New York Agricultural Experiment Station.

GENEVA, N. Y.

DISTRIBUTION OF STATION STRAWBERRIES AND RASPBERRIES.

U. P. HEDRICK AND O. M. TAYLOR.

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U. P. HEDRICK AND O. M. TAYLOR.

INTRODUCTION.

The New York Agricultural Experiment Station has four new varieties of red raspberries and three new varieties of strawberries for distribution during the spring of 1908. These varieties are the incidental outcome of experimental work in plant breeding. They have been grown and compared with practically all of the standard sorts and novelties of their kind and are equal to or superior to all other red raspberries and strawberries grown on the Station grounds in one or more respects. The distribution of these varieties is undertaken that we may ascertain their value and adaptability in the different fruit regions of New York. We hope, too, by sending out these plants, and through the account of their origin herewith given, to stimulate the interest of fruit-growers in plant breeding and to promote local experimentation with varieties of fruit.

The breeding of fruits and vegetables is becoming the most prominent feature of the work of the Horticultural Department of this Station. Since the objects and methods of plant breeding are not well understood by fruit-growers, or the public, a few explanatory statements regarding such work in horticulture at this Station are in place.

For a quarter of a century this Station has been attempting the improvement of horticultural plants. Several new vegetables and at least one meritorious fruit, the Hunn straw-
berry, have been given to horticulture. In the beginning the chief aim was to originate new varieties; but more and more, as the work has been carried forward, new varieties have become incidental and now plant breeding for itself is given chief attention. This Department is now attempting, and has made some progress, in breeding all of the tree fruits, grapes, red raspberries, strawberries and several of the vegetables. Roughly grouped, the objects in carrying on this work are, at the present time:

(1) A study in the correlations of the different characters of plants. Professor S. A. Beach, formerly in charge of the work, has made several contributions to the knowledge of this subject from work done with grapes on the Station grounds.¹

(2) Investigations of the laws of inheritance and variability. A paper on this phase of plant breeding containing a record of the behavior of crossed tomatoes was presented by the writer and Mr. N. O. Booth at the fifth annual meeting of the Society of Horticultural Science.²

(3) The adaptation of plants to new environment. To this end the Station is now testing about 1760 varieties of American and foreign fruits.

(4) The development of hardy plants. The peach is the special object of study in this case. Considerable preliminary work has been done in the study of the factors which influence hardiness of the peach.³ A plantation of all obtainable varieties, 258 sorts, has been set for experimental and breeding purposes, with special reference to hardiness.

(5) The development of resistance to disease. Illustrative of this work two examples may be cited. Several hundred seedling pears are now being grown from parents more or less immune to pear blight, with the possibility of getting a variety comparatively immune to this disease. All obtainable

¹Grape Breeding: Size, Weight and Specific Gravity of the Seed as correlated with Germination and Vigor of the Seedling. Proceedings of the Society for Horticultural Science, 1: 42.
varieties of head lettuce have been grown and selections and crosses made in the hope of getting a variety that will withstand "lettuce rot" and "tip-burn."

(6) Improvement through crossing and hybridizing as a basis for generalizations as to the use of these operations in plant breeding. There are now growing about 2700 crosses and hybrids on the Station grounds and many times as many more have been discarded in the past few years.

(7) Systematic selection from pure-bred seedlings. A considerable number of pure-bred grapes have been and are now being grown for this purpose.

(8) To discover what botanical and horticultural groups of the several fruits and vegetables best transmit their characters to their offspring either as pure-breds or in crosses. Valuable data as to the transmitting power of groups of grapes, apples, raspberries and strawberries have already accumulated.

(9) Incidental to the above lines of research, the production of new varieties. Seven of these are described in this Bulletin.

One or two words further are necessary to a proper understanding of this work by the layman. In all of the plant breeding in this Station an attempt is made to study every plant and to make a more or less full record of its behavior, whether promising or not from the grower's standpoint. With each group of plants the work is along well defined lines, for a definite object, and according to a specific method. The desire is to know exactly how any particular result is attained. No time limit is set to any of the problems in plant breeding and it is not the intention to publish results nor distribute new varieties at stated times. The Station is not a competitor of seedsmen or nurserymen, and does not distribute seeds or plants that can be obtained in the trade. It should be said, too, that the Station is anxious that the trade have and offer for sale any of the new varieties that may be produced in the breeding work of this institution. It desires, too, that seedsmen and nurserymen have a full knowledge of the work done in breeding plants that they may take advantage of any progress made by the Station in this field.
STATION STRAWBERRIES.

The breeding work which gave rise to the three varieties of strawberries now to be distributed was begun in 1898. During this season seeds were saved from three crosses and self pollinated seed was saved from one variety. In making the crosses, and in saving, keeping and sowing the seed the usual precautions were taken with the result that plants as follows were grown in 1899:

<table>
<thead>
<tr>
<th>Cross Description</th>
<th>Number of Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunn X Marshall</td>
<td>255</td>
</tr>
<tr>
<td>Sample X Marshall</td>
<td>31</td>
</tr>
<tr>
<td>Hunn X Atlantic</td>
<td>197</td>
</tr>
<tr>
<td>Marshall, pure bred</td>
<td>61</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>544</strong></td>
</tr>
</tbody>
</table>

The crosses were made by Wendell Paddock, then of this Department, and the subsequent work of selection has been done, in the main, by O. M. Taylor, Foreman in Horticulture. The division of labor with these particular varieties serves as a reminder of the divided work in practically all plant breeding. First, there must be a starting point and, whether of parents to cross or an individual to breed from, good judgment must be exercised in selecting plants with the characters desired most highly developed and so far as known with characters most transmissible. Second, skill must be patiently and persistently exercised in selecting the plants most nearly approaching the ideal in mind until the end sought for is as nearly as possible attained; perfection is scarcely possible.

The history of the 544 plants obtained in 1899 is quickly given. Most of them fruited in 1900 and it was apparent at once that at least three-fourths of them were worthless and these were forthwith discarded. The plants weeded out either produced inferior berries, lacked vigor, or showed one or more markedly poor characters. After a further selection and weeding out in 1901, 31 seedlings remained and these were allowed to form runners which were removed to new beds in 1902.
In the summer of 1903, the 31 seedlings fruited and all but three were discarded. After five years and three crops of fruit the number was reduced from 544 to 3 seedlings. The years following have been devoted to further testing the three remaining seedlings and now, after ten years of selection and testing, these have become named varieties. For fear the length of time taken in the breeding of these strawberries may discourage the prospective plant breeder, it should be said that at the end of the fifth or of the sixth year at most, the value of the three seedlings which we have named was known and the work of producing the new varieties was completed.

The crosses have given varieties as follows:

<table>
<thead>
<tr>
<th>Variety</th>
<th>Number of Plants</th>
<th>Number of Varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hunn X Marshall</td>
<td>255</td>
<td>1</td>
</tr>
<tr>
<td>Hunn X Atlantic</td>
<td>197</td>
<td>1</td>
</tr>
<tr>
<td>Sample X Marshall</td>
<td>31</td>
<td>1</td>
</tr>
<tr>
<td>Marshall, pure bred</td>
<td>61</td>
<td>0</td>
</tr>
</tbody>
</table>

The above results are interesting but scarcely even suggestive. The figures are not nearly great enough to draw conclusions as to the transmitting power of the four parents. About the only generalizations that can be made in regard to these crosses are that in the offspring of those in which Marshall was one of the parents the foliage of this variety appeared in the great majority of the seedlings. So, too, the fruit characters of Hunn were dominant in the resulting seedlings over those of Marshall and Atlantic with which it was crossed.

The following is a description of these seedlings:

**Magnus.**—Parentage, Hunn X Marshall. Blossoms imperfect. Plants numerous, medium to above in height, productive. Leaves large, attractive dark green, attacked slightly by leaf blight in unfavorable seasons; leaf stems medium in length, thick. Fruit stems of average length, thick, and usually double. Calyx large and leafy, set in a slight depression. Seeds raised. Fruit above medium to very large, retains its size well as the season advances, roundish conic to slightly elongated and with pointed apex, very dark scarlet, showing
Hunn blood, variable in color unless well ripened. Flesh rather light at center, firm, juicy, mildly acid, good to very good flavor and quality. The fruit ripens in mid-season. The growth and color of foliage closely resemble Marshall, while the color of the fruit is that of the Hunn. When well colored, this variety ranks among the very best in size, attractiveness, and quality. It is thought that the Magnus will prove a very valuable new sort for home use. Its variable color is somewhat against it as a berry for the market.

Prolific.—Parentage, Sample X Marshall. Blossoms perfect. Plants very numerous, vigorous to very vigorous, usually productive, yielding on the Station grounds as high as 14,052 quarts per acre. Foliage of good size, somewhat susceptible to leaf blight in unfavorable seasons, in color comparatively dark green; leaf stems long, thick. Fruit stems of medium length, stout and usually single. Calyx medium to below in size, depressed, sometimes slightly discolored. Seeds somewhat raised. Fruit very large to above medium, roundish conic to blunt wedge, rather light in color but nevertheless an attractive bright scarlet. Flesh firm, fairly good color at center, agreeably acid and of good flavor and quality. Fruit ripens in early mid-season. The color of fruit is slightly lighter than Marshall, possibly a merit for some markets. On account of its vigor, the great productiveness of its plants, and the attractiveness of the large well-colored berries, this variety gives promise of taking front rank among standard commercial strawberries.

Quality.—Parentage, Hunn X Atlantic. Blossoms variable, averaging semi-perfect. Plants somewhat numerous, fairly productive, healthy, and of average vigor. Leaves medium to above in size, moderately dark green; leaf stems medium to below in length, rather stout. Fruit stems short, stout, usually double. Calyx medium to large, leafy, set in a slight depression. Seeds sunken. Fruit above medium to very large, roundish conic to wedge, or varying to slightly elongated but blunt at apex, light and dark scarlet, glossy. Fresh good color to center of fruit, firm, mildly acid, good to very good in flavor
and quality. Season rather late. Both plant and berry of
the Quality resemble the Hunn more than the Atlantic.

A characteristic of the Quality is its great variability in sex.
On the Station grounds it ranges through all gradations from
perfect to imperfect.

Although lacking somewhat in productiveness, Quality ranks
high in general appearance and in quality, and if these
characteristics show in other localities, the variety is well
worthy of a place in the home plantation and may possibly
prove a good commercial sort.

STATION RASPBERRIES.

The work in breeding raspberries dates back to 1897 and
1898 when seeds from six crosses and self pollinated seeds from
three varieties were saved. As with the strawberries, the
crosses were made by Mr. Paddock and the subsequent work of
selection has been done by Mr. Taylor. The parentage and
numbers of resulting seedlings are as follows:

<table>
<thead>
<tr>
<th>Cross</th>
<th>Number of Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loudon X Marlboro</td>
<td>372</td>
</tr>
<tr>
<td>Marlboro X Loudon</td>
<td>204</td>
</tr>
<tr>
<td>Superlative X Marlboro</td>
<td>273</td>
</tr>
<tr>
<td>Marlboro X Superlative</td>
<td>195</td>
</tr>
<tr>
<td>Loudon X Superlative</td>
<td>35</td>
</tr>
<tr>
<td>Superlative X Loudon</td>
<td>60</td>
</tr>
<tr>
<td>Marlboro pure</td>
<td>32</td>
</tr>
<tr>
<td>Shaffer pure</td>
<td>17</td>
</tr>
<tr>
<td>Caroline pure</td>
<td>3</td>
</tr>
</tbody>
</table>

Total .......................... 1191

The history of these 1191 seedlings is similar to that of the
strawberries in the matter of length of time the majority of
them were permitted to live. At the close of the first fruiting
season all but 44 were destroyed. In the years that have fol-
lowed further selections have reduced the number to eight,
all offsprings of the crosses, no variety worth perpetuating
having come from the pure bred seedlings. In six of the eight
varieties the parents have been Loudon and Marlboro, five from Loudon X Marlboro and one from Marlboro X Loudon. In the other two the parents were, of one, Marlboro X Superlative and of the other, Superlative X Marlboro. Four of the seedlings have been named and are herewith offered for further testing in the State. Three of the remaining seedlings are still on the doubtful list, and the fourth, probably the most valuable of the eight seedlings because of its extreme earliness, will not be ready for distribution until the spring of 1909.

The following is a description of the four seedlings now ready for distribution:

Louboro.—Parentage, Loudon X Marlboro. A comparatively strong grower, intermediate in height and vigor between its parents. The canes are numerous and more closely resemble Loudon than Marlboro in general appearance. The berries average fully as large or slightly larger than either parent and retain their size well as the season advances; the fruits vary somewhat in firmness and color but are fairly firm and in general are a handsome light red; in flavor and quality, good. The berry closely resembles Marlboro in shape and in drupelets. The season is slightly earlier than Loudon. The Louboro has proved hardy except in severe winters and is very productive, yielding over 9,000 quarts per acre on the Station grounds.

While this variety may possibly prove too light in color, and not firm enough in wet seasons, yet it appears to be very worthy of an extended trial as a commercial sort, on account of its extreme productiveness and the large size of the fruit.

Marldon.—Parentage, Marlboro X Loudon. The canes of this variety are lighter in color than those of either parent and in general are of the Marlboro type, though more vigorous and stockier. Suckers appear in great numbers and grow rapidly into hardy and productive canes yielding as high as 10,257 quarts per acre in the Station plantation.

The fruit is large to very large and retains its size well as the season advances, slightly longer than Marlboro, handsome dark red in color, and of average firmness, earlier than either parent. Although not as sweet nor as highly flavored
as the best standard varieties, it ranks better than the average and on account of its hardiness, vigor, productiveness, large size and the handsome color of the fruit, it is worthy of trial as a commercial sort.

Donboro.—Parentage, Loudon X Marlboro. The numerous canes are intermediate in general appearance between the parents, though stockier and stronger than either parent, nearly smooth. The plants have proved hardy, except in the most severe winters, and are very productive, yielding in one season 10,964 quarts per acre. The foliage is a very attractive dark green. The fruit is large to very large and holds up well in size as the season advances; it is an attractive light red in color and very firm. The Donboro resembles Marlboro in shape and color, and is fully equal to this parent in flavor and quality.

This variety has made a high record at the Station as a commercial sort and is worthy of a careful test as a market berry.

Marlative.—Parentage, Marlboro X Superlative. Growth very stocky, semi-dwarf, growing slightly taller than the Superlative, very productive, yielding as high as 11,720 quarts per acre, as grown at the Station. The berries ripen earlier than Loudon. In general appearance the canes resemble Marlboro. The fruit is unusually large, dark red, more attractive than either parent, firm, and good in flavor and quality. The drupelets are very large and somewhat coarse in appearance, so much so that the surface of the berry is uneven. Although Marlative has not proved hardy every season and has shown a strong tendency to crumble some seasons, yet, on account of its unusual attractiveness in size and color, it is worthy of testing as a fancy sort for commercial purposes. Possibly on other soils the tendency to crumble may disappear.

TERMS OF DISTRIBUTION.

There are no restrictions upon recipients of plants as to further distribution of the varieties by sale or otherwise. If the fruits prove meritorious, it is desired that they be generally disseminated as quickly as possible. The only obligations
asked of those who receive plants are that they keep the varieties true to name, give them good care, and that they report to the Station the behavior of the varieties. The Station will furnish blanks for reports. Reports will be asked for, not only once, but from time to time until the value of a variety for a locality is determined. Applicants should state that they will comply with the above conditions.

The plants are furnished to accepted applicants and are packed without charge but the recipient must pay the expressage. Plants will not be sent by mail. Applicants must give both mail and express addresses.

The Station can supply but comparatively few growers of small fruits of the State with the new varieties and reserves the right to make a choice of the growers to whom they will be sent as may be preferred. This choice will depend chiefly on priority of application and upon the number of applicants from a locality. We cannot furnish any of these varieties to citizens of other states.

The number of plants of each variety that can be furnished to one person is 6 for the raspberries and 12 for the strawberries. It is desired that a person receiving any should receive all of the varieties of each or both fruits that a comparative test may be made of them.

An applicant should state whether or not he is growing either or both of the fruits in a commercial way as it is not the wish to send the new sorts to those who are not growing standard kinds with which they may be compared.

Since there are comparatively few plants for general distribution, those who want them for home use only, or to grow them out of curiosity, or because they can be had for nothing, are asked not to apply.

This Station does not invite application for plants, scions or seeds other than those specifically offered through its publications. Generally we cannot furnish them.

Address all correspondence regarding these new fruits to Horticultural Department, New York Agricultural Experiment Station, Geneva, N. Y.