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STOCKS FOR PLUMS  
U. P. HEDRICK



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## STOCKS FOR PLUMS

U. P. HEDRICK

### SUMMARY

Cultivated fruit trees are unions of "stock" and "cion." The chief consideration in choice of stock is ready production of plants. But stock and cion react on each other for better or worse, and the fruit grower as well as the propagator has much at stake in the stocks upon which his trees are grown.

In the adjustments of stock and cion to each other and to their surroundings there may be important reciprocal influences. These can be determined, if at all, only by experiments. Such experiments this Station is attempting to carry out for New York. So far, the work has been confined to four fruits; *viz.*, grapes, apples, cherries, and plums. This bulletin is a report of the work with plums.

Six stocks from 6 species with 15 varieties of plums budded on them are under test. The stocks and varieties are those in most common use in New York. The experimental plat is on the grounds of the Station at Geneva, New York. The treatment is that commonly given the plum in this State. The results presented cover ten seasons.

The six stocks under test are Americana, Marianna, Myrobalan, St. Julien, peach budded, and peach grafted. The varieties are Bradshaw, Grand Duke, Italian Prune, Lombard, Reine Claude, Shropshire, Drap d'Or, Abundance, Burbank, Chabot, Wayland, Forest Garden, Pottawattamie, Wild Goose, and De Soto.

The experiment throws no light on whether or not the adaptability of a fruit to a soil may be changed by the stock. It shows that the peach stock is least well adapted to endure a cold climate. There were no differences in the maturity of wood or crop. Color, quality, and size of fruit were not changed by the several stocks. More time is required to tell whether there is difference in longevity of varieties on the different stocks. There were marked differences in vigor and productiveness as gauged by diameters of trunks and by yield of fruit. These are summarized in the next paragraph.

The experiment shows that of the stocks now in general use in New York, as regards vigor and productiveness, Myrobalan is best for Bradshaw, Grand Duke, Italian Prune, Lombard, and Reine

Claude, the *Domestica* sorts; and for Shropshire and Drap d'Or, the *Insititia* varieties; that Abundance and Burbank grow about equally well on Myrobalan and peach; four of the native plums, Wild Goose, Pottawattamie, Forest Garden, and Wayland, can probably be best grown on Marianna, altho they make very satisfactory trees on Myrobalan; while De Soto, another native, but of a different species, grows best on roots of its own species, *P. americana*.

## INTRODUCTION

Cultivated fruit trees are nearly always unions of two plants. The consorting parts are familiarly known as "stock" and "cion." The cultivated fruit tree is a two-part plant because in no other way can varieties be propagated true to name. Thus, the question of stocks is of great importance to the propagator. Naturally the chief consideration in the choice of stocks to the propagator is ready production of salable plants. He chooses a stock that can be easily and cheaply grown, readily budded and grafted, and that is hardy, healthy, and grows rapidly in the nursery.

But it becomes more and more apparent that the fruit grower has much at stake in the stocks upon which his trees are grown. Nothing is now more certain than that stock and cion react upon each other for better or worse, and tho our knowledge of those reactions is far from complete, yet we do know that it is possible to control the growth and habit of varieties of the several fruits more or less by propagating them on different stocks.

A plant is a most delicate mechanism and is easily thrown out of gear. Soil, climate, care, pests—all of the conditions under which a plant grows—exercise a profound influence, as every cultivator knows. In the manifold adjustments of cion and stock to each other and to their surroundings there must be reciprocal influences. Thus, thru long experience, written accounts of which date back nearly three thousand years, even the citations to which would fill volumes, fruit growers pretty generally agree that there are several important ways in which the stock influences the cion. Chief of these are: The stock may modify the size of the cion. The adaptability of a species or a variety to a soil may be changed by the stock. The stock may help the cion to endure better an incompatable climate. Productiveness may be increased or decreased by the stock. The time of maturity of crop and wood may be changed by the stock



PLATE I.—*PRUNUS AMERICANA*.

The size, quality, or color of the fruit may be influenced by the stock. Some stocks shorten and others lengthen the life of the trees of which they are a part. The stock may change the susceptibility of the tree to insects or diseases.

These brief statements of some of the ways in which the stock may influence the cion serve to show the importance of stocks to the fruit grower. A consideration of these effects of the under-ground part of a fruit tree upon the tops makes plain many difficulties in selecting stocks for any fruit; for, it is apparent that the influences may or may not be desirable; that a stock may be the best for one purpose or place and not for another; that the cion, in its turn, may have a desirable or undesirable reciprocal influence on the stocks; and that the interactions of the several effects are complicated and confused by the modifications caused by soil, climate, and care. To add to the difficulties of this phase of fruit growing, a stock may behave quite differently when grown from seed or when grown from cuttings, and the united stock and cion may make a somewhat different plant when the union is made by budding from that made by grafting. Add to these difficulties the fact that there is much confusion in the identification of the several stocks, and that the sources of supply are not very reliable, and it becomes apparent that this problem of stocks is a very complicated one and one most difficult to solve.

It is not strange, therefore, that neither nurserymen nor fruit growers agree as to the best stocks for any one of the several fruits in which top and bottom are different individuals. Nor is it possible to agree when soil, climate, and use are widely different for any one fruit. The use of stocks, as of fertilizers, and as in orchard management, therefore, must be largely an individual or at most a regional question which must be settled by local experiments. Such experiments this Station is attempting to carry out for New York.

Work with stocks for fruits at this Station has been confined to four fruits; grapes, apples, cherries, and plums. Bulletin No. 355 gave the results of an experiment in which 19 varieties of grapes were grafted on 3 different stocks and compared with the same varieties on their own roots. Bulletin No. 406 gave the results of an experiment in which about a score of the leading apples grown in New York were set on three stocks in three widely separated orchards and

given the same care for ten years. The results of the experiment with stocks for cherries have not been reported. This bulletin is a report on the work with stocks for plums.

The foregoing paragraphs indicate that there are several very distinct problems—it is not putting it too strongly to say there are many distinct problems—to be worked out in ascertaining which are the best stocks for plums. This bulletin is concerned, in the main with but one of the many problems, the one which seems at present most important. Its aim is to answer the question, *What species are the best stocks for the several species of cultivated plums?* We must have an answer to this question before we can proceed with the refinements in this problem of the best stocks for plums.

#### COMPARISON OF STOCKS FOR PLUMS

As a part of the plan to discover the best stocks for fruits in New York, the work with stocks for plums was begun in the spring of 1912. The results herewith presented therefore cover ten seasons. Six stocks from 6 species and 15 varieties representing 7 species are under test. The stocks and the varieties are those in most common use in New York and in the United States. The experimental plat is on the grounds of the Station at Geneva, New York. The treatment is that commonly given the plum in this State.

*The stocks.*—The six stocks under test are Americana (*Prunus americana*), Marianna (*P. cerasifera* x *P. munsoniana*), Myrobalan (*P. cerasifera*), St. Julien (*P. insititia*), peach (*P. persica*) budded, and peach grafted. The Americana stocks were grown from pits of wild plums from the Mississippi Valley; the St. Juliens came from France from pits sown in that country; the Myrobalans from wild trees, pits of which were sown in France; the Marianna stocks were grown from cuttings; the two sets of peach stocks came from pits of wild plants obtained in North Carolina. The varieties in the experiment were budded on seedlings of the several stocks in the summer of 1910, with the exception of the grafted peaches; these were root-grafted in the spring of 1911. All of the trees in the experiment were set in the orchard in April, 1912.

#### DESCRIPTIONS OF STOCKS

The stocks used in the experiment are readily distinguishable from flower, fruit, leaf, or tree. Fortunately all are easily identifiable from the leaf for it is the leaf that nurserymen and fruit growers



PLATE II.—MARIANNA.



will see oftenest in the nursery row and on suckers about orchard plants. Descriptions of the gross characters of the whole tree must be given, however, for it is not only necessary to identify the stock but also to form a very clear idea of the plant from which the stock is grown.

#### AMERICANA STOCKS

##### (*P. americana*)

This stock is readily recognized at all stages of summer growth by its leaves. These are large, obovate or oval, acuminate at the apex, rounded at the base, thin and firm in texture; margins sharply serrate, often doubly serrate. The shape and teeth of the leaf, which are characteristic, are well shown in Plate I. The upper surface of the leaf is more or less roughened, light green; the lower one is glabrous or sometimes pubescent, coarsely veined. The petiole is slender, two-thirds of an inch long, usually glandless. The fruits are roundish, usually more than an inch in diameter, red or rarely yellow, dull, with a turgid free or clinging stone. The tree is often shrubby but may attain a height of thirty feet with spreading, crooked, pendulous branches which are more or less spiny.

*Prunus americana* is the predominating native plum. The tree is slow in growth but vigorous, self-assertive, hardy, healthy, and thrives in many soils. When grown on its own roots, the trees are crooked, with many thorny, zigzag branches making them among the unmanageables of the orchard. Several characters suggest their suitability for stocks. Chief of these is hardiness. This species is hardy wherever plums are grown in the United States, and it is as a hardy stock that it has and will be used if its use is to continue. A second character that commends it is that it is a good clean stock as regards diseases. The fungi that trouble plum stocks in the nursery trouble this one but little. Then again it is easily budded and a remarkable characteristic is that nearly all varieties of the several cultivated species take well on seedling Americanas.

More than two hundred varieties of *P. americana* have been named, and whether or not some sorts are better than others for stocks has not been determined. There are also several botanical varieties and several closely related species which might be tried for stocks in regions where hardiness is a prime requisite.

In the nursery, budding plants of Americana are raised only from the pits. Cuttings do not strike and layers appear not to have been tried. Two-year-olds on this stock are usually strong, vigorous trees but hardly as large, as desirable, nor do as great a proportion of buds of other species take on this stock as on several others. The Americana is much used by nurserymen when trees for exceptionally cold climates are desired. The trees in the wild and under cultivation withstand a temperature of 40 degrees below zero. A fault of this stock is that the trees sucker badly.

#### MARIANNA STOCKS

(*P. cerasifera* x *P. munsoniana*)

This stock is easily identified thru its leaves and fruits which are shown very well in Plate II. The leaves are elongated-oval, about 1 inch wide and 2½ inches long, thin, apex and base acute; margin very finely serrate, with small black or amber glands; upper surface smooth, glabrous, with a shallow groove in the midrib; lower surface pale green, lightly pubescent along the midrib and larger veins; petiole slender, three-quarters of an inch long, tinged with red, with one to three very small globose, greenish-brown glands. The fruits are round-oval, about an inch in diameter, bright red overspread with thin bloom, with a rather small, clinging stone. The trees are large, very vigorous, with a broad spreading top, and are remarkably free from insect and fungous troubles in both the nursery and orchard.

Marianna is a cross between *P. cerasifera* and *P. munsoniana* which originated in Marianna, Texas, in the seventies of the last century. Its parents are probably De Caradeuc, a Cerasifera, and Wild Goose, a Munsoniana. It has been used as a stock because of four outstanding characters: It grows very readily from cuttings; trees grown on this stock sprout little or not at all; it unites readily with nearly all plums, and even peaches and apricots are easily grown on Marianna roots; and nursery trees on Marianna make a vigorous, healthy growth. Unfortunately the resulting tree on this stock is not as long-lived, vigorous, and productive as is desirable. In the North the stocks do not grow from cuttings quite readily enough to make Marianna satisfactory, altho there is no trouble on this score in the South or on the Pacific Slope.

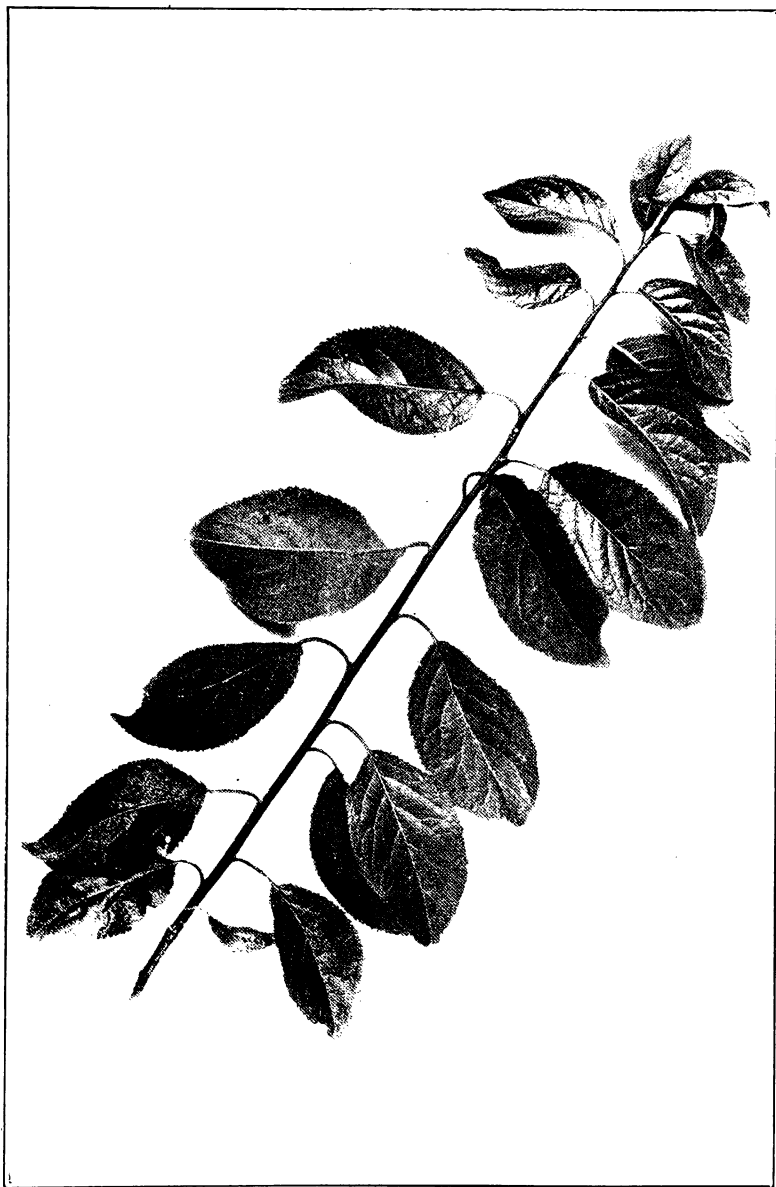


PLATE III.—MYROBALAN.

## MYROBALAN STOCKS

*(P. cerasifera)*

Myrobalan is held in high esteem as a stock for plums wherever this fruit is much grown in Europe or America. Few fruit growers know the plant, however, as the trees are seldom seen and the stocks almost never sprout. The leaf is very distinct so that in the nursery or from the occasional sprout in the orchard, the plant is easily identified. Plate III shows leaf and fruit very well, and with the following brief description will enable any one to identify this stock.

Leaves small, short-ovate, apex acute, base rounded, thin, texture firm, light green; nearly glabrous on both surfaces at maturity, hairy along the midrib on the lower surface; margins finely and closely serrate. Petiole one-half to three-quarters of an inch long, slender, hairless, glandless. Fruit small, cherry-like, globular or depressed-globular, red or yellow, with a small turgid stone. Tree rather small with slender, twiggy, sometimes thorny branches. The plants are very variable in many characters.

The Myrobalan plum is often confused with varieties of *P. domestica* but is easily distinguished from them by its smaller leaves which are also more ovate, thinner, and have their margins more finely serrate than those of the Domesticas. Tree and fruit are very different, but these can seldom be used as a means of identifying stock and so need no discussion.

Myrobalan has been used as a name for *P. cerasifera* for four centuries, with some confusion, however, as the name had earlier been used, and still is, for several plum-like fruits of the East Indies which do not belong to the genus *Prunus*. This species is also known as the Cherry plum and occasionally one hears it called "Mirabelle," a name which belongs to a very different plum. Little has come from the Myrobalan in the way of varieties grown for fruit-producing, but it has furnished several valuable ornamental groups and has been used as a stock for over 300 years.

The Myrobalan is the commonest stock for plums in North America. In the nurseries of New York and of the eastern and northern states generally, it is used almost exclusively. At present most of the Myrobalan stocks used in this country are imported from France, where they are grown from seed which comes for most part from Italy. A few stocks are imported from Italy to America, and some are now being grown from Italian seed planted in the state of Wash-

ington. Some French growers formerly grew this stock from cuttings which gave plants much more uniform than those which now are grown entirely from seed, with the result that there is more or less variability.

Myrobalan takes precedence over other stocks in this country for the following reasons: Plums on this stock form large handsome trees in the nursery; Myrobalan stocks are easily budded and make a good union with nearly all other plums; the seedlings are cheap; and trees on this stock seldom sprout in the North. Disadvantages are: The trees send up many sprouts in the South; the roots are winter-killed in very cold climates, not, however, in the plum regions of this State; some varieties overgrow this stock making a malformed trunk; and, according to some, plums on this stock are short-lived, and the trees are said to be slow in coming into bearing.

#### ST. JULIEN STOCKS

(*P. insititia*)

The St. Julien plums constitute a division of *P. insititia*, now used almost exclusively as stocks upon which to grow varieties of the Domesticas. Originally the name seems to have been applied to a single variety but now a group of several more or less similar sorts, much like the common Damson, pass under this name. The St. Juliens have been known for several centuries, and while still rather commonly used as stocks for plums, and somewhat for peaches and apricots, they are not as well thought of now for this purpose as formerly. Plate IV shows the characters of leaf and fruit of *P. insititia* very well, and with the following description will enable anyone to identify the stock from the foliage without trouble.

Leaves numerous, roughened by the prominence of the nerves on the lower surface, short, ovate, rounded and slightly pointed at the apex, attenuated at the base; dark green above, paler beneath; margins with very close, short, slightly inclined teeth; petiole an inch long, yellowish, lengthening into a very prominent midrib, with a few small glands near or on the base of the leaf. Fruit and tree very similar to that of the common Damson.

St. Julien stocks were formerly imported in considerable quantities from France, where they are still largely grown for European nurseries. These French stocks are largely grown from seeds, altho French pomologists recommend that they be propagated from suckers or

layers of carefully selected mother plants, and caution against the use of seeds, which they say produce variable, twiggy, spiny, and crooked stocks. St. Julien stocks are seemingly nowhere grown in America for stocks.

There is a wide-spread opinion among plum growers that this is the best stock for plums. It is commonly believed that the trees on this stock are very vigorous, hardy, long-lived, sucker but little from the roots, and are adaptable to many soils. They find, however, that the trees are not as hardy to cold as might be wished for in extremely cold climates. Nurserymen, as a rule, like Myrobalan better than St. Julien stocks for several reasons: The seedlings of St. Julien are expensive and sometimes impossible to obtain; they are more difficult to bud as a rule than the Myrobalan stocks; the young trees on this stock do not make as good a growth; and the St. Julien stocks are very susceptible to fungi in the nursery row.

#### PEACH STOCKS

(*P. persica*)

The common peach is in favor with many nurserymen as a stock for plums. For this purpose seedlings should be grown from seed collected in the mountains of Tennessee and the Carolinas, since seedlings so grown are most vigorous and uniform. Trees from seed taken from canneries are neither as vigorous or uniform. Plate V shows the foliage of one of these stocks. On the peach, plum trees quickly grow into fine salable trees; are supposed to come into bearing earlier; there are no sprouts from roots; budding is easily done; and, theoretically, the trees are especially well adapted when on this stock to warm sandy and gravelly soils to which the peach is usually well suited. The peach makes the cheapest and most easily obtained stock for plums in the average American nursery.

Japanese plums in particular make excellent trees when worked on peach stocks. The roots in this union are as hardy as the tops, and stock and cion are sufficiently congenial to make the resulting tree long-lived. Most varieties of American species grow very well on peach roots, but the Domesticas and Insititias do not always make a good union with the peach, and the tops are hardier than the roots. A disadvantage of peach stocks is that peach borers often destroy the tree, whereas they seldom attack the plum on other stocks. Plums on peach are probably more common in the orchards of the far West than in the East.

## DOMESTICA STOCKS

*(P. domestica)*

In Europe several varieties of *P. domestica* are used as stocks for other varieties of this species. Plate VI shows the foliage of one of these stocks. In America no *Domestica* is commonly used as a stock by nurserymen. In this test of stocks, therefore, it has not been thought necessary to include any of the *Domestica* stocks used in Europe. The plan is to test all of the varieties used in this experiment on their own roots with the expectation that if this method proves particularly desirable for any variety, that variety in future work might be tried as a stock. At best, however, *Domestica* stocks can hardly come into as general use as some other of the stocks discussed for they are not readily available and as none of the Damsons "take" well on this stock, nor, curiously enough, do all *Domestica* varieties unite as well as might be wished on the *Domestica* stocks commonly used in Europe.<sup>1</sup>

## PLUMS ON THEIR OWN ROOTS

Plum growers sometimes grow trees from suckers taken from the base of old trees. In New York, Reine Claude and similar varieties are rather commonly grown in this way by amateurs and gardeners. This method can be used, of course, only when the trees are on their own roots. This can be told by the foliage of the sucker in the case of *Domestica* varieties, the foliage being easily recognized by all. For the purpose of comparison, however, we show in Plate VI typical *Domestica* foliage. It is generally believed that trees are better adapted to heavy soils when grown on their own roots.

An attempt is being made in this experiment to grow all of the varieties under test on their own roots by whip-grafting the various sorts on whole-root peach roots with the expectation that the peach

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<sup>1</sup>R. G. Hatton, M.A., Director of the East Mailing Research Station, East Mailing, Kent, England, has recently published (*Jour. of Pomology* II, No. 4, Sept. 1911) the results of a most careful study of stocks for stone fruits in which it appears that *Domestica* is much more commonly used as a stock for plums in Europe than in America. Hatton's report shows that the Europeans have reached refinements in the use of stocks for stone fruits not yet known in America. Our nurserymen are generally content to use one or two species as stocks for several species of cions. All varieties of a species are usually grafted on one stock. A greater variety of stocks is in use in Europe, and the incompatibilities of stock and cion are better understood. And yet, according to Hatton, there is still much confusion in the use of plum stocks in Europe. His report shows that in England, they, too, have an interesting field of research with stocks for fruits.



PLATE IV.—ST. JULIEN.



root will eventually die, and, the cion having sent out roots, the plum would be growing on its own roots. This method has been put in practice by commercial plum growers in a few instances with good results. The report of the examination of the several varieties grown, as set forth in later pages, is most interesting.

#### NONDESCRIPT STOCKS

Several species of *Prunus* besides those discussed are occasionally used in American plum orchards for particular purposes or particular environments. Seedlings of *Munsoniana* plums are supposed to make good stocks for wet soils. *Hortulana* stocks have been used somewhat for varieties of several species of native plums finding favor because they seldom or never sucker. The Sand plum (*P. angustifolia watsoni*) and the Sand cherry (*P. besseyi*) are recommended as dwarfing stocks upon which other plums come in bearing early and bear abundantly. The Sand cherry is supposed to be an exceptionally hardy stock. The apricot and almond are sometimes used as stocks for plums in the far West. None of these nondescripts are sufficiently promising to warrant their being tried in this test.

#### VARIETIES OF PLUMS IN THE TEST

The 15 varieties from 6 species in this experiment were selected as the best representatives of plums grown in New York and the United States in home and commercial orchards. Five varieties of *P. domestica*, Bradshaw, Grand Duke, Italian Prune, Lombard, and Reine Claude, come from five distinct groups in that species; Shropshire and Drap d'Or represent the blue and yellow, sour and sweet forms of *P. insititia*; Abundance, Burbank, and Chabot are the commonest Japanese plums from *P. salicini*; *P. hortulana* is represented by the type-form Wayland and Forest Garden from the botanical variety *minerii* of this species. Pottawattamie and Wild Goose are two types of *P. munsoniana*; *P. americana* is represented by its most commonly planted variety, De Soto. All of these varieties are described in the *Plums of New York*, to which most readers have access, and need not be discussed nor described here. The planting plan of stocks and varieties is shown in Table 1.

TABLE 1.—PLANTING PLAN OF STOCKS AND VARIETIES.

TREE NUMBER	Row 39, AMERICANA	Row 40, MARIANA	Row 41, MYROBALAN	Row 42, ST. JULIEN	Row 43, PEACH, BUDDED	Row 44, PEACH, GRAFTED
1 to 6	Bradshaw	Bradshaw	Bradshaw	Bradshaw	Bradshaw	Bradshaw
7 to 12	Chabot	Chabot	Chabot	Chabot	Chabot	Chabot
13 to 17	Grand Duke	Grand Duke	Grand Duke	Grand Duke	Grand Duke	Grand Duke
18 to 22	Burbank	Burbank	Burbank	Burbank	Burbank	Burbank
23 to 26	Reine Claude	Reine Claude	Reine Claude	Reine Claude	Reine Claude	Reine Claude
27 to 30	Italian Prune	Italian Prune	Italian Prune	Italian Prune	Italian Prune	Italian Prune
31 to 34	Shropshire	Shropshire	Shropshire	Shropshire	Shropshire	Shropshire
35 to 38	Forest Garden	Forest Garden	Forest Garden	Forest Garden	Forest Garden	Forest Garden
39 to 42	Pottawattamie	Pottawattamie	Pottawattamie	Pottawattamie	Pottawattamie	Pottawattamie
43 to 45	Abundance	Abundance	Abundance	Abundance	Abundance	Abundance
46 to 48	Wild Goose	Wild Goose	Wild Goose	Wild Goose	Wild Goose	Wild Goose
49 to 51	Wayland	Wayland	Wayland	Wayland	Wayland	Wayland
52	Lombard	Lombard	Lombard	Lombard	Burbank	Italian Prune
53 to 56	Drap d'Or	Drap d'Or	Drap d'Or	Drap d'Or	Italian Prune	Drap d'Or
57 to 60	De Soto	De Soto	De Soto	De Soto	Reine Claude	De Soto

## CULTURAL NOTES

The buds and grafts for the 15 varieties were taken from one tree each of the several sorts growing on the Station grounds and worked on the stocks in the spring and summer of 1910. The trees were set in the orchard in April, 1912. There were a few resets from the nursery the following spring, but the trees were of the same age. In subsequent years a few trees died, as will be indicated in the discussion on the following pages, all of which were discarded in taking the final results. When set the trees had their central leaders headed back to about 2 feet; few and in most cases none of the side branches were headed back, but any excess in number over those required to make a well-spaced head were removed. In subsequent prunings a central leader was permitted to grow and the number of branches was reduced, while now and then an extra long branch was headed back. Clean culture with a cover crop was the rule for the orchard. The trees received the usual applications of spray for the plum. In these respects it is seen that the treatment was that given the plum in the orchards of this State.

The chief criteria of the value of a stock are yield, vigor of tree, and longevity of tree. This experiment throws light on the first two of these criteria. How does the stock influence the yield and vigor of the tree?

## INFLUENCE OF STOCK ON SPECIES

Table 2 shows the average yield of plum trees on the six different stocks. Table 3 shows the influence on vigor. Fruit growers must understand that in an experiment such as this there are many factors



PLATE V.—PEACH.

which may be sources of error, and hence the figures in the two tables are probably not exact indexes of the behavior of the 15 varieties on the 6 stocks, but the figures as they stand show the value of the several stocks so plainly, especially when used with judgments made by the eye, that they need not be subjected to the refinements of corrections for probable error, nor could they be shaded or weighted for the influences of environment which have, of course, greatly modified them.

An analysis of the figures shows that the five varieties of the European plums, Bradshaw, Grand Duke, Reine Claude, Italian Prune, and Lombard, yield fruit much the best when grown on Myrobalan stock. The trees of all of these varieties grow best on this stock. They fruit next best on their own roots, followed in order by peach, Marianna, St. Julien, and Americana; but the trees are next best on St. Julien, own roots, peach, and Marianna, with Americana last. It is surprising to find that the trees on St. Julien yield so poorly, and from the appearance of the trees it would seem that the breaks—accidental variations—have been against this stock.

Two of the Japanese plums, Chabot and Burbank, fruit markedly best on Myrobalan stock; but the third, Abundance, is poorer on this stock than on any other. The trees of all three varieties are much the best on Myrobalan. Abundance seems to be distinctly a case in which the stock gives too great vigor to the tree. Chabot and Burbank fruit second best on the peach, while Abundance fruits best on this stock. The trees seem to be second best on St. Julien, third on peach, followed by own roots, Marianna, and Americana. The three varieties of this species yield on the other stocks in the order following: St. Julien, Americana, own roots, and Marianna.

Of the two varieties of *Insititia*, Shropshire and Drap d'Or, both are best in tree on Myrobalan, and Drap d'Or fruited best on this stock, but Shropshire bore most fruit on the peach. Unfortunately, the trees of Drap d'Or on peach were winter killed. These two varieties yielded about equally well on St. Julien and own roots, rather poorly on Marianna, and were failures on Americana. After Myrobalan, the trees were best in order named on peach, St. Julien, Marianna, Americana, and own roots. It must be remembered, however, that one of the varieties, Drap d'Or, did not fruit on peach roots.

TABLE 2.—AVERAGE YIELDS OF PLUM TREES ON DIFFERENT STOCKS, 1916 TO 1922.

Stocks	BRADSHAW	CHABOT	GRAND DUKE	BURBANK	REINE CLAUDE	ITALIAN PRUNE	SHROP- SHIRE	FOREST GARDEN	POTTA- WATTOMIE	ABUN- DANCE	WILD GOOSE	WAYLAND	LOMBARD	DRAP D'OR	DE SOTO
Americana	19-3	36-1	46-3	72-11	36-8	10-9	36-10	56-14	61-4	31-3	32-7	56-12	53-5	12-0	28-13
Marianna	14-6	25-8	78-3	91-13	29-1	122-0	43-6	64-11	71-3	19-1	161-15	64-8	88-6	21-6	8-11
Myrobalan	34-11	60-9	60-1	111-14	52-3	225-8	61-6	87-8	75-6	18-1	186-0	45-10	114-14	26-14	22-2
St. Julien	12-3	47-1	65-13	98-8	35-4	21-2	44-14	54-2	51-6	22-11	144-7	61-12	98-4	14-8	24-4
Peach, budded	27-3	54-0	43-10	101-6	40-0	38-12	76-15	60-9	98-2	39-11	51-2	38-3	—	—	—
Peach, grafted	26-9	26-5	55-10	76-3	45-2	28-12	54-6	69-1	57-1	27-11	38-8	—	—	12-2	—

TABLE 3.—AVERAGE INCREASE IN TRUNK DIAMETER OF PLUM TREES ON DIFFERENT STOCKS, 1912 TO 1921.

Stocks	BRADSHAW	CHABOT	GRAND DUKE	BURBANK	REINE CLAUDE	ITALIAN PRUNE	SHROP- SHIRE	FOREST GARDEN	POTTAWAT- TOMIE	ABUN- DANCE	WILD GOOSE	WAYLAND	LOMBARD	DRAP D'OR	DE SOTO
Americana	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Marianna	4.0	4.6	4.2	4.5	4.5	3.9	4.4	4.8	3.5	4.4	4.25	6.1	3.8	2.9	4.9
Myrobalan	4.4	3.8	4.8	4.9	4.7	4.2	4.2	4.7	3.8	4.4	5.0	6.1	4.5	4.2	4.75
St. Julien	5.9	6.3	5.4	6.0	5.8	4.9	5.1	5.2	4.3	5.75	4.7	6.1	5.3	4.6	5.2
Peach, budded	5.4	5.7	4.7	4.8	4.7	4.9	4.3	4.6	3.6	4.8	4.8	5.75	5.1	3.8	4.4
Peach, grafted	4.1	5.0	4.6	4.6	5.0	4.0	4.7	4.6	4.1	4.7	4.4	5.0	—	—	—
	4.5	4.0	4.5	4.7	4.7	4.75	4.2	4.4	4.3	4.9	4.3	—	—	3.1	4.4



PLATE VI.—COMMON PLUM.

The one variety of Americana, De Soto, fruited best on Americana stock, but the best trees grew on Myrobalan stocks. The fruiting order after Americana for this variety was St. Julien, Myrobalan, and Marianna. Unfortunately there were no trees of De Soto on the peach. The trees were best after Myrobalan on Americana and Marianna, while those on St. Julien and own roots seemingly did equally well. Hail and wind had broken the tops of all the trees of De Soto so that the data are not at all conclusive.

Wild Goose and Pottawattamie represent Munsoniana. Wild Goose bore most fruit on Marianna, an interesting fact, since Wild Goose is probably one of the parents of Marianna. It bore next best on Myrobalan followed by peach, St. Julien, own roots, and Marianna; but Pottawattamie bore best on Myrobalan and own roots, followed by St. Julien, peach, Marianna, and Americana. The trees seemingly grow equally well on Marianna, Myrobalan, peach, and own roots, not quite so well on St. Julien, and rather poorly on Americana. Only one of the varieties, however, was grown on peach and own roots.

The two representatives of Hortulana, Forest Garden and Wayland, fruited best on Marianna, but made by far the best trees on Myrobalan. In fruiting order, they did next best on Myrobalan, equally well on St. Julien and Americana, and poorest on peach. Wayland was not grown on own roots, but Forest Garden on own roots was second best to trees on Myrobalan. The trees of this species grew best on Myrobalan followed in order by Marianna, Americana, peach, St. Julien, and own roots.

From this analysis of Tables 2 and 3 the following conclusions can be drawn: Myrobalan is the best general purpose stock. Plum growers probably cannot go far astray in buying any variety of any species worked on this stock. Certainly *Domestica* plums, in which New York plum growers are most interested, should be grown on this stock. Despite the fact that one of the *Insititias*, Shropshire, fruited best on peach, Myrobalan is the best stock for the Damson and Mirabelles of *P. insititia*. Peach, as was the case with one of the varieties of *Insititia* in this experiment, is too tender to cold for any of the Damsons in New York.

Despite a rather poor showing in Tables 2 and 3, St. Julien probably is the second best general purpose stock. Certainly it should take second place as a stock for *Domestica* and *Insititia* varieties, for

while it does not make a remarkable showing in the tables, there is that about the trees that appeals to the eye so strongly that fruit growers in the experimental orchard usually rank St. Julien with Myrobalan.

The peach proves to be a surprisingly good stock even tho the experimental orchard is on soil which no one would choose as a good peach soil. It is probably too tender to cold to make a good general purpose stock in New York except for the Japanese varieties which would be as susceptible to winter killing as the peach roots. Altho this experiment as yet throws no light on longevity, there is a popular prejudice against this stock as producing a short-lived tree.

Own roots show surprisingly well for *Domesticas* and *Insititias*, so well for the *Domesticas* as to suggest that some of the European *Domestica* stocks ought to be tried for orchard varieties of this species. The method used in this experiment, that of whip-grafting a cion of the *Domestica* varieties on a piece of peach root with the expectation that the cion will take root, is not difficult and is worthy of further trial.

The varieties of *Munsoniana*, Wild Goose and *Pottawattamie*, and of *Hortulana*, Forest Garden and *Wayland*, can without doubt be best grown on *Marianna* stocks, especially since in the regions where these varieties are largely grown *Marianna* stocks are easily grown from cuttings. So far as New York is concerned, this stock may as well be dismissed from consideration since the varieties named and their related sorts are now no longer grown.

It seems certain that *Americana* stocks are suitable only for varieties of the same species in New York. It is possible that where hardiness is a prime requisite *Americana* stocks might be used for varieties of other species.

The most important ways in which the stock may modify the cion were stated on page 4. Of these several ways the influence on productiveness and vigor of tree have been discussed in full. What about the others? The experiment can throw no light on whether or not the adaptability of a fruit to a soil may be changed by the stock. Since several trees on peach were winter-killed, it seems that this stock is least well adapted to endure a cold climate. No difference could be noted in the time of maturity of wood or crop of the several varieties on the six stocks. Color, quality, and size of the fruits were not perceptibly changed by the several stocks. More time is re-



quired to tell whether there is a difference in longevity of varieties on the different stocks. There were no indications that any variety was more susceptible to any insect or disease on one stock than on another.

### CONCLUSION

Finally, this experiment shows that of the stocks now in general use for plums in this region, Myrobalan for the Domestica, Insititia, and Japanese varieties, the only species of this fruit commonly grown in New York, is the most satisfactory. Possibly peach stocks will prove as satisfactory as any for Japanese varieties, but the plum grower will not go far astray when Japanese sorts are worked on Myrobalan stocks. Here, happily, is a case in which present practices seem to be justified, for Myrobalan is now the commonest stock used in the nurseries and orchards of New York.

It remains now to determine whether these several species and varieties of plums are long-lived on Myrobalan stocks; what varieties of these species, if any, show incompatibilities with the Myrobalan stock; whether or not, as well may be, some strains of Myrobalan do not make better stocks than others; whether or not stocks of this species can be grown from cuttings or layers to avoid the variation found in all seedlings, and, lastly, and of most importance, whether plums will behave on this stock in other soils as they have done on the Station grounds.