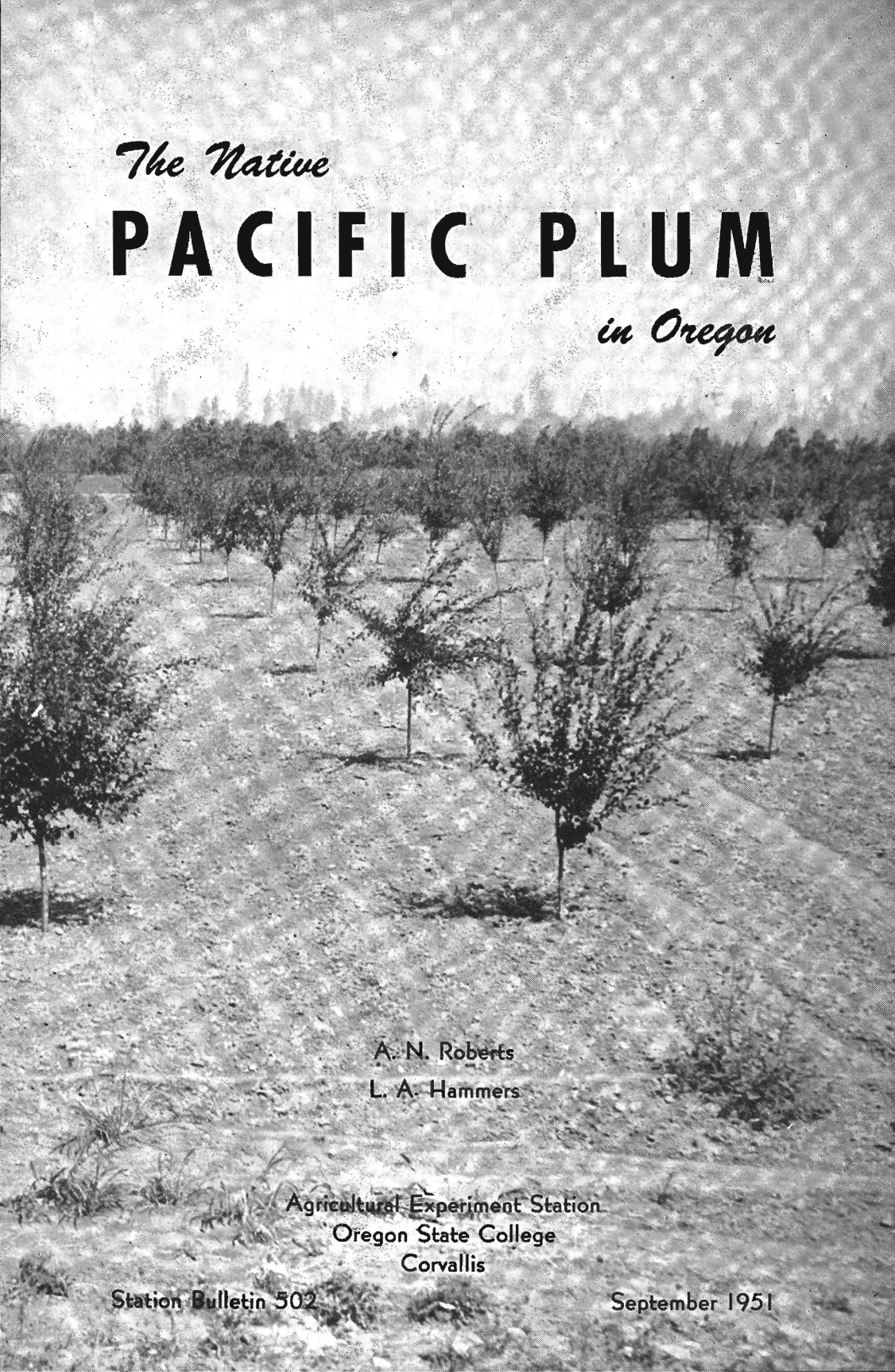

The Native PACIFIC PLUM *in Oregon*

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Corvallis

Station Bulletin 502 September 1951

Foreword

The research work being done on the native Pacific Coast plum is in keeping with the policy of the Experiment Station to aid and assist promising new Oregon enterprises. Such enterprises often become vital cogs in the economy of the state. Oregon's extensive horticultural industry offers many examples of ventures which started from small beginnings but which ultimately assumed major importance with proper technical assistance and guidance.

The fruit of the native Pacific Coast plum has long been prized because of its distinctive qualities. When made into jams, jellies, and preserves, it has a flavor all of its own. From the beginning, however, the domestication of this plum has been retarded because of certain obstacles. Fungus diseases often interfered with its normal setting of fruit. Information as to suitable strains and varieties has been lacking, the pollination status of the plum has not been known, and the trees often failed because they were propagated on unsuitable rootstocks. It is problems such as these that the Experiment Station is attempting to solve.

This bulletin is essentially a progress report on the investigations to date.

F. E. Price

Dean and Director

Cover photo—An experimental planting of *Prunus subcordata* at the Experiment Station's horticulture farm near Corvallis. This planting, the youngest of three, was established for special rootstock studies.

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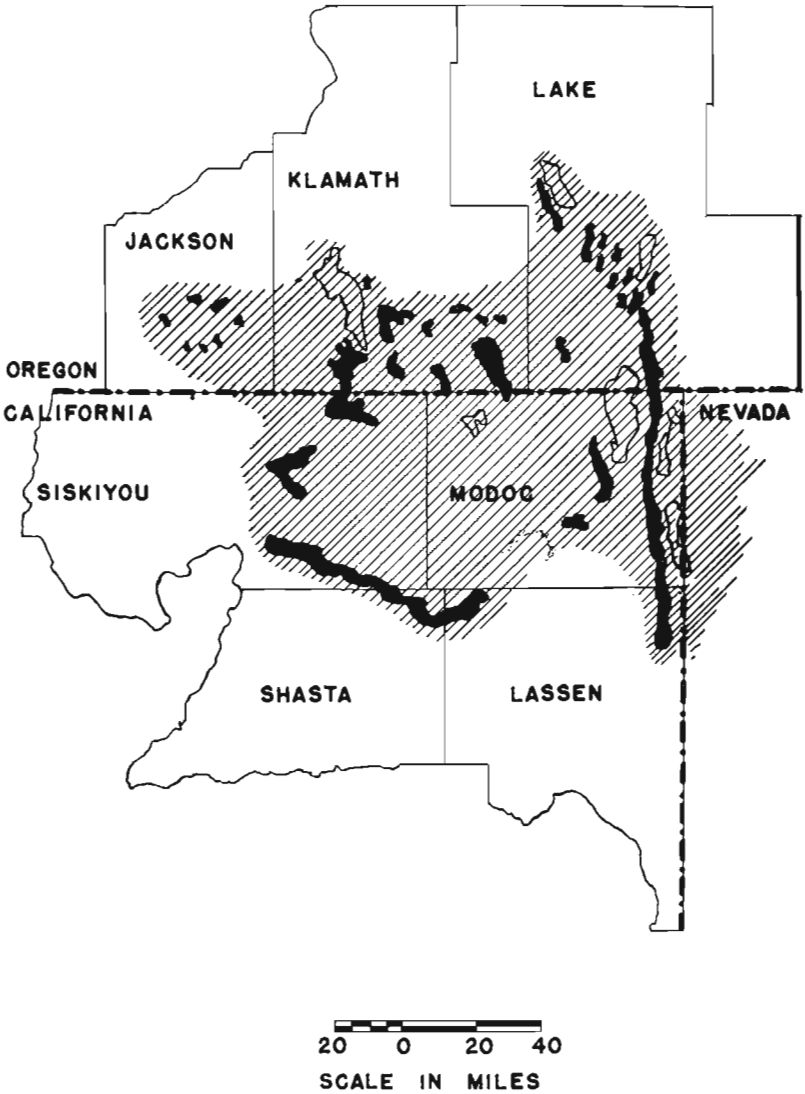


Figure 1. *Prunus subcordata* is found growing wild in a limited area east of the Coast Range from southern Oregon to central California. The areas of greatest abudance of wild thickets are shown as black.

The Native PACIFIC PLUM *in Oregon*

A. N. Roberts and L. A. Hammers
Department of Horticulture

THE Pacific or Western plum (*Prunus subcordata,* Bentham) is a native species found growing wild in a relatively limited region east of the Coast Range from southern Oregon to central California. It occurs in greatest abundance in Lake and Klamath counties in Oregon and in Modoc and Sierra counties in California. The wild plum thickets are a familiar sight in the vicinity of both Goose and Summer lakes in Lake County and around the numerous dry lake beds and reservoirs of southern Klamath County. While the greatest concentration of the native thickets in California seems to be in the general vicinity of Mount Shasta, the plum is found in more or less abundance east and south of the Nevada line, especially in the foothills of the Sierra Nevadas. It has been reported as far south as Yosemite Valley.

An attempt has been made in Figure 1 to show the region in which the plum is found and in particular the areas of greatest concentration. Although a general survey of the region has been made by the writers, more information is necessary before a complete distributional map can be made. This is true particularly of the areas in California. The map as presented is based on observations made in the field and on information supplied by county agricultural agents, foresters, ranchers, and others familiar with the region.

Figure 2. Wild plum thickets are a familiar sight in the vicinity of Summer Lake in Lake County. This is a typical wild plum thicket near an intermittent stream furnishing water for the thicket in the spring.

The plum usually forms thickets of small to large shrubby trees along streams in canyons, on hillsides, or in the open areas of pine forests. In other cases the thickets are found on ridges which are thought to be the shore lines of prehistoric lakes. There is a general similarity in the sites on which the plum thrives and spreads throughout the region, so much so that one can almost predict the location of the thickets.

The largest trees are found in those thickets growing on the deeper, sandy-loam soils in the canyons where water is ample, and in the richer bottom lands adjoining the old lake beds. The hardiness of the species and its ability to adapt itself to adverse conditions is typified by the scrubby little thickets found growing out of rock slides at high elevations. An occasional thicket is found, however, where drought or exposure has all but killed out the stand.

The region in which the plum is native has an elevation of from 1,000 to 5,000 feet, although it has been observed growing in favorable locations in the mountains of the region at elevations as high as 6,000 feet. At these higher elevations the plums are less apt to bear abundant crops and are late in ripening.

Botanical Description

This plum was described originally from the upper valley of the Sacramento where it appears to have been collected first by Karl Theodore Hartweg in 1836 or 1837. The following description of the species is from Hedrick's "Plums of New York," 1911. (1)

1. Bentham Pl. Hartweg. 308 1848
2. Torrey Pac. R. Rpt. 4:82 1854
3. Brewer and Watson Bot. Calif. 1:167 1880 (in part)
4. Lemmon Pittonia 2:68 1890
5. Greene F. Francis 1:49 1891
6. Bailey Cornell Sta. Bul. 38:76 1892
7. Sargent Sil. N. Am. 4:31, 32, Pl. 154 1892

"Tree small, rarely attaining a height of twenty-five feet, sometimes a shrub ten or twelve feet high and often a bush but three or four feet in height; trunk medium in length with a diameter of 8 to 12 inches; bark gray-brown and deeply fissured; branches stout and spreading; branchlets glabrous or pubescent, bright red becoming darker red and finally a dark brown or gray; lenticels minute, whitish.

"Leaves round-ovate, subcordate or truncate, or sometimes cuneate at the base; margins either sharply or obtusely serrate, sometimes doubly serrate; young leaves pubescent but at maturity nearly

glabrous, somewhat coriaceous, dark green on the upper and pale green on the lower surface, with very conspicuous midribs and veins; stipules acute—lanceolate, caducous.

"Flowers white, fading to rose, about an inch across; appearing before the leaves; usually borne in threes often in pairs on short pubescent pedicles; calyx campanulate, with lobes pubescent on the outer and hairy on the inner surface; petals twice the length of the sepals, obovate, and contracted into short claws; filaments and ovary glabrous; style slender and funnel-shaped at the apex.

"Fruit ripens in late summer or early autumn; roundish or oblong, about one inch in length borne on a short, stout stem, dark red or purplish; flesh sub-acid, well flavored, clinging to the flattish or turgid stones which vary greatly in size, pointed at both ends, crested on the ventral edge and grooved on the others.

"*Prunus subcordata* Kelloggii, named in honor of Dr. Albert Kellogg Lemmon, an early explorer and settler in California, is distinguished from the species in being a somewhat taller and more slender plant. The branches and bark are of a characteristic ash-gray, so distinct in color from *Prunus subcordata* that this is often called the 'Gray-branch' plum. The leaves are orbicular or elliptical, not cordate, cuneate at the base and nearly glabrous. The fruit is bright yellow instead of red and larger than that of the species, being an inch or more in diameter with a more nearly free stone. This plum inhabits the region of Mount Shasta where it has been known since the time of the early gold diggers, attracting more attention as a food and promising more for the cultivator than *subcordata*. Botanists seem to have given this plum comparatively little attention and careful attention may give it specific rank. Locally, and now somewhat in the trade, it is known as the Sisson plum, after a Mr. Sisson, living near Mount Shasta, who has brought it to notice. At present, Kelloggii seems to be the branch of promise for the improvement of the wild plums of the Western Coast."

A plum fitting this description apparently is not known at the present time. Persons who knew the Sisson family do not recall a type of the wild plum having the above characteristics. A survey of the Mount Shasta region has failed to provide information concerning this variety, and it appears lost for the time being.

Another botanical variety, *Prunus Oregana* Greene, is described by Hedrick as follows: " . . . is from its description an interesting plum of which, however, it has been impossible to secure a glimpse even of herbarium material and of which we can, therefore, only publish Greene's description as follows:

" 'Evidently allied to *P. subcordata*, but leaves little more than

an inch long, subcoriaceous, pubescent on both faces, in outline oval or broadly elliptic, never subcordate, commonly acutish at both ends, serrulate; flowers unknown; fruits in pairs or threes, on pedicels one-half inch long or more, densely tomentose when very young, more thinly so, yet distinctly tomentulose when half grown.

" 'Known only from specimens collected on the Yanex Indian reservation in southeastern Oregon by Mrs. Austin, in 1893; and a most remarkable species, as connecting true *Prunus* with *Amygdalus*. But that it is a plum and not an almond is evident'."

Hedrick continues, " . . . without any firsthand knowledge of this species it is thought best to consider it only under the allied species, *Prunus subcordata*."

A type thought to be the same as the one described by Greene is in the group of selections made by the Oregon Agricultural Experiment Station. This type is indeed an interesting form and in its native habitat is now referred to as the wild apricot or "coyote plum." A more complete study of some of the types may throw light on the relationship of this plum to other Prunus species. It is apparent that it is related more closely to the old world species of plums than it is to the other native American species. A more complete discussion of these various types is found in the section devoted to the seedling variations and clone selections.

Historical Note

As mentioned earlier, it was around the middle of the nineteenth century that this plum was observed by Hartweg in the interior of California. Indians, trappers, gold-seekers, and ranchers of the region where the plum is found have in turn esteemed the fruit. The Indians ate the fruit raw or cooked and often dried considerable quantities. The early settlers of the region regarded it as the most useful of all the wild fruits of the Coast and each had his own favorite thicket.

From early times, various attempts have been made to bring the species under cultivation. Mention has already been made of the work of Mr. Sisson in the vicinity of Mount Shasta. E. J. Wickson (2) in his "California Fruits," writes as follows regarding the culture of this plum by early settlers. "In 1856 there was, on the Middle Yuba River, not far from Forest City, in Sierra County, a wayside establishment known as 'Plum Valley Ranch,' so-called from the great quantity of wild plums growing on and about the place. The plum by cultivation gave a more vigorous growth and larger fruit. Transplanted from the mountains into the valley they are found to

ripen earlier. Transplanted from the mountains to a farm near the coast, in Del Norte County, they did not thrive. One variety, moved from the hills near Petaluma in 1858, was grown as an orchard tree for fifteen years and improved both in growth and quality of fruit by cultivation. . . . Recently excellent results have been reported from the domestication of the native plum in Nevada County, and fruit shown at the State Fair of 1888 gave assurance that by cultivation and by selecting seedlings valuable varieties can be obtained. It is stated that in Sierra County the wild plum is the only plum which finds a market at good prices, and that cultivated gages, blue, and egg plums scarcely pay for gathering. The wild plum makes delicious preserves."

Luther Burbank used this species to some extent in his plum hybridizing work and his records show that three varieties introduced were derived at least in part from this species. These varieties were Nixie (*subcordata* seedling), Glow (supposedly containing *P. maritima, P. subcordata, P. nigra* and *P. Americana*) and Early Crimson, supposedly being a hybrid of *P. subcordata* and old world species. Burbank (1) wrote of this species as follows: "I have produced most magnificent plums, oval in form or round, sweet as honey or sweet as the French prune, greatly enlarged in size, tree improved in growth and enormously productive, the different varieties ripening through a long season. Most of these are light and dark red. Some of them, when cooked, are far superior to cranberries, having the exact delicious flavor so much liked in this fruit, and the same color.

"From the crosses of subcordata with the Americana, Nigra, Triflora and other species, some of the most beautiful and highest flavored fruits which I have ever seen have been produced. These vary in color from almost pure white to light yellow, transparent flesh color, pink, light crimson, scarlet, dark crimson and purple; in form round, egg shaped or elongated—oval; trees both upright and weeping, enormously productive, and in one or two cases the fruit, by hundreds of experts, has been pronounced the best plum in flavor of any in existence. Most of these selections are extremely productive."

It appears, however, that none of the hybrids produced by Luther Burbank are now in existence. Attempts to trace them have failed. That the fruit is capable of improvement by selection and hybridization hardly can be doubted. Its hardiness and late blossoming habit alone should be of value in developing varieties for regions where late spring frosts are a problem.

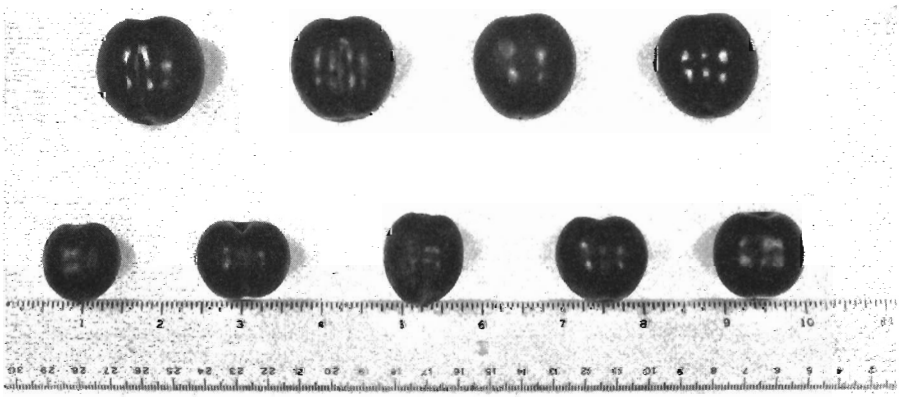
Aside from the exploratory work by Burbank, very little attention was given to the development and improvement of the species

until fairly recently. Several enterprising individuals in both Oregon and California have selected superior types from the wild for planting as orchard trees. Some of these plantings have served to demonstrate the possibilities of the plum both for commercial and home planting. In recent years, selection of desirable types for study and testing have been made by both the Oregon and California Agricultural Experiment Stations, with the cooperation of county agricultural agents, ranchers, foresters, etc. At least three nurseries are known to be propagating selected types of the plum.

Variability of the Species

Like the other native plum species, the Pacific plum is an exceedingly variable one. The range in tree size, vigor, and habit is considerable, as is the size, shape, color, and quality of the fruit. While some of this variation can be attributed to the effects of environment, most of it is undoubtedly due to heredity. Some of the thickets are composed of dwarf shrubs 3 to 4 feet in height and very dense. Others may be a group of trees 15 to 20 feet in height with trunks 8 to 10 inches in diameter and resembling well-grown orchard trees. The fruit will vary from small, dry-fleshed types the size of a sour cherry to large, fleshy fruits the size of small Italian prunes. Some of the fruits are so astringent as to be worthless, while others are sweet and free from astringency. Those familiar with the better types of the species believe a slight degree of astrin-

Figure 3. The fruit of this native American plum will vary from small, dry-fleshed types the size of a sour cherry to large, fleshy fruits the size of small Italian prunes. The flavor is quite distinctive.



gency is desirable since it imparts a distinctive flavor to the preserves and other culinary products made from the fruit.

An interesting observation in connection with this plum has been the degree of uniformity of the individuals in one thicket and, in some cases, in a given area, such as a canyon. In some instances several types will be found growing in close proximity but this is not usually the case. It appears that most of the thickets have developed from one or a few seedlings through the suckering of a wide-spreading, lateral root system. Roots have been traced for considerable distances from one plant to the next. This deep and widely spreading root system, no doubt, contributes to the ability of the plum to grow and thrive under adverse conditions at times. For this reason there is interest in propagating it on its own hardy root for orchard planting, but in this case the tendency toward suckering is a considerable handicap.

How the original thickets got started is somewhat of a mystery, since the writers in all their searching have yet to find a new, young seedling developing in the vicinity of the thickets. It appears that at one time conditions were more favorable for seed spread and germination than they are at present. The dry, cold winters of the region at present apparently are not conducive to a high percentage of seed germination and development. Rodents have been observed to store large quantities of the seed as food, which would also tend to reduce the chances of new plants being produced. This lack of seedling production may account for the uniformity of the plums in a given thicket. The part played by migratory water fowl in disseminating the seed of this species in the early history of this region would, no doubt, be significant.

Studies on Seedlings

A study of seedling variation with this plum is under way at the Oregon Agricultural Experiment Station. Seeds from various wild thickets are being grown to determine the degree of variation manifested by seeds from various sources. A study of both fruit and plant characters indicate that the seeds from some thickets are more variable than those from others. This probably accounts for the conflicting ideas that exist as to the trueness-to-type of trees grown from seed.

Unnamed Selections from Native Thickets

Since 1943, the Oregon Agricultural Experiment Station has made numerous selections from the wild thickets in both Lake and Klamath counties of Oregon. Although these selections have not

been tested thoroughly for orchard purposes, budwood of some of the more promising types has been released for propagation to those who wish to make plantings. The best of these eventually may be selected and given variety names, but for the present, the selections cannot be recommended fully. They are being suggested for trial with the thought that they are among the most promising so far found. Further trial and search for superior types may alter the picture in future years. Pending the time when more will be known regarding the performance of the different varieties, it probably is best for growers to set out a number of the more promising ones.

Among the more promising selections found, the following appear to be worthy of consideration. Sufficient fruit has been produced in the Oregon Agricultural Experiment Station plantings to give some idea as to their order of ripening, which in 1949 and 1950 extended over a month's time.

The descriptions of these selections are based on observations made in the native thickets and in the cultivated orchard at the Experiment Station. The time of bloom of the various selections is based on limited observations made from 1948-1950 at the Station, and while not an entirely reliable index of their order of bloom, does indicate that a range in time of bloom can be obtained.

Selections

Early

LAKE COUNTY II.

Trees of this selection on peach roots are upright-spreading in habit and are producing desirable orchard trees. It was selected for its heavy production of early, well-flavored fruit of good appearance without excessive astringency. The flowers open with the average for the group.

Fruit: round oblate (diameter ¾ inch), bright cherry red, darkening with advanced maturity, resembling a large Montmorency sour cherry; stem fairly short (average ½ inch), slender and separates readily from the fruit; flesh firm, amber colored, apricot-like; stone free, tendency to cling at edges, round and cherry-like (diameter ½ inch); quality—good; average astringency when fully ripe.

Early midseason

LAKE COUNTY IV:

Selected for its early, high-quality fruit of little astringency. It has not yet been tested sufficiently as an orchard tree for complete evaluation but, based on qualities observed in the native thicket, it should be one of the best.

LAKE COUNTY IX:

On peach roots, this selection is producing a vigorous, low-spreading, bush-like tree. The fruit is of large size and of the best quality. Those who desire a high-quality plum on a low-growing tree or shrub should give this selection a trial. It blossoms with the average.

Fruit: medium to large (average 1 inch diameter). Apricot shaped with bright, medium-dark red color; stem—short, thick, and separates readily from the fruit; flesh—bright amber color and typical of the species, firm and meaty; stone—free, medium sized, flattened and of apricot shape. Quality—of the best and worthy of trial.

Midseason

LAKE COUNTY VI:

This selection produces a desirable type orchard tree that is upright-spreading in habit, but not overly vigorous. It was selected for its heavy production of well-flavored, nonastringent fruits in the wild thicket. It blossoms with the average of the selections.

Fruit: of medium size (diameter $\frac{3}{4}$ to 1 inch), oval in shape; color—bright dark red over yellow, giving an orange appearance,

Figure 4. There are several commercial plantings of this wild plum in southern Oregon. Some selections are adapted to orchard planting and flower abundantly in the spring, producing a profusion of white flowers.

very prominent suture line; stem—of medium length ($\frac{3}{4}$ to 1 inch) and thickness; flesh—amber colored, firm, and meaty; stone—large, oval ($\frac{1}{2}$ by $\frac{3}{4}$ inch) and tendency to cling to flesh. Quality—better than average. Worthy of trial.

LAKE COUNTY X:

This plum was selected primarily for its light-colored, non-astringent fruit of mild flavor. On peach roots, five-year-old trees show excellent orchard habit and are the most vigorous trees in the planting. Although, possibly, not as productive as some of the other selections, it is worthy of trial. It is one of the earliest to bloom, being almost a week ahead of the latest.

Fruit: small to large in size; oval in shape; color—light blush of red on one side over light yellow; stem—medium length and thickness; flesh—typical, amber colored, firm, and meaty; stone—free, medium size, flattened; quality—good, free of astringency when ripe to the extent that it can be eaten out of hand; distinct flavor, one of the best.

Late

LAKE COUNTY I:

Trees of this selection on peach roots have developed desirable orchard form with dark green leaves. It was selected for its late, high quality fruit of good size and appearance.

Fruit: medium size; round in shape with a tendency for halves to be unequal; color—bright cherry red over a yellow undercolor; stem of average length and thickness; flesh—typical of species in color and texture; stone—free, medium size; quality—good, fairly free of astringency and with better than average flavor. Promising late variety.

LAKE COUNTY III:

This is one of the most outstanding selections of the species found to date. This late selection (ripens approximately 3 weeks after Lake II) on peach roots produces a desirable-type orchard tree with fruit that is of the best in appearance and quality. When fully ripe the fruit has good dessert quality with the distinctive flavor of the species. It is one of the latest to bloom.

Fruit: size—one of the largest (diameter $\frac{3}{4}$ to 1 inch); shape oblong cordate, prominent suture line; color—bright dark-red, mottled with carmine over yellow; stem—short, thick (average $\frac{1}{2}$ inch); flesh—amber colored, firm, and meaty as best of the species; stone—free, not excessively large (1 inch by $\frac{3}{4}$ inch), prune shaped; quality—moderate astringency, excellent flavor, one of the best. Recommended for trial.

Others

KLAMATH I

This plum is bright red in color, of good size and shape and of excellent flavor. Although not grown as an orchard tree sufficiently long to know its tree habit, its fruit quality as observed in the wild makes it worthy of trial.

The above are the best of selections observed to date. Many others are not described, since they are only of botanical interest and would have little orchard value. Other selections have been made in recent years, but sufficient time has not elapsed to evaluate completely their fruit and tree characters.

Numerous selections also have been made by the California Agricultural Experiment Station under the direction of Dr. L. H. Day and Mr. John Hayes, Farm Advisor of Modoc County. Descriptions of these selections, however, are not available at this time.

A. E. Rugg of Lakeview, Oregon, has made a number of outstanding selections from the wild and these can be seen growing as ten-year-old trees on peach and myrobalan roots at his ranch south of Lakeview near Goose Lake. One of the largest and sweetest types of this species seen by the writers is found in Mr. Rugg's orchard.

Suggestions for Orchard Culture

Varieties

Although numerous selections have been made by local observers in the plum region and by the Oregon Agricultural Experiment Station, these have not been tested sufficiently to determine the best for the several purposes for which they may be used. It is quite possible that those with the best dessert qualities will not make the best preserved product. No doubt there will be several of the selections or varieties that will be suitable for orchard production and with a range in ripening dates. The latter would help materially in spreading the harvesting period. A selection of varieties with different blossoming dates would also lessen the frost hazard. Certain of the varieties would, no doubt, escape the occasional late spring frosts.

The necessity of having two or more varieties to provide for cross-pollination is another argument in favor of growing more than one variety. This problem is discussed in detail under the section on pollination requirements.

Location, sites, and soils

Although the plum is found native in a relatively limited area, it seems reasonable to assume that it will be adapted to a much wider

range of conditions than that found in its native habitat. While it has not been grown in a variety of locations as yet, its performance under the mild, moist winter conditions at the Oregon Agricultural Experiment Station plantings at Corvallis as contrasted to the cold and relatively arid winter environment of the southeastern part of the state would seem to indicate a rather wide range of adaptability. Without a doubt, this plum is sufficiently winter hardy to withstand the most severe locations in Oregon, but the question of late spring frosts is another matter. Although it is better suited, with its late blossoming habit, than most of the cultivated plums to escape this hazard, it is sometimes damaged. How it compares with other plums, as well as fruits in general, in both bud and blossom hardiness has not been determined accurately. Limited observations indicate that it is more hardy than some.

In general, it appears that the climatic conditions found in those areas where the plum is native are more conducive to a heavy set of high-quality fruit of this species. It has been rather difficult in the Experiment Station planting at Corvallis to obtain satisfactory sets of fruit free from brown-rot and splitting of the pits, although the trees themselves have made exceptional growth. It would seem advisable, therefore, to limit the planting of orchards of this plum to those areas in the state where the matter of winter hardiness and late-blossoming habit are of prime importance.

In planting any fruit orchard in these areas, considerable attention should be given to selecting a site that will provide air drainage, as well as that of water. Frost pockets should be avoided. A sunny slope that is not too steep for cultivation, overlooking lower ground, will ordinarily provide a certain amount of protection from frost. Experience and observation on the part of the prospective grower of his own locality, however, is by far the most reliable method of selecting an orchard site to meet these requirements.

In locating the planting site in some areas, the question of deer damage may have to be considered. In some localities, at certain times of the year, this can be a serious problem. This is especially true with young trees. Some developments are being made in the matter of deer repellents, but if possible, it is better to avoid such a situation in the beginning. Other forms of wildlife may be a factor in some areas.

In many cases, the matter of accessibility of the orchard to workers and machinery for cultivation and harvesting operations will need to be considered. A source of labor supply for harvesting such a crop cannot be overlooked, assuming the planting is to be a commercial one.

Although the plum on its own roots apparently is adapted to rather adverse conditions as to soil and moisture, when it is propagated on peach roots for orchard planting the situation may be entirely different. Sufficient information on some of these points is not yet available. It would seem, however, with a crop of such value per acre, that a good orchard soil should be used.

A good orchard soil is one that has reasonably good depth, fertility, and drainage, and at the same time is fairly retentive of moisture. Deep, loamy soils will hold moisture sufficiently well to reduce or even eliminate the necessity for irrigation. Most of the plums and peaches prefer the lighter, sandy-loam soils, even with a little rock, to the heavy, poorly drained clay soils. Since this plum is being grown primarily on peach roots it would seem advisable to avoid those soils that are quite heavy and subject to occasional wet, seepage spots.

The amount and quality of the fruit produced will depend a great deal on the soil, and may mean the difference between success and failure in establishing a good orchard.

Propagation and rootstocks

Seed: The wild Pacific plum can be propagated from seed, but like our other common fruit plants, the seedlings will not necessarily resemble the parent plant from which the seed was taken. The seed is easy to germinate, if handled properly. Studies have shown that the pits germinate readily the first year if sown in the open ground during the fall months and allowed to stratify naturally. These field germination tests were conducted at the Corvallis Station, where fall and winter temperatures ranged from 18° to 65° F. during the two years the tests were conducted. Whether or not the seed can be germinated in this manner under eastern Oregon conditions is questionable. In that area, it would be advisable to cover the seed with a heavy mulch and keep the soil moist during the winter months. In the spring the seed beds could then be uncovered.

Controlled tests in refrigerated boxes showed that the seed germinated best if subjected to temperatures of approximately 40° F. for a three months' period. After that time the seed will germinate rapidly. The seed should be stored in moist sand during the period of stratification. If timed properly, the seed can be lined out in the spring after the period of storage and before the seedling starts to emerge from the seed. Prior to this storage treatment in the fall or winter the seed can be held dry following its removal from the fruit.

Table 1. GERMINATION OF *Prunus subcordata* SEED. SELECTIONS FALL SOWN IN NURSERY ROW.

Seed planted on October 19, 1943. Count made May 20, 1944.

Selection number	Seeds planted	Seeds germinating	Germination
			Per cent
I	32	13	40
IA	13	7	54
II	33	11	33
IIA	29	6	20
III	24	12	50
IV	22	8	36
VA	88	38	43
VB	96	49	51
Mixed seed	100	68	68
XI Type I	74	30	40
XI Type 2	4	1	25
XI Type 3	4	2	50
XII	27	4	14
Hampton selection	100	37	37
VII	8	5	63
VIII	162	13	8
IX	81	23	28
X	67	22	32
Bly Mountain selection	106	27	25
Totals and average	1,070	376	35

The percentage germination will vary a great deal and will depend on the source of the seed and the way it is handled. The percentage germination obtained from several seed sources used in tests at the Oregon Agricultural Experiment Station is shown in Table 1.

Vegetative propagation

In order to obtain trees true to a selected type, it is necessary to resort to vegetative methods of propagation rather than seeds. Attempts at propagating the Pacific plum from root and stem cuttings or by layerage have not proved sufficiently promising to warrant the use of these methods.

Since the desired selections can be increased readily by budding on a suitable rootstock, this seems the most practical method of producing trees for orchard planting. While considerable information is available on the suitability of various rootstocks for many plums, little attention has been given to a study of stocks suitable for this species. Based on observations made in the 6-year-old planting of these plums at the Oregon Agricultural Experiment Station Farm and in a 10-year-old commercial orchard in Lake County, it appears

Figure 5. *Prunus subcordata* sends up suckers from its roots and it is in this way that the thickets reproduce themselves in the wild state.

that the peach makes a satisfactory stock for most of the plum selections. It should be remembered, however, that it sometimes takes many years fully to evaluate a rootstock as to its compatability and longevity.

The myrobalan plum, commonly used as an understock for other species of plums, has been suggested as a stock by some observers. In one planting where myrobalan has been used there is a noticeable dwarfing of the trees and a tendency to sucker below the union, as compared with those on peach roots nearby. Both of the plantings were budded low on their respective stocks. The high degree of variation in myrobalan stocks complicates the question of its suitability as a stock for this plum. While certain myrobalan clones may be compatible with the plum, others may not. A study is now underway to determine, if possible, the most suitable stock for this plum under the conditions where it is to be grown. Numerous plum rootstocks are included in the tests, as well as peach rootstocks and seedlings of the wild plum itself. These rootstocks include *P. Americana,* myrobalan plum (*Prunus cerasifera* Ehrh.) and Marianna plum (*P. cerasifera* x *P. munsoniana*). The possibility of growing the plum on its own hardy, adaptable root should not be overlooked. However, the seedlings have not been handled as easily in the nursery row as have some of the more commonly used plum stocks and are difficult to transplant.

Until such time as more information is available on the suitability of these various stocks, the peach root is most reliable.

Pollination

Pollination studies made by the authors during the spring of 1948 in both the wild thickets and cultivated orchards of Lake County indicated that this plum is self-unfruitful and requires cross-pollination to assure a maximum set of fruit. It appears that the various selections or varieties are inter-fruitful and will effectively pollinize one another. These studies are being continued to determine more fully the pollination requirements of the various selections and their ability to set fruit under various climatic conditions.

The failure of the plums to set adequate crops of fruit at times in the wild thickets is not fully understood. That late spring frosts destroy the blossoms in some years is without a doubt a common cause. However, weather conditions at blossoming time may cause poor sets of fruit even though not accompanied by frost.

Unfavorable weather conditions may adversely affect the normal development of the flowers or the activity of the pollinating insects.

Figure 6. Seedlings of the western plum were planted at the Station farm to demonstate the variability of the species. These seedling plums show one alternate method of planting for commercial growing.

Cold, wet weather may prevent the normal shedding of the pollen or if pollination has taken place may interfere with subsequent fertilization. The activities of pollinating insects are either restricted or eliminated entirely during cold, wet weather. Strong winds also hamper their flight.

It is possible also for certain disease organisms to attack the flowers, particularly under certain climatic conditions, and thus cause a small set of fruit. Brown-rot blossom blight (*Sclerotinia cinerea*) is especially destructive to the blossoms under Willamette Valley conditions.

The age and nutritional condition of the tree also are factors in determining the amount of fruit a tree will set and mature. The plum trees ordinarily will start to produce blossoms the second or third year in the orchard, but seldom will set much fruit until the fourth year if they are making the desired amount of growth. Care must be taken to see that the young tree does not bear so heavily one year as to devitalize it to the point that it will not set a crop the following year.

Because of the many and varied factors that influence pollination and fruit set, it often is difficult to determine with accuracy the cause of low fruit yields. It is best to avoid conditions that may bring about such a condition.

Winter injury

The ability of this plum to survive severe winter conditions as an orchard tree will depend on several factors. The variety, maturity and condition of the plant at the time such conditions develop will determine to a considerable extent the injury that might result. The exposure of the trees will have a bearing on the amount of winter desiccation that may develop. These and other complex factors determine the relative winter hardiness of the trees. Differences between varieties as to winter hardiness have long been accepted. A well-grown tree, adequately supplied with stored food, in good health and not weakened by insects or by production of a late heavy crop, in general will be best able to survive winter conditions. Such a plant usually will develop sufficient maturity to be winter hardy. Winter injury due to desiccation occurs most commonly where the soil freezes deeply and where drying winds are frequent. It is thought that drying occurs even when the soil is not frozen because roots take up water slowly from cold soil. Under such conditions, water may be lost more rapidly than it is replaced and drying may proceed beyond the point where recovery is possible. The trees should go into the winter with ample moisture both in the soil and plant.

If in an area such as Klamath County with rather short summers the leaves are removed by insects or from other causes in late summer, all the wood above ground fails to become as resistant to winter injury as it would have become if the foliage had been retained. A heavy crop on a tree reduces considerably its resistance to cold during the first half of the winter. Trees on poorly drained, clay soils tend to be slow in acquiring hardiness and are the most apt to be killed by cold in early winter.

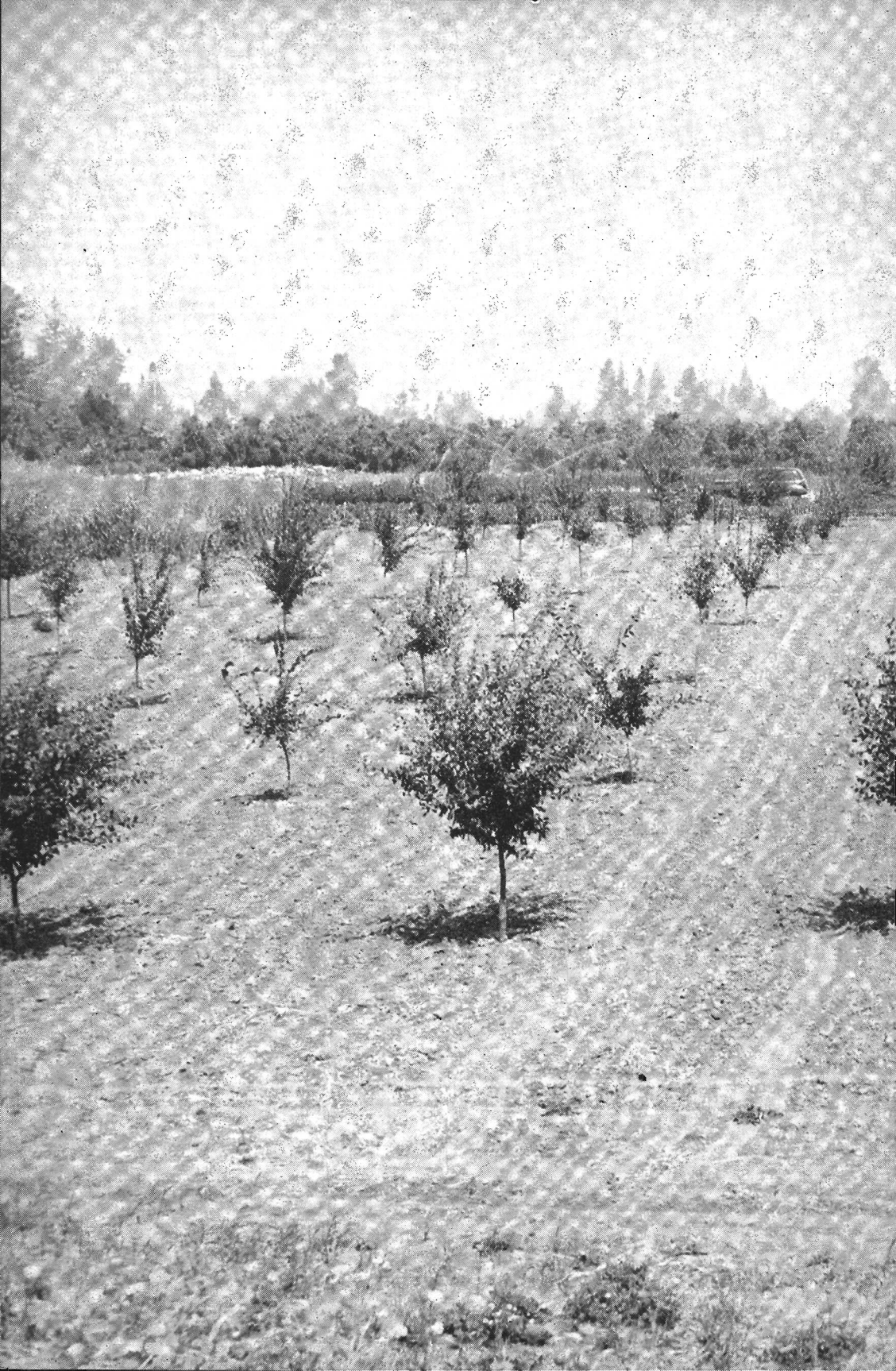
Uses

Although some of the nonastringent types of this plum are eaten fresh, they have gained their high esteem from the excellent preserve or sauce made from them. These plum preserves are well known among ranchers and sportsmen in southern and eastern Oregon, where they are used with meat dishes and in particular with wild game. Several enterprising individuals and concerns in the state are already marketing the product on a limited scale. The manner in which the product is accepted in those areas where the plum is known attests to its popularity.

Those who have made a study of the plum and its preserved product caution that too much cooking will result in a loss of flavor and bitterness. Mr. and Mrs. A. E. Rugg of Lakeview, Oregon, who have a commercial planting of these plums, are recognized authorities on the preparation of a very fine plum preserve. Their favorite recipe has been offered kindly for use here:

"After removing the pits, grind the wild plums with a coarse knife. To each 4 cups of plums add 5 cups of sugar. Mix well before putting on to cook, and stir often while cooking. After the fruit reaches a full rolling boil, cook about three minutes. Place in jars and seal. Use only firm plums."

References

(1) Hedrick, U. P., The Plums of New York, State of New York Department of Agriculture, Eighteenth Annual Report, Vol. 3, Part II. 1911.

(2) Wickson, E. J., California Fruits, 52, 1891.