicator crops that may be grown on those soils. The Soils Department of the Agricultural Experiment Station stands ready to give further specific aid by examination of properly prepared soil samples. Based on that examination, it will give recommendations for the proper handling of such soils for the best returns.

Wm. A. Schoenfeld

Director

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Identification and Productivity of Western Oregon Soil Types*

By

W. L. Powers, E. F. Torgerson, and E. V. Dannen

Introduction

Identification and productivity of a soil is determined by a soil survey. This soil survey gives a scientific basis for any adequate plan of soil improvement, land use or conservation. During the past quarter-century, soil surveys of most of the agricultural areas of western Oregon have been made and the key to soil types of this region is now regarded as fairly complete.

This bulletin is intended to help farmers, land owners, land appraisers and county agricultural agents to make use of the fund of information accumulated for surveyed areas. It is hoped that through this circular farmers will be better able to recognize and understand the characteristics of the type or types of soil that are found on their farms, their average supply of available nutrients, crops for which they are suitable, and fertilizer needs and soil management methods that should be helpful in soil improvement.

Progress of the Soil Survey (*Table 1*)

A detailed cooperative Federal-State soil survey was started in 1917. To date some 11,020,617 acres have been mapped. This includes all Willamette Valley counties as well as the Josephine, Columbia, and Astoria areas. Older surveys were made by the U. S. Bureau of Soils for the Medford and Marshfield areas and a cooperative survey of the Douglas area is now under way.

In eastern Oregon the Grande Ronde, Umatilla, Baker, Deschutes, and Wasco areas have had detailed soil surveys. General surveys have been made of some 1,500,000 acres included in reclamation projects and of a similar sized area in soil conservation districts. Areas included in surveys are shown in Figure 1 and Table 1.

* *Acknowledgment.* The authors received the cooperation of Soil Survey Inspectors of the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering, Messrs. Macy Lapham, A. E. Kocher, and Ray Roberts in preparation of the tentative soil key. A committee on Land Classification of the Oregon Society of Soil Science, of which Dr. Stanley W. Cosby of the Soil Conservation Service served as chairman, cooperated. Various members of the departments of farm crops, horticulture, animal husbandry, and soils were consulted in the preparation of the relative productivity ratings. To all of these the authors are very grateful.

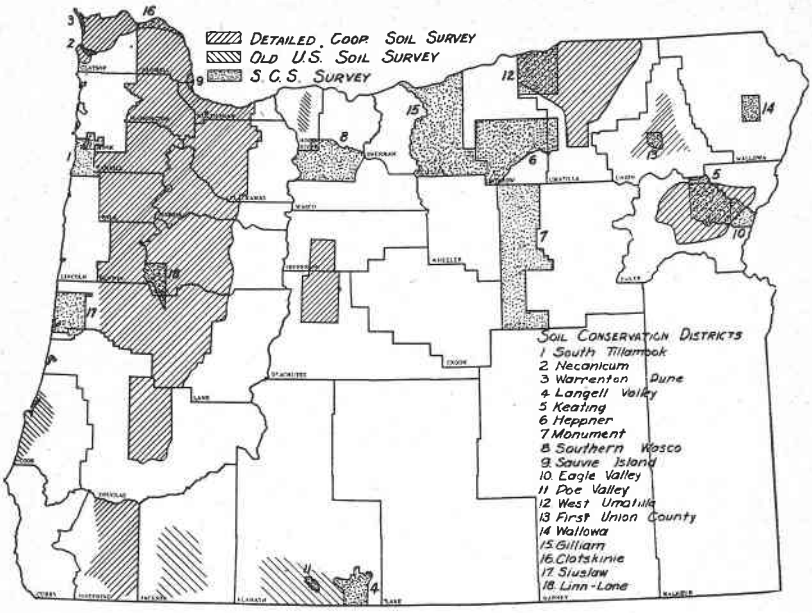

Figure 1. Soil surveyed areas in Oregon.

Soil surveys provide basic data

The soil survey:

- ▶ Gives an invoice of soil resources.
- ▶ Gives the farmer information as to methods of soil management and maintenance.
- ▶ Aids the new settler in selecting a location and getting started right.
- ▶ Guides the county agent or soil specialist in advising settlers.
- ▶ Forms a basis for introduction of new farm crops or practices.
- ▶ Is a valuable guide to the determination of irrigation and drainage requirements or feasibility for different soils.
- ▶ Is useful in locating roadways.
- ▶ Lays the foundation for investigations for developing a permanent system of agriculture for every kind of soil or for each farm.
- ▶ Furnishes the basis for systematic study of fertilizer needs of different soil types.
- ▶ Helps stabilize agriculture and land appraisals, lessens the guess work in farming and gives a scientific basis for land use and conservation.

Soil surveys of the agricultural area of the state should be completed promptly to enable permanent systems of agriculture to be worked out before the virgin fertility is reduced to the point of unprofitable production.

Soil development

Western Oregon soils were developed under a coastal climate with a moist open winter and dry period in summer. These soils were derived largely from basaltic rocks and by chemical processes of weathering. They are faintly to definitely acid and of a slightly heavy texture in most cases. They extend in elevation from sea level to above the timber line. Western Oregon soils developed

Table 1. SUMMARY OF OREGON SOIL SURVEY TO SEPTEMBER 1947

Total area in Oregon	96,699 square miles—61,188,480 acres		
OLDER SURVEYS—United States Bureau of Soils (reports out of print)	*Acres*	*Year*	
Medford Area	348,160	1911	
Marshfield	627,200	1909	
Hood River and White Salmon (Washington ½, Oregon ½)	72,000	1912	
Klamath	159,360	1909	
Total	1,206,720		1,206,720
COOPERATIVE SURVEYS—Oregon Experiment Station and U. S. Bureau of Soils	*Acres*	*Year*	
Willamette Valley			
Yamhill	445,440	1917	
Washington	487,840	1918	
Multnomah (out of print)	209,920	1922	
Benton (out of print)	414,720	1920	
Clackamas	623,360	1921	
Polk	476,160	1922	
Linn	977,920	1924	
Marion	542,080	1926-27	
Eugene Area	830,720	1925	
Total	5,008,160		5,008,160
Other Areas			
Josephine	489,600	1919	
Grande Ronde Area	184,960	1926	
Columbia	433,680	1928-29	
Umatilla (in press)	1,181,440	1929-36	
Astoria Area (in press)	120,000	1937-38	
Baker Area (unpublished)	220,000	1937-39	
Deschutes Area (report being written)	336,795	1945	
Wasco Orchard (published)	4,778	1944	
Douglas Area (incomplete)	160,000	Begun 1941	
Total	3,021,253		3,021,253
SOIL CONSERVATION SURVEYS (11 districts)	1,784,524	1940-45	1,784,524
Total acres surveyed			11,020,657

General surveys have been made of practically all reclamation projects that have been given much consideration for irrigation or drainage. Reports on file in the Soils Department office are public data and can be consulted. The general agricultural and feasibility surveys cover about 1,500,000 acres.

Published reports by the U. S. Reclamation Service contain soil and agricultural feasibility reports of the following areas: Deschutes, Ochoco, Silver Lake, John Day, Warner Valley, Harney, Malheur, Baker, Vale, and Owyhee projects.

Some 10.6 million acres have modern surveys and 1.2 million acres have old surveys, while 1.5 million acres have been classified for reclamation.

under an annual precipitation range of 20 to 136 inches and for the most part under medium to heavy vegetative cover. Some of the great forest soils of the world are represented in the area.

The form and structure (morphology) of western Oregon soil profiles has been affected by parent material, position, drainage, and age, as well as climate and vegetative cover.

Soil may be regarded as a natural, active body with an inactive (inert) mineral skeleton and an active colloidal covering which is the secondary product of weathering and the seat of life of the soil. As a soil matures, it loses characteristics of the parent material and comes to have those acquired as a result of the climatic zone in which it ages.

Classification of soils

SOIL PROVINCES

There are three natural soil provinces in western Oregon, each containing related soils developed under a characteristic climate-vegetation complex. They are:

- The sub-humid Willamette-Umpqua province, which includes 3 soil groups and 29 soil series.
- The humid Coast with 4 soil groups and 26 soil series.
- Southern Oregon or Rogue River province with 4 soil groups and 24 soil series.

SOIL GROUPS

Soil groups within each of these provinces include:

- Recent alluvial soils with slightly developed permeable profiles. A sub-group of peat soils is included.
- Old valley filling soils with fairly mature and moderately compact, heavier-textured subsoils.
- Residual or hill lands which developed in place over the parent rock. These are divided into sub-groups according to the kind of rock which gives rise to them.
- A group of soils in the Coastal province, caused by the marine terrace.

SOIL SERIES

Soils of the foregoing groups are divided into series, each of which include soils that are similar in respect to:

- Range of color
- Topography
- Common origin
- Drainage
- Profile characteristics
- Agricultural value

Example: Willamette series is the grayish-brown, gently undulating soil on yellowish-brown, permeable subsoil in the old valley filling group.

SOIL TEXTURE

Soil texture refers to the average or effective degree of fineness and is judged by moistening and kneading soil in the hand until structural crumbs are broken down.

SOIL CLASS

Soils of similar texture are grouped into a class, e.g., clay loam. Texture is determined by mechanical analysis which consists of separation of the mineral soil particles into size groups. Eight principal groups of textural classes are:

Sand—over 90 per cent sand
Loamy sand—80 to 90 per cent sand
Sandy loams—40 to 80 per cent sand, less than 20 per cent clay
Loams—23 to 52 per cent sand, less than 27 per cent clay
Silt loams—50 per cent or more silt, 27 per cent or less clay
Clay loams—27 to 40 per cent of clay, less than 53 per cent silt

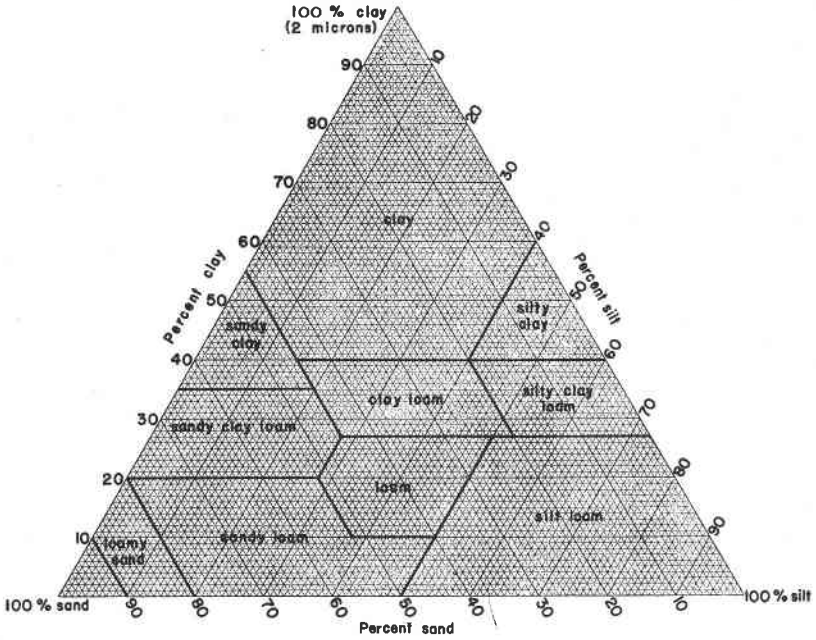

Figure 2. Guide for textural classification of soils.
U. S. Department of Agriculture, Bureau of Plant Industry, Soils, and Agricultural Engineering

Silty clay loam—27 to 40 per cent of clay (more than 40 per cent silt)

Clays—40 per cent or more of clay

Clay is very fine, plastic, sticky and has a high capacity to absorb.

Silt particles are larger than clay and feel floury or velvety if wet.

The diagram (Figure 2) will facilitate determination of soil class.

SOIL TYPES

The soil type is the unit of classification and is based on the following profile characteristics:

(1) Geological origin
(2) Topography
(3) Native vegetation

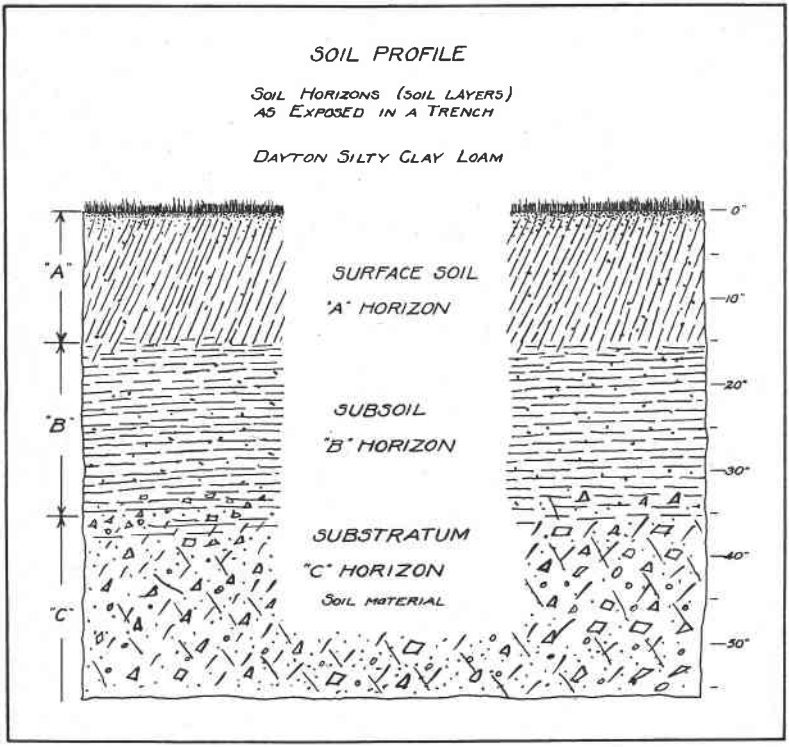

Figure 3. Profile of Dayton soil as exposed in a tile trench.

(4) Profile structure
(5) Physical composition
(6) Texture
(7) Drainage
(8) Color
(9) Chemical reaction and composition
(10) Organic matter content
(11) Agricultural value or native productiveness.

NAMING SOILS

The name of the soil type consists of two parts:

(1) The name of the series, for example, Dayton, and

(2) The texture of the particular member of the series, for example, Silt loam = Dayton silt loam soil type.

THE SOIL PROFILE (Figure 3)

The soil profile includes all that may be seen in a vertical cut through the soil layers and into the underlying soil material. Therein is recorded the history of the soils development.

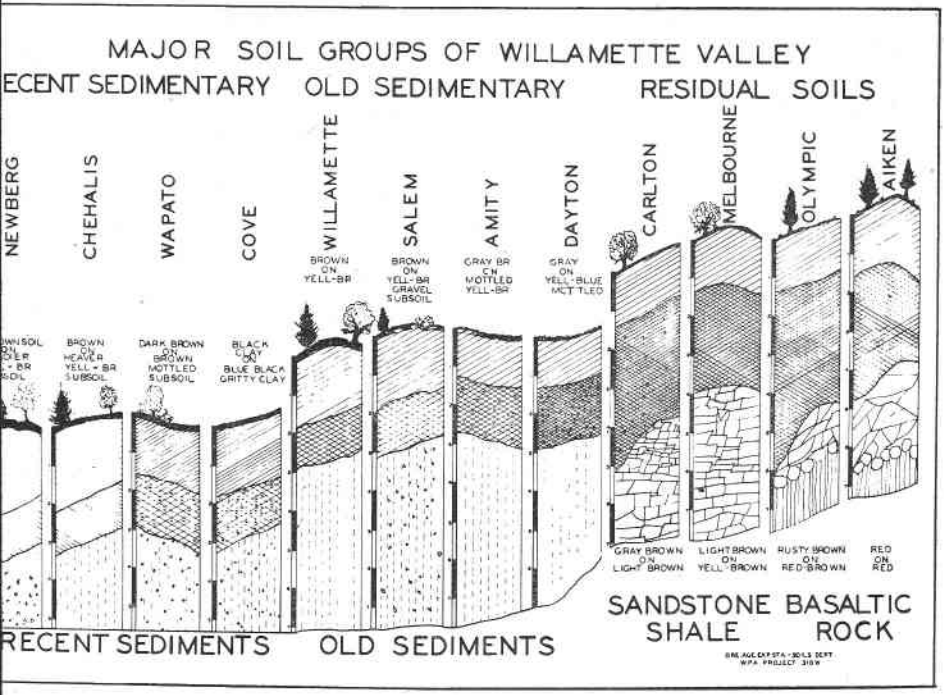

Figure 4. Major soil groups of the Willamette Valley.

SOIL HORIZON

A layer or section of the soil profile more or less well defined and occupying a position somewhat parallel to the surface is called a soil horizon. Some leaching from the surface into the subsoil occurs. A mature soil has a leached yet humus-enriched surface or *A* horizon. Below this the accumulation zone has a more compact structure, finer texture and less-aerated *B* horizon. Below the root zone is the slightly weathered soil material or *C* horizon.

DOMINANT WESTERN OREGON SOILS

The accompanying inserted folders or keys show the distinguishing soil series characteristics and the major groups and subgroups to which they belong. Only the dominant series will be discussed individually.

I. WILLAMETTE-UMPQUA PROVINCE

(The main group and subgroup of this province are indicated in Figure 4.)

1. Recent stream bottoms

a. *Chehalis* soil series includes chocolate-brown soil on lighter brown, easily pulverized (friable) subsoil. Area, 218,000 acres; textures, loam to silty clay loams; weight, about 80 pounds per cubic foot, depending on its texture; usable water capacity, about $1\frac{3}{4}$ inches per foot; reaction, neutral and calcium supply, good; nitrogen, organic matter, and phosphorous, moderate; sulphur, low.

Crop rotation with legumes, to which sulphate of lime is applied in early spring at the rate of 125 pounds an acre, is profitable. Supplemental irrigation may increase yields as much as 100 per cent. Phosphated manure and cover crops will keep up water capacity and fertility. Use of 30 pounds an acre of borax may be needed with certain crops. Such crops would include beets, carrots, and alfalfa. Crops considered suited to this soil are potatoes, corn, alfalfa, clover, truck, small fruits, nuts, and prunes.

b. *Newberg* series is similar to Chehalis but has a coarser subsoil. As this soil is subject to erosion, cover and trees should be maintained near the river for bank protection. It is estimated that in one county 1,000 acres of this soil has been ruined by erosion in the past ten years. Topography may necessitate sprinkler irrigation. This soil usually needs boron for alfalfa or beets.

2. Main valley floor
   a. *Willamette,* the leading and representative series, is a brown earth or grayish-brown soil on yellowish-brown subsoil and well drained. Area, 351,000 acres; textural types, loam to silty clay loam; weight, about 80 pounds per cubic foot; water capacity, two inches per foot; chemically well supplied with nutrients; slightly acid. Lime usually pays its way and is an aid to legumes and nitrate formation associated with legumes. Crop rotation is of first importance on these rather heavy soils. Calcium sulphate (land plaster) is needed on legumes and phosphated manure with other crops. General farming, dairying, and fruit plantings have all succeeded on this soil.

Figure 5. Dayton silty clay loam: A meadow podzol showing gray leached A horizon on columnar B horizon.

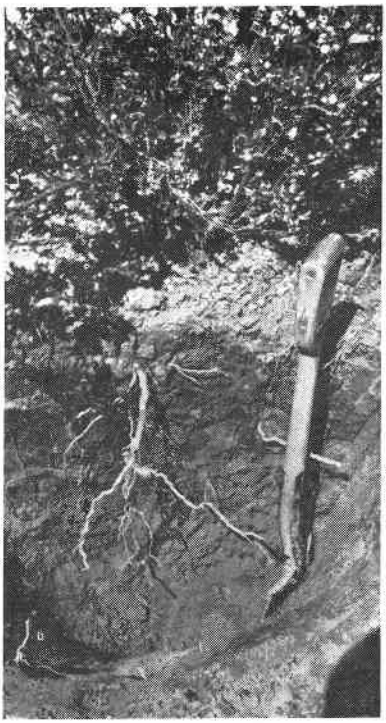

Figure 6. Amity silty clay loam with compact, mottled accumulation horizon that impedes drainage and roots.

b. *Dayton* series is gray with mottled, stiff subsoil and is poorly drained. Plant-food supply and acidity are moderate. Drainage, liming, crop rotation, phosphated manure, and calcium sulphate on legumes improve these lands. Forage and grass-seed crops are suitable.

3. Residual hill lands
   a. *Olympic* soil series is most extensive in the valley. It is red or reddish-brown soil high in iron on red sticky subsoil on basalt. Iron enriched seepage veins are found in places in the subsoil or above the winter water table in depressions. Like other hill soils, there are variations in depth and slope. These rather heavy-textured soils are usually well drained, can be worked early, and in general do not erode seriously. Reaction

Figure 7. Lateritic ironpan near top of Rainier grade in Olympic soil area. Pan is older relic.

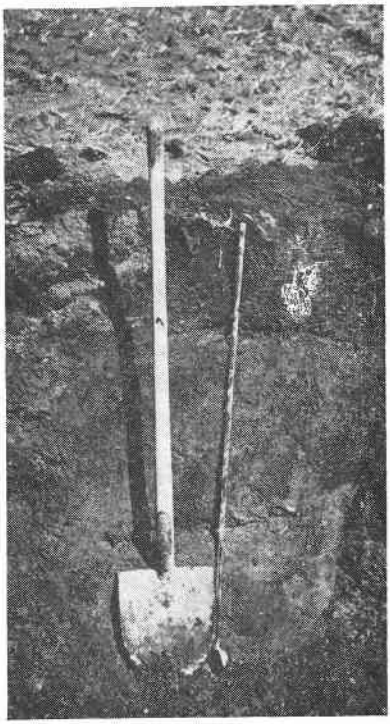

Figure 8. Olympic silty clay loam with compact B_1 upper subsoil, and dense B_2 lower subsoil, horizon near Lacomb.

is distinctly acid. Available phosphate is low and calcium is rather low. Organic matter is moderate in amount, and sulphur supply is limited. Use of lime is fundamental for growing soil-building legumes in crop rotation. Phosphated manure is helpful, especially on older lands. Calcium sulphate is safer to use than elemental sulphur on these acid soils. Grazing areas can be improved. Rougher areas may be reforested. General farm crops, prunes, nuts, and small fruits usually succeed on these soils.

b. *Melbourne* series is light-brown soil on yellowish-brown subsoil underlaid with sandstone or shale. It has been mapped mainly on the west side of the Willamette Valley. Being derived from sandstone, it is higher in silica and has less stable crumbs and fewer iron-bearing pellets than the brighter red soils of basaltic origin.

Soil-profile studies of hilly Melbourne, which has been grain-farmed for a generation, and of adjacent sod borders indicate that in places from one-fourth to three-fourths of the original top plow-depth soil has been eroded away. Water-infiltration tests show in one case an average absorption of one-ninth inch per 10 minutes in the old grain land as compared to four-ninths inch for the same time in the native sod border. Chemical analyses indicate that 25 to 30 per cent of the native supply of soil organic matter and nitrogen has been lost from extensive areas of old cultivated Melbourne soil and that leaching of bases has been accelerated. The lime requirement is frequently as much as one-half ton higher on the old land. Lime and phosphate are needed for soil building legumes. Grain, vetch, and grass seed and on the deep phase some horticultural crops are grown.

In general top soil of these different series tends to be somewhat deeper in the lower valley or north of Salem.

The *Umpqua Valley soil survey* is incomplete. Soils there include Melbourne, Willamette, Amity, and Newberg series. Some drainage of back-bottom is needed. Irrigation, green-manuring cover crop, phosphated manure, and gypsum are helpful. Seeding and the control of brush and fire will increase production of foothill pastures.

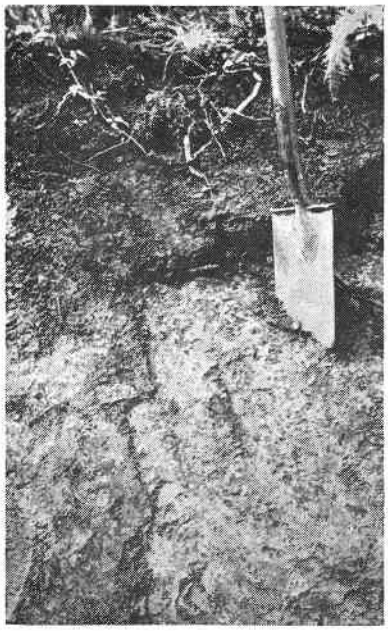

Figure 9. Meda profile with granular humus-enriched A horizon and faintly mottled compact B horizon on shale.

Figure 10. Sifton gravelly sandy loam on stony loam near Scappoose.

II. HUMID COAST PROVINCE

Oregon Coast Region soils may be grouped into:

- Recent water-laid and sedimentary soils.
- Marine terraces.
- Old alluvial soils.
- Hill lands formed in place from weathered rock residues.

Nehalem is the coastal counterpart of Chehalis with somewhat paler colored profile.

Necanicum is similar to Willamette series yet more highly leached and bleached.

Blacklock series is representative of the Marine Terrace and is a ground water podzol with raw coniferous humus up to 6 inches depth; then a bleached gray structureless siliceous horizon about 14 inches thick. This is followed by coffee-brown ironpan which is fairly hard for about 2 inches. It then gradually becomes softer and carries down in streaks or casings between or around lumps of sandy material to near the ground water level at a depth of about 36 to 40

inches where the color becomes an even olive drab. Lime, phosphate, and organic matter improve the soil. Associated series are the young *Empire* series and the very young yet stabilized sandy *Westport* series.

Soil improvement measures needed for this area are: Drainage of wet land, use of lime and phosphated manure for crop land, supplemental irrigation on improved, seeded pastures. Increased use of liquid manure pits is needed. Pasture improvement may involve controlled burning, then prompt seeding of perennial grasses and legumes, and control of weeds and brush. It also involves regulated, rotated or deferred grazing to permit reseeding.

Potash pays on peat, and a little borax and manganese appear to be helpful.

Figure 11. Blacklock loamy sand with leached gray A horizon under rich layer of raw humus, then ironpan and coatings to olive gray saturated C horizon at 40 inches.

Figure 12. Empire loamy sand with slight iron seams in B horizon and soft sandstone parent material.

III. SEMIHUMID SOUTHERN OREGON SOILS

Soil surveys have been made of the Medford and Grants Pass districts of southern Oregon. These soils are generally semihumid in character, are nearly neutral, free from accumulations of salts, or lime carbonate, and possess heavier-textured subsoils. These soils include three groups:

- Recent alluvial soils
- Old valley filling materials
- Residuals on (a) sedimentary (b) basic or (c) granitic rocks.

Columbia is the leading recent soil in southern Oregon. This is a grayish-brown light textured soil, becoming slightly heavier at 15 to 20 inches in depth yet showing little profile development.

Medford soil is the leading pear soil in the valley region represented by several of the heavier-textured types including adobe. The surface is dark brown, almost black to a depth of 10 to 16 inches. Below the surface layer is dark, yellowish-brown, compact subsoil extending to a depth of 6 or more feet.

Sites series is a bright yellowish-red counterpart of Melbourne. It occurs east of Medford over sedimentary sandstone and shale. It is yellowish-red to a depth of 1 to 2 feet, with bright red heavy-textured, moderately compact subsoil, varying in depth of 2 feet on hillcrests to as much as 6 feet in comparatively smooth areas.

Siskiyou is from granitic material and consists of from 12 to 18 inches of gray sandy loam over compact, faint pinkish-gray sandy clay loam resting on soft granitic bed rock 3 to 6 feet down.

Holland series is closely associated to Siskiyou and derived from similar material. It consists of 12 to 15 inches of brown to yellowish-brown coarse sandy loam over somewhat heavier-textured or slightly more compact sandy loam of slightly paler color. At an average depth of about 30 inches the subsoil grades into reddish-brown, weathered material of heavy texture, then through a transition of underlying granite. Some iron-cemented pellets and fine granitic rock fragments are present in the surface soil.

Olympic series is a representative of the basaltic country in both the upper and lower Rogue River Valley, and clay loam and clay adobe have been mapped. Under the warmer climate of southern Oregon, heavy textures have developed. The soil is less friable and lower in organic matter than in the Willamette Valley.

For soil improvement, irrigation is a general need wherever feasible. It is an aid to cover cropping or crop rotation and use of legumes and manure in humus building.

Practically all these soils are improved by increasing the nitrate supply. Orchards and cereals or row crops after non-legumes are in need of nitrate. Old pear orchards are given as much as 20 pounds of nitrate per tree each two years. Nitrogen fertilizer may be necessary for successful cover crops.

Sulphur or sulphates are generally needed for legumes. Phosphates are effective with legumes or corn on red soils or sandy land. In general, the dark, deep alluvial soils respond less to fertilization than the shallow or sandier lands.

Soil Survey field methods

An accurate base map and trained soil surveyors are two essentials for a detailed soil survey. The detailed soil survey of an area consists in ascertaining and indicating on a map the extent and location of each type. Equipment used in the work consists of an accurate base map such as aerial photographs, compass, colored pencils, drawing instruments, speedometer, pedometer, soil augers, and perhaps a conductivity bridge, filter, and simple reagents for testing soil reaction.

Each soil type is represented on the map in a different color. The usual scale is one square inch per square mile. All roads, streams, houses and other landmarks are indicated on this map. The area occupied by each soil type established is shown in a separate color. The field party of two *trained soil surveyors* traverses each road in every section and works out over the land in each forty-acre tract indicating the character of soil on the map after test holes or fresh exposures have been examined. Soil areas as small as five to ten acres in the tillable sections are shown on the map. Smaller areas or variations are usually described in the report.

Each type of soil in the county is sampled when the field work is nearly completed and these samples are taken to the laboratory for analysis.

Use of the soil map

In map reading it is convenient for most persons first to place the map with the top to the north. After locating a few of the towns or main landmarks, it is simple to trace the roads to the locality to be studied. Turns or road corners, farm lanes and buildings will help in identifying the field to be examined. Houses are shown as small black squares, main roads as solid double lines, and secondary roads as double dotted lines. Streams which flow the year round are indicated by single blue lines. Intermittent streams are shown by broken blue lines. Within each color area is an abbreviation for the soil type name, and the legend on the margin of the map will

show the name of the soil type which the color and symbol represent. The legend will also show the scale—the inches per mile on which the map is drawn. Soil maps are sectionized to show the township, range, and section numbers.

Digging test pits in the larger areas should help one to become familiar with the characteristics of any particular type. Wet soils usually have mottled subsoils, the light drab, gray, and yellow colors indicating lack of oxidation where water periodically keeps out air.

The soil report and its use

A description of each soil type will be found in the soil report in which the county soil map is enclosed. Careful reading of the description of the soil or soils shown on the map as occurring on any legal subdivision will supply information as to characteristics, drainage, crops suitable, range in value, and the means of soil improvement.

The report also describes the physiography, climate, agriculture, transportation, and market conditions for the area.

Use of Experiment Station soil plot and analytical data

Chemical analyses have been made of official samples of most soil types from each county or area. Greenhouse, field, or fertilizer trials have been made with leading soils. A fund of information thus accumulated is of great value in advising farmers. This information is being made available in a series of bulletins dealing with special subjects. These studies are calculated to help develop permanent systems of agriculture for these soils.

Crop rotation with humus building legumes is of first importance in maintaining productiveness of western Oregon soils. Use of barnyard manure, green manure, and crop residues is very beneficial. Liming is helpful on the wet soils of the northwest Oregon floor following drainage and is most needed on the red hill lands. Tiling is needed for nearly a million acres, and half a million acres in the Willamette Valley will respond to supplemental irrigation.

Land-plaster (or sulphur on soils of basic reaction) is profitable with legumes such as clover and alfalfa and should be applied very early in the spring. Superphosphates should help the grain yields especially on the older cropped soils and the lighter textured soils in the lower Valley. Borax at the rate of 15 to 30 pounds an acre is needed on sandy or peaty soils and old leached lands of the humid and subhumid soil provinces. Cover crops and nitrogen fertilizer are needed for horticultural crops as in Rogue River Valley. Potash pays on the local peat areas.

Field examination and judging of soils

Native vegetation and climatic conditions including the amount and distribution of rainfall and the dates of first and last killing frosts are important. Bull pine and chaparral indicate droughty soils frequently of the Camas series. Buttercup, forget-me-not, and tussocks indicate impeded drainage. Oak is characteristic vegetation on Melbourne and Carlton soils.

The agricultural experience, kind and yield of crops that have been grown in the district (as well as public improvements, community indebtedness, transportation and market conditions), should be considered. The main points in judging a prospective farm are the depth and character of the soil. The soil should be permeable and at least 4 to 6 feet deep.

Location and topography are important

The depth of soil should be determined by the use of spade or auger. A simple soil auger is made from a carpenter's wood auger by welding it to a half-inch gas pipe which may be cut into 18- or 36-inch sections with extensions and connections for reaching to a depth of six feet or more. A much larger number of test holes may be made in a limited time with an auger of this kind than with a spade, and it is more conveniently carried. Test holes should be made in a number of representative places. A gravelly substratum or hard-pan will be revealed by such examination.

The working properties of the soil may be determined with the fingers. The percentage of sand, clay, and organic matter may be estimated by putting a tablespoonful of soil into a tumbler partly filled with water, shaking up and allowing it to settle. The coarse particles will form the first layer in the bottom, and the organic matter will tend to float on the surface.

Soil sampling

Cooperative detailed soil surveys are being made of the agricultural areas by the soils department of the Oregon Agricultural Experiment Station. As rapidly as possible, physical and chemical analyses of representative samples of each type are being made. These are followed by fertilizer tests and other studies calculated to determine the most constructive methods of management of these soils.

Soil samples taken according to directions by people in Oregon will be examined by the Experiment Station and, if possible, identified as to type. Advice will be given regarding their physical and chemical type characteristics and recommendations will be made as to their management.

Simple tests for soil acidity, alkalinity, lime or phosphate needs, or organic matter content will be made where it seems desirable. The findings will be reported to the one sending properly taken samples.

Directions for soil sampling

The purpose of taking soil samples is to obtain information relative to the following points:

- **Identification of soil type.**
- **Soil reaction.**
- **Mechanical or chemical composition.**
- **Percentage of moisture content during growing season.**
- **Depth to rock, loose sand or gravel, hard-pan, etc.**

Where examination is for orchard location, the soil auger used should be at least 6 feet long. If soil auger is not available, a post-hole auger or shovel may be used.

Selection

1. If you recognize two or three distinct soils on your farm collect soil samples from each.
2. If one of these soils covers 20 acres or more select a spot in this field that will be typical of the area.
3. In order to know when you have a typical spot, you may need to make three or more borings. There is no better way to find out.

Collecting the soil sample by horizons

Take samples from an open field and avoid paths, gopher holes, etc., from which modified and not typical samples are likely to be obtained.

Surface soil

1. Select an average spot, pull up growing plants, brush aside half decayed vegetable matter, and bore or dig a vertical hole to a depth of 8 to 10 inches (plowing depth). Repeat this several times at one-rod intervals. (This repetition is not necessary for subsoil and substratum.)
2. Mix well these soil samples on a piece of cloth or stout paper. Dry this mixed sample; place cupful of the dried soil in clean canvas bag, can, or ice cream carton.
3. Label carefully, "surface soil," and indicate range of depth, e.g., 0 to 8 inches.
4. If same kind of soil extends deeper, state to what depth and collect a second composite sample of the rest of the surface horizon.

Subsoil

5. Bore down below surface, to a depth of between one and two feet, until you find a change in either the color, texture, or structure of soil.

6. After reaching another change, stop and mix the soil thoroughly and place in bag.

7. Label "subsoil" and give range of depth found.

Substratum

8. Dig or bore to the depth of six feet, if practicable, and if hard-pan gravel or other peculiarity in structure is noted, send sample properly labeled. If solid rock is found, state at what average depth. This deep sample is an aid to identification.

9. Label "substratum" and indicate depth at which found.

Miscellaneous information which should accompany soil samples

10. Send a description of the land, which should include legal location, as complete a history of the field as possible, name of nearest town, probable selling price of land, elevation above nearest river, direction and grade of slopes, drainage, how long cropped, by what crops or fruits, what yields, whether fertilizers have been applied, and any peculiarities which may have a bearing on the agricultural qualities of soil.

11. State the Township, Range and Section Number of the land from which these samples are taken.

12. Do not fail to label samples carefully, placing name of sender on each sample wrapper. Fasten letter to package.

13. Send samples prepaid to

SOILS DEPARTMENT,
AGRICULTURAL EXPERIMENT STATION,
OREGON STATE COLLEGE,
CORVALLIS, OREGON

Productivity ratings

Relative productivity ratings for some index crops that are rather generally grown are indicated in the accompanying tables. Many specialty crops are grown on only a few of the soil series.

The recent alluvial soils are generally deep, permeable, and unleached, nearly neutral and among the most productive soils of the region. Their low situations make them somewhat more subject to flooding and frosts.

Table 2. Estimated Acre Yields on Willamette-Umpqua Province Soils

I. Old Valley Filling Soils

Soil type or group	Area	Winter wheat	Winter oats	Potatoes	Red clover	Alfalfa	Vetch and oats	Apples	Ryegrass seed	Walnuts	Strawberries	Pasture	General agricultural value (1-10)
	Acres	*Bushels*	*Bushels*	*Bushels*	*Tons*	*Tons*	*Tons*	*45-pound boxes*	*Pounds*	*Tons*	*Pounds*	*Cow months*	
Willamette													
Loams	135,168	35	50	150	3.0	3.0	3.0	400	900	1.25	4,000	6	1
Si L and SiC L	216,512	30	45	125	2.5	2.5	2.8	.....	900	.....	4,000	5	1
Irrigation and rotation	.....	45	55	225	4.0	5.0	....	.....	.....	1.5	6,000	15	....
Amity													
Loams	159,424	25	35	100	2.5	....	2.6	300	600	....	.....	4	3
Si C L's	118,144	22	30	.....	2.0	....	2.5	.....	500	.....	.....	3	4
Hillsboro F S and loam	12,224	35	50	175	3.25	3.0	3.0	400	900	1.25	4,000	6	1
Salem													
F S L, L, G L	33,416	30	40	100	2.5	2.5	2.5	300	700	.....	3,000	5	1
C L, Si C L	23,168	25	35	.....	2.0	....	2.0	.....	600	1.0	3,500	4	2
Dayton													
L and Si L	125,696	....	....	.....	....	....	....	.....	500	.....	.....	4	5
Si C L and C	57,600	....	....	.....	....	....	....	.....	450	.....	.....	3	6
Powell, Si L	46,912	25	35	200	2.5	2.5	2.5	250	.....	1.00	4,000	5	1
Salkum, C L, G C L, Si C L.	25,792	20	30	.....	....	....	2.0	.....	450	.....	3,000	4	3
Concord, Si L, C L, Si C L.	29,148	....	....	.....	....	....	....	.....	500	.....	.....	4	6
Courtney, C L, G Si C L	13,504	....	....	.....	....	....	....	.....	300	.....	.....	4	5
Sifton, S L, G S L, G V F S L, and G L	10,496	20	30	.....	2.0	....	2.0	.....	.....	.7	3,000	4	6
Clackamas													
G L and G C L	22,592	22	30	.....	2.0	2.0	2.25	.....	600	.....	.....	5	4
Si C L and C	8,640	20	....	.....	....	....	....	.....	500	.....	.....	4	5
Grande Ronde, C L and Si C L	5,760	....	....	.....	....	....	1.5	.....	400	.....	.....	3	7
Holcomb, Si L, C L and Si C L	32,032	18	25	.....	....	....	1.5	.....	500	.....	.....	....	....
Veneta, L, C L	18,368	15	25	.....	....	....	1.5	.....	300	.....	.....	3	8
Total	1,117,596	....	....	.....	....	....	....	.....	.....	.....	.....	....	....

Where there are blanks under any crop, this usually indicates that the crop is not recommended for the soils listed opposite the blank at the left of the table. One should, if considering the crop for such soils, get additional information from authorities.

No attempt is made to list all important crops here. These are crops that indicate how crops of different types respond to the soils listed.

Key to Abbreviations in Tables 2 through 7

C clay
F fine
G gravel or gravelly
L loam
S sand or sandy
Si silt or silty
Sty stony

Table 3. Estimated Acre Yields on Willamette-Umpqua Province Soils

II. Recent soils

Soil type or group	Area	Wheat	Oats	Potatoes	Red clover	Alfalfa	Vetch and oats	Apples	Walnuts	Strawberries	Pasture	General agricultural value (1-10)
	Acres	*Bushels*	*Bushels*	*Bushels*	*Tons*	*Tons*	*Tons*	*45-pound boxes*	*Tons*	*Pounds*	*Cow months*	
Chehalis												
F S L, L	34,980	40	70	160	3.0	4.0	2.5	400	1.25	4,000	6	1
Si L, C L, Si C L	183,735	35	70	150	2.75	2.5	2.75	400	1.25	6,000	7	1
Irrigated and fertilized Si L, C L, Si C L	.....	50	75	250	4.0	5.5	3.00	500	1.5	4,000	14	....
Newberg												
F S L, S L, L	62,272	30	50	150	2.0	4.0	2.5	350	1.0	3,500	6	2
Si L, Si C L, etc.	36,736	....	....	.....	.....	.....	.....	.....	.....	.....	....	....
Si L, Si C L irrigated and rotated	.....	35	60	160	2.5	3.0	2.75	350	1.25	4,000	8	....
Columbia						.....	.....	.....	.....	6,000	....	....
F S L	4,672	35	50	140	2.5	2.5	2.75	250	.....	3,500	6	3
S L, L, Si L	6,144	40	60	150	2.75	2.75	3.00	275	.....	4,000	8	1
Camas												
F S, G S L	20,544	30	40	125	2.0	2.5	2.50	.....	.....	3,000	5	3
L, Si L, C L	16,192	25	45	140	2.25	2.75	2.75	.....	.....	3,500	6	2
Wapato												
Si L	19,776	....	30	.....	.....	.....	.....	.....	.....	.....	7	5
Si C, C	182,976	....	25	.....	.....	.....	.....	.....	.....	.....	6	6
Sauvie												
Si L, C L, Si C L	24,192	50	40	150	.....	.....	.....	.....	.....	.....	9	7
Si L, C L, Si C L drained	.....	55	50	200	.....	.....	2.75	.....	.....	.....	12	1
Whitson, Si L, S C, Si C L	8,960	....	....	.....	.....	.....	.....	.....	.....	.....	5	5
Cove, C	29,440	....	....	.....	.....	.....	.....	.....	.....	.....	4	8
Toutle, S	3,840	....	....	.....	.....	.....	.....	.....	.....	.....	....	9
Burlington, F C	676	40	50	150	2.5	2.5	2.5	.....	.....	3,500	10	2
Muck and peat	5,888	....	50	.....	.....	.....	.....	.....	.....	.....	....	7
Muck and peat, drained	.....	....	60	.....	.....	.....	.....	.....	.....	.....	....	1
Total	654,427	....	....	.....	.....	.....	.....	.....	.....	.....	....	....

Table 4. Estimated Acre Yields on Willamette-Umpqua Province Soils

III. Residual hill soils

Soil type or group	Area	Winter wheat	Oats	Alta fescue	Vetch	Apples	Walnuts	Strawberries	Pasture	General agricultural value (1-10)
	Acres	*Bushels*	*Bushels*	*Pounds*	*Tons*	*45-pound boxes*	*Tons*	*Pounds*	*Cow months*	
Olympic										
Loams and Si L	222,592	25	35	300	2.2	250	.75	2,000	4	3
C L, Si C L, C	476,712	20	30	250	.....	250	....	2,500	4	4
Aiken										
C L, Si C L	279,744	28	40	275	2.5	275	.75	2,500	4	3
Si C L, shallow	3,520	25	35	225	.....	.....	....	.....	3	6
Viola, C L and Si C L	26,432	....	20	125	2.0	.....	....	.....	4	5
Melbourne										
L	73,088	20	25	.....	2.25	275	.5	3,000	4	4
C L, Si C L, C	304,768	18	22	.....	.....	.....	....	2,500	4	5
Sites										
L	25,644	27	25	.....	2.0	300	....	3,000	3	4
Si C L, C	14,016	25	22	.....	.....	.....	....	2,500	5	4
Carlton										
Si L, C L	26,792	30	40	400	2.5	250	....	3,000	6	3
Si C L, C	50,816	25	25	350	2.0	.....	....	2,500	6	4
Cascade, Si L, C L	85,760	25	30	200	1.75	.....	....	2,500	4	4
Polk										
L	20,416	28	35	250	2.25	250	.75	2,000	4	3
Si C L	10,496	....	....	275	2.00	.....	....	.....	4	4
Waldo, C L	1,280	18	20	.....	1.75	.....	....	.....	3	6
[1]Rough stony land	5,440	....	....	.....	.....	.....	....	.....	4	7
[1]High, broken, and stony	140,032	....	....	.....	.....	.....	....	.....	2-3	8
[1]Rough mountainous	1,455,680	....	....	.....	.....	.....	....	.....	3	9
	14,080	....	....	.....	.....	.....	....	.....	2	10
Total	3,221,244	....	....	.....	.....	.....	....	.....	....	....

[1]Yamhill county only.

The well-drained old valley filling soils in the sub-humid and humid soil provinces are usually of good depth, water capacity, and fertility. They have medium to heavy texture and moderately compact subsoils. They are low in calcium content (noncalcareous) except for some soil series in the Rogue River Valley.

The hill group of soils tend to be distinctly acid in sections of heavy rainfall. They tend to be rather heavy in texture and to have dense subsoils. Frequently there are cropping limitations as to topography and depth.

Lotus and subterranean clover are especially promising legumes for acid soils.

Specialty crops usually are grown on the better soil types. For example: Fiber flax and sugar beet seed on Chehalis, Willamette or Newberg silt loam or loam; cannery crops on Newberg and Chehalis loam or sandy loam; and mint and cranberries on peat. Bulbs are grown on loam or sandy loam well supplied with organic matter and moisture.

Table 5. ESTIMATED ACRE YIELDS ON SOILS OF NEW SERIES UMPQUA SUB AREA

Soils	Alfalfa	Oats and vetch	average vetch and oats	Prunes	Improved	Native	General agricultural value (1-10)
	Tons	*Tons*	*Bushels*	*Tons*	*Cow months*	*Cow months*	
Old alluvial							
Kerby, dry	1.5	1.75	25	.7	4	3	4
Drain	.....	1.5	20	....	6	4	7
Yoncolla	.....	1.75	25	....	6	4	5
Melrose	.....	1.5	20	....	4	3	6
High terrain							
Maxwell	.....	1.0	15	....	2	1	9
Sweeney	.....	1.5	25	....	6	4	6
Residual							
Dillard, dry	1.5	2	40	....	4	3	3
Recent							
Glide, irrigated	2.75	2.5	40	.7	15	3	2
Umpqua, irrigated	4	3	60	1.0	18	4	1

Table 6. Estimated Acre Yields on Coastal Province Soils[1]

Soil type	Hay, rye-grass, and clover	Clover and grass silage	Hay, oats, and vetch	Roots	Small fruits, straw-berries	Pasture	Bent-grass seed	Principal use when drained	General agricul-tural value (1-10)
	Tons	*Tons*	*Tons*	*Tons*	*Pounds*	*Cow months*	*Pounds*		
Excellent									
Recent alluvials permeable									
Sauvie (and Coquille) silty clay loam	3.00	12.0	3.50	40	.....	12	125	Feed and seed crops	2
Clatsop silty clay loam	2.50	9.0	3.00	35	.....	10	100	Feed and seed crops	2
Nehalem (Chehalis) silty clay loam	2.50	8.0	3.50	27	3,000	17	75	General crops	1
Nehalem loam	2.00	7.0	3.00	27	4,800	6	75	General crops	1
Nehalem silt loam	2.00	8.5	3.00	27	3,500	6	75	General crops	....
Good									
Necanicum (Willamette) loam	1.75	7.0	2.50	25	3,000	5	.....	General crops	1
Brallier peat	2.50	8.0	3.00	30	.....	8	100	Pasture	3
Cinebar silt loam	1.50	5.0	2.00	25	.....	5	.....	Hay and pasture	3
Klaskanine (Salem) silt loam	1.75	6.0	2.00	25	2,500	5	.....	Hay and pasture	2
Dolph loam	1.75	.....	.....	....	.....	....	.....	Pasture	2
Myrtle	1.25	5.0	2.00	....	.....	5	.....	Pasture	3
Meda (outwash, Astoria)	1.50	5.0	2.00	....	2,500	4	.....	Hay and pasture	2
Fair									
Brenner (Wapato) silty clay loam	1.50	6.0	2.50	25	.....	6	75	Feed and seed crops	3
Melbourne loam	1.25	5.0	2.00	20	2,500	3	.....	General crops	3
Astoria (and Riverton clay loam) (Melbourne) silt loam	1.25	5.0	2.00	20	2,000	4	.....	General crops	3
Brallier peat	2.00	7.0	3.00	25	.....	8	75	Pasture	3
Spalding peat (spagnum)	2.25	7.0	2.50	25	.....	7	.....	Pasture	....
Arago	1.25	5.0	2.00	....	.....	8	.....	Hay and pasture	3
Daniels (Aiken)	.....	.....	.....	....	.....	3	.....	Pasture and forestry	3
Poor									
Warrenton loamy fine sand	1.25	5.0	2.00	25	2,000	2	.....	Pasture and truck	5
Hebo silty clay loam	1.25	5.0	2.00	....	.....	4	.....	Pasture and hay	3
Grande Ronde silty clay loam	1.25	5.0	1.50	18	.....	4	.....	Pasture and hay	3
Blacklock fine sandy loam, silty loam, loam, clay	1.00	3.0	1.00	18	.....	2	.....	Pasture and truck	4
Empire fine sandy loam	1.00	.....	.....	....	2,000	2	.....	Pasture and forestry	5
Coates	1.00	4.0	.....	18	1,500	3	.....	Hay and pasture	3
Winema (Rendzine)	1.00	3.0	1.50	....	2,000	....	.....	.....	3
Westport	.....	.....	.....	....	.....	....	.....	Grass	5

[1]Where good farm practices (drainage, liming, and fertilization) are used.

Soil fertility and type	Area	Silage corn	Alfalfa	Winter barley	Pears	Tomatoes	Pasture		Agricultural value (1-10)
							Irrigated	Dry	
	Acres	*Tons*	*Tons*	*Bushels*	*45-pound boxes*	*Pounds*	*Cow months*	*Cow months*	
I. *Residuals*									
Aiken, C L; C Adobe, S....	9,280	6	....	24	.....	34-60	....	....	3, 4, 5
Olympic L, C L, C Adobe..	33,856	6	....	30	.....	.....	15	3	3, 4
Igneous rocks									
Siskiyou C L S	28,352	....	4-5	15	.....	29-80	15	2	5
Tolo L and Sty L	87,680	5	3	18	.....	25-90	10	2	4
Holland C S L	18,816	....	3.5	30	.....	25-50	15	3	4
Climax C Adobe	17,216	6	3.5	30	.....	.....	12	2	4, 5
Brownsboro C S L	3,136	....	3	18	.....	40-80	10	1	5
Sediment rock									
Sites L; G CL-deep, F S L; G F S L	30,336	6	....	24	.....	47-100	12	2	4, 5, 6
Hugo Si L	6,528	....	....	18	.....	.....	10	1	5
Josephine Si C L	27,136	6	3.5	22	.....	37-100	18	3	5
II. *Alluvials*									
Granites									
Barron C S; C S L; S L..	32,912	5	3.5	22	.....	29-80	18	3.5	5, 4
Hanford C S L	192	....	9	20	200	40-	21	5	3
Clawson L; Si L	3,072	6	3	25	.....	.....	15	3	4, 5
Green stones									
Coleman A L	5,888	5	3.5	30	175	.....	15	3	2
Medford F S L, L, G F S L, G C L; C Adobe	13,504	10	5	40	350	100-125	24	4	1, 2
Basaltic									
Meyer Si C L; C Adobe....	11,200	8	5	30	300	.....	21	5	2, 3
Coker Clay Adobe	6,528	8	4	35	250	75-125	18	3.5	3
Shale									
Phoenix C L Adobe, C Adobe	5,120	7	3	30	300	75-125	15	3	3
Agate G L, deep; G L and G S L	29,120	....	3	18	175	37-50	9	1	5, 8
Old terraces									
Salem F S L; G S L C Adobe	11,904	8	5.5	40	325	.....	24	6	1, 3
Antelope C, C Adobe	4,224	7	4	35	.....	100-	12	2	4
Bella Vista F S L	576	6	5	25	200	.....	24	6	1
Jerome S L	2,752	....	3	20	.....	25-80	18	3	5
Kerby L, C L, Sty L	37,056	6	4	25	200	30-100	18	4	3, 4
Corning G L; G C L; C L	27,584	6	3	25	.....	.....	15	2	3, 4
III. *Recent alluvials*									
Neil F S L; C Adobe	5,632	10	6	45	350	100-	24	6	1, 3
Evans F S L	1,920	6	5	30	200	100-	21	5	2
Sams	4,672	5	4.5	25	300	100-	21	5	2
Columbia F S L, L	32,256	12	5.0	45	300	50-75	24	6	1
Wapato C	1,216	....	4.0	25	.....	20-40	18	4	4
Hanford, C S L	192	9	4.0	25	.....	50-87	21	4	8
Rough mountainous, river wash and placer diggings	.....	....	....	....	.....	.....	....	....	9 10