

6000.

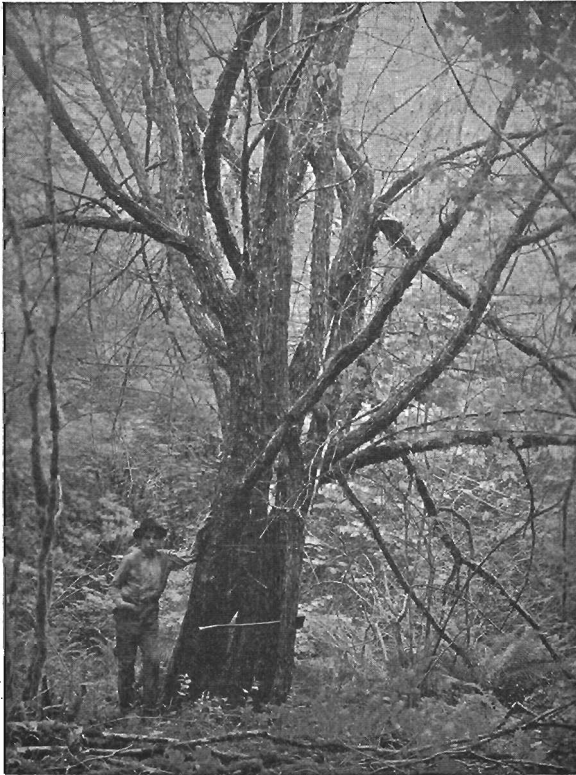
Bulletin No. 81.

July, 1904.

Department of Horticulture

OREGON AGRICULTURAL EXPERIMENT STATION

CORVALLIS, OREGON.



PYRUS RIVULARIS—OREGON CRAB APPLE.

# THE APPLE IN OREGON

By E. R. LAKE

THE BULLETINS OF THIS STATION ARE SENT FREE TO ALL RESIDENTS OF OREGON WHO REQUEST THEM.

OREGON  
 AGRICULTURAL COLLEGE  
 MAY 25 1925  
 LIBRARY

Withdrawn From  
 Oregon State College  
 Library

## Board of Regents of the Oregon Agricultural College and Experiment Station.

---

Hon. J. K. Weatherford, <i>President</i> .....	Albany, Oregon.
Hon. John D. Daly, <i>Secretary</i> .....	Portland, Oregon.
Hon. B. F. Irvine, <i>Treasurer</i> .....	Corvallis, Oregon.
Hon. Geo. E. Chamberlain, <i>Governor</i> .....	Salem, Oregon.
Hon. F. I. Dunbar, <i>Secretary of State</i> .....	Salem, Oregon.
Hon. J. H. Ackerman, <i>State Supt. of Pub. Instruction</i> , Salem, Oregon.	
Hon. B. G. Leedy, <i>Master of State Grange</i> .....	Tigardville, Oregon.
Hon. William W. Cotton.....	Portland, Oregon.
Hon. Jonas M. Church.....	La Grande, Oregon.
Hon. J. D. Olwell.....	Central Point, Oregon.
Hon. William E. Yates.....	Corvallis, Oregon.
Hon. J. T. Apperson,.....	Park Place, Oregon.
Hon. W. P. Keady.....	Portland, Oregon.

---

### OFFICERS OF THE STATION.

#### STATION STAFF.

Thos. M. Gatch, A. M., Ph. D.....	<i>President.</i>
James Withycombe, M. Agr.....	<i>Director and Agriculturist.</i>
A. L. Knisely, M. S.....	<i>Chemist.</i>
A. B. Cordley, M. S.....	<i>Entomologist.</i>
E. R. Lake, M. S.....	<i>Horticulturist and Botanist.</i>
E. F. Pernot, M. S.....	<i>Bacteriologist.</i>
George Coote.....	<i>Florist.</i>
F. L. Kent, B. S.....	<i>Dairying.</i>
C. M. McKellips, Ph. C., M. S.....	<i>Chemistry.</i>
F. E. Edwards, B. M. E.....	<i>Chemistry.</i>
H. D. Gibbs, B. S.....	<i>Chemistry.</i>

# THE APPLE IN OREGON

## PART I

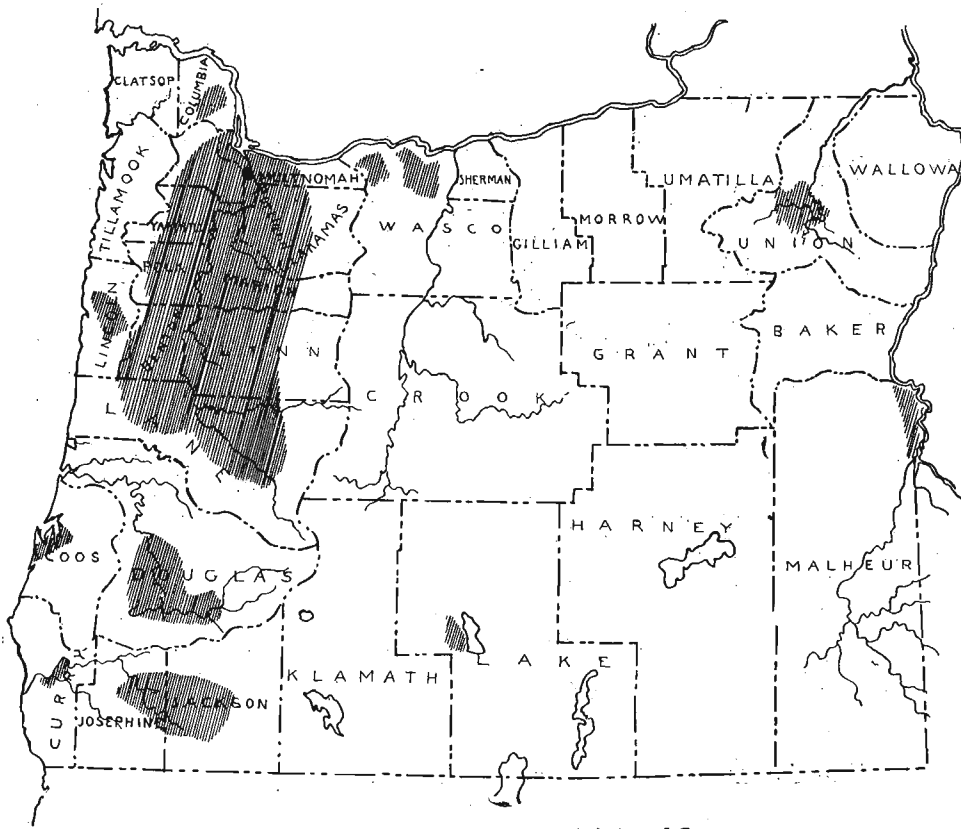
Topics Discussed.—Early History.—Earliest Varieties.—Later Plantings.—The Problem of Planting.—Site as to Soil.—Site as to Aspect.—Selection of Trees.—Planting.

---

This series contemplates four parts. Parts II, III and IV will deal with cultivation, pruning, harvesting, packing, storing, marketing, and manufacturing the inferior fruit into secondary products, and such other topics as naturally accompany the discussion.

## INTRODUCTION

"An apple orchard is sure to bear you several crops besides the apple. There is the crop of sweet and tender reminiscences dating from childhood and spanning the seasons from May to October, and making the orchard a sort of outlying part of the household. You have played there as a child, mused there as a youth or lover, strolled there as a thoughtful sad-eyed man. Your father, perhaps, planted the trees, or reared them from the seed, and you yourself have formed and grafted them, and worked among them, till every separate tree has a peculiar history and meaning in your mind. Then there is the never failing crop of birds—robins, finches, king-birds, oreoles, red-birds, starlings and others, such a crop!"—*John Burroughs.*



Map of the apple growing districts of Oregon.

## EARLY HISTORY.

---

The history and development of apple culture in Oregon is unique. The story of the peculiar, almost romantic, conditions under which this fruit was introduced into the state by the pioneers; the eagerness with which the first settlers planted apple trees, and the fabulous prices for which the first fruit sold, sounds today more like a tale of the days of chivalry, than a sketch of times in Oregon fifty years ago. Though the story has been told over and over, it will be well worth reciting again in connection with this brief study of "the apple in Oregon."

In Iowa in the spring of 1847 Henderson Luelling planted a few score of yearling grafted apple trees in boxes along with other small trees of plum, cherry, pear, peach, and cuttings of grapes and bush fruits. In the early summer these boxes were lifted, placed in a wagon, and in due time—six months—reached Oregon. Throughout the long and hazardous journey, made with ox team, Mr. Luelling guarded with an ever increasing attachment these few hundred struggling plants, destined to be the basis of a great fruit industry in the new west.

The first orchard of grafted fruit in Oregon was planted that fall on a piece of freshly cleared land near Milwaukie. Thus began the orchard industry in Oregon. These trees and plants, brought across the plains at a measureless cost, in trials and hardships, to the owner, flourished in their new home; and in the years following returned—"a dollar a drop for the sweat I lost in getting the necessary water to keep them alive while we crossed the desert; and their luscious fruit repaid me many times over for the jeers, ridicule and contentions\* of my comrades."

Mr. William Meek, a fellow traveller with Mr. Luelling, brought a sack of apple seed from the same region, and the following spring (1848) the two formed a partnership and established the first nursery in Oregon, alongside the first orchard of grafted fruit.

\*It is said that in a few of the most difficult parts of the trail some of the party insisted upon throwing away the heavy boxes of trees in order to lighten the load. At such times only the evident disposition to fight, on the part of Mr. Luelling, saved them.

"It is related that the first big red apple produced by Oregon soil was borne upon a one year old root-graft in this early nursery in the fall of 1848, (?) and so great was the fame of it, and such the curiosity of the people, that men, women and children came from miles around to see it, and made a hard beaten track through the nursery to this joyous remiuder of the old homestead so far away.

"The first orchards of notable size were planted in the Waldo hills, on French prairie and near Salem. The following varieties were the common ones of those early days: Red June, Summer Sweet, Red Astrachan, Gravenstein, Talman Sweet, Blue Pearmain, W. W. Pearmain, Gloria Mundi, Genet Baldwin, Rambo, Winesap Jennetting, Seek-no-Further, Tulpahocken, American Pippin, Red Cheek Pippin, Rhode Island Greening, Virginia Greening, Little Romanite, Spitzenberg, Swaar, Waxen, and a spurious yellow Newtown Pippin, since called Green Newtown Pippin and generally considered worthless. Some few other varieties were probably introduced at the same time but of these there is no certain record.

"In 1850 Mr. Lewelling returned to the east and selected at the nursery of A. J. Downing, among other trees some Yellow Newtown Pippins, which were dug under the personal supervision of Mr. Downing. These trees were brought across the Isthmus. On fruiting these proved to be nothing more than the so-called Green Newtown Pippin of the first introduction, and the real Yellow Newtown Pippin as we have it now was not introduced until some years later.

"The first box of apples offered for sale in Portland by Mr. Lewelling was eagerly purchased at one dollar apiece, netting him seventy-five dollars. Following this, prices ranged from one dollar per pound to twenty-five dollars per box and retailed at as high as one and one half dollars per pound, and in one instance two dollars and fifty cents was paid for one apple.

"In 1853 the surplus, a few boxes securely bound with strap iron were shipped to San Francisco and sold for two dollars per pound.

"In 1854 the surplus amounted to five hundred bushels and was sold at a net price of one and one-half dollars to two dollars per pound.

"In 1855 six thousand bushels were shipped returning a net price of twenty dollars to thirty dollars per bushel.

"In 1856 shipments amounted to twenty thousand boxes. This year one box of Esopus Spitzenberg sold in San Francisco for sixty dollars net, and three boxes of Winesaps sold in Portland for one hundred and two dollars.

"From this time till 1869 the shipments during the fall and winter months varied from six to twelve thousand boxes per month. From 1870 shipments to California declined, as the young orchards of that state were coming into bearing at such a rate as to not only supply their own demand but to furnish some for exportation. In consequence of this loss of market, prices fell so low that thousands of bushels annually rotted beneath the trees, other thousands of bushels were consumed by stock. The enormous prices obtained during the fifties resulted in the planting of a great acreage of orchards. With the loss of the California market came a total collapse in the industry, since there were no adequate means of transporting the great yield of fruit from these young orchards to suitable markets."—*Dr. J. R. Cardwell, in First Oregon Report.*

Speaking of the abundance of fruit at that time E. L. Smith says:

"At a farm near Salem I purchased several hundred boxes of the largest Winesaps I had ever seen. I could have bought almost unlimited quantities of this fine fruit at from twelve and one-half to fifteen cents per bushel. In an orchard near Jefferson this fruit was still cheaper for there I remember seeing great Golden Belleflowers falling to the ground to the evident satisfaction of the pigs beneath the trees."—*E. L. Smith, at Farmers' Congress, Salem, 1902.*

The following note written in reply to a question asked Mr. Minto in February, 1902, throws an interesting ray of light upon the early orchards of Oregon:

SALEM, OREGON, Ebebruary 14, 1902.

I should judge from my knowledge of the French Canadian settlers, that Joseph Gervais, who settled at Chemaway, was the first planter of apple trees in the Willamette Valley. He was the natural leader of his class, and in 1845 his orchard of apple trees looked to be twelve or fifteen years old at least. The Monteith brothers, Walter and Thomas, got water sprouts from Gervais' orchard which were the first planted at Albany, Linn county. Mr. Gervais used to seem proud to bring apples to Salem for sale at \$3 per bushel in 1849. I never saw nor heard of another French Canadian who had apple trees as old as his appeared nor that ever had apples to sell. Gervais came to Oregon with Mr. Hunt, Astor's partner, in 1811.

JOHN MINTO.

In reply to a request for an item from the "old orchard" for this bulletin the following was received from J. H. Lambert, a pioneer in Oregon orcharding:

PORTLAND, January 22, 1902.

The first trees were planted in the fall of 1847 and the varieties planted for the next few years were many; but, as the apple became an important item of commerce, the leading varieties for many years were the Yellow Newtown, Winesap and Baldwin. The Newtown was the highest priced but the Winesap was the most profitable being a most vigorous tree and a prolific bearer, and at that time, of good size, good quality and a fine, showy, red apple. The Baldwin was an early winter apple but the other two were good keepers and would ship well as late as May. I think there never has been any finer or more perfect apples raised than were grown in the Willamette Valley from 1854 until early in the seventies at which time the diseases and pests began to make their appearance and got in their destructive work. Young blood and new appliances may bring back the day of "Oregon's big, red apples."

Neglect of the crop and trees naturally followed this period of depressed prices. Soon the lichens began to give the trees the appearance of old age; lack of pruning was followed by close-matted and bushy tops, (See Fig. 1.); fences decayed, and stock took free use of the deserted orchard; in time, weeds, brush and trees of the native species sprang up and contended for the possession of the soil (See Fig. 4) and now one only too often sees seared, defenseless trees valiantly trying to maintain their broken files against the onrush of the aggressive fir. See Fig. 5.

### LATER PLANTINGS.

The ebb of the apple crop in Western Oregon was during the eighties and early nineties. The decline had been rapid during the decade preceding 1890. With the loss of the California market, which was being supplied largely with the local product; the introduction of the codlin-moth; the appearance of scale and other fungous troubles; the premature breaking-down of many of the old



Fig. 1

orchards, due to lack of care in tillage and pruning, and to unsuitable sites, and the consequent decline in quality and appearance of fruit, the apple industry of Western Oregon which, only a few years previously had been the boasted pride of the Pacific Coast, winked-out, leaving a marvellous display of decrepit, moss-covered, fungus-ridden, worm-infested prematurely old apple trees, that should rightly have been in their prime (See Fig. 6). But though most of the pioneer orchards were things of the past it was not so with the impressions wrought by the luscious red and yellow apples

—their fruitage. The oft-repeated story of the “old-time-fruit” in the days when the “Oregon Big Red Apple” was famous, had its influence.

In the meantime men from the middle-west, with a knowledge of the commercial importance of this fruit, were investigating the possibilities of apple-culture on the coast. The sight of the orchard ruins of Western Oregon filled them with awe and forebodings. Almost to a man they were convinced of the evident unfitness of this great section for successful orcharding. Stunted, ill-shaped, scrawny trees appealed to them from every outlook; or, perchance,

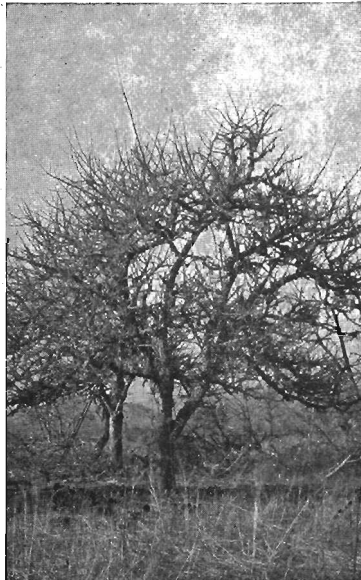


Fig. 2

on some slightly knoll an hoary, lichen-splotched giant (Fig. 2), the very embodiment of ideals for future generations, might chance to meet their eyes, but its merits were of only passing moment, for all around were ruins, ruins, orchard ruins everywhere. And while these searchers after apple lands settled in eastern and southern Oregon, and have done much to bring these sections into high repute as fruit growing regions, the fame and profit of western Oregon apple orchards steadily waned. During this period of indifference and neglect many of the first orchards became so pest-

ridden and prematurely old that they were wholly abandoned. Some were entirely removed, while others were left to their own handicapped efforts in a fight against the ever-aggressive fir,\* and destined to remain for years a picturesque feature of western Oregon landscape (See Figs. 4, 5, 6)—the horticultural ruins of an age of grain and stock raisers not yet extinct. For, it should be kept in mind that the Oregon orchardist of that day was generally a man whose conception of horticulture was incorporated in the phrase "seed time and harvest." On his calendar there was no season for cultivation; no period for pruning; and no time for



Fig. 3

thinning, and spraying was unknown. The crop was gathered or harvested in those days. Now we pick it. But this period of decline and abandon was fraught with a definite, though unseen purpose. It was the period of incubation of the germ of progressive present-day methods of apple-culture. Upon these ruins of the past we are today erecting some ideal orchard structures (See Fig. 11b). And while it is true that most of the newer plantings of apples are in small tracts there is a pronounced growing sentiment in favor of

\**Pseudotsuga taxifolia*. Douglas spruce, Oregon pine, Red fir.

planting in larger, commercial areas. The recent success in marketing the crops of large orchards in both eastern and southern Oregon, has given an impulse to the consideration of the commercial aspects of apple-culture, such as we have not heretofore known. The early orchards of this section were planted near the homes, and as many of the pioneers selected the open prairie, much of which is level-lying land, for their homes, it came about that many of the orchards were planted upon heavy, poorly drained land, a condition which contributed much to the early decline in vigor and productiveness of these first orchards. Today the prospective orchardist, before planting, makes a full investigation of the various phases of the subject, especially as to the inter-relation of climate and soil; to the different varieties of trees; insect and fungous pests; inter-pollination; market demands, secondary products of the crop; economy of tillage and other manual operations as affected by the character of the site, and various minor features. As a result of this close attention to the requirements of the crop there are thousands of young apple trees being planted upon the better sites in the Willamette valley, once the boasted home of the big red apple. With the proper selection of varieties, skillful treatment of soil and tree, and constant warfare against the pests there would appear to be no reason why this section should not in a large measure regain its lost prestige in apple growing.

---

### THE PROBLEM OF PLANTING.

Before the question of what to plant arises in the mind of the person about to engage in the growing of the apple there have come those other questions; shall I grow apples; if so, to what end; for home, local market, or shipment? And it is presumed that to these questions a final answer has been given. Whether this reply makes the one or the other object the purpose of the planting matters little, so far as the real work of planting and future care is concerned; though too often the plants upon which a crop is grown for home use are given little or no intelligent, appreciative attention.

There is no adequate excuse for the usual neglect of the trees, shrubs and vines that produce the fruits for home use. Only clean, healthy, vigorous trees may be expected to produce choice fruit and what tiller of the soil, would that his family should have fruit of an inferior quality (See Fig. 3). The plea that is usually offered in extenuation of the offense of an ill kept fruit-bearing plantation (see Fig. 11a) is that "we can't take time from the regular work to look after it." This is the merest absurdity. An essential part of man's duty to himself and family is to maintain good health. No single part of our usual diet does more to promote this condition than wholesome fruit. It is only with the best of health that the soil-tiller may expect to successfully compete with his fellow, hence, how important that he avoid, as far as possible, all demands upon the physician's services. For such demands mean a lessening of his earning capacity as well as an increase in financial expenses. Not alone this, for the growing of good fruit for home use gives a tone, keenness and enthusiasm to the family such as many times repays the outlay. The man, woman or child who works much out doors craves a good supply of fresh fruit, and such an one works harder and more cheerfully when liberally supplied with it. Reasons enough, certainly, why the fruit-garden about the home should be cultivated and the plants otherwise well treated.

And thus it should appear evident that there is really no essential difference between the problem of planting for home and that of planting for the market except, so far as relates to the varieties most desirable for the particular purpose in view.

**Location.**—From several points of view the problem of where to locate the apple orchard is one of considerable moment. Now that good, clean fruit, free from worms and fungi, is to be secured only at the expense of liberal and effective spraying it is important that the orchard be located so that this work may be done to the best advantage. Other conditions being equal one should locate near the home buildings and water supply. For the home orchard it will not be difficult to group the trees about the buildings in such a manner as to make them easily accessible for spraying, the most important, yet the most neglected part of the orchard's care, at present. But, for the commercial orchard the question of location assumes various other phases, such as the cost of land; access to shipping points; facility of tillage, depending upon character of soil and

climate; the inter-adaptability of climate and varieties, and the prevailing climatic conditions of the locality.

The usual standard varieties of apples do not begin to yield net results until about eight or ten years old if planted upon a soil of good body and suitable fertility. The cost of cultivating, pruning and spraying this growing crop for so long a period, added to the expense of first preparation and planting, together with the original cost of land makes a very formidable looking expense sheet; and when to this is added a fair allowance for interest on the investment it will be seen that the bringing of an apple orchard into bearing involves the expenditure of a no inconsiderable sum of money of which the original cost of the site may be an unduly large factor in the case of high priced land. Only when some particular advantages of soil, drainage, climate or suitability for desired varieties is to be gained may one feel free to look upon the first cost of land as an item of passing significance. Upon the inherent qualities of the location as above enumerated, and not upon the money value placed upon it, is the success of the orchard to rest. However, it is of little moment whether the land cost fifteen or forty dollars as against the successful growth of a crop of apple-trees. Still, it would be unwise to purchase at the higher price except some particular advantage to tree growth and fruitfulness appears evident. Every dollar used above the amount required to obtain a suitable site means the setting aside of so much "dead capital," a phase of the subject that must be kept well in mind throughout the whole consideration of orchard-building. While none but the thorough-going tree culturist—the man who loves trees and fruits for themselves—should engage in commercial orcharding, it is well enough that even he should have a clear conception at all times of cost and returns. Nothing so intensifies one's pleasure in labor, though it be a labor of love, as successful financial outcome. To have a hobby and that hobby a money-maker, is the acme of present-day incentives. And while nothing should be said that would in the least detract from the sentiment, love of nature, and broad ideals that should characterize our rural employments, yet our keenest appreciation usually comes from a knowledge of the value that others place upon the products of our labor.

Hence, select for a site as low priced land as is compatible with the desired requirements; deep, well-drained, moderately heavy, friable, fertile soil, in a locality where climatic conditions and

transportation facilities are favorable to the development of the crop.

### SITE, AS TO SOIL.

Upon this very important phase of orchard-making all authorities are practically agreed. From the old orchards, and especially the old trees, of both Europe and America, the east and the west—the same lessons are learned. With one accord these trees, though separated by leagues of land and water, proclaim the creed of the apple tree—complete air and water drainage and a deep loamy soil.

Speaking upon this topic about two hundred years ago, Miller, an English authority, said:

“A gentle hazel loam, which is easy to work and does not retain the wet, is the best. Although these trees will grow on very strong land they are seldom so thriving, nor, is the fruit so well flavored as upon trees grown on a gentle soil. Dry sandy or gravelly soils are wholly unfit for the apple tree.”

Delaville\* writing upon the subject of soils suitable to fruit culture in France, says:

“A good soil for all fruit trees is composed of equal parts of sand, clay and lime.”

Baltet,† a popular French horticultural writer in discussing the subject of soils desirable for the apple remarks that,

“A wheat soil is the soil for the apple tree when grown as a standard.”

The importance of thorough drainage in connection with a good soil is emphasized by the same author in these words:

“The fruit of the apple is largest in the humid valleys, but best flavored on the hills and dry table-lands. The excess of humidity, as the need of free air, inducing canker and favoring the aphid.”

Nanot‡ in his treatise upon the cider apple thus speaks of the soil as bearing upon this fruit:

“The apple is not very particular as to the nature of the soil; it neither dislikes very clayey, very limy nor very sandy soils—but the best flavored and longest keeping fruits come from trees grown on clay-loam.”

Dr. L. H. Bailey,§ speaking of apple growing in the eastern United States, says:

\*Cours Pratique D'Arboriculture Fruitiere, 1897.

†Traite de la Culture Fruitiere, 1900.

‡Le Culture du Pomme a Cidre, 1895.

§Field Notes on Apple Culture 1893.

"As a rule, rather light or loamy soils, with deep and porous subsoils, are best adapted to apple growing. Natural drainage is imperative. Apple trees are impatient of wet feet."

At a meeting of the Oregon State Horticultural Society, held in Newberg in 1901, E. L. Smith made the following statements while speaking briefly of the apple:

"Apples grown on sandy soil will weigh much less per bushel than those grown on clay or clayish soils, other conditions being equal. Apples to be long keepers must be grown on soil having some clay."

In reply to a question relative to this point Col. G. B. Brackett, the pomologist of the U. S. D. A., writes (1904): "I know of no experiments along this line, but I am inclined to think that apples grown upon clay loam, other conditions being equal, would be somewhat heavier than those grown upon light sandy soil. I know that apples that are grown on heavy clay soil are apt to keep better than those grown upon light, sandy, porous soil. Of course keeping qualities depend somewhat upon latitude and also upon the elevation at which they are grown."

From somewhat extended general observations in the apple orchards of western Oregon during the past decade or more, I am convinced that much of our soil is admirably suited to the apple tree. The land upon which the Douglas Fir thrives when not too steep and rocky is usually well adapted to the culture of this fruit. The alluvial soils of the minor valleys when of a depth of eight to twelve feet or more produce thrifty, vigorous, long-lived trees. Some of the best old orchards in the state are located upon the gentle rolling lower hill lands of Yamhill county, while some of the cleanest and thriftiest of the younger generation orchards are to be found on the red hill lands of Polk and Marion counties. In the selection of a site on the higher elevations or even upon the lower hill lands, care must be exercised to the end that shallow soils may be avoided. Streaks, patches or larger areas of these lands are occasionally underlaid at a depth of a few feet by strata of impervious rock. Such sites are wholly unfit for orchards. Only a close and thoughtful inspection of hill land tracts will enable one to avoid setting trees on soil too shallow for the successful growth of long lived and fruitful trees.

Many excellent small orchards are to be found upon the river bottom lands in all parts of the Willamette Valley. While these latter sites are well suited to the growth of the apple tree it is prob-

able that better returns, horticulturally, may be obtained by the cultivation, upon such sites, of the smaller fruits and the choicer vegetables, especially when near-by markets are reasonably good. The latter crops cannot be grown upon the higher lands with the same degree of success as attend their culture upon the river-bottoms, while with the apple there is no apparent difference save, perhaps, in the degree of earliness with which the trees begin to bear profitable crops.

Generally speaking, orchards upon bottom lands will begin to bear from one to three years later than those upon the higher lands. There are well known instances in which trees planted upon river-bottom land as a result of an abundance of water have extended their vegetative period three to four years beyond the normal period for the same varieties when grown upon correspondingly good up-land sites. The economics of horticulture would appear to point toward the up-lands as affording the more promising sites for the apple orchard, since the value of such lands will not increase as fast as that of the more restricted tracts of suitable river-bottom soils.

During recent years a trouble that has caused much uneasiness among orchardists in timbered sections is the appearance of a fungus that causes the loss of many trees. Usually death results after the tree has reached bearing age. The foe attacks the tree under cover of the soil and no indications of its presence appears until it has such a firm hold upon the tree that its loss cannot be prevented. Timbered land is generally infested with several so-called toadstool fungi, which live upon the native tree growth. The forms that infest the native oak and possibly other trees, when deprived of their host plants through the clearing of the land, have the power of adapting themselves to other trees, as those of our common orchard fruits. These fungous plants appear to be able to live in the soil for some length of time after the host trees have been removed, even to the stump. If young trees are set out on such land they are liable to attack and if attacked there is, so far as present knowledge goes, no hope for the tree. It will live a few years, varying with the vigor of the fungus, but throughout this time it leads a precarious life making little if any returns to the cultivator.

Until the life history of these plants is better known and some preventive against their ravages has been discovered, new land should be avoided in the setting out of an orchard. Land that has

been under croppage less than five years, especially if previously timbered with oak should be deemed unfit, or at least distrusted, for orchard planting, except a previous examination showed the absence of these tree-inhabiting fungi upon the native timber.

**Drainage.**—Having settled the matter of soil the next important point is the drainage of the site. If possible, by all means select a site that is naturally well drained. It should be so drained that both an excess of water and cold air can readily escape to a lower level. While the apple very much dislikes a wet, soggy soil, it equally dislikes a site upon which cold air may stagnate. Cold air seeks the lowest levels. It frequently carries with it the frost waves that kill blossoms in the spring, or immature wood in the autumn. The force of this point is readily impressed upon the minds of all those who drive over the gently undulating sections of our valley after nightfall in the spring or early autumn months. Every hollow, especially if it be one without a pronounced outlet to lower levels, fills up with cold air and as one passes from the crest to the bottom and up the opposite side the change from the cold air of the bottom to the warmer strata above is as distinctly marked as the passing from a warm room to the open air on a frosty morning. Such places, hollows or pockets, into which cold air may settle and remain with little or no motion, are death traps not alone for the apple but for fruit trees in general. Though the soils in such places may be good and deep and water drainage of the best, yet is the site deficient in one of the most important elemental features of a site—air drainage. It is as imperative to keep still cold air away from the tree's head as it is to keep stagnant water away from its feet.

For the home orchard it may be impracticable to plant upon an ideal site, so far as water drainage is concerned. In such an event means for artificial drainage may be employed. Tiling easily ranks first for this purpose and if laid at a depth of four to five and one-half feet and twenty to forty feet apart corresponding with the distance apart of the rows, a measurably good system of drainage may be provided; but, it cannot be expected to take the place of natural drainage; for, it is quite impracticable to put the tile twelve or more feet deep to which depth it is desirable that the roots may have access without being subject to standing water.

## SITE, AS TO ASPECT.

"Aspect is sometimes important if the locality is liable to late frosts, a northern aspect is to be preferred as the trees will start later on such a site; if there is no danger from late frosts, as near large bodies of water, then a southern aspect is probably the best as it gives a higher color and finer flavored fruit."—*Bailey, Field Notes on Apple Culture, 1893.*

"The apple as cultivated in the open air is found in all exposures, yet those of the south are not expedient in cold or dry situations. A northern exposure for certain non-colored varieties gives a good product, notably with Canada Reinette. For the varieties which must be colored a sunny exposure, east, south or west is to be preferred."—*Passy, Arboriculture Fruitiere.*

"A gentle eastern or northeastern slope, as a rule is the most desirable for an apple orchard site, but this may vary with the section."—*Brackett.*

"Perhaps the very best aspect on the whole is a gentle slope to the southwest, because in such positions the trees when in blossom are somewhat protected from the bad effects of a morning sun after spring frosts. But, to remedy this more perfectly it is sometimes the practice to plant on the north side of hills, and this is an effectual way where early frosts are fatal, and where the season is long and warm enough to ripen the fruit in any exposure.

"Deep valleys with small streams of water are the worst situations for fruit trees, as the cold air settles in these valleys on calm frosty nights, and buds and blossoms are frequently destroyed. On the other hand the borders of large rivers or inland lakes are the most favorable, as the climate is rendered milder by large bodies of water. And then the slight fog rising from the water in the morning softens the rays of the sun, thus gradually dissolving the frost and preventing the damage that might otherwise occur from sudden thawing."—*Downing, Fruit Trees of America, 1838.*

"The warmer exposure of a southern slope may, and often does, favor the premature swelling of the buds and starting of the sap during mild, pleasant and bright early spring weather and vegetation is often seriously injured from this cause. Some planters, however, prefer a southern slope, thinking that the fullest exposure to the sun is essential; others select a northern aspect, in the hope that they may there avoid a too early excitation of vegetable life, and also that the heats of summer may be thus moderated. In my own opinion, the aspect is a matter of little consequence to the success of an orchard, though my predilections are in favor of an easterly exposure. The dangers of a southern aspect in summer, and the advantage of a northern slope, may, in a great degree, be obviated or obtained by judicious planting and pruning. In many parts of the country it is much more important to consider the exposure with reference to the prevailing winds of the region, and to select the site and aspect that will insure protection."—*Warder, American Pomology. 1867.* See Figs. 9a and 9b.

"The aspect of a fruit plantation exerts great influence upon the temperature of the soil and upon the force of the winds, and it therefore becomes an emphatic problem in the location of an orchard. There is a great diversity of opinion respecting the proper exposure for fruits, some growers contending that the northward slope is always the best, and others preferring a southward exposure. The truth is that no one exposure is best in all cases. Much de-

pends upon the location and the particular environment of the plantation. In locations adjoining bodies of water, the best slope is toward the water; in interior and frosty regions the best slope would be a north or west one if not so pronounced as to retard the autumn growth; if one desires early or high colored fruit, a warm, sunny exposure, to the southward or southeastward would be best."—*Bailey, Principles of Fruit Growing 1897.*

The diversity of geological formation and exposure in the apple-growing districts of Oregon render this topic of aspect a peculiarly interesting one. In some sections little attention aside from that given to heavy winds is necessary; in other sections the southern exposures, while desirable in many respects, are liable to have a thin soil underlaid by impervious rock; in still other sections the northern slopes, ideal in several features, have a soil rich, deep, full of humus, very moist, and thus prone to keep the tree growing too late in the season, and unduly retard the bursting of the buds in the spring; and in yet other sections the aspect is quite a matter of indifference, as in the Rogue and Grande Ronde river valleys proper. But, upon the bench lands of these sections, when more attention is given to the planting of orchards upon them, due attention to aspect will be of no little importance, and may be a deciding factor between success and failure with particular varieties. Especially in Rogue river valley would it appear that the later keeping varieties will demand the cooler northern exposures while the earlier varieties will do best upon the southern and eastern slopes.

In the Willamette valley, except in the districts tributary to the "gaps" in the coast mountains through which strong sea breezes issue, a southern aspect would seem generally desirable, providing it is not on a hillside with thin soil. The general low altitude of the valley, together with the average high humidity, makes an open or southern aspect desirable, since under such conditions fruit will tend to take on a higher color, an item of considerable importance in the commercial part of the crop. For early or mid-season varieties, however, and particularly those for home use, where one attaches more importance to fine specimens with clear skins, mellow flesh, and juicyness and where several days or a week's time in the date of ripening does not detract from the value of the product, a northern, western or sheltered aspect may be of first choice.

While high color is usually a feature of much commercial value in the apple, those who have formed a discriminating taste and grow fruit for their own use give it but passing notice. Thus it is

that the aspect most desirable for the commercial orchard may be of but secondary importance to the home orchardist.

As much of the autumn weather in western Oregon is of low light value, owing to the humidity, it is necessary to use considerable discretion when selecting a site for the growing of a commercial apple crop of the late keeping varieties, if one would have a high colored product one year with another. Judicious wood pruning and thinning of fruit will materially aid in enabling the fruit to get the most advantage from the light available.

---

### SELECTION OF TREES AND PLANTING.

The proper selection and planting of trees is an important part in the starting of an orchard.

**Tree Ideals Faulty.**—At the outset it may be said that our general ideas of the character of a first-class tree for planting are quite faulty. Each variety of fruit tree is more or less characteristic in its form of growth—"habit" as it is often termed, and it is fortunate that this is so, else what a monotonous appearance our orchard plantations would assume. To this fact, that each variety possesses a characteristic habit, we should give more than passing attention when selecting trees for a new orchard. For, in order to obtain first-class trees for planting, and, none other should be used, the orchardist must have a knowledge of the "points" of a good tree of the variety under consideration. Some trees while in the nursery assume an erect, strict habit with an even regular taper; others are kinky, irregular in the direction of ascent and having an uneven taper; and still others are short, thick and inclined to branch. Yet, notwithstanding this wide divergence of character, these trees may all be first-class. The character or habit of the variety must be fully studied and then trees possessing a strong inclination to follow the type habit should be selected. Oftentimes no better source of information on these points can be found than the nurseryman. It is his business to study trees. If the market sets, as it often does, in its misguided demand, a general uniform require-

ment for all trees, then the nurseryman is obliged to meet it, and the attempt is made to grow all varieties to a common type, or else discard those varieties that do not form a "pretty tree" of gross vigor regardless of important merit. When the planters learn that the trees of no two varieties have the same habit; in fact, that no two trees are alike, then may we expect to find nurserymen growing trees for their real merits and not for looks. It may be a real merit for a tree to be straight, slender and gradually tapering, or it may be a merit for it to be kinky, thick and with little taper. It all depends upon the variety. If you have not well defined ideas of the requirements of first-class trees then take counsel of a reliable local nurseryman of some years standing if such an one is to be found in your locality. If not, then deal with the established firm that is nearest you and one that would be connected naturally with your locality commercially. Under such circumstances it is generally safe to rely upon the dealer to send you first-class trees of the varieties ordered, for his business reputation rests upon the service he performs. In this age, when the market value of an object depends so largely upon looks; and, when our ideas or tastes in this direction are the result of faulty education, it is little wonder that our ideas of what looks good may be quite out of harmony with the real merits of the object under consideration.

**Age of Trees to Plant.**—Formerly, and even at present in some parts of the east, writers advise the prospective orchardist to purchase two-year-old, or even three-year-old trees for transplanting. But such advice is rarely if ever given in Oregon at the present time. Trees one year old are old enough. The younger a tree is when removed from the nursery the less of its active root system is left there. The least check is given to a plant when it can be transferred with root and stem systems intact. It is quite impracticable to remove a grafted or budded tree from the nursery without more or less injury to its root system. The younger the tree is, however, the less will be this injury, and consequently the less the check in its development as a result of removal. As the tree gets older larger wounds are made upon the roots as they are severed, and these wounds offer a place for attack by fungi, and often prove the source of much trouble to the future tree. When the young tree is removed from the nursery row relatively small roots are severed, the wounds,

if properly treated, soon heal and danger from fungous foes is reduced thereby to a minimum.

One-year-old apple trees often grow to be five feet, and more, tall, and five-eighths of an inch and more thick, on Oregon nursery land. It is rarely if ever that we find yearling apple trees less than three feet in height. There is no reason for asking for larger trees for transplanting.

**How to Plant.**—The trees selected, next comes the planting. If possible the roots should be carefully pruned immediately upon removal from the nursery row. This can only be done when the nursery is near by and the buyer can be on the ground at the time removal is being made. Trees should remain out of the soil only so long as is necessary to transfer them to the packing or heeling-in grounds. If one can get the trees at the nursery when lifting operations are in progress, he can remove all bruised and broken roots; make clean and smooth all ends where roots have been cut or broken off by the lifting implements; cover the trees with moist cloths, straw or hay and convey to the site for planting with as little delay as may be, at all times using great care not to expose the roots to drying winds or frosts while out of the ground. Upon getting the trees at place of planting, or the home, heal them in at once. If the trees have been transported by rail or boat see that all broken roots are removed and that fresh, clean, smooth cuts replace broken, bruised or roughly made end wounds before they are heeled-in.

**Heeling-In.**—Dig a trench on the north side of a building, in the shade of a grove or on the north slope of a hill. Make the north side quite steep; give the other side an easy slope; place the trees upon the sloping side, one, two or three deep, with their neatly trimmed roots close up to the steep side or face of the trench, then cover them over with fine soil to the depth of a few, or several inches, depending upon whether or not they are to endure freezing weather while heeled-in. This treatment first of all keeps the air from the roots, keeps them moist and enables the wounds to “callus” a process necessary to the perfect healing of the wounds and the early and vigorous production of new rootlets. When once the trees are rooted, pruned and heeled-in they are in the best condition for awaiting the time for the next step—planting.

### THE TIME TO PLANT.

In western Oregon fall planting is to be advised. The soil tiller has less rush-work at this time; the soil is usually in good workable condition; trees set out in the fall get fully settled into place before growing weather opens the following spring; and, usually a tree planted in the fall will have begun to put out little roots before the soil is in fit condition for work in the spring. These conditions all tend toward more favorable results from the work of transplanting.

The following quotation from a letter written by Karl J. Stalkland shows how the best orchardists of eastern Oregon view this matter:

"I know of only one objection to fall planting for this section and that is, that owing to heavy falls of snow some of the trees might be broken down. This occasionally occurs in this region, once in ten years perhaps. I consider fall planting advisable for this section because, if the land is not prepared and the trees set out in the fall our cold, wet springs will so delay the work, often to the extent of a month, that at least a third of the first season's growth will be lost. Except for accidents which might result in the death of a few trees, as through the failure to keep stock out of the newly set orchard, everything is to be gained by fall planting.

Good advice would be to recommend that the site be well prepared in the fall and that trees be planted at the earliest possible moment in the spring. Such a course, if followed, and the work done well and with dispatch would result nine times out of ten in satisfactory growth and the possibility of loss from freezing out, breakage from heavy snow, and injury by loose stock would be avoided. The chief difficulty with early spring planting is that it is quite impracticable to get the wet unmanageable soil in close contact with the roots of the newly set tree. The usual disposition among young planters is to wait till the spring planting fever tingles in the nerves. When this course is followed he invariably loses heavily on the first year's growth and this greatly affects the subsequent development of the tree."

**Distance to Plant.**—Austen, writing upon this topic over two hundred years ago, says:

"He should choose to prescribe the planting of these trees fourteen to sixteen yards asunder; for both trees and fruits have many great advantages if planted a good distance one from another. The sun refreshes every tree, the roots, body, and branches, with the blossoms and fruits; whereby the trees bring forth more fruit, and those fairer and better. When trees are planted at a large distance, much profit may be made of the ground under and about these trees by cultivating garden-stuff and small fruits. When trees have room to spread they will grow very large and great and the consequences of that will be, not only multitudes of fruits, but also long-lasting, and these two are no small advantages. Men are mistaken when they say, the more trees in an orchard the more fruit; for one or two large trees which have room to spread will often bear more fruits than six or ten of those that grow near together and crowd one another. Let men but observe some apple trees that grow a great distance from other trees and have room enough to spread both their roots and branches, and they shall see that one of those trees, having come to full growth, hath a larger head, more boughs and branches, than four, six or more of those which grow crowded near together, though of the same age."

Most of the local nurserymen advise planting the apple from thirty to forty feet apart. Though formerly, when the large old orchards were planted the usual distance was sixteen and one-half feet. In more recent years twenty to twenty-four feet has been the more common practice. Recently some of the larger growers like the Olwell brothers are taking the position that the trees in an apple orchard should be planted at least thirty-six feet apart each way on the heavier soils. For the first few years this seems like a useless waste of land. But if the soil is such as an apple orchard ought to be put upon, it will not be long before it will be apparent that to successfully operate the implements of tillage, spraying and harvesting, the trees, at thirty-six feet apart are close enough. Yet, notwithstanding this position of many of the larger orchardists, as well as the eastern authorities some of our most successful orchardists take exception to these distances. Karl Stackland, a most successful grower of the apple, says: "An area will yield about so much good fruit, and it matters little whether the trees are twenty or forty feet apart, so far as the ultimate yield is concerned."

The force of the positions taken upon this point depends primarily upon the character of the soil and varieties grown. Early apples and the varieties of rather dwarf stature do not need as much room as those of more vigorous habit, or later maturity. Then again, trees grown on a deep, heavy moist, soil, where the season of growth is long, need much more room than when grown upon light, shallow, dry soil, if it is permissible to put the apple upon such soils as the latter. But using these terms only in a comparative manner, which might be done when discussing the soils of the river bottom lands of the Willamette Valley and the foot hill lands of

portions of southern and eastern Oregon where some most excellent apples are grown, the position is still one that holds good in all sections equally well, for not all apples of western Oregon are grown on bottom lands nor are all apples grown in southern Oregon and eastern Oregon grown on bench lands.

Generally speaking the bottom lands of any section are deeper and moister than the hills or table lands of the same section, but they are not always heavier as is particularly exemplified along the narrower river valleys where the so-called "bars" are nearly always composed of light drift or sedimentary soils. However, the moisture retaining power of these soils is equal to or greater than that of the more clayey upland soils. The presence of moisture is the significant factor. From the evidence that can be adduced from the apple growing sections of the state it is very plain that trees of the same variety will often make twice the growth in some localities that they do in others, though the size and appearance of the fruit may be identical, with this difference, that the fruit on the dwarfier trees is earlier and consequently higher colored. Trees of Northern Spy and Baldwin are often found upon the lower or heavier soils of the Willamette Valley that never yield a fruit with highly colored cheeks, except in very unusual, bright, warm autumns. In fact, if it were not for these unusual seasons one would be tempted to question the tittle of the variety. And yet, there are trees of these varieties grown on the nearby hills which always produce fruit of high color, thus showing that the trees on the heavier soil cannot mature their fruit without a longer season, and this, due in a large part, to the fact that the tree devotes more time to vegetative functioning. Other conditions being equal dwarf growing trees, shortage in water supply, lightness of soil, and closeness of trees tend to induce early fruitfulness and maturity. But, in the presence of ample water and deep, fertile soil, trees may grow so vigorously as to cause branches to interlap thus rendering the tops a matted, bushy mass of fruitless wood, much of which must be removed before the trees begin to bear, and in many instances some of the trees themselves must be taken out before space sufficient for ripening a good crop of well colored fruit can be had. Such conditions cause much loss in both time and labor, and the trees thus grown yield an inferior product, all of which may be avoided by planting the trees at such a distance as will allow ample space for full growth and the formation of an open head with free access to light and air.

For standards this would be not less than thirty-six feet on good soil and forty feet would probably be better. On lighter or shallower soils the distance apart might be reduced to thirty or thirty-two feet.

**Double Planting.**—In order to bring all of the soil of the orchard into early service some of our best orchardists, especially in eastern Oregon, recommend the planting of two or more types of trees at the time of setting out the orchard, for example: If the orchard is to be composed of standard varieties, set at forty feet apart, half way between the trees each way should be set trees of some early bearing varieties, as plums, cherries, summer and autumn apples and early pears.

As the standard trees begin to bear these "fillers" as they are commonly termed, may be removed. The advantages claimed for this mode of planting is that the standards are protected by the fillers, which come to maturity earlier, and a crop is produced from the soil thus helping to pay the expenses of tillage for the period during which the standards are growing wood. Others of our leading orchardists contend that better results follow the growing of herbaceous crops as potatoes, beets, tomatoes and even corn. The tendency of most people to leave trees, when planted as fillers, until they encroach upon the space and food supply of the regular plantation leads one to accept the latter view as being the better for the average planter to follow. There is a greater probability that annual crops would be discontinued before their culture would in any way detract from the care and food supply required by the permanent plantation.

Some of the thriftiest, cleanest, best-cared-for small young orchards in this state are to be found at May Park, a suburb of La Grande. Figs. 7a, 7b, 8a and 8b show the character of the secondary crops grown in this section—corn, tomatoes, potatoes, melons, beets, carrots, strawberries and others of the like. There are no cases of double planting with these later orchards, though some of the earlier plantations at a nearby orchard section were put out upon this plan. In this district thirty feet is considered ample space for an apple tree. As grown here the tree is headed low (See Fig. 15), branches are shortened in; the growing season is one of normal length, or even a little short, and the resting period somewhat severe; hence the vegetative vigor of the tree is some-

what reduced, and thus the trees of the varieties grown find quite space enough in thirty feet.

**Plan of Planting.**—There are two general styles of orchard plantings: the hexagonal and the square. Fig. 12 represents a plat planted on the hexagonal plan. The rows are twenty-eight and

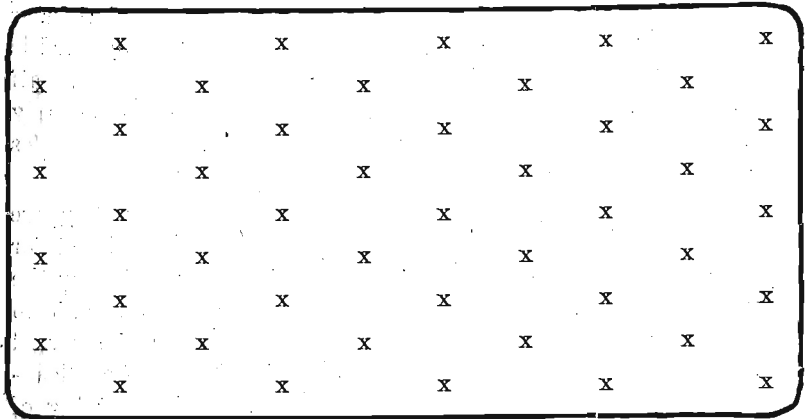


Fig. 12. 52 trees, 33 feet apart.

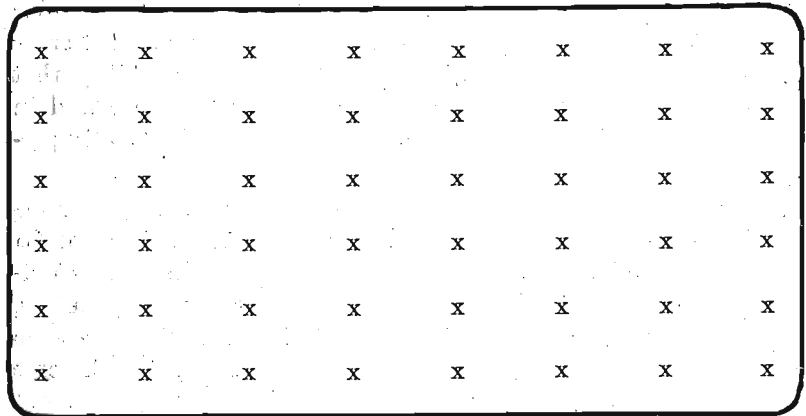


Fig. 13. 49 trees, 32 feet apart.

one-half feet apart three ways, while the trees are thirty-three feet apart. Fig. 13 represents a plat planted on the square plan. The rows are thirty-two feet apart at right angles. Even at the closer

distance in this latter plan there are less trees to the acre. With rows farther apart there would be about the same relative difference between the numbers of trees per acre on the separate plans.

In the former style each tree is equally distant from the six adjacent trees surrounding it, or, in other words, all adjacent trees are equally distant; while in the latter style, each tree is equally distant from only four adjacent trees. Thus, it will be seen that by adapting the hexagonal plan the land space is more economically used; the trees are more evenly distributed over the land.

To lay out a piece of land on the square plan it is necessary to establish two base lines at right angles, which may be done by sighting along the long and short arms of an ordinary carpenter's square, set upon three stakes driven at the corner of the proposed plantation, and setting two rows of stakes in lines continued from the arms. Put the stakes as far apart as the rows are to be and when the stakes have been set, in lines at right angle to each other, to the limit of the piece of land to be planted, move the square to the corner diagonally opposite the first used and run lines of stakes along the other two sides of the piece. Then by using a few long stakes two men can "line-in" the stakes for the body of the plantation. The outside rows of trees ought to be at least one rod inside of the fence line. If carefully done this sight staking is as good as a surveyor's work for orchard purposes.

If the plan adopted is the hexagonal, then a somewhat more different course is to be followed in the first part. Establish one base line for the first row of trees. Let this row be from one rod to twenty feet from the fence line. See Figs. 10a-10b. Firmly drive small one inch square stakes where each tree of this row is to be set. Procure a wire, No. 10 or 12 is about right weight, make a fixed loop in both ends so that the distance between the extreme ends of the loops is one inch more than the distance at which the trees are to be planted. Then let A put one loop over stake one; let B put a stake through the other loop, step off toward the center of the field; when the wire is taut, he shall describe a short arc in the earth with the point of the stake. Let A then step to stake two, row one, over which he places the the loop in his end of the wire; when the wire is again drawn taut another short arc is made. Where the two arcs intercept a stake should be driven for the first tree in row two. While A remains at stake two, row one, B passes to a point at which he estimates the next stake for row two should

be placed, another short arc is described, and A passes to stake three, row one. A second intercepting arc is made and B places stake two of row two and so on till the row is complete. From this point other stakes may be sighted in as the two base rows will afford a good foundation. If the site is rolling the stakes of these first two rows ought to be four to six feet long.

After the plat is well staked it is ready for planting and herein probably lies the most difficult part for the beginner, as he too often finds it impracticable to get the trees planted in as good lines as the stakes were. A little device for keeping the tree exactly in the place occupied by the stake is illustrated in Fig. 14. When about

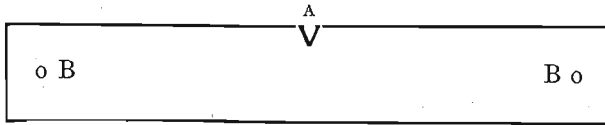


Fig. 14

to plant a tree place the notch A over the stake which has been set in place for a tree, then drive a stake through each of the holes B B, in this way the guide is fastened in such position that the notch is over the spot in which a tree is to be set. Now remove the guide leaving the three stakes in position. Pull out the center stake, dig the hole for the tree, place the guide in position with holes B B over the two outside stakes; put the tree in position so that it occupies the notch A. Cover the roots with earth, firmly pressing it with the feet. When the hole is filled, and the tree sets firmly, remove the guide, pull up the two end stakes and repeat with next tree. If the work is carefully done the trees should line up as well as the stakes did. Trees having irregular trunks, must be so set that the general line of growth will be in position. If there is a likelihood of strong wind prevailing from a definite quarter during the first few years growth of the trees they should be so planted as to lean firmly in the direction of the wind.

The trees should be so set that when the soil about them fully

settles they will still be in the ground as deeply, or better, two or three inches deeper than before removal from the nursery.

The hole into which the young tree is transplanted should be made large enough so that all roots may assume a fully extended and spreading position. No roots should be placed in a curled or twisted position. The center of the hole should be higher than the margin. This will allow the roots to assume a natural position, slightly downward and outward. The earth that is placed immediately in contact with the roots should be finely pulverized and pressed down firmly. For this purpose the feet may be effectively used, care being exercised that no injury is done the roots by tramping directly upon them. When the hole is about half filled no further pressure is needed, and the soil may be thrown in loosely, finishing by heaping it up about the trunk five or six inches above the general surface.

In sections where more or less frost accompanies the winter season fall-planted trees may be rendered good service by the addition of a coarse mulch to the surface of the soil, but under no conditions allow the mulch to surround the trees closely, otherwise rodents may infest it and "bark" the tree. If it is spread upon the ground and then a small mound of earth, as before stated, surrounds the tree, thus preventing the mulch material from coming in contact with it, damage from the small gnawing animals may be fully prevented.

## LIST OF BULLETINS

*(In print) published by the Oregon Agricultural Experiment Station to July, 1904.*

Circular No. 1—Dairying in Oregon .....	Shaw, French and Kent
No. 6, 1890—Chemistry, Zoology .....	Washburn
No. 7, 1890—Small Fruits and Vegetables .....	Coote
No. 8, 1891—Varieties of Wheat and Flax .....	French
No. 10, 1891—Entomology .....	Washburn
No. 28, 1894—Pig Feeding, continued .....	French
No. 29, 1894—Horticulture, Pruning, etc. ....	Coote
No. 30, 1894—Potatoes and Roots, continued ..	French
No. 32, 1894—Five Farmers' Foes .....	Craig
No. 33, 1894—Tent Caterpillar .....	Washburn
No. 34, 1895—Fruits and Vegetables .....	Coote
No. 35, 1895—Pig Feeding, continued .....	French
No. 36, 1895—Composition and Use of Fertilizers ..	Shaw
No. 37, 1895—Experiments in Cattle Feeding ..	French
No. 38, 1895—Fruit Pests .....	Washburn
No. 39, 1895—Grasses, Chemistry .....	Shaw
No. 40, 1896—Prunes, Apples and Pears .....	Hedrick
No. 42, 1896—Feeding Sheaf Wheat .....	French
No. 43, 1897—Flax Culture .....	French
No. 44, 1897—Review of Oregon Sugar Beets .....	Shaw
No. 47, 1897—Cheat and Clover .....	Shaw and French
No. 50, 1898—The Fertility of Oregon Soils .....	Shaw
No. 51, 1898—Marketing Fruit .....	Craig
No. 52, 1898—Nut Culture .....	Coote
No. 53, 1898—Sugar Beets .....	Shaw
No. 54, 1898—Flax, Hemp, Dairy, etc. ....	French and Kent
No. 55, 1898—Chemistry of Cherries .....	Shaw
No. 57, 1899—Brown Rot .....	Cordley
No. 58, 1899—Rose Culture in Oregon .....	Coote
No. 59, 1899—Sugar Beet Experiments of 1898 ..	Shaw
No. 60, 1900—Apple Tree Anthracnose .....	Cordley
No. 61, 1900—The Oregon Prune .....	Shaw
No. 62, 1900—Miscellaneous Investigations .....	Shaw
No. 63, 1900—Prevention of Smut on Oats—Preliminary Bulletin .....	Pernot
No. 64, 1901—Investigation of Diseases in Poultry ..	Pernot
Circular Bulletin concerning Acid Soils in Oregon—1900 .....	Knisely
No. 65, 1901—Creameries and Cheese Factories of Western Oregon .....	Kent
No. 66, 1901—The Grape in Oregon .....	Lake
No. 68, 1902—Birds of Oregon .....	Woodcock
No. 70, 1902—Testing Milk and Cream .....	Kent
No. 71, 1902—Stagnant Water Germs in Milk .....	Pernot
No. 74, 1903—The Cultivation of Vegetables and Notes on Varieties .....	Coote
No. 75, 1903—Insecticides and Fungicides .....	Cordley
No. 76, 1903—Leguminous Forage Plants .....	Withycombe
No. 77, 1903—Continuation of Bulletin No. 74 on Onions, Strawberries, Vegetables .....	Coote
No. 78, 1904—Canning Cheese .....	Pernot
No. 79, 1904—Plant-Food and Use of Fertilizers .....	Knisely
No. 80, 1904—Some Results in Swine Feeding .....	Withycombe

Copies will be sent to applicants so long as the supply lasts.

Address JAMES WITHYCOMBE,  
Director of Experiment Station, Corvallis, Oregon.



**Fig. 4**



Fig.15



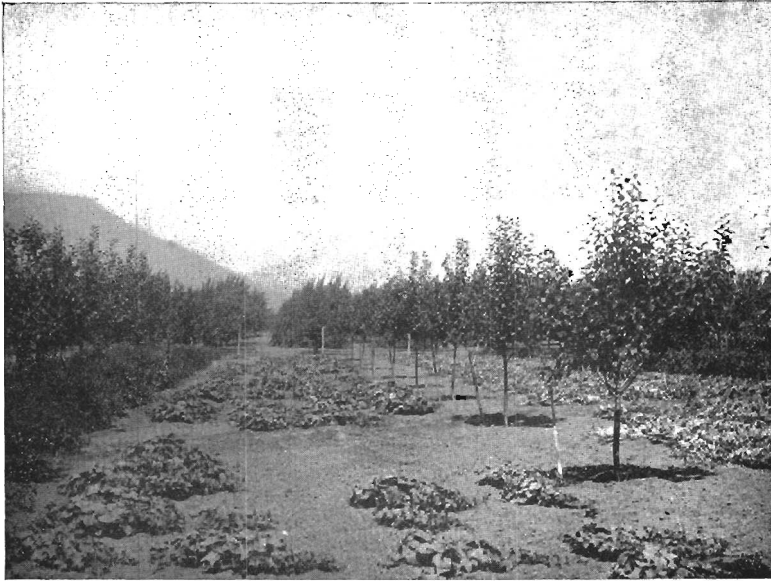
Fig. 6



**Fig. 7 a**



**Fig. 7 b**



**Fig. 8 a**



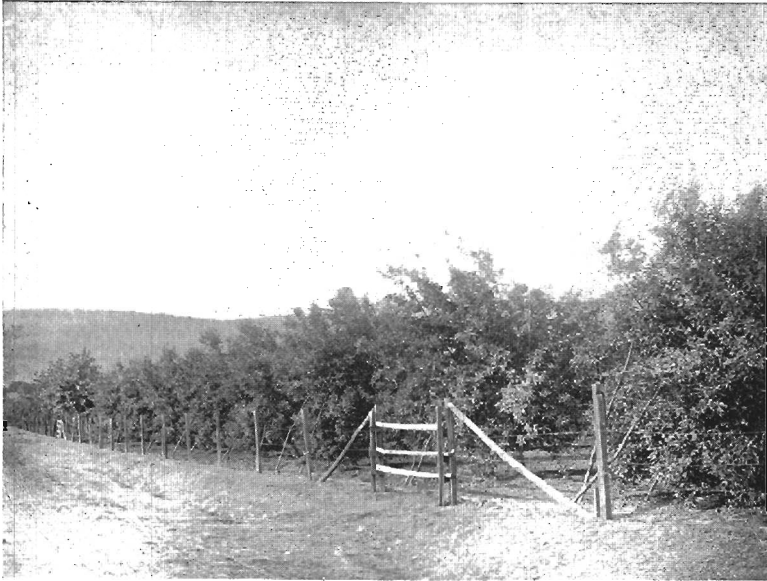
**Fig. 8jb**



**Fig. 9 a**



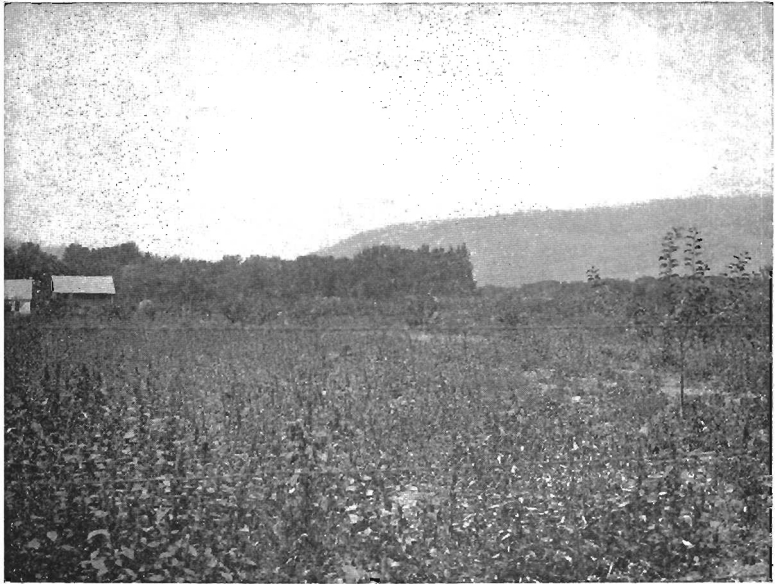
**Fig. 9 b**



**Fig. 10 a**



**Fig. 10 b**



**Fig. 11 a**



**Fig. 11 b**