

# SOIL SURVEY OF POLK COUNTY, OREGON

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## DESCRIPTION OF THE COUNTY

Polk County is in the northwestern part of Oregon on the west side of Willamette River, the western boundary of the county being about 15 miles from the Pacific Ocean. Portland is about 35 miles from the northeastern corner of the county. Yamhill County bounds the area on the north, Lincoln and Tillamook Counties on the west, Lincoln and Benton Counties on the south, and Willamette River, which forms the boundary between Polk and Marion Counties, on the east. Polk County is roughly rectangular in shape. It has an area of 744 square miles, or 476,160 acres. Over 150,000 acres are now under cultivation, and possibly 200,000 additional acres are cultivable, now in forest or brush, the greater part of such land lying in Willamette Valley.

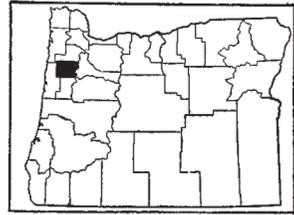


FIG. 50.—Sketch map showing location of Polk County, Oregon

The topography and elevation of Polk County vary considerably. The eastern part consists mainly of stream valley and bench lands, which in the main are nearly level to gently undulating, and have an elevation varying from 20 to 300 feet above sea level. The western part consists of rough mountainous land, heavily forested.

The soil survey of this county joins with similar soil surveys<sup>1</sup> of Yamhill and Benton Counties on the north and south, respectively. A small part of Polk County, T. 7 and 8 S., R. 3 and 4 W., about 75 square miles, is included also in a much earlier soil survey of the Salem area.<sup>2</sup>

Like the Yamhill and Benton County areas, Polk County comprises three main topographic divisions: (1) The stream bottoms and lower alluvial terraces; (2) the valley floor and higher bench lands; and (3) the hilly and mountainous areas.

The alluvial stream bottoms and lower adjacent terraces occur along Willamette River, principally in the vicinity of American Bottom, and as a strip 1 mile wide and 4 miles long south of McNary in the eastern part of the county. At other points along Willamette River these areas vary from one-fourth to one-half mile in width. They are also extensively developed along South Yamhill River in the northwestern part of the county, along Baskett Slough and

<sup>1</sup> Soil Survey of Yamhill County, Oregon, Field Operations, Bureau of Soils, U. S. Department of Agriculture, 1917.

Soil Survey of Benton County, Oregon, Field Operations, Bureau of Soils, U. S. Department of Agriculture, 1920.

<sup>2</sup> Soil Survey of the Salem area, Oregon, Field Operations, Bureau of Soils, U. S. Department of Agriculture, 1903.

in the territory south of Holmes Gap, along Rickreall Creek and along Luckiamute and Little Luckiamute Rivers. The land is smooth to slightly undulating, the surface being broken by old stream channels, shallow basins, and ridges. These areas are all more or less subject to overflow.

An extensive area of valley floor and bench lands occurs in the northern part of the county, extending eastward to about 2 miles east of McCoy, southward to about 1 mile south of Perrydale, westward to  $1\frac{1}{2}$  miles west of Ballston, and northward to the county line, covering approximately 21 square miles. A second extensive area lies north of Independence and Monmouth, extending to the vicinity of Greenwood, and covering about 22 square miles. A smaller area of about 6 square miles lies in the vicinity of Suver in the southeastern corner of the county, and many smaller areas lie in other parts of the county. The surface of these areas is nearly level to moderately undulating.

The hilly and mountainous areas are grouped into two main subdivisions, the Coast Range or rough mountainous region and the lower-lying foothills or moderately undulating hills.

The rough mountainous area occupies that part of the county lying west of a line drawn north and south through Falls City, with the exception of the valleys along South Yamhill River and Gooseneck Creek. This territory includes the most heavily forested sections of Polk County. With the exception of the lumber industry, there has been very little development in this part of the county.

Eola Hills, in the northeastern part, constitute a ridge of high hills extending from Eola beyond the Yamhill County line. They have an average width of about 5 miles.

The eastern boundary of the lower foothills of the Coast Range in the southern part of the county extends to Willamette River at Buena Vista, thence northwestward to a point 1 mile west of Mulkey, thence westward to Dallas, thence north  $2\frac{1}{2}$  miles, and thence east to the Eola Hills.

Polk County was organized in 1845. According to the 1920 census the population is 14,181, of which 81 per cent is classed as rural. The density of the rural population is 16.2 persons per square mile. About 90 per cent of the population is American born, and the remainder consists mainly of Canadians, Russians, and Germans, but includes a few English, Scandinavians, Scotch, Irish, and other nationalities.

Settlement is confined mainly to the agricultural districts of the eastern and central parts of the county and to a few of the larger lumber-mill towns. Dallas, the county seat, is centrally located and has a population of 2,701. Other important towns are Independence, with population of 1,143; Falls City, 994; and Monmouth, 582, the latter town being the seat of the Oregon State Normal School.

Good shipping and transportation facilities are furnished by a line of the Southern Pacific Co., now electrified, which traverses the eastern part of the county and has branch lines connecting Dallas, Falls City, Salem, and other adjacent points. The Valley & Siletz Railroad enters the south-central part of Polk County and connects with the Southern Pacific Co. at Crisp and Independence.

The eastern part of the county is traversed by the West Side Pacific Highway. Dallas and other important towns are connected

with this highway by branch roads which are paved or otherwise improved. Some of the roads traversing the more remote or hilly parts of the county are graveled or otherwise improved, but in the extreme western part roads are few and unimproved. During the rainy season they are in poor condition.

The more thickly settled rural parts of the county are provided with telephone service and rural mail delivery.

The more extensive shipments of poultry, fruit, vegetables, and other farm products are made to Portland and other outside points. The local towns are the markets for the rest of the produce.

#### CLIMATE

Polk County has a mild and temperate climate, with a rainy winter season, a dry summer, and a long growing season. The snowfall is very light. Most of the precipitation in the winter months falls in the form of rain.

According to the records of the Weather Bureau station at Wallace Orchard, in the extreme eastern part of the county, the normal rainfall is 39.89 inches, almost 70 per cent of which falls during the period from November to March, inclusive. The wettest year on record at this station was 1916, when the total precipitation was 51.93 inches; and the year of least rainfall on record was 1918, with a total rainfall of 34.05 inches.

With the proper conservation of the water stored in the soil during the winter rainy season, the spring rains are normally sufficient for the production of crops. The summers are usually very dry, July and August each having approximately 0.5 inch of rainfall. The distribution of rainfall is apparently sufficient for most crops, although experiments conducted at the Oregon Agricultural Experiment Station show that it is profitable to irrigate the land for late-season crops. The dry summers are very favorable for harvesting hay crops, and fall and spring rains are favorable for the growth of winter grains.

The mean annual temperature for Wallace Orchard is 51.3° F. The highest temperature recorded is 100° and the lowest -14°, but these extremes are rare. A mean temperature of 39.5° shows the mild character of the winter season. During the winter rains the temperature is very moderate, with the lower temperatures occurring during clear, bright weather. The prevailing winds are from the southwest during the rainy period, shifting to the north and northeast in clear, cool weather. This region is free from continuous and prolonged hot weather, such as occurs in the Middle West and East. Occasional hot spells may last two or three days, but the daily cool ocean breeze moderates the temperature in the latter part of the afternoon, and rarely fails to cool the atmosphere by evening, making the nights cool and refreshing. The average date of the last killing frost in the spring is April 30, and of the first in the fall October 21. The latest recorded killing frost in the spring occurred on May 31, and the earliest in the fall September 12. The average frost-free season is 173 days.

The records of the Weather Bureau station at Wallace Orchard represent climatic conditions of the eastern part of the county. The

western part is hilly and mountainous, and the rainfall is much greater, but there is very little difference in the temperature and snowfall as shown by the records of the Weather Bureau station at Falls City, located just south of the center of the county near the foothills of the mountainous section. The rainfall increases rapidly as the mountains are approached, and the climatic records of this latter station more nearly show the climatic condition of the central and western parts of the county.

The average annual precipitation at Falls City is 78.49 inches. The wettest year on record at this station, 1902, had a total precipitation of 103.39 inches, and in the year of least rainfall, 1911, a total of 49.71 inches was recorded. The average date of the last killing frost in the spring is May 9, and the average earliest in the fall is October 22, giving an average frost-free season of 165 days. The earliest recorded killing frost in the fall occurred September 16, and the latest frost recorded in the spring occurred June 19. The mean annual temperature at this station is 50.2° F., a recorded maximum of 101° in July and a recorded minimum of -5° in January.

The higher altitudes in the mountains are largely responsible for the wider range in temperature in the extreme western part of the county and the shorter growing seasons in many sections.<sup>3</sup> Snow is common in the Coast Range, but seldom remains on the ground more than a few hours on the valley floor and eastern parts of the county.

The following tables give the normal monthly, seasonal, and annual temperature and precipitation recorded at the Weather Bureau stations at Wallace Orchard and Falls City:

*Normal monthly, seasonal, and annual temperature and precipitation at Wallace Orchard*

[Elevation, 173 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1918)	Total amount for the wettest year (1916)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	38.8	67	-14	6.25	4.48	5.28	2.8
January.....	38.6	69	8	6.40	4.99	6.88	4.0
February.....	41.1	65	17	4.57	7.45	7.42	.9
Winter.....	39.5	69	-14	17.22	16.92	19.58	7.7
March.....	45.5	77	21	3.89	4.35	10.83	.1
April.....	49.3	86	26	2.59	1.40	3.08	.1
May.....	54.4	91	26	1.92	1.49	3.07	.0
Spring.....	49.7	91	21	8.40	7.24	16.98	.2
June.....	61.1	92	35	1.36	T.	1.70	.0
July.....	65.4	100	40	.55	.40	2.76	.0
August.....	65.8	100	38	.42	.89	.43	.0
Summer.....	64.1	100	35	2.33	1.21	4.89	.0
September.....	59.8	94	32	2.24	.30	.94	.0
October.....	52.0	81	23	3.22	3.69	1.96	.0
November.....	44.3	66	20	6.48	4.61	7.58	.1
Fall.....	52.0	94	20	11.94	8.60	10.48	.1
Year.....	51.3	100	-14	39.89	34.05	51.93	8.0

<sup>3</sup> No Weather Bureau records are available for the extreme western part of Polk County.

*Normal monthly, seasonal, and annual temperature and precipitation at Falls City*

[Elevation, 355 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1911)	Total amount for the wettest year (1902)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	39.6	59	17	13.42	8.53	22.02	0.5
January.....	37.9	65	-5	12.34	14.73	8.64	6.1
February.....	41.0	65	1	11.70	4.02	21.16	.9
Winter.....	39.5	65	-5	37.46	27.28	51.82	7.5
March.....	44.3	80	21	8.38	1.52	14.50	1.6
April.....	48.9	88	25	4.06	.33	5.79	T.
May.....	53.2	90	26	3.00	5.92	3.81	.0
Spring.....	48.8	90	21	15.44	7.77	24.10	1.6
June.....	57.9	96	32	1.52	.66	1.11	.0
July.....	63.4	101	36	.41	.03	1.07	.0
August.....	62.7	100	36	.48	.00	.02	.0
Summer.....	61.3	101	32	2.41	.69	2.20	.0
September.....	58.2	90	26	2.69	4.86	1.37	.0
October.....	51.2	86	25	5.03	2.10	3.55	.0
November.....	44.6	71	17	15.46	7.01	20.35	.8
Fall.....	51.3	90	17	23.18	13.97	25.27	.8
Year.....	50.2	101	-5	78.49	49.71	103.39	9.9

## AGRICULTURE

Agriculture has been the main industry of Polk County since its organization in 1845. The open prairies along Willamette and South Yamhill Rivers, the first parts to be settled and improved, were covered with an excellent growth of native grasses which provided pasturage for cattle, and the few crops grown were mostly subsistence crops. As the population of the county increased and agriculture was extended, wheat and oats were grown more extensively. The increased acreage devoted to grains and forage crops made it necessary to send the range cattle back into the hills for summer pasturage. In recent years dairying and fruit growing have made remarkable progress, being now the leading agricultural industries of the county.

According to the census report, in 1879 wheat occupied 52,020 acres, producing 825,896 bushels; oats, 11,611 acres, producing 338,226 bushels; barley, 958 acres, yielding 25,358 bushels; and the acreage of hops was only 35 acres. During the decade 1869-1879 wheat was the most extensively grown crop, having twice the acreage of all other crops combined. Fruit production was limited to home demands.

During the next decade, 1879-1889 the acreage of wheat was decreased by 10,000 acres, but the production increased nearly a quarter of a million bushels, probably the result of changing from spring to winter varieties. Potatoes nearly doubled in production, increasing from 21,529 to 42,635 bushels; and the acreage of oats was

increased 41 per cent over that of the previous decade. Barley decreased about 30 per cent in acreage, occupying 672 acres, which produced 22,812 bushels. Hops acreage increased from 35 to 340 acres. Apples and peaches were produced on a commercial basis, with 82,055 apple trees producing 73,727 bushels, and 2,217 peach trees producing 1,288 bushels.

The next decade, 1889-1899, was marked by the introduction of red clover, the census for 1899 reporting an acreage of 500 acres, which produced 1,057 tons of hay. Wild grasses occupied 162 acres and tame grasses 7,249 acres, yielding 13,322 tons of hay. During this decade the introduction of clover, diversification of crops, and crop rotation were important strides toward permanent agriculture. The census for 1899 reported 3,549 acres of grain cut green for hay, yielding 5,842 tons. Wheat increased in acreage. Oats again showed a large increase, totaling 20,590 acres. Potato production advanced from 42,635 to 83,395 bushels, and apples from 122,923 trees produced 27,224 bushels. With the introduction of silos the acreage in corn increased. The acreage devoted to hops showed an enormous increase, from 340 to 2,568 acres, owing to favorable climatic conditions and excellence of product. The acreage planted to fruit trees increased 25 per cent. Dairy products were valued at \$29,324; poultry products, \$34,643; animals sold and slaughtered, \$144,317; fruits and nuts, \$23,849.

The period from 1900 to 1910 was characterized by still greater diversification of crops, and a conspicuous reduction in the wheat acreage from 49,346 to 13,089 acres. Beans were introduced among the cultivated crops, but occupied only 15 acres. Oats increased from 20,590 to 31,091 acres. Clover also advanced from 500 to 2,601 acres. Grains cut green for hay increased from 3,549 to 15,525 acres. Hops nearly doubled in acreage, totaling 4,497 acres in 1909. Apples increased in production from about 27,000 to over 70,000 bushels. The Oregon prune became commercially important during this decade, the 1910 census reporting 121,430 trees in 1909, yielding 128,082 bushels. The number of grapevines increased from 5,227 to 12,303. Nut production was first reported in the 1910 census, 455 trees yielding 6,875 pounds in 1909. Small fruits showed a large increase in acreage; strawberries increased from 18 to 108 acres. Dairy products, exclusive of home use, increased in value from \$29,324 to \$203,185; poultry from \$34,643 to \$153,246; and fruits and nuts from \$23,849 to \$165,139. The total value of all farm products in 1909 was \$2,990,724.

During the period from 1910 to 1920 the great increase in acreage of wheat over the previous 10 years, from 13,089 acres in 1909 to 32,126 in 1919, was the result of war demands. Hops, which reached their highest acreage in 1909, with 4,497 acres, yielding 3,949,426 pounds, decreased to 1,576 acres in 1919, with a production of 1,274,540 pounds. Owing to the development of the dairy industry, silage crops were grown on 1,452 acres, with a production of 6,505 tons. This period is characterized by a remarkable increase in the fruit industry. Prunes and plums showed the most conspicuous increase, from 121,430 trees in 1909, yielding 128,082 bushels, to 518,165 trees in 1919, yielding 273,579 bushels. Cherries increased from 11,971 to 54,143 trees; and peaches and nectarines from 4,238 to

18,041 trees. Nuts, principally Persian (English) walnuts, increased from 455 to 12,093 trees. The total value of the agricultural products of the county showed a material increase over that of the previous decade. Cereals increased in value from \$621,195 to \$2,215,712; fruits and nuts from \$165,139 to \$1,161,269; dairy products from \$203,185 to \$540,373; and poultry products from \$153,246 to \$294,034. A total valuation of all agricultural products shows an increase from \$2,990,724 in 1909 to \$6,309,508 in 1919.<sup>4</sup>

It is evident from the foregoing description that the agriculture of Polk County consists of general farming, fruit production, dairying, poultry raising, and trucking. The principal money crops are wheat, fruit, oats, and potatoes. Potatoes continue to be an important cash crop, nearly every farm devoting some acreage to their culture, both for home use and the market. Potatoes fit in particularly well in a crop rotation, being especially adapted to the lighter or sandy soils.

Clover, now recognized as an important crop in establishing a permanent system of agriculture, was grown on 2,654 acres in 1919. In connection with dairying it is cut for hay, producing a palatable and nutritious forage. As a seed crop it is attracting considerable attention, more seed being allowed to mature each year. Clover seed promises to become a leading cash crop. The usual practice is to allow the crop to mature for seed the first year, when the clover is free from weeds, and the second year to cut it for hay, following which the stubble is plowed under and the field planted to grain or a cultivated crop.

Corn has made a larger increase in acreage during the decade ending 1919 than any other crop, owing to the recognition of its excellence for use as silage and to the development of early maturing varieties. Corn on 1,287 acres in 1919 produced 30,218 bushels, and silage crops (mostly corn) on 1,452 acres produced 6,505 tons of feed.

The fruit industry of Polk County is an extensive and highly specialized form of agriculture. Because of the marked adaptability of the soils to fruits, and of the large financial returns, orchards have largely replaced grain fields on the so-called "red-hill soils" of Willamette Valley. The 1920 census showed that the total value of fruits and nuts in 1919 was second only to that of cereals. The upland residual soils, derived from igneous rocks, are particularly adapted to prunes, apples, and walnuts. Prunes showed a tremendous increase, although many prunes are grown on other soils (Pl. XLVI, figs. 1 and 2). Dallas, the county seat, is said to be in one of the largest prune-producing sections in the world. Apples, though not so important, come second, and are famous for their quality. Walnut culture is receiving considerable attention, owing to the successful production of the trees in bearing. There are probably 255 acres of walnut groves, practically all being of the Franquette variety, which requires a deep, well-drained soil.

The acreage of small fruits and berries has shown a consistent increase, and the surplus fruit is utilized by several canneries. Cherries are becoming commercially important and are being more

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<sup>4</sup> This is exclusive of the value of animals sold and slaughtered, which was not reported by the 1920 census.

extensively grown. They flourish on hill lands, and when intelligently handled are profitable. Peaches are grown to some extent, and show considerable promise on the lighter soils. Pears are grown commercially, flourishing on the deeper hill soils.

Crop rotations are practiced on many farms, the most common consisting of grain, followed by clover for one or two years, then a cultivated crop, such as corn, potatoes, or beans. The clover is sown in February or March on fall-sown wheat or oats, or it may be sown alone in May. A mixture of oats and vetch for hay is frequently substituted for clover where the latter is difficult to grow.

According to the 1920 census the value of all domestic animals in Polk County was \$1,683,307. There were 6,027 horses, 105 mules, 10,687 cattle, 10,185 hogs, 12,731 sheep, and 12,742 goats.

Of the 10,687 cattle reported 9,295 are classed as dairy cattle, of which 5,875 are cows and heifers over 2 years old. The dairy industry brings in considerable revenue yearly. In 1919 the value of the dairy products, exclusive of home use, was reported as \$540,373. Jersey is the predominating breed of dairy cattle.

The value of chickens and eggs produced in 1919 amounted to \$294,034, and receipts from the sale of poultry products in that year amounted to \$169,137. In the same year 111,526 pounds of wool were produced, valued at \$51,780; and 34,222 pounds of mohair, valued at \$18,377.

Prior to 1900 the census reports no commercial fertilizers used in Polk County. In 1909 only 55 farmers, or 3.5 per cent of them, expended a total of \$1,819, or \$33.07 per farm reporting the use of fertilizers. The 1920 census shows that a total of 149 farmers, or 8.5 per cent, expended a total of \$17,475, or \$117.28 per farm. In general the soils of the valley are acid, and agricultural lime is recommended on soils where it is difficult to obtain a stand of red clover. Superphosphates are especially recommended for depleted lands when grain, potatoes, corn, and clover are to be grown. Gypsum, or land plaster, is used as a top-dressing on legumes, and is applied at the rate of 60 or 80 pounds per acre.

Farm help employed on the farms of Polk County is mostly American born. At fruit, berry, and hop harvesting time there is an extensive migration of labor from the cities and towns. Farm laborers are paid from \$50 to \$60 a month, and day laborers, during harvest and haying, \$3 a day.

The 1920 census shows that 78 per cent of the farms are operated by the owners, 19.3 per cent by tenants, and 2.7 per cent by managers. These figures show an increase in the number of farm owners and a decrease in the number of tenants over the figures reported in the 1910 census.

The 1920 census reports a total of 1,761 farms in the county, averaging 136.1 acres. Of this average farm acreage 57 per cent, or 78.3 acres, is improved land.

Farm improvements average better than in most of the farming communities of the State, especially in regard to dairy barns and dwellings. A good grade of work animals is kept and a number of tractors are in use. The farm machines are of the modern types and are usually well sheltered.

Land values vary considerably in different parts of the county, depending on location, improvements, and topography. In 1922 the value of improved lands for general farming ranged in the valleys from \$80 to \$175 an acre, unimproved hill lands from \$25 to \$60, and bearing orchards of prunes, apples, peaches, cherries, and nuts from \$300 to \$700 an acre. The 1920 census reported an average value of \$90 an acre.

#### SOILS

Polk County is in the northwestern part of Oregon, in the Pacific coast soil region. The eastern part of the county, which is the more important agriculturally, lies in Willamette Valley. The eastern and northeastern parts of the county, about one-eighth of the total area, have smooth to gently undulating topography. The western part lies wholly in the Coast Range Mountains. The soils of Polk County are similar to soils developed in a humid climate, having developed under conditions of mild winters with comparatively heavy rainfall, and cool to warm, though dry, summers. The soils in the eastern part of the county lack the rich, pronounced colors of those in the western part, where the rainfall is much heavier, the former soils being more grayish brown and grayish yellow to brown in color.

The soils of the county are grouped into series, each comprising soils which are similar in color and profile, and which are derived from the same parent material. The individual soils of a given series are designated as types, type being the unit in soil classification and mapping. The types of a series differ from each other in texture, as determined by the quantities of sand, silt, and clay contained in their topsoils.

The earlier soil survey of the Salem area, which embraced portions of Polk and Marion Counties, was made according to a much less detailed system of mapping. At that time soil series indicated little besides place names, and all the soils then mapped in Polk County were designated as types of the Salem series, regardless of origin or character of profile.

The region is one in which variations from place to place of climatic features and the characteristics of the natural vegetation are very slight. The open woodlands of the eastern part of the area referred to in the discussion of the agriculture seems to have been a characteristic recently acquired by the region. This interpretation is based on the characteristics of the soils. The soils are all light in color. If the open woodland had been in existence for a long time prior to the advent of the white man, and had prevailed in areas in which natural drainage is good, the soils, owing to the grass cover under which they have developed, would have been dark in color.

All the maturely or fully developed soils within the county are light in color and free from carbonates and readily soluble salts, not only in the true soil and subsoil but to a considerable depth. They have well-developed textural and color profiles, and though the rainfall affecting their development is high, it falls during the winter months, leaving a long period during which the soil and its cover of vegetable debris dries out thoroughly. True podsol soils, therefore, have not developed.

The broadest differences between the various soils of the region are the result of the various degrees of natural drainage under which they have developed. On this basis there are two general groups of soils: (1) Those developed under good drainage conditions, and (2) those developed under poor or imperfect drainage conditions. The former group includes the various soils of the Aiken, Olympic, Sites, Melbourne, Salkum, Salem, Willamette, Newberg, and Chehalis series. The soils of the other series are poorly or imperfectly drained.

The soils of each of these major groups have been differentiated one from another on the basis of the character of the material from which they have developed, the processes by which the parent material was accumulated, and the varying degrees of drainage. The character of the parent material is described under each series.

The soils of the Aiken series are residual, being derived from basaltic or similar basic igneous rocks. They have surface soils varying in color from red to brownish red, and subsoils which are red and generally slightly more compact and heavier in texture than the surface layers. Bedrock usually underlies these soils below a depth of 3 feet, so that there is a sufficient depth of soil to meet crop requirements. Areas of these soils vary from smooth and rolling (Pl. XLVI, fig. 1) to rough, the latter condition generally occurring at the highest elevations. Only one type of this series of soils, Aiken silty clay loam, including a shallow phase, is mapped in this county.

The soils of the Olympic series have brown to dark-brown and in places reddish to rusty-brown surface soils, and rusty-brown to reddish subsoils. These soils occur on the lower slopes of the hills on which occur, at higher elevations, the Aiken soils. They also occur along canyons and steep mountain slopes. These soils, like those of the Aiken series, are derived chiefly from basic igneous rock. In places the soils are shallow. In some places it is difficult to determine boundary lines between areas of Olympic soils and Carlton and Melbourne soils. The Olympic series is represented in this area by Olympic silty clay loam, and Olympic clay loam, including a shallow phase.

The Sites soils have red to brownish-red surface soils and moderately compact, red, or dull-red subsoils. These soils are similar to the Aiken soils, having the same color, but they differ in origin, being derived mainly from shales and sandstone. It is difficult to distinguish between soils of these two series where they are closely associated, as it is difficult to distinguish between the parent rocks where they are considerably weathered. The soils of the Sites series as mapped in this survey may include some undifferentiated soils of the Aiken series. Sites silty clay loam is the only member of the Sites series mapped in this county.

The Melbourne series includes soils that are characterized by brown to rather dark-brown surface soils, and brownish-yellow or reddish-yellow, moderately compact subsoils which are generally mottled with gray or with yellow, red, and brown iron stains. The surface soil in virgin areas is generally dark brown in color, containing a high percentage of organic matter. Small iron-cemented, shotlike pellets of brown or rusty-brown color occur in many places, though not so abundantly as in the Aiken and Olympic soils. The Melbourne soils in this survey are somewhat lighter brown in color than those

which are typically developed in other counties. In Polk County the Melbourne soils approach the characteristics of the soils associated with them, namely, the Carlton soils. Thus in mapped areas some patches of undifferentiated Carlton material are included. The Melbourne soils are derived from sandstones and shales, partially weathered bedrock occurring in the subsoil in many areas. Soils of the Melbourne series in this county generally represent smooth and gently rolling areas, but include a small area of steep, rough land. The series is represented by Melbourne clay loam, with a shallow phase, and a reddish phase of Melbourne silty clay loam.

The soils of the Salkum series under virgin condition have thin surface layers, an inch or more in thickness, consisting of light-brown material containing partially decayed vegetable mold or humus. The subsurface layers are typically rich-brown or reddish-brown silty clay loams, underlain by compact, heavy-textured, reddish-brown or dull-red subsoils which in places contain weathered gravel or cobbles. The Salkum series includes soils derived from old valley-filling materials of mixed origin and which form high terraces. They are underlain by shale or sandstone, which in places has determined the distinguishing characteristics of these soils. Only one type of the series, Salkum silty clay loam, is mapped in Polk County.

The soils of the Salem series are brown to moderately dark brown in color, underlain by lighter-brown to rich-brown subsoils which contain considerable waterworn gravel embedded in the material and underlain by gravelly substrata. The soils of this series are similar to those of the Willamette series in color, origin, and profile, the main difference being the occurrence of underlying gravel in the Salem soils. The Salem soils are of mixed origin, a considerable proportion of the gravel being derived from basaltic rock. The areas of Salem soils are comparatively smooth to moderately undulating, and they occur on the higher terraces, which are not ordinarily subject to overflow. Some included patches have a darker-colored surface soil than is typical of the Salem soils. Likewise, small areas of the clay loam and loam members of the series are included in mapped areas of Salem silty clay loam, the only type of this series mapped in Polk County.

The Willamette series includes soils having dull-brown or rather rich-brown surface soils and slightly lighter brown, moderately compact subsoils which grade into more friable materials in the lower strata. Where typically developed, soils of this series are comparatively free from mottling, but areas with faint mottlings in the subsoils have been included. Willamette soils occur as areas of smooth valley lands and slightly higher lands which are undulating to slightly rolling and have good natural drainage. Mapped areas of this type include some patches of soil varying from rather pronounced light-gray to a dark color, and others in which the subsoil materials have a higher degree of compactness than the typical soils. Willamette silt loam is the only member of the series mapped in the county.

Soils of the Chehalis series resemble those of the Willamette series in color of surface soils and subsoil, but tend to be of slightly richer brown when moist. They occur on the lower terraces and first bottoms, which are subject to overflow, and do not have the heavier-

textured or moderately compact subsoils which are characteristic of the Willamette soils. These soils represent recent alluvial materials, derived mainly from sedimentary and basaltic rocks, occurring on the flood plains and low recent terraces along streams. The topsoils of this series are colored rich brown and are underlain by brown subsoils. The materials composing the surface soils and subsoils are similar, there being no distinct line of demarcation to depths of 4 or 5 feet in many places. Areas of Chehalis soils are smooth and have sufficient slope to provide good drainage, except areas of the heavier-textured types where drainage may be somewhat restricted. Three types of this series, Chehalis silty clay loam, Chehalis silt loam, and Chehalis fine sandy loam, occur in the county.

The surface soils of members of the Carlton series vary from dull-brown to light grayish-brown in color, with some rather pronounced grayish inclusions. The subsoils are moderately compact and of light-brown to yellowish-gray color in many places, being generally somewhat mottled with gray and iron stains. The areas of Carlton soils are smooth to gently rolling. In places the Carlton soils merge into soils of the Amity series, and mapped areas include small undifferentiated patches of the latter soils. These soils occur on the lower foothill slopes, the lower rolling hills, the flatter benchlike hill areas, and areas which are subject to seepage in places (Pl. XLVII, fig. 1). The latter areas generally have somewhat lower rainfall than the typical soils of the Melbourne series, and are usually more sparsely forested. Surface drainage of areas of Carlton soils is generally fairly well developed, but subdrainage is restricted. Two types, Carlton silty clay loam, with a light-textured phase and a heavy-subsoil phase, and Carlton clay loam, occur in Polk County.

The Amity soils, or "half-white land," are intermediate in color and character between the brown Willamette soils and the soils of the Dayton series, locally known as "white land." They have light dull-brown to light grayish-brown surface soils, mottled with dark rusty brown, and moderately compact, grayish-brown or brown subsoils which are distinctly mottled with gray and in places with red and brown iron stains. Included in this series are some soils which have a dark-gray or bluish-gray color. Areas of Amity soils vary from nearly level to gently undulating. Soils of the Amity series are closely associated with those of the Willamette and Dayton series, differing from the Willamette series in having more grayish-brown surface soils and more compact and more distinctly mottled subsoils and from soils of the Dayton series in having more pronounced brown surface soils and in lacking to a considerable degree the compact, heavy, drab layer in the subsoils. These soils are derived from the weathering of old valley-filling materials of water-laid deposition. One type of the series, Amity silty clay loam, is mapped in Polk County.

The Holcomb series includes soils having dark grayish-brown, brown, or light-brown surface soils underlain by brownish-gray or gray, heavier-textured subsoils which are mottled with rusty brown or yellow. These soils represent old valley-filling deposits which have weathered under conditions of poor drainage, but which subsequently developed better surface drainage or received an overwash of brown, well-oxidized material. The areas of Holcomb soils gen-



NO. 11619

FIG. 1.—AN AREA OF AIKEN SOILS NEAR OAKDALE SCHOOL, SHOWING SURFACE FEATURES

Young walnut grove in foreground, prune orchard in background

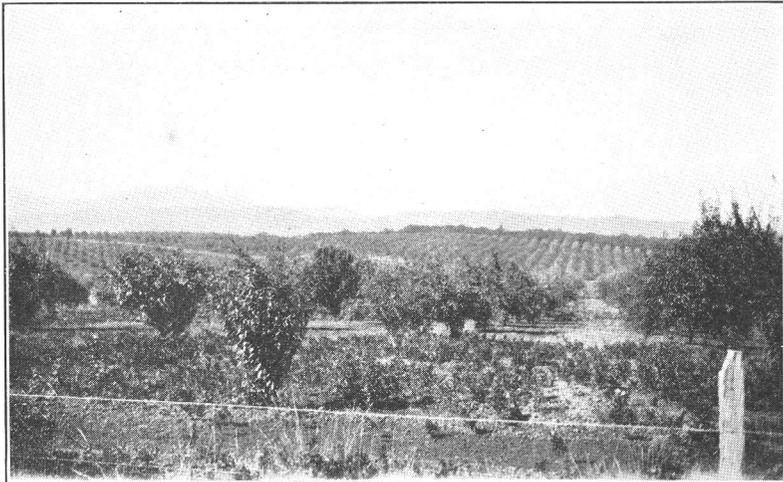
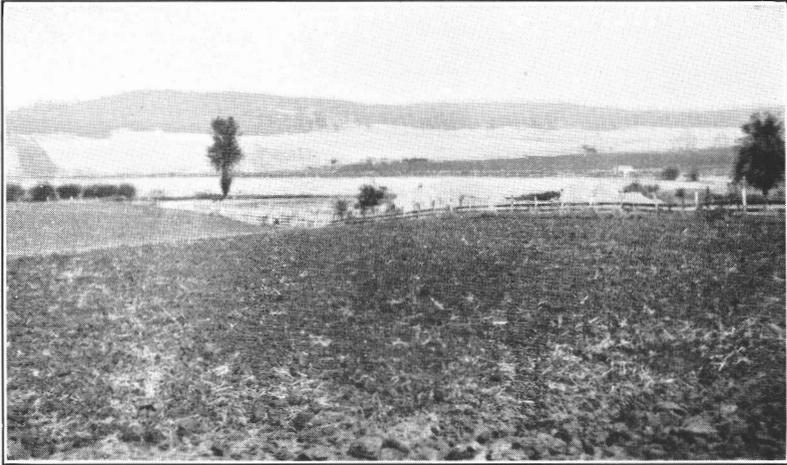


FIG. 2.—YOUNG PRUNE TREES ON MELBOURNE SILTY CLAY LOAM, REDDISH PHASE, ON THE FOOTHILLS OF COAST RANGE MOUNTAINS



NO. 11624

**FIG. 1.—AN AREA OF CARLTON SOILS SHOWING SURFACE FEATURES**

On the wooded hills in the background are soils of the Melbourne series



**FIG. 2.—A YOUNG PRUNE ORCHARD ON SALKUM SILTY CLAY LOAM**

erally have smooth surfaces with slight slopes. Subdrainage is retarded by the heavy subsoils, so that water frequently stands on areas of Holcomb soils for several days following unusually heavy rains. Holcomb silty clay loam is the only type of this series mapped in this survey.

Soils of the Dayton series vary in color from light gray to rather dark gray, and they have very compact, drab, rather impervious, plastic clay subsoils which are mottled with gray and rusty brown. Deeper down the material is more friable, yellowish gray or yellowish brown in color, and mottled. Soils of this series are locally known as "white land." As mapped in Polk County, this series includes soils of somewhat darker, and in many places pronounced bluish-gray color, and heavy in texture. The soils occur on flat areas and in basins where both surface and underdrainage are poor. Dayton silt loam is the only type of this series mapped in Polk County.

The Grande Ronde series includes soils which have yellowish-brown surface soils, slightly mottled, and upper subsoils that are yellowish-brown and moderately compact, grading downward into dull-yellow material or yellow subsoils, compact, and mottled with gray and rusty brown. These soils vary rather widely in color and drainage features. They are derived almost entirely from sedimentary rocks and are associated with the Melbourne and associated soils. Areas of this soil are smooth to gently sloping, providing only fair to good surface drainage; in most places the underdrainage is retarded. Grande Ronde silty clay loam is mapped in Polk County.

The Newberg soils have brown or dark rich-brown surface soils and somewhat lighter-brown subsoils which are lighter in texture and porous, consisting mainly of fine sand and fine sandy loam materials. Soils of the series are similar to the Chehalis soils with respect to origin, occurrence, and color of surface soils and subsoils, but they differ from them in having lighter-textured, porous subsoils, in occurring in lower-lying areas, and in their areas having more irregular surfaces. The latter characteristic is the result of more frequent erosion caused by overflows. Soils of the Newberg series are so closely associated with the soils of the Chehalis series that members of one series merge into those of the other, so that mapped areas of Newberg soils include patches of Chehalis soils. Two members of the Newberg series are mapped in the county, the fine sandy loam and silty clay loam, the latter with a light-textured phase.

The Wapato series includes soils with brown, dark-brown, or dark grayish-brown surface soils, mottled with gray, rusty brown, and yellow, underlain by brown, dark-brown, bluish-gray, or drab subsoils with similar mottlings. Considerable variation in color, owing to drainage conditions, exists in the soils of this series. Some of the broader basinlike areas are characterized by deeper and more compact subsoils which are heavy in texture, yellowish in color, and strongly mottled with rusty-brown, red, and yellow iron stains. The Wapato soils occur on alluvial deposits along minor streams and in basins which are subject to overflow. Both surface

and internal drainage of areas of these soils are poorly developed. Two types of this soil are mapped, Wapato silty clay loam and Wapato silty clay.

The surface layers of the Cove soils are dark gray, very dull dark brown, or black in color, containing a high percentage of organic matter. The subsoils consist of black, bluish-gray, or drab-colored, heavy-textured, waxy materials mottled with gray and iron stains. These soils occur in flat valley basins and on small flood-plain areas, the lower-lying areas being subject to overflow. These areas are smooth and level, and the drainage in many places is poor. Cove clay, including sloping and gray phases, are mapped in the county.

In the following pages of this report the different soils of the county are described in detail and their agricultural uses and possibilities are discussed; the accompanying soil map shows their location and distribution in the county; and the following table gives the name, acreage, and proportionate extent of each soil type mapped in Polk County:

*Acreage and proportionate extent of each soil type in Polk County*

Soil	Acres	Per cent	Soil	Acres	Per cent	
Aiken silty clay loam.....	12,992	3.4	Amity silty clay loam.....	33,152	7.0	
Shallow phase.....	3,520		Holcomb silty clay loam.....	704	.1	
Olympic clay loam.....	14,272	3.3	Dayton silt loam.....	10,432	2.2	
Shallow phase.....	1,408		Grande Ronde silty clay loam.....	1,280	.3	
Olympic silty clay loam.....	12,992	2.7	Newberg fine sandy loam.....	2,752	.6	
Sites silty clay loam.....	2,176	.4	Newberg silty clay loam.....	1,344	.4	
Melbourne clay loam.....	32,832	7.3	Light-textured phase.....	640		
Shallow phase.....	1,728		Wapato silty clay loam.....	23,168	4.9	
Melbourne silty clay loam, reddish phase.....	32,832	6.9	Wapato silty clay.....	2,880	.6	
Salkum silty clay loam.....	6,400	1.3	Cove clay.....	3,904	1.1	
Salem silty clay loam.....	3,904	.8	Gray phase.....	832		
Willamette silt loam.....	13,888	2.9	Sloping phase.....	256		
Chehalis fine sandy loam.....	3,136	.6	Riverwash.....	384	.1	
Chehalis silt loam.....	5,760	1.2	Rough mountainous land.....	207,104	43.5	
Chehalis silty clay loam.....	15,232	3.2				
Carlton clay loam.....	12,800	2.7	Total.....	476,160	-----	
Carlton silty clay loam.....	7,360	2.5				
Light-textured phase.....	2,752					
Heavy-subsoil phase.....	1,344					

#### AIKEN SILTY CLAY LOAM

The surface soil of Aiken silty clay loam consists of a layer of brownish-red, friable silty clay loam about 2 inches thick, containing considerable organic matter and underlain by a red or brownish-red silty clay loam to a depth of 12 inches. The subsoil to a depth of 36 inches consists of red, compact, silty clay loam or clayey material underlain by basaltic rock at depths varying from 3 to 6 feet, but in some shallow areas the bedrock outcrops. Small rounded red to rusty-brown iron concretions or pellets, locally called "shot," varying in size from very small to that of a pea, occur on the surface and embedded in the soil in many places. Locally the soil is called "red shot soil." Angular fragments of basaltic rock are common on the surface or embedded in the soil. This soil is usually friable, and can readily be put in good physical condition, owing to its granular structure and content of organic matter.

Aiken silty clay loam is not an extensive soil, though it is mapped as several large areas in the county. The largest body occurs in the

Eola Hills, extending from Eola on the south 5 miles northward, and averaging about 2 miles wide. Other important areas lie northwest and southwest of Spring Valley School, one-half mile south of Goose-neck School, and 1 mile south of Airlie. Small areas are scattered over the county.

Areas of Aiken silty clay loam range from gently rolling to rough and broken. Most of this soil occurs on the smooth tops of rolling hills (Pl. XLVI, fig. 1). Some areas are too steep and hilly for cultivation. Drainage is usually well established.

Although this soil is very productive, a large proportion of it is uncultivated, being still forested with a heavy growth of valuable fir and oak. Ferns are abundant, and their eradication is a serious problem. Thorough cultivation for several successive seasons is the only sure method of exterminating them. The principal crops grown on this type of soil are prunes, wheat, oats, walnuts, and some small fruits; the latter are usually planted between rows of prune trees.

Prunes are one of the most important commercial crops grown on this type of soil, the yields ranging from three-fourths to  $1\frac{1}{4}$  tons of dried fruit per acre. Cherries have not proved satisfactory, owing to the prevalence of gummosis and to their frequent failure to fruit well. Wheat yields from 15 to 20 bushels per acre and oats from 20 to 25 bushels. Persian (English) walnuts are becoming an important crop, and will soon occupy a prominent place in the agriculture on this soil.

The current value of well-improved prune orchards and walnut groves on Aiken silty clay loam ranges from \$400 to \$700 an acre, and of other improved land from \$40 to \$100 an acre.

Aiken silty clay loam is one of the best soils in the county for the production of prunes and walnuts. Where proper air drainage exists, where the soil is more than 3 feet deep, and where other conditions are favorable, the trees are vigorous and productive.

The Oregon Agricultural Experiment Station has obtained increased yields of clover on this soil by applying from 1 to  $1\frac{1}{2}$  tons of limestone per acre. Aiken silty clay loam and other red hill soils are usually low in available phosphorus, though chemical analyses show that this kind of soil contains a fairly good supply of phosphorus, but usually in unavailable form. Wheat, oats, and other grains grown on this soil require liberal applications of phosphates for best results.

Where wheat and oats have been grown continuously for a number of years, organic matter may be restored to the soil by sowing vetch as a winter cover crop and turning it under in the spring. This practice is also recommended for improving orchards. Good results are obtained where cultivated crops, such as potatoes, beans, and corn, are included in the rotation, as frequent cultivation helps to eradicate weeds and ferns. Long-cropped soils of this type are greatly benefited by applications of 200 or 300 pounds of superphosphate for clover, potatoes, and corn, best results being obtained when this fertilizer is broadcast after plowing and then thoroughly disked or harrowed into the soil. Good results are obtained where superphosphate is used once in a three-year rotation just previous to planting a cash crop. The addition of organic matter and lime also

will aid in making available the natural supply of phosphorus in the soil. Land plaster sown broadcast on clover in the spring at the rate of from 40 to 100 pounds per acre has increased the yields.

*Aiken silty clay loam, shallow phase.*—Aiken silty clay loam, shallow phase, consists of red or brownish-red soil from 6 to 18 inches deep, similar to the surface soil of typical Aiken silty clay loam, overlying basaltic rock. Basaltic boulders or fragments ranging in size from 2 inches to 1 foot in diameter occur on the surface in many places.

The phase usually occurs on steep, hilly, and broken areas, but there are a few included patches which have smooth, rounded surfaces. The largest body of this soil lies on the west slope of the Eola Hills. The land is not extensive and is of little agricultural value. Drainage is good to excessive. During the dry summer months areas of this soil are practically devoid of vegetation. Small areas are cultivated, but most of the land is forested or used for pasture.

#### OLYMPIC CLAY LOAM

The surface soil of Olympic clay loam to a depth of 8 inches consists of brown, or rather dark-brown, friable silty clay loam. The subsoil consists of a compact, reddish-brown, silty clay loam material. Basaltic bedrock underlies most of this soil at depths varying from 2½ to 6 feet, and in places angular fragments of basaltic rock occur on the surface and embedded in the soil, but ordinarily not in quantities sufficient to interfere with cultivation. Shallow areas where the bedrock comes to the surface occur along the steep slopes. In texture this type of soil approaches Olympic silty clay loam, so that undifferentiated patches of silty clay loam are included in mapped areas of Olympic clay loam.

Olympic clay loam is very closely associated with Aiken silty clay loam, and in many places occurs on the lower portions of slopes on which the latter soil occurs. The largest body mapped in the county lies a mile east of Bethel School, extending north to the county line. Other extensive areas are mapped in the vicinity of Wallace Hill, west and south of Fern School, and west and south of Airlie.

Areas of this soil range from gently rolling to rough, and drainage is well established.

Olympic clay loam is of minor agricultural importance, owing to its comparatively small extent. Most of this land is so steep and rough that it is not cultivated, and is either covered with fir and oak or is used for pasture. This is naturally a productive soil and produces good crops, chief among which are wheat and oats, although prunes are being planted very extensively on it. A considerable number of sheep and cattle are pastured in the uncultivated sections, the pasturage being especially good in the spring and fall.

The current value of improved Olympic clay loam varies from \$50 to \$90 an acre, and unimproved land from \$25 to \$35. Improved orchard land sells for about the same price as that of Aiken silty clay loam. Recommendations for the improvement of this soil are practically the same as for Aiken silty clay loam.

*Olympic clay loam, shallow phase.*—Olympic clay loam, shallow phase, consists of a brown or dark-brown clay loam from 7 to 20 inches deep, overlying massive basaltic rock. It is mapped in Polk

County as a few small areas conforming in surface soil to the typical Olympic clay loam. Patches of rock outcrop are included in mapped areas of this phase.

Areas of this soil range from steep, hilly, and broken to gently rounded, and drainage is good to excessive. The largest body mapped occurs about three miles northwest of West Salem. This phase is not extensive and has little agricultural value. During the dry summer months vegetation is scanty, owing to a lack of soil moisture. A few small areas are cultivated, but most of it is forested or used for pasture. The land is usually sold with adjoining areas of other soil types.

#### OLYMPIC SILTY CLAY LOAM

The surface soil of Olympic silty clay loam as developed in Polk County is a rich-brown or reddish-brown silty clay loam about 10 or 12 inches deep, well supplied with organic matter and containing small iron concretions or shotlike pellets. The subsoil to a depth of 36 inches consists of brown, moderately compact clay loam or silty clay loam material, underlain by bedrock at depths of from 3 to 6 feet.

This type of soil is rather friable and mellow under cultivation, and in this county it is somewhat lighter textured than the typical soil mapped in adjoining counties. In mapped areas are included patches of Olympic silt loam.

Areas of this soil type are confined to the central part of the county, west of Dallas, and form the eastern boundary of the rough mountainous area. The most extensive area extends north from Falls City for about 9 miles in an almost continuous strip, ranging from 1½ to 3 miles in width.

The topography of the area varies considerably. The lower slopes of the rough mountainous area include steep draws and rough, broken areas, but most of this land varies from rolling to hilly, all being well drained.

Olympic silty clay loam is not extensively developed in Polk County and is of little agricultural value, as the greater portion of it is inaccessible. Only a very small part is under cultivation; the remainder is covered with a heavy forest growth.

Olympic silty clay loam is a naturally productive soil, having a high water-holding capacity, and is especially adapted to fruit growing and general farming. The crops grown and the methods of handling this kind of soil are similar to those described under Olympic clay loam.

The following table shows the results of mechanical analyses of samples of the surface soil and subsoil of Olympic silty clay loam:

*Mechanical analyses of Olympic silty clay loam*

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>						
5614123	Surface soil, 0 to 12 inches . . .	1.2	2.3	1.4	10.0	8.0	50.0	27.0
5614124	Subsoil, 12 to 36 inches . . . . .	.7	2.1	1.4	9.0	11.6	51.3	23.9

## SITES SILTY CLAY LOAM

The surface soil of the Sites silty clay loam, from 6 to 10 inches deep, is a brownish-red, slightly compact silty clay loam having a thin surface layer which contains a high percentage of organic matter and which in many places contains small rounded iron concretions. The subsoil to a depth of about 18 inches consists of a dull-red, heavy silty clay loam material or a compact clay, slightly jointed. The deeper subsoil consists of a jointed purplish-red clay. Disintegrated sandstone and shale occur in many places at depths varying from 3 to 7 feet.

In this survey much of the material constituting this type of soil is heavy in texture, and patches of Sites clay are included in mapped areas of this type. This soil is more granular and friable than would be suggested by its mechanical composition. Under average field conditions the soil appears to have the physical properties of a silty clay loam. Mapped areas of this soil include some patches of a reddish phase of Melbourne silty clay loam, which has much the same color as the Sites soil.

Areas of Sites silty clay loam range from smooth or gently rolling to steeply sloping, some areas being too steep for cultivation.

This is one of the least important and extensive residual soils in the county, the largest areas occurring 1 mile west of Dallas, 1 mile south of Putnam, 1 mile east of Tartar, 1½ miles southeast of Oakdale School, and 1½ miles northeast of McTimmonds School.

About 50 per cent of this land is under cultivation, the rest being forested with fir and oak. Wheat, oats, and vetch are the principal crops grown, although prunes and cherries are being extensively planted.

The current value of improved farm land of this type ranges from \$60 to \$100 an acre, unimproved land from \$25 to \$50, and orchard land from \$300 to \$700 an acre.

Sites silty clay loam is recognized as one of the best fruit soils of the county. Both prunes and walnuts are grown successfully. Although the soil is naturally productive, the addition of barnyard manure and crop residues is very beneficial. Methods for the improvement of this soil are similar to those recommended for Aiken silty clay loam.

## MELBOURNE CLAY LOAM

The surface soil of Melbourne clay loam consists of light-brown loam about 2 inches deep, which contains variable quantities of organic matter, and a deeper layer of brown or light-brown clay loam to a depth of 10 inches. The subsoil to a depth of 28 or more inches consists of a brownish-yellow, moderately compact clay loam material, which is underlain by sandstone or shale. The rock in the subsoil is usually highly weathered and does not greatly interfere with drainage. The surface soil usually contains a fair supply of organic matter, except where the soil has been cropped to grain for a number of years.

This soil is predominantly of smooth silty texture, though varying somewhat. As mapped it joins with a small area of Melbourne silty clay loam in Benton County; but as the silty clay loam areas in this

county are small, they were included in mapped areas of Melbourne clay loam.

This type of soil as occurring in Polk County generally occurs on the lower smooth hills, including gently rounded hills. A very small part of the land is steep and rough, but the greater part can be cultivated easily. Drainage is usually excellent throughout areas of this soil.

Melbourne clay loam is extensively developed in the southeastern part of the county; the largest area, 2 miles west of Monmouth, is 4 miles long and varies from 2 to about 4 miles in width. Other large areas occur south of this one and west of Lewisville School, and smaller areas are scattered over the eastern, central, and north-central parts of the county.

Melbourne clay loam is a naturally productive soil and is well adapted to most crops of the county. Wheat and oats are the main crops grown, but fruit growing is rapidly increasing on areas of this soil. Prunes, apples, and cherries are the principal tree fruits, and several varieties of small fruit are produced to some extent.

About 40 per cent of this land is under cultivation, the remainder being forested with fir and oak. Many areas have a rather heavy fern growth which is very difficult to eradicate, but which can be destroyed by thorough cultivation.

The current value of improved land of this type varies from \$50 to \$90 an acre, and unimproved land at some distance from markets from \$25 to \$50 an acre.

Where grain has been grown on this soil continuously for a number of years the soil organic matter has become greatly diminished, and it must be restored by applying barnyard manure or by growing and plowing under green-manure crops, such as oats, vetch, clover, or other legumes.

*Melbourne clay loam, shallow phase.*—Melbourne clay loam, shallow phase, consists of a brown to yellowish-brown surface soil, usually varying in depth from 4 to 10 inches, underlain by a brown to yellowish-brown subsoil of a clay loam texture, resting on bedrock at an average depth of 15 inches. Outcrops of the bedrock occur in places.

This phase is confined chiefly to 2 large bodies lying west and south of Holmes Gap. The total area of this soil in the county is small, approximating 3 square miles.

On account of its small extent and low agricultural value, this is an unimportant soil. The water-holding capacity is very low, owing to the shallowness of the soil, which allows the land to dry out very rapidly after the spring rains. In the spring and fall it affords some pasturage.

As there is practically no farming done on this soil, it is usually sold with other soil types.

The results of mechanical analyses of samples of the surface, sub-surface, and subsoil of typical Melbourne clay loam are given in the following table:

*Mechanical analyses of Melbourne clay loam*

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>						
561432	Surface soil, 0 to 2½ inches...	0.7	0.9	0.8	11.4	22.8	42.6	20.9
561433	Subsurface, 2½ to 10 inches...	.5	1.3	.8	10.5	17.8	46.5	22.7
561434	Subsoil, 10 to 28 inches.....	.0	.2	.3	11.6	19.0	39.3	29.6

## MELBOURNE SILTY CLAY LOAM, REDDISH PHASE

Typical Melbourne silty clay loam is not mapped in Polk County, but is represented by a reddish phase which approaches in color the soils of the Sites series, and which represents a gradation between Melbourne and Sites soils.

The surface soil of Melbourne silty clay loam, reddish phase, consists of a light chocolate-brown or reddish-brown silty clay loam from 10 to 18 inches deep, in which a distinct purplish tint is generally present. Under virgin condition the surface is overlain by a thin layer of material of somewhat duller color and containing appreciable quantities of organic matter. This organic material, where the land is plowed, becomes incorporated with the soil, giving to it a slightly darker color and adding somewhat to its ease of cultivation, and increases productiveness. The subsoil consists of a compact purplish-red or brownish-red, heavy silty clay loam or silty clay material which becomes somewhat jointed on drying. Bedrock is generally, though not everywhere, present within the 3-foot section, occurring at an average depth of 30 inches. The subsoil material directly overlying the partly decayed rock is light reddish brown or light brownish red in color, generally tinged with yellow.

Mapped areas of the phase include conspicuous patches in which the surface soil is brownish red, similar to the soils of the Sites series. In other patches, where a yellowish color is developed in the subsoil, the soil is similar to the soils of the Melbourne series. As mapped in this county the phase joins with a small area of Melbourne clay loam in Yamhill County.

The reddish phase of Melbourne silty clay loam is an extensive soil, having development throughout the hilly section of the county. Some of the largest areas are in the vicinity of Dallas, Falls City, Pedee, and Buell. Smaller areas occur north of Wallace Bridge on South Yamhill River and in other localities.

Areas of this land are generally hilly, only a few areas being too steep for cultivation. Usually air drainage is good over areas of the type, rendering the soil well adapted to the production of fruit. Surface and subsurface drainage are well developed.

The native forest, consisting largely of oak, has been cleared from about 40 per cent of this land and the soil is utilized largely for the production of prunes. Apple, walnut, and pear trees also occupy a small acreage, and are very productive. Wheat and oats are grown to a minor extent, but are not so productive as on the soils of the valley floor. Prunes yield from three-fourths to 1¼ tons of dried fruit per acre (Pl. XLVI, fig. 2). Most of the apple orchards are young, and produce an average yield of about 150 boxes an acre.

Prune orchards are given clean cultivation throughout the summer, the ground being cultivated sufficiently to keep down weeds and to maintain a light mulch. The sowing of vetch between the tree rows is becoming a general practice. The seed is either sown broadcast or is drilled in during November. The vetch is plowed under early in the spring, usually the latter part of March, or as soon as the weather conditions allow. Little commercial fertilizer is used, though some orchardists make light applications of nitrates in the late spring.

The current value of unimproved land of this phase ranges from \$35 to \$60 an acre, depending on location and cost of clearing; and improved land in prune-bearing orchards from \$300 to \$700 an acre or more, depending on location and age of trees.

This soil may be greatly improved generally by the addition of barnyard manure or by the turning under of green-manure crops, the latter being especially recommended for the orchards. Light applications of nitrates and also rock phosphate would also prove beneficial.

#### SALKUM SILTY CLAY LOAM

The surface layer of Salkum silty clay loam to a depth of 1 or 2 inches consists of a surface mulch of loose light-brown earth of granular structure containing an appreciable quantity of organic matter. The surface layer is underlain to a depth of 7 to 10 inches by a reddish-brown or rich-brown, moderately compact, heavy silty clay loam which is easily tilled. Iron-cemented pellets occur here and there, and these help to maintain the friability of the soil. The subsoil consists of two layers; an upper of dark reddish-brown or dull-red, compact, silty clay loam or silty clay material to depths varying from 18 to 28 inches, in which are embedded a few well-weathered gravel and cobbles; and a second, underlying layer of well-weathered, heavy-textured material in which are embedded partly disintegrated gravel and cobbles. Although not impervious to air or water, this subsoil material is very compact. In many places the gravelstones are so weathered as to be broken readily by a soil hammer. Owing to the partly oxidized condition of some of the more recently weathered rock fragments, spots or streaks of rusty brown and yellowish brown appear in some places in the subsoil. In road cuts at a depth of 50 inches or more the underlying shale and sandstone is exposed in many places.

This soil is well developed in Polk County, some of the largest areas occurring north and northeast of Dallas. Other small areas lie southwest of Dallas, and in the vicinity of Falls City. The general surface of these areas is typical of flat, gently sloping terraces which have been rather deeply entrenched by streams, being hilly or rolling, with a few flat-topped areas or terraces of considerable extent. Drainage of the surface soil and subsoil is excellent.

Areas of Salkum silty clay loam were at one time heavily forested with fir and oak, but now about 85 per cent of the land is cleared and intensively cultivated. Prunes, apples, cherries, and pears, the major crops, and walnuts, filberts, small fruits, and general farm crops are grown.

This soil is well adapted to fruits and nuts, and good yields are obtained. Prunes yield from three-fourths ton to 1½ tons of dried

fruit per acre, depending largely on the age of the trees and the care given the orchard (Pl. XLVII, fig. 2). Most of the apple orchards are young and yields are light, ranging from 100 to 150 boxes an acre. Cherries, pears, and walnuts yield well.

The current value of this kind of land varies widely, according to location and state of improvement. Prune orchards in a vigorous state of production are held at \$400 to \$800 or more an acre, improved land not in orchard \$70 to \$140 an acre, and unimproved land \$40 to \$75 an acre.

Salkum silty clay loam is a productive soil, but considerable thinning of fruit is necessary in apple orchards, as seasons of drought are apt to result in small, unsalable apples. The turning under of cover crops and light applications of commercial fertilizer should be practiced more generally to maintain the orchards in a vigorous state of production.

In the following table are given the results of mechanical analysis of a sample of surface soil of Salkum silty clay loam:

*Mechanical analysis of Salkum silty clay loam*

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
5614130	Surface soil, 0 to 8 inches ----	<i>Per cent</i> 0.4	<i>Per cent</i> 2.0	<i>Per cent</i> 1.4	<i>Per cent</i> 6.8	<i>Per cent</i> 9.8	<i>Per cent</i> 50.6	<i>Per cent</i> 29.2

SALEM SILTY CLAY LOAM

The surface soil, about 2 inches deep, of Salem silty clay loam consists of a friable dark-brown loam containing a moderate quantity of light-brown organic matter, underlain by a rich-brown, mellow silty clay loam to a depth of about 10 inches. The subsoil to a depth of 36 inches is a reddish-brown, compact, silty clay loam material containing gravel. In the lower subsoil stratum gravel predominates.

In Polk County mapped areas of this soil include patches in which the soil has a darker-colored surface soil than is typical of the Salem soils, resembling the Clackamas soils as mapped in Clackamas County. Patches of soil heavier textured than typical are also included in mapped areas of Salem silty clay loam. Areas west of New Grand Ronde have gravel in the surface soil in sufficient quantity to modify the physical character and to interfere with cultivation. Where this condition occurs the drainage to some extent is rather excessively developed, and crops suffer from lack of moisture during dry seasons. Such areas are indicated on the soil map by gravel symbols.

This is one of the unimportant soils of the county, and is of very small extent. The largest areas are in the vicinity of Buell, along Gooseneck and Mill Creeks. Other areas occur in the vicinity of New Grand Ronde and near Valley Junction School.

Areas of this soil are smooth to gently undulating. This soil usually occurs on low stream terraces having elevations from 5 to 15 feet above overflow. Near Buell it occurs on higher terraces, ranging from 30 to 50 feet above overflow.

Salem silty clay loam is usually a productive soil where the surface soil is free from gravel or where the gravel lies at a depth of 20 or more inches. In most areas it compares very favorably with the Willamette soils, though in the areas near Buell and New Grand Ronde the surface soil is very shallow and dries out during the summer.

Oats, wheat, barley, and vetch are the main crops grown, and give fair yields. Grain sown in the fall gives better results than when sown in the spring, as the soil may dry out before the spring-sown crop has properly matured.

The current value of improved land of this type varies from \$80 to \$100 an acre, and the more gravelly areas from \$30 to \$60.

The supply of organic matter in this type of soil being low, the soil has a tendency to dry out during the summer. The addition of barnyard manure or the turning under of green-manure crops are good practices, as these materials will not only supply needed organic matter but will greatly increase the water-holding capacity of the soil.

#### WILLAMETTE SILT LOAM

The surface soil of typical Willamette silt loam, to an average depth of about 14 inches, consists of light-brown to brown silt loam. In virgin areas the first 2 inches is a friable silt loam containing a moderate supply of organic matter. The subsoil, between depths of 14 and 28 inches, is a light-brown, moderately compact silt loam material, and below a depth of 28 inches it consists of slightly heavier and more compact material to depths varying from 28 to 36 inches. Although the surface and subsoil materials are usually distinctly brown, areas of this soil mapped in Polk County include some patches in which the surface soils are grayish brown or very dull grayish brown, resembling the Amity soils. In these patches the soils are recognized locally as better soils and as having greater agricultural value. Other patches have been included in which the surface soils are heavier in texture than Willamette silt loam.

Areas of this type of soil vary from gently undulating to slightly rolling. The soil usually occurs in areas having good natural drainage near stream channels and draws, and on the higher knolls and slight elevations above the flatter valley floor. Owing to their favorable positions, areas of this type of soil have good surface drainage, and underdrainage is generally better developed than on other soils derived from old valley-filling materials. Where this soil occurs on the more flat to slightly undulating areas the drainage may be slightly restricted, especially where areas join the Amity or Dayton soils.

Willamette silt loam is well distributed over the northeastern and southeastern parts of the county. The principal areas occur in the vicinities of Perrydale, Broadmead, Enterprise School, and McCoy, and smaller areas lie along Luckiamute River, and in American Bottom.

Willamette silt loam, although one of the less extensive soils derived from old valley-filling material, is recognized as one of the best soils in the county for general farming. From 80 to 90 per cent of it is under cultivation, and the remainder is forested with fir and oak.

This type of soil is well adapted to all general farm crops grown in the county. The principal crops are wheat, oats, red clover, oats-and-vetch hay, corn, and some fruit, particularly prunes (Pl. XLVIII, fig. 1). Dairying is probably the most important industry on this soil, and the sale of dairy products constitutes the chief source of income on many farms. Cattle are pastured on clover during the summer and fall, and fed during the winter on clover hay, corn silage, or oats-and-vetch hay. Potatoes, vegetables, and berries are grown on nearly all farms. Wheat yields from 20 to 35 bushels an acre, oats from 30 to 80 bushels, red clover from 1½ to 3 tons, and potatoes from 100 to 200 bushels. Since this soil is especially adapted to red clover, this crop should be planted more extensively. The large demand for clover hay, especially by dairy farmers, makes this a very profitable crop to include in all rotations.

The current value of this type of soil varies from \$100 to \$175 an acre, depending on location and improvements.

Willamette silt loam, though a naturally productive soil, has been cropped to wheat and oats so continuously that crop yields on some areas have been greatly reduced. This soil responds very quickly to good treatment, and the fertility can be readily built up by the addition of organic matter, such as barnyard manure, crop residues, and clover and vetch as green manure. Where good stands of clover are difficult to obtain, the addition of 2 tons of ground limestone per acre or a small quantity of gypsum has been found profitable. The Oregon Agricultural Experiment Station recommends the use of superphosphate, especially for grain and potatoes and for soils that have been continuously cropped to grain. To keep up the fertility and to increase crop yields rotations are strongly recommended. Experiments on this soil show an increase of 50 per cent in yield under crop rotation as compared with continuous cropping.<sup>5</sup>

#### CHEHALIS FINE SANDY LOAM

Typical Chehalis fine sandy loam consists of a brown fine sandy loam from 14 to 20 inches deep, underlain by a brown fine sandy loam or loamy material. The surface soil is mellow and friable, making cultivation very easy.

Mapped areas of Chehalis fine sandy loam include patches in which the soils may be darker brown in color, slightly coarser in texture, or more open than the typical soil; also some patches of sandy loam are included.

Areas of this type of soil vary from smooth to gently undulating; but like most areas of recent alluvial soils in this county, they have shallow depressions into which the surface water drains.

This soil is comparatively unimportant in Polk County, as it covers a total area of only about 5 square miles; but it is a very fertile and desirable soil, adapted to a wide range of crops. The largest body of Chehalis fine sandy loam is in American Bottom. Another area is mapped in the extreme southeastern part of the county, extending as a narrow strip along Willamette River, and other areas are mapped north of West Salem and northeast of Independence.

<sup>5</sup> Oregon Agricultural Experiment Station Circular 44, Crop Rotation and Soil Fertility.

Most of this land is planted to hops, which yield from 1,500 to 4,000 pounds an acre, average yield 2,200 pounds. Alfalfa, potatoes, small fruits, and early vegetables, to which this soil is especially adapted, are grown, and the production of these crops should be encouraged on this soil. Peaches are also grown on this land to a limited extent.

The principal need of this soil is organic matter, which if supplied would materially increase its water-holding capacity. This soil tends to dry out during the summer.

The results of mechanical analyses of samples of the surface soil and subsoil of Chehalis fine sandy loam are given in the table following:

*Mechanical analyses of Chehalis fine sandy loam*

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>						
561477	Surface soil, 0 to 18 inches...	0.1	1.2	6.5	54.3	14.3	15.9	8.1
561478	Subsoil, 18 to 36 inches.....	.0	.1	.6	17.7	23.8	42.3	15.5

#### CHEHALIS SILT LOAM

Typical Chehalis silt loam consists of a rich-brown silt loam from 6 to 10 inches deep, underlain to a depth of 4 feet or more by a rich-brown material, varying in texture from clay loam to a light, silty clay loam. Mapped areas of this type include patches of rather heavy-textured soil, representing Chehalis silty clay loam, which were too small to show on this map.

This soil type occurs in various parts of the county, the larger areas situated along South Fork Siletz River east and west of Valsetz, along North Fork Rock Creek and along Ritner Creek in the western part of the county. Other areas occur along Little Luckiamute River, between Falls City and Bridgeport and along Luckiamute River, in the vicinities of Pedee and Parker. Other small areas are mapped in the vicinity of New Grand Ronde and on the Willamette River bottoms.

Areas of Chehalis silt loam are nearly level to slightly undulating. In many places the more level areas are broken by depressions roughly paralleling the stream courses. The drainage of land of this type is usually excellent.

Chehalis silt loam is one of the most important agricultural soils derived from recent alluvium, a large part of it being under cultivation, especially along Willamette River. It is a very productive soil. It is mellow and easily tilled, well drained, and suitable for all crops grown in the county, especially alfalfa, potatoes, and early vegetables. The part not under cultivation is forested with ash, alder, fir, oak, and willow.

Wheat, oats, red clover, oats and vetch hay, and hops are grown to a large extent; potatoes, corn, and berries are secondary crops. The yields of all crops are good.

Improved land of this type currently sells for \$90 to \$175 an acre, but if close to market is held for as high as \$250.

## CHEHALIS SILTY CLAY LOAM

The surface soil of Chehalis silty clay loam consists of brown, silty clay loam from 6 to 10 inches deep. The subsoil consists of a brown, silty clay loam material, in many places extending to a depth of 5 feet or more. Mapped areas of the soil include some patches in which the subsoil is somewhat mottled and contains iron stains, somewhat similar to those found in the Wapato soils. In many places the surface soil when moist has a very pronounced reddish-brown tinge. This soil is rather plastic and sticky when wet, but in most places it works up into a fairly mellow condition when drained and properly managed.

This type of soil merges into Chehalis silt loam, so that these two soils are not easily differentiated in many places. Thus, mapped areas of Chehalis silty clay loam include patches of light, silty soils which represent Chehalis silt loam.

In Polk County, Chehalis silty clay loam is one of the most extensive types of soil derived from recent alluvium, and it occurs in many parts of the county. The largest areas are east of McNary and Oakpoint School. Other moderately extensive areas lie along Rickreall Creek at Rickreall and along Little Luckiamute and Luckiamute Rivers. Small areas occur throughout the valley portions of the county.

Areas of this type are nearly level to slightly undulating. The soil usually occurs on the higher elevated areas of the recent stream bottoms, lying 10 to 25 feet above the normal flow of the streams. During periods of very high water much of it is flooded for a very short time. Drainage on these areas is restricted in places, on account of the heavy subsoil which checks the downward movement of water.

The greater portion of Chehalis silty clay loam is under cultivation, most of the remainder being covered with fir, oak, and willows. The principal crops are wheat, oats, and clover. Wheat yields from 18 to 40 bushels an acre, averaging 30 bushels; oats from 30 to 65 bushels, averaging 50 bushels; clover seed from 1 to 6 bushels; and clover hay from 1 to 3 tons an acre. Other crops that yield well are peaches, berries, potatoes, and hops.

The current value of improved land of this type varies from \$90 to \$150 an acre, depending on location and improvements.

Chehalis silty clay loam is naturally a fertile soil and produces very good crops, but owing to its adhesive character and tendency to puddle it must be worked at the right time. Drainage will probably be necessary on the flatter areas to obtain best results. The incorporation of organic matter would render the soil more mellow.

## CARLTON CLAY LOAM

The surface soil of Carlton clay loam consists in virgin areas of a rather dull grayish-brown silt loam about 2 inches deep, containing a small quantity of organic matter. Where typically developed the subsurface to a depth of 8 inches is a dull grayish-brown, slightly compact clay loam, mottled with yellow and rusty brown. This is underlain by a third layer extending to a depth of about 22 inches, which consists of a dull grayish-brown, compact, clay loam material,

and then to a depth of 36 inches the material is a compact, light grayish-brown, heavy clay loam material, mottled with gray and a few rusty-brown stains. As mapped in this survey type areas include patches in which the soil is similar in texture to Carlton silty clay loam or silty clay.

Carlton clay loam is a residual soil derived mainly from sandstones and shales, but areas of it mapped in this survey may include patches of soil derived from basaltic rock. The parent rock in places is encountered at a depth of 3 feet, but in most areas at a greater depth.

Carlton clay loam is well developed in different parts of the county, and is the most extensive type of the Carlton series. The largest bodies occur northwest of Zena School, in the northeastern part of the county, east of Red Prairie School, three-fourths mile northwest of Holmes Gap, northeast of Helmick, and in the vicinity of Buena Vista. Other bodies lie north of Concord School, southwest of Monmouth, and in the vicinity of McTimmonds School, southeast of Falls City.

The soil occurs as gently sloping to gently rolling land on the lower hills and slopes of the higher areas (Pl. XLVII, fig. 1). Surface drainage is well developed but subdrainage is restricted in many places, owing to the compact subsoil.

This is a fairly extensive type of soil and one of the agriculturally important residual soils in this county. Approximately 65 per cent of it is under cultivation, a large part of the remainder is in pasture, and the rest forested with fir and oak. The principal crops grown are wheat, oats, oats-and-vetch hay, and some clover. Wheat on this land yields from 15 to 35 bushels an acre, with an average of 25 bushels; oats from 30 to 70 bushels, with an average of 40 bushels; clover from 2 to 3 tons of hay, and in favorable seasons from 5 to 6 bushels of seed.

The current value of improved land of this type ranges from \$80 to \$125 an acre, and unimproved land from \$30 to \$60.

Carlton clay loam is well adapted to general farm crops, as it is a naturally productive soil, easily worked, and responds readily to good management. Most of this land is in need of organic matter, and liberal applications of barnyard manure or a green-manure crop turned under would improve its productiveness. The application of limestone is recommended where otherwise it is impossible to get a stand of clover. It can be further improved by drainage, in many places a cut-off drain along the hill slope being sufficient to carry off seepage water from the higher hills.

#### CARLTON SILTY CLAY LOAM

The surface soil of typical Carlton silty clay loam consists of light grayish-brown silty clay loam from 6 to 10 inches deep somewhat mottled with gray and rusty brown. The upper subsoil to a depth of 15 inches is a light grayish-brown, moderately compact, silty clay loam or silty clay material; the lower part to a depth of 36 or more inches may be colored dull yellowish-brown and somewhat mottled with gray and rusty brown.

In mapped areas there are included patches in which the soil is somewhat more brown in color than is typical of the Carlton soils,

also patches in which the subsoil is tougher and less permeable. In the latter case the soil resembles the heavy-subsoil phase of Carlton silty clay loam. In some areas the soil is heavier in texture than typical, and mapped areas of this soil include patches of silty clay.

The largest area of Carlton silty clay loam occurs west of Mill Creek in the vicinity of Fern School, and extends  $2\frac{1}{2}$  miles north to the Yamhill County line. Other areas occur 1 mile north and  $1\frac{1}{2}$  miles southeast of Smithfield, 1 mile northwest of Buena Vista, south of Monmouth, and in the vicinity of Airlie. Smaller areas occur in different parts of the county.

Soils of this type occur as gently sloping or gently rolling land, the lower foothills and foot slopes of higher hills (Pl. XLVII, fig. 1). Surface drainage usually is well developed, but subdrainage in many places is restricted.

A large part of this soil is under cultivation, principally to wheat, oats, and some clover. Wheat yields from 15 to 35 bushels per acre, with an average of 22 bushels, and oats from 25 to 45 bushels, with an average of 30 bushels. Clover produces fair yields of hay and seed. Considerable corn is successfully grown, according to reports. This soil type is farmed in the same manner as Carlton clay loam, and suggestions for improvement are the same.

*Carlton silty clay loam, light-textured phase.*—The surface soil of Carlton silty clay loam, light-textured phase, may consist of a light grayish-brown or dull-brown silty clay loam or silt loam to a depth of about 10 inches. In places it is slightly compact, but contains sufficient organic matter and coarse materials to make it a friable and easily worked soil. The subsoil to an average depth of 20 inches is a light grayish-brown, moderately compact silt loam material, and to a depth of from 40 to 56 inches it is compact, light brownish gray or light grayish brown in color, and slightly mottled with yellowish gray.

In many places the subsoil material grades into sandstone and shale bedrock at a depth of 3 to 6 feet. Areas of this phase mapped south of Monmouth resemble the Willamette soils, and in other localities it resembles the Melbourne and Amity soils, making it difficult in places to distinguish between them. This accounts for the fact that mapped areas of light-textured Carlton silty clay loam may include patches of these other soils.

Carlton silty clay loam, light-textured phase, occurs in widely separated areas, the most extensive occurring 3 miles south of Monmouth, 1 mile west of Mulkey, and northwest of Orchard School. Other areas occur west of Perrydale and south of Bethel School. On account of its small extent this soil is of minor agricultural importance. It occurs on the smooth and gently rolling lower foothill slopes.

This phase of Carlton silty clay loam is practically all under cultivation, producing fair to good yields; but the continuous cropping to wheat and oats has seriously depleted the soil organic matter. Wheat, oats, clover, and oats-and-vetch hay are the principal crops grown. This kind of land is well adapted to the general crops of the county, and it responds readily to good management.

The current value of improved land of this kind varies from \$85 to \$125 an acre, depending on location and improvements; and unimproved land from \$25 to \$60 an acre. Where seepage from the



NO. 11536

FIG. 1.—A PRUNE ORCHARD ON WILLAMETTE SILT LOAM NEAR SHERIDAN



NO. 11535

FIG. 2.—OAT-AND-VETCH HAY ON WAPATO SOILS NEAR DALLAS



higher areas occurs on this soil a proper system of drainage would be beneficial.

*Carlton silty clay loam, heavy-subsoil phase.*—The surface soil of the heavy-subsoil phase of Carlton silty clay loam to a depth of 8 or 10 inches is a brown or light-brown silty clay loam, which in the more poorly drained areas is somewhat grayer than typical. The subsoil consists of a drab or bluish-gray, tough, plastic clay, which in some places extends to 36 or more inches without change. In most places the subsoil is underlain by shale or sandstone at a depth of 24 or more inches. Where the waxy clay subsoil characteristic of the series does not occur above a depth of 20 inches the surface soil is generally underlain by gray or brownish-gray material mottled with rusty brown or yellow.

The phase has developed from shales and sandstones and generally occurs in small areas along the base of hills, and it borders drainage ways in many places and other areas having poorly developed subdrainage.

Some of the largest areas of this soil occur one-half and 1½ miles north of Highland School, and other areas of smaller size are mapped near Dallas, Worden, and Smithfield.

The native vegetation, consisting largely of stunted oak, covers about 50 per cent of this land. About 30 per cent of it is under cultivation, and the remainder is used as meadow and grazing land. Wheat and oats are grown on the larger part of the acreage under cultivation, and a few plantings of prunes have been made. Yields of all crops are generally low, and crops suffer markedly from drought during seasons of low rainfall.

Installing cut-off drains on the higher slopes above areas of this soil and incorporating liberal quantities of organic matter would probably improve the drainage.

When included in areas of other soils, this kind of land tends to lower land values.

#### AMITY SILTY CLAY LOAM

The surface soil of Amity silty clay loam, from 7 to 12 inches deep, consists of light-brown to light grayish-brown silty clay loam mottled with dark rusty brown, being decidedly grayish in color when dry and a pronounced brown when moist. The subsoil usually consists of two distinct layers, an upper one which may consist of a grayish-brown, dark-brown, or drab-colored material, moderately compact, and silty clay loam in texture, slightly mottled with rusty brown to a depth of 20 inches, and a lower layer to a depth of 40 inches which consists of a friable, light grayish-brown silty clay loam material mottled with yellow, red, and brown stains.

The Amity silty clay loam is an extensive soil type in Polk County. It is sometimes called "half-white land," being intermediate in color and having drainage conditions between the Willamette and the Dayton soils, locally known as "white land," which have poor drainage. One of the chief distinctions between the Amity and Dayton soils is the degree of compactness and the imperviousness of the upper subsoil.

Mapped areas of Amity silty clay loam include patches in which the soil has a pronounced dark-gray or bluish-gray color.

In a large area mapped as this soil, west and north of Oakpoint School, the soil is not typical because of its somewhat light texture. Along the northern boundary of the county the soil approaches Amity silt loam in texture and joins with areas of Amity silt loam in Yamhill County.

Amity silty clay loam comprises flat to undulating land, usually between the extremes of flat and rolling areas.

In Polk County Amity silty clay loam is the most extensive of the soils derived from old valley-filling materials, and it occurs on different parts of the valley floor, the more important areas lying south of Gerlinger and Greenwood, in the vicinities of Monmouth and Independence, and east and south of Spring Valley School. Other areas lie in the vicinity of Ballston, Perrydale, and south and west of Suver, and smaller areas occur throughout the county.

Practically 80 per cent of the land of this type is cultivated, the rest being used chiefly for pasture, with a small part covered with fir and oak forest. The principal crops grown are wheat, oats-and-vetch hay, and red clover, and less extensively corn, barley, and potatoes. Dairying is one of the chief industries, and a large part of the farm products is used for cattle feed. Wheat yields from 15 to 30 bushels, with an average of 20 bushels an acre; oats from 35 to 80 bushels, with an average of 50 bushels; clover from 1½ to 3 tons of hay and from 2 to 6 bushels of seed. This soil produces well in favorable seasons, but care must be taken not to puddle the soil, as it becomes rather plastic when wet.

The value of this soil varies considerably, depending on location. The average current value of improved land of this type is about \$100 an acre, ranging from \$80 to \$140.

The most important immediate need of Amity silty clay loam is drainage. Much of this soil has been continuously cropped to grain for years, so that the organic matter has been much depleted. Where available barnyard manure should be applied, or green-manure crops should be grown and turned under.

The results of mechanical analyses of samples of the surface and subsurface layers, and the upper and lower subsoil of Amity silty clay loam are given in the following table:

*Mechanical analyses of Amity silty clay loam*

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>						
561401	Surface, 0 to 2 inches.....	0.2	1.0	1.0	2.6	10.8	65.0	19.4
561402	Subsurface, 2 to 12 inches....	.0	.1	.2	.8	9.6	63.6	25.6
561403	Subsoil, 12 to 18 inches.....	.0	.2	.2	.8	10.4	61.9	26.6
561404	Subsoil, 18 to 36 inches.....	.0	.0	.2	1.1	10.8	70.0	18.0

HOLCOMB SILTY CLAY LOAM

The surface soil of Holcomb silty clay loam to a depth of 10 or 12 inches is a brown or light-brown mellow silty clay loam. Under virgin conditions the soil is gravelly and is covered with a layer of

flaky material 1 or 2 inches in thickness, which contains considerable organic matter. The subsoil to a depth varying from 22 to 28 inches consists of brownish-gray or light grayish-brown, silty clay loam material, considerably mottled with yellow or rusty brown. The mottlings increase with depth to the lower subsoil, below which they disappear to some extent. The lower subsoil material is more crumbly and gray when dry, but very sticky when wet. At a depth of 36 or more inches the material is drab or bluish gray in color, clayey or silty clay in texture, and has a tough, waxy consistence, rendering this layer very impervious. Holcomb silty clay loam differs from the related Dayton soils in having a tough subsoil material, which generally continues to greater depths, and in having a surface soil colored a pronounced brown.

Holcomb silty clay loam occurs on deposits of old valley-filling material which have flat or gently sloping surfaces, and it appears to have formed under conditions of poor drainage, but subsequently to have developed better drainage, particularly in the surface soil.

Some of the largest areas of this soil are north of Salt Creek School, west of Gold Creek School, and in the vicinity of Dallas. Other areas are situated about a mile southeast of New Grand Ronde, and about one-half mile west of Eola. The latter body has a somewhat darker-colored surface soil than typical.

In places the land is forested with oak and fir, though for the most part it is clear of tree growth and is either cultivated or used as pasture land. Wheat and oats are the principal crops grown, and alsike clover and prunes are grown with fair success on some areas. The yields are not always satisfactory, as crops suffer from drought much more quickly on this soil than on land having better drainage or more permeable subsoils.

This type of soil, usually occurring in small bodies, is sold in connection with other soils. It has a somewhat depressing effect on the value of associated soils.

The following table gives the results of mechanical analyses of samples of the surface soil and the upper and lower subsoil of Holcomb silty clay loam:

*Mechanical analyses of Holcomb silty clay loam*

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>						
5614125	Surface soil, 0 to 10 inches	0.4	1.4	0.9	2.5	7.0	65.4	22.2
5614126	Upper subsoil, 10 to 26 inches	.0	.8	.6	2.2	6.4	67.5	22.4
5614127	Deeper subsoil, 26 to 36 inches	.0	1.8	.8	3.9	5.2	54.4	33.9

#### DAYTON SILT LOAM

The surface soil of typical Dayton silt loam consists of a moderately compact silt loam 8 or 10 inches deep, ranging in color from light gray to a rather dark dull gray, and mottled with yellowish-brown and light rusty-brown stains. On dry, barren, or cultivated areas the soil usually has a very light gray or whitish appearance, as compared with the adjoining soils, and is locally known as "white

land." The second layer to a depth of about 14 inches is moderately compact, gray or light-gray silty clay loam or silty clay material, mottled slightly with rusty brown. The third layer, from 14 to 24 inches deep, consists of a very compact, impervious, and plastic drab or grayish material of fine texture, which is mottled in many places and varies in thickness from about 5 inches or less where the soil grades into associated soils of the Amity series, to about 15 inches where its development is typical. Below the heavy impervious layer is a friable, yellowish-gray or yellowish-brown silt loam or silty clay loam material mottled with red and rusty brown.

Mapped areas of Dayton silt loam include patches in which the soils are slightly darker than typical, or have a pronounced bluish-gray surface soil.

This soil is somewhat heavier in texture than the same type mapped in Yamhill County. Mapped areas of Dayton silt loam may also include patches of silty clay loam and silty clay.

This soil contains a very small quantity of organic matter, and it is very plastic and puddles easily if it is not worked at the proper time. It is usually too wet in the spring to allow field work as soon as the adjoining soil types. Furthermore, this is one of the first soils to dry out in the summer, so that crop returns are usually very low.

Areas of Dayton silt loam are prevailingly flat and there is little difference in their elevation. They occur in the lower depressions on the valley floor, which positions result in very poor surface drainage. The impervious subsoil retards the downward movement of water and causes water to stand on the surface during the winter and until very late in the spring. Tiles placed in the lower friable subsoil just below the compact layer have in many cases provided effective drainage. The soils department of the Oregon Agricultural Experiment Station recommends that on this kind of land the drains be placed at a depth of about 36 inches and approximately 4 rods apart, the distance between the tile lines depending on the character of the subsoil. If the impervious layer is less than 10 inches thick tile could be placed farther apart; and if greater than 10 inches somewhat closer.

Dayton silt loam is not a very extensive soil in this county, although it occurs in several large areas, the largest being mapped in the vicinities of Suver and Independence. Fairly extensive areas are between Zena and Lincoln Schools, and south of Tucker, and smaller areas occur in different parts of the county.

Probably 50 per cent of the land is under cultivation, and the remainder is used chiefly for pasture or hay. The main crops grown are oats, alsike clover, cheat hay, and oats-and-vech hay. Oats yield from 15 to 35 bushels an acre, with an average of about 25 bushels; wheat from 10 to 15 bushels; cheat hay from 1 to 2 tons; and alsike clover from 1 to 2 tons. In the northern part of the county some hay is baled and sold, but much of it is fed to dairy cattle and sheep.

The current value of improved Dayton silt loam ranges from \$50 to \$75 an acre, and other areas from \$40 to \$60.

Drainage of this land is necessary before other permanent improvements can be made, and best results are obtained by tiling.

In many places the increase in the first few crops has paid the expense of installing tile, and it is the concensus of opinion among farmers who have put in tile drains correctly that it is a safe and profitable investment.<sup>6</sup> Fair results are obtained by allowing the surface water to drain off through the dead furrows.

The next step in the improvement of this soil is the addition of organic matter to the soil, either by adding barnyard manure or by turning under green-manure crops. Results of experiments conducted at the Oregon Agricultural Experiment Station on this type of soil show that vetch is a good first crop for drained "white land," to be followed by winter grain seeded with clover, with agricultural lime disked in after plowing at the rate of 1½ tons an acre for an initial application and 1 ton in each rotation thereafter. A rotation including small grain, clover, and an intertilled crop, in which the clover or grass is left one or two years, depending on the stand, should, with a little manuring, maintain the organic matter and nitrogen of this soil. To maintain the mineral plant-food elements sulphur or gypsum may be applied to the young clover, and superphosphate to the cultivated crop at the rate of 100 pounds an acre applied with manure, or at the rate of 200 pounds when used alone.

#### GRANDE RONDE SILTY CLAY LOAM

The surface soil of Grande Ronde silty clay loam to a depth of about 2 inches consists of a layer of a slightly mottled grayish-brown or yellowish-brown silt loam or silty clay loam, which contains root mold and other organic matter, underlain to a depth of about 7 inches by a dull yellowish-brown silty clay loam low in organic matter and usually having poor tilth. The subsoil to a depth of 14 inches is a yellowish-brown, silty clay loam material, rather compact; and below a depth of 14 inches to 36 or more inches a yellow or dull-yellow clay loam material mottled with gray and rusty brown. Owing to the small acreage of Grande Ronde soils in Polk County, patches of clay loam and silty clay are included in the mapped areas of it. At the county line the area joins with a small area of Grande Ronde clay loam in Yamhill County.

This soil has developed from old valley-filling material which occurs at the base of low hills on which occur residual soils derived from materials originating from sandstone and shale rock. These soil-type areas are level or gently sloping. Surface drainage is only fair, and this condition, with the compact stratum which retards sub-drainage, results in a poorly drained soil.

Land of this type is not extensive in Polk County and it is agriculturally unimportant, practically all of it occurring one-half mile north and one-half mile south of New Grand Ronde, and east of Valley Junction School. Wheat, oats, and some clover are the principal crops grown on it. Yields are normally low, but where the land is drained the yields are much better.

This land currently sells for \$35 to \$60 an acre, depending on improvements and location.

<sup>6</sup> Oregon Agricultural Experiment Station Bulletin 178, Farm Drainage, and Station Circular 47, Drainage and Improvement of White Land and Similar Wet Land, give results of experiments conducted on this type of soil.

Drainage is the first consideration in the improvement of this soil. A large quantity of seepage water from the hills can be diverted from areas of this soil by placing intercepting or cut-off tile drains at the bases of adjacent slopes. Rotation of crops, with some clover and vetch turned under, would be beneficial in increasing the soil supply of organic matter.

#### NEWBERG FINE SANDY LOAM

Newberg fine sandy loam consists of a rich-brown fine sandy loam from 9 to 11 inches deep, underlain by a rich-brown, loamy fine sand material to a depth of 36 or more inches. The surface soil contains a large quantity of organic matter.

This soil type is not extensive, and occurs chiefly along Willamette River on areas only a few feet above the normal stream flow. One of the largest areas lies along Willamette River. This area begins as a very narrow strip at West Salem and extends north about 3 miles, having a maximum width of about one-half mile. Other important areas occur near Wells Landing in American Bottom, northeast of Independence, and north of Lincoln School. These areas are smooth to undulating, being broken in places by shallow swales or depressions, with intervening low, rounded, and well-drained ridges. Except during periods of high water, the drainage is very good.

About 40 per cent of this land is under cultivation, and the remainder supports a growth of ash, fir, alder, and willow. Where the water table lies at a considerable depth the soil is somewhat subject to drought during the summer, but where the water table is comparatively near the surface, moisture is supplied by capillarity.

The principal crops grown are potatoes, corn, oats, peaches, and hops. Other crops grown less extensively are clover, wheat, and blackberries. Hops and alfalfa are well adapted to this kind of soil.

The current value of improved land of this type ranges from \$80 to \$150 an acre, depending on improvements; and unimproved land from \$35 to \$80 an acre.

Newberg fine sandy loam is a fertile soil, easily worked and well adapted to the production of early vegetables, and especially berries. The addition of organic matter, which would increase the water-holding capacity, is important on this soil, as the land is apt to dry out during the summer.

#### NEWBERG SILTY CLAY LOAM

The surface soil of Newberg silty clay loam consists of a rich-brown to dark-brown, mellow silty clay loam from 6 to 12 inches deep, which contains a considerable quantity of organic matter. The surface soil is underlain to a depth of about 28 inches by a dark-brown, moderately compact, silty clay loam or silty clay material, which in turn is underlain to a depth of 36 inches by a brown or light-brown sandy loam material. Some of the mapped areas of this soil contain patches in which the soil is rather heavy in texture, and other patches in which the soil is similar to the Chehalis soils.

Newberg silty clay loam is of small extent in the county and it is confined entirely to the Willamette River bottoms, the largest areas occurring 1 mile southeast of McNary and one-half mile southeast

of Oakpoint School. Several very small areas occur in other parts of the "bottoms."

These areas are generally moderately undulating, low, rounded mounds and ridges, with shallow swales or depressions intervening at short intervals being the main topographic features. This land is subject to periodic overflows, but owing to its favorable topography and porous character of the subsoil, the drainage at other times is excellent.

About 60 per cent of this land is under cultivation, but because of its small extent it has only local agricultural importance. The principal crops grown are wheat, hops, oats, and clover. Although early vegetables are grown to some extent, the lighter textured soils of this series are more favorable for these crops. Peaches, berries, and corn should be planted more extensively on this type of soil.

Newberg silty clay loam is a naturally productive soil. Great care must be exercised in its management on account of the heavy texture of its surface soil. There is less danger from drought on this soil than on the lighter soils, because of its heavier textured subsoil.

*Newberg silty clay loam, light-textured phase.*—Newberg silty clay loam, light-textured phase, consists of a surface layer from 8 to 12 inches deep of a brown silt loam or light-textured silty clay loam, underlain to a depth of 40 or more inches by a light-brown, loamy fine sand. Mapped areas may include some patches of Chehalis soils.

Owing to its very small extent, it is of comparatively little agricultural importance. The largest area occurs west and southwest of Halls Ferry, and other small areas are south of Judson Landing.

Areas of this soil are rather level or billowy. They comprise the lower bottom lands near the river and are subject to annual overflow; at other times the drainage is excellent.

Although this land is very limited in extent, it is locally important, as it is fertile, easily worked, well drained and especially suitable for early truck crops and small fruits. The principal crops grown are oats, corn, hops, clover, potatoes, peaches, and berries, good yields of which are reported.

The current value of improved land of this kind varies from \$90 to \$175 an acre, depending on location and improvements.

Although the light-textured Newberg silty clay loam retains moisture better than the fine sandy loam during dry periods, for best yields it is necessary to increase the organic matter by growing and turning under such crops as alfalfa, clover, vetch, and oats. Alfalfa is a very promising crop, and the Oregon Agricultural Experiment Station recommends that the acreage of this crop be extended on well-drained soil similar to this.

#### WAPATO SILTY CLAY LOAM

The surface soil of typical Wapato silty clay loam consists of about 8 inches of brown or dark dull-brown, heavy silty clay loam, in many places mottled with rusty-brown iron stains. The subsurface soil to a depth of 20 inches is underlain by a dull-brown, heavy silty clay loam material, and deeper by a dark grayish-brown, drab, or bluish-gray clay mottled with gray and rusty brown. Mapped areas

of this soil in Polk County include patches of soil varying in color from grayish black to brown, and some patches of Wapato silty clay.

Wapato silty clay loam is confined to the overflow lands along the smaller streams, to areas in local basins, and on alluvial-fan slopes. A large part of this land is overflowed annually, and many areas remain wet until late in the spring. The surface is usually smooth and flat to gently sloping. Surface drainage in places is fairly well developed, but subdrainage is poor. This is an extensive soil and occurs in most parts of the county, important areas being mapped along Rickreall Creek, southeast of Dallas. Other areas occur along Little Luckiamute River, three-fourths mile south of Bridgeport, extending southeast for about 3 miles, northwest of Rickreall, and along Salt Creek. Many narrow areas occur along streams.

Wapato silty clay loam is a moderately productive soil. At present only a small part of the land is under cultivation, the greater part being unimproved and used chiefly for pasture. A large proportion of the type areas are covered with a growth of oak, ash, willow, and alder, or native grasses. The principal crops grown are wheat, oats, corn, vetch, and alsike clover (Pl. XLVIII, fig. 2). Wheat yields from 20 to 30 bushels an acre, averaging 25 bushels; oats from 35 to 75 bushels, averaging 55 bushels; and alsike clover from 1 to 2½ tons of hay.

The current value of this type of soil where improved ranges from \$50 to \$90 an acre, and unimproved from \$20 to \$50 an acre.

Where adequate drainage is provided this soil is suitable for the production of the crops commonly grown in the county.

The following table gives the results of mechanical analyses of samples of the surface soil, upper subsoil, and lower subsoil of Wapato silty clay loam:

*Mechanical analyses of Wapato silty clay loam*

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>						
561416	Surface soil, 0 to 8 inches.....	0.3	1.1	1.0	6.6	11.2	50.8	29.1
561417	Subsoil, 8 to 20 inches.....	.2	1.0	1.0	4.9	14.6	49.2	29.2
561418	Subsoil, 20 to 36 inches.....	.0	.5	.7	9.2	12.2	22.3	54.9

WAPATO SILTY CLAY

The surface soil of Wapato silty clay consists of a brown or dull grayish-brown friable silty clay to a depth of about 2 inches, underlain by a dark dull-brown silty clay mottled with drab and rusty brown to a depth of 26 inches. The subsoil to a depth of 36 or more inches consists of a dull-brown or grayish-brown heavy silty clay mottled with rusty brown and drab. The surface 2-inch layer contains considerable organic matter. The soil of mapped areas of this type is quite variable. Patches of black or brown mottled soils are included.

Along the northern boundary of Polk County an area of this soil joins with an area of Chehalis silty clay loam in Yamhill County. More recent investigation during the work in the Polk County survey indicates that the area in Yamhill County referred to more properly resembles Wapato soils.

Wapato silty clay is one of the least extensive soil types in Polk County. The larger areas lie one-fourth mile north of Tucker, one-half mile north of Rickreall, and near Gold Creek School, Butler, and Fern School in the northwestern part of the county. Other areas are south of Perrydale, and along Luckiamute River.

Areas of this soil are nearly level. The type is confined chiefly to the first bottoms or overflow areas along the minor streams of the county.

About 40 per cent of it is under cultivation, the remainder being used principally for pasture. Wheat yields range from 15 to 30 bushels, averaging 20 bushels an acre; oats from 30 to 50 bushels, averaging 40 bushels; clover from 1½ to 3 tons, averaging 2 tons; and clover seed from 4 to 8 bushels, averaging 6 bushels.

Tile drainage is the first step in the improvement of this soil. Owing to the high clay content, the soil cracks and bakes on drying, making tillage very difficult at times. These areas should be left in permanent pasture. Liberal applications of manure or the turning under of green-manure crops will improve the soil.

The following table shows the results of mechanical analyses of samples of the surface and subsurface layers and subsoil of Wapato silty clay:

*Mechanical analyses of Wapato silty clay*

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>						
561439	Surface, 0 to 1½ inches.....	0.0	0.2	0.0	2.6	7.8	54.3	35.1
561440	Subsurface, 1½ to 9 inches....	.2	.0	.0	2.2	6.8	53.0	38.1
561441	Subsoil, 9 to 36 inches.....	.2	.4	.2	.8	6.8	54.3	37.1

#### COVE CLAY

Cove clay consists of a black or dark grayish-black or very dark dull-brown material from 8 to 15 inches deep and generally high in organic matter, underlain by a heavy-textured, waxy, bluish-gray or drab-colored clay, in many places mottled with rusty brown.

This soil occurs on gently sloping to flat or almost level areas. It occurs in low, basinlike areas and on gentle slopes bordering higher-lying soils. Owing to its heavy subsoil, drainage is poorly developed. The largest areas in the county lie along Baskett Slough. Another extensive area is mapped one-fourth mile south of Rickreall, where the soil is not so black as typical. Smaller areas are mapped in several other places in the county.

This type of soil is of small extent and of minor agricultural importance. A small part is under cultivation; the remainder is in pasture or covered with ash and maple trees or a heavy growth of rushes.

Dairy cattle are pastured on this land to a considerable extent, as the native grasses thrive and afford good pasturage when pastures on other soil types have dried up. Only fair yields of cultivated crops are reported on this soil. It is recognized as a fertile soil, but often contains a high quantity of inactive or inert organic matter. The first need of this soil is good surface drainage. Tile drains

are ineffective in places, owing to the fact that water does not readily pass through the clayey subsoil material into the tile.

Land of this type is very difficult to handle, as it is very heavy and sticky when wet, and unless care is taken in working it it may bake and become very cloddy. The addition of organic matter aids in making the soil more mellow and in liberating otherwise unavailable elements of plant food. The land should be left in permanent pasture as much as possible. The farm crops department of the Oregon Agricultural Experiment Station recommends the following grass mixture for wet lands of western Oregon: English rye grass, 8 pounds; orchard grass, 3 pounds; redtop, 3 pounds; alsike clover, 2 pounds; and white clover, 1 pound.

*Cove clay, gray phase.*—Cove clay, gray phase, consists of light-gray to dark grayish-black silty clay or silty clay loam from 2 to 8 inches deep, underlain by a black waxy clay which is mottled with gray, yellow, and rusty brown. Areas of this land are flat like those of typical Cove clay, and the soil differs from Cove clay only in having an alluvial overwash layer of light-gray or dark grayish-black material.

The largest area lies  $1\frac{1}{2}$  miles south of Holmes Gap, having a maximum width of about one-half mile and extending for 2 miles north and south. Several other small areas lie to the west of this one.

Owing to its small extent, this land is of minor agricultural importance. It is handled in the same manner as typical Cove clay.

*Cove clay, sloping phase.*—Cove clay, sloping phase, consists of a black to dark grayish-black clay about 12 inches deep, underlain by a black to grayish-brown, compact, waxy clay slightly mottled with rusty brown. The surface soil of this phase is generally a little lighter in texture and not quite so black as typical Cove clay, and it has a more compact subsoil. Areas of this soil are smooth and gently sloping. This soil occurs on outwash or alluvial-fan deposits.

Owing to its small extent and limited use, it is unimportant agriculturally. The largest area mapped lies 1 mile northeast of Polk.

Surface drainage usually is good, but underdrainage is very poor, owing to the heavy compact subsoil. The soil is potentially productive, but on account of its poor physical condition and the difficulty in getting a good seed bed this land should be kept in permanent pasture. Recommendations for the improvement of this soil are the same as for typical Cove clay. This kind of soil is sold with adjoining soil types.

The current value of this land ranges from \$25 to \$60 an acre, depending on location and improvements.

The following table gives the results of mechanical analyses of samples of the surface soil and subsoil of typical Cove clay.

*Mechanical analyses of Cove clay*

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>						
561414	Surface soil, 0 to 10 inches.....	0.3	1.2	0.5	4.0	8.2	50.0	35.9
561415	Subsoil, 10 to 36 inches.....	.5	1.4	.7	3.4	7.4	44.8	41.9

## RIVERWASH

Riverwash consists of a miscellaneous mixture of sand, gravel, and cobblestones, usually poorly assorted and occupying stream channels and narrow strips immediately adjacent to the larger streams. It occurs in areas which are only a few feet above the normal flow of the river. This land is of practically no agricultural value, as it rarely supports any vegetation and is under water for a considerable period annually. During the summer months, when the water is low, the coarse porous material does not hold sufficient moisture to support crops. Small parts of areas of riverwash material furnish some pasturage during favorable years.

The extent of riverwash materials in Polk County is not large, occurring only as narrow strips along the banks of Willamette River. The larger areas lie north of Lincoln, southeast of McNary, and northwest of Wigrich Landing.

## ROUGH MOUNTAINOUS LAND

Rough mountainous land as mapped in this county includes areas which are of rough mountainous character, and which are uncleared, unimproved, and not utilized for farming. Under present economic and agricultural conditions it was not considered expedient to attempt the classification and mapping of the soils of these areas in detail. The soils are mainly of residual origin, belonging mainly to the Melbourne and Sites series. There are areas of Olympic and Aiken soils also. Bedrock occurs at depths varying from 4 to 40 inches, outcropping in many places. With future development certain areas of these lands may be brought under cultivation. The area of rough mountainous land in Polk County joins with areas of Melbourne clay in Yamhill County which have somewhat less adverse topography.

Rough mountainous land occupies nearly all of the western half of the county. The larger part of this area has a heavy stand of good commercial timber, but is crossed by very few roads or trails.

Lumbering is a very important commercial industry of Polk County. Lumber companies own large tracts of rough mountainous land and are operating in different parts of the county. In some of the cut-over and open districts there are some small areas cultivated. Grazing is profitable in many places and will continue to grow more important as the forest is removed.

Extension Bulletin 366 of the Oregon Agricultural Experiment Station, Management of Range Grazing Land, gives information on the care and handling of ranges to obtain best results on this type of land.

Bulletin 185 of the Oregon Agricultural Experiment Station, entitled "The Management of Willamette Valley Soils," makes the recommendations indicated in the following table:

*Recommendations for the management of Willamette Valley soils*

Soil series	Major soil groups	Important requirements	Crops benefited	Time and method of applying fertilizers	Rate per acre
		Superphosphate.	Clover, potatoes, grain, corn.	Once in 3-year rotation ahead of cash crop. Broadcast on or drilled in with fertilizer attachment on planter.	200 to 300 pounds.
Aiken..... Olympic Sites..... Melbourne.....	Red hill soils.....	Lime.....	Clover on old grain land.	Broadcast before seeding down.	2 to 3 tons.
		Land plaster.....	Legumes.....	Broadcast.....	100 pounds.
		Nitrates.....	Potatoes, corn, and grain when following nonlegumes.	do.....	100 to 200 pounds.
Salkum..... Salem..... Willamette.....	Valley soils, well drained.	Superphosphate.	Grain and potatoes.	Same as for red hill soils.	Do
		Nitrates.....	Potatoes when following nonlegumes.	Broadcast.....	
Amity..... Holcomb..... Dayton..... Grande Ronde..... Chehalis.....	Valley soils, wet, heavy "white," and "half-white" land.	Lime, after drainage.	Clover.....	Broadcast before seeding down.	2 to 3 tons.
		Land plaster.....	Wheat, barley, legumes.		
	Brown second-bottom soils.	Land plaster.....	Wheat, barley, legumes.		80 to 100 pounds on legumes.
Newberg.....	Sandy first-bottom soils.	Phosphate with nitrates.	Alfalfa, clover, potatoes, corn, grain, beans.		Same as for red hill soil.
		Land plaster.....	Legumes.....		
Wapato Cove.....	Recent alluvial soils, black and sticky.	Drainage.....	Alsike clover, beans, hairy vetch.		

NOTE.—All valley soils need organic matter. Rotation and manure prove very profitable. Gypsum is excellent for clover and young alfalfa.

## SUMMARY

Polk County is situated in the northwestern part of Oregon and has an area of 744 square miles, or 476,160 acres. The eastern and principal arable part of the county includes the floor of Willamette Valley, which is nearly level to undulating. The lower foot slopes of the eastern portion of Coast Range Mountains, which occur in the western part of the county, are undulating and rolling. The western half of the county is rough and mountainous, and is covered by a heavy growth of commercial timber.

Polk County is drained by Willamette, Luckiamute, South Yamhill, and Siletz Rivers, and Rickreall Creek.

Polk County is one of the smaller counties of the State, and has a population of 14,181. Dallas, the county seat, has a population of 2,701. The Willamette Valley area is well settled, whereas the rough mountainous areas are only sparsely settled. The eastern part of the county has good transportation facilities. A considerable mileage of the highways is paved, and paving construction in other parts of the county is in progress.

The climate is characterized by mild winters and cool, dry summers. The mean annual rainfall is 39.89 inches at Wallace Orchard in Willamette Valley, and 78.49 inches in the western part of the county. The greater part of the rainfall occurs from the latter part of September to April. The mean annual temperature is about 51° F.

The agriculture of Polk County consists of general farming, fruit production, dairying, poultry raising, and vegetable gardening. The most important crops grown are wheat, oats, clover, potatoes, prunes, apples, pears, peaches, and hops. Dairying is rapidly becoming the leading industry. Fruit production ranks second in value of products sold. The common rotation practiced in the county is grain, followed by clover for one or two years, and then a cultivated crop. Very little commercial fertilizer is used at the present time.

The average size of the farms in this county is 136 acres. Farms are operated mostly by owners. The current value of improved land for general farming ranges from \$75 to \$175 an acre, and bearing orchards from \$300 to \$700 an acre.

The arable soils of Polk County are divided into three groups—residual soils, old valley-filling soils, and recent alluvial soils. The residual or hill soils include those derived from igneous rocks, such as basalt, dolerite, and andesite, and those derived from sedimentary rocks, sandstone, and shale.

The soils derived from igneous rocks are grouped into the Aiken and Olympic series, and those derived from the sedimentary rocks into the Sites, Melbourne, and Carlton series.

The soils derived from old valley-filling materials are classed as Salkum, Salem, Willamette, Amity, Holcomb, Dayton, and Grande Ronde soils.

The soils derived from recent alluvial materials are classed as Chehalis, Newberg, Wapato, and Cove soils.

Soils of the Aiken, Olympic, Sites, and Melbourne series where there is good depth are well adapted to prunes, apples, cherries, walnuts, and general farm crops.

Soils of the Carlton series where drainage is not restricted are adapted to general farm crops.

The Willamette, Salem, and Salkum soils are well drained and are especially suited to red clover, oats, corn, and other crops.

The more poorly drained soils of the Amity, Grande Ronde, Holcomb, and Dayton series are adapted to oats, vetch, and alsike clover. Drainage will increase the crop-producing power of these soils.

The lighter-textured Chehalis and Newberg soils are recognized as especially adapted to berries, peaches, potatoes, early truck crops, and alfalfa.

The soils of Polk County are for the most part productive. The flat valley and hill soils, where the subsurface drainage is restricted, respond favorably to drainage, and this should be the first step in the permanent improvement of these soils.



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