Vegetable Tests on Sandy Soil at
The Umatilla Experiment Farm

BY

R. W. ALLEN

CORVALLIS, OREGON

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*On leave of absence.
VEGETABLE TESTS ON SANDY SOIL AT THE
UMATILLA EXPERIMENT FARM

By R. W. ALLEN,
Superintendent of the Umatilla Branch Experiment Station.*

CONDITIONS SURROUNDING EXPERIMENTS

The conditions by which the experiments discussed in this bulletin were surrounded are almost typical of the average sandy soil of the Columbia River Basin. Climatic conditions are probably somewhat more severe than in the average place, owing to the land being low and more or less subject to frost. The soil was rather new and low in fertility, and was afforded but little protection from the wind.

The Umatilla Experiment Farm is located in the northwest portion of Umatilla county, near Hermiston, a distance of approximately two hundred miles east of Portland. The country to which the work is applicable comprises the light sandy soil areas which lie adjacent to the Columbia River and its tributaries in the semiarid country popularly termed the Inland Empire.

THE CLIMATE

The climatic conditions in this district are suitable for numerous kinds and varieties of vegetables. Warm days generally occur early in the spring, which makes it possible to grow hardy plants at a very early period. The growing season is long, the principal part of it warm, and it is well adapted to sturdy plants requiring considerable warm weather. Rapid maturing plants, such as radishes and lettuce, can be successfully grown in the spring and fall. There is an average frost-free period of about 167 days. The following table gives dates of spring and fall frosts from 1909 to 1915 inclusive.

Table I. Killing frosts at Hermiston Ore. 1909 to 1915 inclusive.

<table>
<thead>
<tr>
<th>Year</th>
<th>Last in spring.</th>
<th>Minimum temperature</th>
<th>First in autumn.</th>
<th>Minimum temperature</th>
<th>Frost-free period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Date</td>
<td>F°</td>
<td>Date</td>
<td>F°</td>
<td>Days</td>
</tr>
<tr>
<td>1909</td>
<td>Apr. 21</td>
<td>27</td>
<td>Oct. 16</td>
<td>30</td>
<td>173</td>
</tr>
<tr>
<td>1910</td>
<td>Apr. 30</td>
<td>27</td>
<td>Oct. 15</td>
<td>31</td>
<td>169</td>
</tr>
<tr>
<td>1911</td>
<td>Apr. 29</td>
<td>31</td>
<td>Sept. 23</td>
<td>25</td>
<td>156</td>
</tr>
<tr>
<td>1912</td>
<td>Apr. 22</td>
<td>31</td>
<td>Oct. 6</td>
<td>31</td>
<td>173</td>
</tr>
<tr>
<td>1913</td>
<td>Apr. 22</td>
<td>29</td>
<td>Sept. 24</td>
<td>31</td>
<td>153</td>
</tr>
<tr>
<td>1914</td>
<td>Apr. 20</td>
<td>30</td>
<td>Oct. 20</td>
<td>31</td>
<td>194</td>
</tr>
<tr>
<td>1915</td>
<td>Apr. 22</td>
<td>29</td>
<td>Oct. 5</td>
<td>30</td>
<td>159</td>
</tr>
<tr>
<td>Average</td>
<td>Apr. 23</td>
<td>29</td>
<td>Oct. 7</td>
<td>30</td>
<td>167</td>
</tr>
</tbody>
</table>

*The Umatilla Branch Experiment Station is located on the Umatilla Irrigation Project near Hermiston, Oregon. It is supported and operated by the State of Oregon and the United States Government. The work is being directed by the Division of Horticulture of the College and the Office of Western Irrigation Agriculture of the Department of Agriculture.
Some of these frosts, however, are not severe enough to injure hardy truck crops. For such vegetables as can withstand several degrees of frost there is frequently a much longer growing season. Crops usually grow quite rapidly in spring, but their advance is sometimes checked during the warmest weather. When evaporation is diminished, by the occurrence of cool days in late summer and autumn, most crops checked in growth by warm weather regain normal vigor and make a rapid growth. Checking the growth of some crops in this manner permanently weakens them, while others are not harmed by it if they are given sufficient irrigation. For the purpose of avoiding injury from the wind, truck crops should be protected by windbreaks, such as can be formed by thick or mixed planting of crops or by permanent windbreaks (1). The most frequent and destructive winds usually occur during the spring. While the plants are young and tender greater damage is done than at later times. Melons and other plants of vining nature not having adequate protection are subject to injury by high winds at any time during the entire season.

SOIL

The soil upon which these determinations were made is somewhat variable in character. This uneven condition is largely a result of grading, which was necessary in preparing it for irrigation. In physical characteristics this soil is about an average of sandy soils being irrigated in this locality, the predominating type being a medium to coarse sand, which is considerably in need of organic matter and nitrogen. Its open character renders the frequent use of irrigation necessary.

Soil conditions on the Umatilla and neighboring projects are quite variable, ranging from a coarse sand to fine sandy loam. The finer soils are capable of retaining much more moisture and respond to cultivation more readily than do the coarser types. The coarse soils are in some places quite productive. This is usually a result of a uniformly high moisture content being maintained under the influence of seepage, or of a high water table. The production of coarse soils having an abundance of moisture is much greater than the same type under irrigation conditions.

These soils are very easily worked, on account of their being loose and friable, which makes tillage much less important than on heavier soils. The most important factor in their proper manipulation is that of supplying sufficient fertilizer. Irrigation is also important on account of frequent and light applications of water that are necessary to maintain a desirable moisture condition for normal crop growth. Where land is not influenced by ground water, irrigation or vegetables is necessary at intervals of six to ten days, though only light applications of water are required.

(1) Oregon Experiment Station Bulletin No. 125, Windbreaks and Hedges for the Irrigated Sandy Soils of Eastern Oregon.
NEED OF EXPERIMENTAL TESTS

Owing to the lack of systematic tests being made to determine the most successful varieties of vegetables for this type of soil, which has not as yet been extensively farmed, thorough, comparative tests are necessary. On account of peculiar soil conditions, many plants which succeed in other places do not thrive here. The cultural treatment necessary for vegetables differs greatly from that required in other localities. For the purpose of determining in the broadest manner and in the shortest practical time which varieties can be used to the best advantage a number of variety and cultural tests have been conducted.

MANNER OF CONDUCTING EXPERIMENTS

Numerous varieties of vegetables have been grown under a wide range of cultural conditions and in soil possessing different degrees of fertility. On account of difficulties encountered in hastening soil improvement, the majority of the tests have been conducted on new, or comparatively new land. The most hardy varieties that are of commercial importance have been selected in every instance, and a great number of vegetables have been grown to determine their value when placed under such conditions as must be met by farmers who desire to produce them extensively. Care was taken to prepare a good seed bed, to irrigate in a careful manner, and to protect the young crops, as much as possible, from such external agencies as wind, frost, insects, etc.

VALUE OF RESULTS

The results of the work with vegetables is of considerable value, owing to the fact that the most successful varieties of numerous crops have been determined. It is also of importance in that considerable has been determined in suitable cultural and irrigation methods. Many factors, minor in character yet perplexing, have been encountered, but space does not permit their being discussed at this time. Furthermore, they are of such a minor nature and variable character that their control must be left to the individual growers. The work herein described is quite general and should be of value to everyone working under similar conditions. Its greatest value, however, lies in the guide it furnishes people who will subsequently undertake the development of lands similar to those upon which the determinations were made.

EXTENT OF AREA TO WHICH THE RESULTS ARE APPLICABLE

The results of this work are applicable to all the light soils in the Columbia River Basin, which comprises the lower portion of the main and tributary valleys where practically the entire extent of medium to coarse sandy lands are located.

At higher altitudes, where finer soils prevail, the limitations of results given herein should be greatly broadened. Not only should the most successful crops in this locality succeed well under such conditions, but numerous others that were tried should succeed, and many
crops of secondary value here should be valuable for such locations and soils.

This report, therefore, is of importance to farmers and gardeners operating irrigated lands throughout the entire Columbia River Basin.

RESULTS OF VARIETY AND CULTURE TESTS OF VEGETABLES

The work in determining the most successful methods of handling the kinds and varieties of vegetables best suited to commercial gardening has been continued for six years. Many varieties have been tried from once to five or six times. In presenting the material gained by this work it is divided into two parts. One deals with crops that are promising on account of their production and marketing possibilities and the other with those that appear to afford little or no profit on account of their being ill suited to one or the other of these conditions.

SOIL TREATMENT

Irrigation. Frequent light applications of water are necessary to establish and maintain proper moisture conditions for vegetable crops in sandy soils. The water should be applied by means of shallow furrows, well opened up and short. To conduct it through long and rough furrows results in waste of time and water, and causes over irrigation of land near the flumes or ditches. Inadequate moistening of the most remote portions of the field frequently results from the use of long furrows.

Tender and shallow-rooted crops require irrigation at intervals of 5 to 7 days, while hardy and strong-feeding crops succeed quite well when water is applied not oftener than once in 10 days.

Where seepage lands are used for vegetables, care should be taken not to plant on soil under which the water table is too close to the surface, or to go to the other extreme, both of which will result in failure. On account of the very slight movement of water under the influence of capillary attraction in soils rather coarse in texture, moisture does not move upward or laterally to any great extent. It is necessary on this account fully to understand the action of water in seepage areas, and to place the furrows close together when irrigation is applied to such soils.

Cultivation. Preparation of advisable seed bed in these light soils is readily accomplished. The coarser types of soil become very loose as the moisture dries out of the surface, hence tillage after the application of irrigation water is many times of but little if any value. On the fine sand, sandy loam soils, and land that has been improved by the application of organic matter to a point where it becomes more or less compact after being irrigated, frequent light cultivation is necessary.

The invasion of weeds, and the increase of organic matter in gardens render cultivation necessary at much more frequent intervals in old than in new tracts. The operation, however, is not difficult on account of the ease with which the land can be worked.
Fertilizers. Soil improvement can be accomplished in the most effective manner by the use of stable manure or green manure crops of legumes. Manure should be broken up and at least partly decayed, as long straw and other coarse materials decay slowly, consequently they do not benefit the crops as much or as quickly as finer or partly decayed materials do. To keep manure well moistened hastens decay, Figure 1.

Green manure crops are also of value, but with them alone it is frequently difficult to maintain the fertility of new land at a sufficiently high standard to insure desirable crop growth. The crops used for this purpose frequently need to grow late in the spring to be of value. On this account they sometimes prevent truck crops being started at the proper time.*

Commercial fertilizers are of little value. Of materials other than nitrogen and organic matter there appears to be ample, but in some instances they are not readily available until acted upon by such processes as result from the growth of plants and decay of organic materials in the soil. The open character of the land admits of soluble materials being readily leached out; soluble fertilizers such as nitrate of soda are therefore liable to heavy loss by leaching. Under such conditions they are of little benefit to the crops unless very carefully handled.

It is necessary to apply manure liberally to garden lands, from time to time, in addition to using green manure crops, on account of the rapidity with which organic matter disappears from the soil.

* Oregon Experiment Station Bulletin No. 120, Improving Sandy Soils by the use of Green Manure Crops, deals quite fully with the use and value of these crops.

The illustrations in this bulletin are from photographs taken on the Umatilla Experiment Farm.
SEED

The great importance of securing seed of highest quality can not be over estimated. Seed that is purchased without proper knowledge of its quality and purity frequently is low in percentage of germination, and not true to variety. Farm and garden seed bought in bulk under guarantee is usually much better than package seed. Carefully selected and properly stored seed from local gardens is preferable to that which is produced in other places, owing to the importance of adaptation of plants to the localities in which they are grown. This is particularly noticeable in corn, and is doubtless equally pronounced in many other crops in which the results are not so readily determined.

Frequent use should be made of the Seed Testing Laboratory at the Agricultural College, which is maintained for the purpose of determining the quality of seed for the residents of the State. It is prepared to assist all who send material from which to have determinations made.

PLANTING

Advice on distance and manner of planting garden seed is so widespread that little attention need be given it here. It should be generally observed, however, that in light soils the seed should be put in somewhat deeper than in heavy soil, on account of the danger of the surface drying out and preventing its proper germination. Deeper planting is less important early in the spring than it is during May and June when warm days frequently occur.

Tender plants can be crowded close together advantageously for the purpose of shading the ground. This is particularly true of watermelons, cantaloupes, beans, etc. Close planting of melons has the additional advantage of diminishing injury from the wind by distributing the runners.

Such plants can frequently be alternated with rugged and tall plants to good advantage on account of the protection from wind or sun, or both, afforded by the latter. A few rows of corn or narrow strips of fall-sown rye are quite effective for protecting tender vegetables.

The seed should be placed in moist soil soon after irrigating, as applying water to germinate the seed is frequently detrimental. This is particularly true of potatoes, as a poor stand, and not infrequently almost complete failure, result from irrigating the land between planting time and the appearance of the plants above the ground. This is shown in Figure 8.

When getting seed, the frequent necessity of replanting should be born in mind. For some reason replanting becomes necessary when best possible conditions of the soil are maintained. This difficulty has been encountered with almost every crop used. It appears in some instances to be due to low temperature of the soil, and not infrequently to poor seed.
IMPORTANT VEGETABLE CROPS

By the trials completed, a number of crops have been found to succeed quite well. A few of these present very good opportunities when certain varieties are selected and properly cared for. Others of lesser importance bid fair to become of importance when soil conditions are improved to meet their needs, or when adequate markets are established.

Asparagus. To establish an asparagus bed the land should first be heavily fertilized with stable manure, at the rate of 30 loads to the acre, or even more. Partly decayed manure should be gotten if possible, and it should be thoroughly worked into the soil by plowing and disk ing. Asparagus roots one year old, of good vigor, should be chosen and set in early spring, or in the fall.

Two and one-half to 5 feet should be left between the plants in the rows, and 4 to 6 feet between the rows. The plants should be put down to a depth of 6 or 8 inches. If planted shallower, the crowns come too close to the surface and are liable to injury from deep cultivation necessary in the spring to remove the old stumps. They can best be set by plowing furrows across the field after it has been properly marked off, and locating the plants at the intersection of the furrows and cross marks.

Frequent applications of stable manure should be made, as asparagus is a strong feeder and utilizes large quantities of food materials. Care is necessary in irrigating asparagus; for it should be influenced to grow all summer. If for lack of water it is allowed to become dry at any time growth is checked and the strength of the plants correspondingly impaired.

Well-cared-for beds can be cut to a limited extent the second year, but it is best to permit them to go until the third season. Two varieties, Connovers Collossal and Palmetto, have been grown together to determine their comparative value. The Palmetto is the better in many respects. Being the rankest grower, it produces a larger percentage, as well as a large number, of marketable shoots. On account of the early season it springs up quite early.

Asparagus is frequently caught by spring frosts, but the injury from this cause results in no greater loss than the cutting that is above the ground. It is very well adapted to the district and could well be planted to much greater extent. At present while the district produces enough to supply the local demand, it does not produce enough to establish an outside trade.

On account of the quantity of fertilizer necessary for this crop, it is impossible to grow it on a large scale under present conditions; but it can be handled nicely upon every farm where there is a dairy herd. Asparagus, in short, should become an important commercial crop.

Eggplant. Considerable work has been done to determine the best varieties of eggplant and the most successful manner in which to grow and handle the crop. Early fruit and heavy yields are desirable.
Four leading varieties, Black Beauty, Black Pekin, Early Long Purple, and New York Improved, were tried under identical conditions. The Black Pekin was found to be undesirable on account of the fruit being exposed and subject to sunscald, which renders it unfit for marketing. Early Long Purple is suitable for limited use on account of being very early, but the shape of the fruit is somewhat undesirable, as it is long and slender. The Black Beauty is more uniform in size and shape than either of the others, yields less, but produces more salable fruit than the New York Improved. Both Black Beauty and New York are successful and very desirable for general use, since the plants are prolific and bear fruit of excellent quality.

Propagation of Plants. Plants were propagated in hotbeds, in coldframes, and by placing the seed in the field, with, and without, protection. It was found that planting in the field was only partly successful, and should not be resorted to except for very late crops.

Good plants can be started in either the hotbed or coldframe, though the former has the advantage of growing them the more rapidly. Planting should be done in late February or in March. Best results are usually secured by starting the plants in the hotbeds, and later transplanting to the coldframes, where they are given considerable space. By this treatment the plants become larger, stronger, and in much better shape to place in the field than if grown entirely in the crowded rows of the hotbed.

Care should ever be taken to prevent the plants becoming checked in their growth, as they recuperate slowly and frequently do not regain normal vigor.

Protection in the Field. For the purpose of hastening the development of plants that early maturity of the crop might result, garden frames, Figure 2, were placed over a number of plants which were put out April 11. Some were covered with glass, others with burlap, and others were left unprotected. A portion of each of these subdivisions
had the additional treatment of a quantity of manure being placed under the plants. This was done by digging a trench and placing in it the manure, over which the plants were set. Table I, shows the results of this experiment.

Table I, showing the results of covering eggplant transplanted April 11, and also the influence of manure placed under hills at time of transplanting.

<table>
<thead>
<tr>
<th>With manure and frames</th>
<th>With manure and no frames</th>
<th>With frames but no manure</th>
<th>Neither manure nor frames</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Plants Set.........</td>
<td>17</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Number Plants Matured....</td>
<td>16</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Number Fruits Produced...</td>
<td>70</td>
<td>100</td>
<td>16</td>
</tr>
</tbody>
</table>

* Not of salable size.

Figure 3. Field of eggplant. Plants in rows 1 and 2 were protected by glass covers. Loss of unprotected plants by frost cause of missing hills. Rows 1 and 4 were fertilized with manure placed underneath the hills. The second and third rows received no manure.

No success resulted from the use of seed in the field, which constituted the remainder of the experiment. One plant grew from seed under glass and produced 3 unsalable fruits. A severe frost which occurred April 21 either destroyed or so seriously weakened the unprotected plants that none bore fruit of salable character.

Two varieties that were used in the experiment, Black Beauty and New York Improved, responded in similar manner to the manure treatment, which was shown by the vigor and production of the plants. The fertilized plants were from 50 to 100 per cent larger than the others. Practically, only one-fourth as much salable fruit was produced by the unfertilized as by the fertilized plants. The average number of salable
fruits per plant produced under the influence of manure and glass was 6.07, and with glass and no manure 1.55.

The first fruit of marketable size appeared on the more vigorous plants which received manure. It was ready to market about July 12, practically three months after the plants were set in the field. A decided advantage is noted in this treatment for early production, as the first products from this experiment were ready for market 15 days before the first products of plants set under normal field conditions a month later.

Row 3, Figure 3, shows the growth made by plants set out April 25 without manure, and row 4 shows plants of the same variety and size planted over manure on the same date. A small trench was dug where row 4 stands and in it a layer, about 3 inches thick, of well-decayed stable manure was placed. This was covered with 6 inches of the soil that was removed in making the trench, when the plants were set as in the other rows. The results are shown in Table II.

Table II, showing difference in yield of eggplant produced by plants and seed grown with and without liberal fertilization with manure.

<table>
<thead>
<tr>
<th></th>
<th>No. of fruit produced</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Row 1 manured</td>
</tr>
<tr>
<td>Black Beauty Plants</td>
<td>104</td>
</tr>
<tr>
<td>New York Plants</td>
<td>158</td>
</tr>
<tr>
<td>Black Beauty Seed</td>
<td>2</td>
</tr>
<tr>
<td>New York Seed</td>
<td>0</td>
</tr>
</tbody>
</table>

Greater irregularity in vigor of plants appeared in the unfertilized part than over the manure. The earliest fruit, and greatest quantity of early fruit was received from the fertilized portion. This demonstrates that liberal fertilization not only increases the yield, but increases production early in the season when highest prices usually prevail.

To Determine the Influence of Hotbed Treatment and Age of Plants at Transplanting Upon the Success of the Crop. Table III shows the treatment of the plants in this experiment and the results obtained. All the plants were in a fair state of vigor when transplanted and grew nicely in the field.

Table III. Showing the date of seeding, nature of seedbed and date of transplanting plants in the field. It also shows the yield of marketable fruit received from the various portions of the experiment.

<table>
<thead>
<tr>
<th>Date Seeded in Hotbed</th>
<th>Nature of Seedbed</th>
<th>Date Transplanted</th>
<th>Number of &quot;eggs&quot; per 150-ft. row.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Black Beauty</td>
</tr>
<tr>
<td>March 16</td>
<td>Hotbed</td>
<td>May 15</td>
<td>307</td>
</tr>
<tr>
<td>March 16</td>
<td>Hotbed</td>
<td>May 22</td>
<td>229</td>
</tr>
<tr>
<td>March 31</td>
<td>Old Hotbed</td>
<td>May 15</td>
<td>276</td>
</tr>
<tr>
<td>March 31</td>
<td>Old Hotbed</td>
<td>May 23</td>
<td>227</td>
</tr>
<tr>
<td>April 11</td>
<td>Hotbed</td>
<td>May 15</td>
<td>254</td>
</tr>
<tr>
<td>April 11</td>
<td>Hotbed</td>
<td>May 23</td>
<td>214</td>
</tr>
<tr>
<td>April 11</td>
<td>Coldframe</td>
<td>May 15</td>
<td>127</td>
</tr>
<tr>
<td>April 11</td>
<td>Coldframe</td>
<td>May 23</td>
<td>229</td>
</tr>
</tbody>
</table>
Production of the two varieties from each hotbed treatment was as follows:

- Early hotbed: 977 lbs.
- Same hotbed when it had cooled off: 999 lbs.
- Late hotbed: 828 lbs.
- Coldframe: 718 lbs.

This shows that the manner of starting the plants, if they are hardy and properly cared for after transplanting, has no great influence on the yield. The plants from the coldframe were slightly less vigorous than the others.

The number of fruits produced by Black Beauty was in some instances greater than the yield of New York Improved under identical conditions in this experiment. In a number of previous trials the New York produced the heavier of the two. The two varieties succeed quite similarly and appear to average about equal yields, Figure 4.

Figure 4. Black Beauty eggplant, left, and New York Improved, right, showing comparison of yield, size, and uniformity of fruit, September, 1913. The product shown here does not represent the full crop.

Production of Similar Plants Replanted at Different Times. The results of this experiment are shown in Table IV.

<table>
<thead>
<tr>
<th>Date Planted</th>
<th>No. Eggs Produced</th>
<th>Av. Weight</th>
<th>Calculated Acre Yield lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 15</td>
<td>1873</td>
<td>1.44 lbs.</td>
<td>28554</td>
</tr>
<tr>
<td>May 25</td>
<td>1649</td>
<td>1.35 lbs.</td>
<td>23689</td>
</tr>
</tbody>
</table>

The differences noted here, which are quite uniform, appear to be due to the more advanced stage of maturity reached by the earliest plants. The vigor of growth was very similar, but the crop of the late planting was cut down by the occurrence of cool weather and frosts.
The yield and average weight of fruit shown above was computed at the close of the season, when approximately 20 per cent of the crop had been gathered and marketed. The results are, therefore, slightly less than if the entire crop had been considered. Early planting lengthens the season of production and consequently results in increased yields.

The plants in this experiment, as in several others, were placed 18 inches apart in the row. They became crowded, showing that more space should be given them. Normal growth of a relatively smaller number of plants is preferable to the restricted growth that results from crowding them too closely together.

Shipping and Marketing Eggplant. As a result of the experiments with eggplant, and observations made of its success throughout the country, it is evident that production is not a difficult problem. Lack of success in marketing, however, has been very pronounced, especially when shipment is made by express. Marketing is doubtless the one factor which prevents extensive production of eggplant in this district.

The product of the experiments carried out in 1914 was partly used to study the demands of our limited markets.

As so little eggplant is marketed from any one district in the Pacific Northwest, there is no standard or common method of handling it. The usual practice, however, is to pack the fruit without grading or wrapping, into cantaloupe crates or small boxes. In our experiments shipments were sent to a number of cities to learn from these sources the number and size of fruits that are most desired in a crate, and to find the value of wrapping to prevent shrinkage.

Moisture is given off rapidly by eggplant when it is exposed. This is particularly true if it is not fully matured. When shipped in open
crates without wrapping, therefore, it shrivels in a short time, becoming
dull in appearance and soft.

As they were the most readily available containers, potato crates
were used to ship in. A heavy grade of paper, 18 inches in width, was
used for wrapping, Figure 5.

The first shipments of carefully graded and wrapped eggplant were
sent to wholesale dealers without previous engagement. Letters were
mailed them asking for comments as to the quality, condition upon ar-
rival, sizes desired, and size of containers best suited to their demands,
with a request for suggestions on these points.

Comments from the different firms were quite varied. All spoke
favorably of the quality and appearance of the product. Some stated
that medium sized "eggs" were preferred by the trade, and others
recommended large sizes. Wrapping to prevent the collecting of dust,
and to minimize shrinkage received favorable comment. By one firm,
in particular, special mention was made of this practice.

From every source came the statement that the market was very
limited and that the people needed to be educated to the use of
eggplant.

The potato crate, which holds eighteen oversized, and 22 to 26
medium-sized, fruits, is too large for the average dealer. The canta-
loupe crate, which holds about half as many and weighs, when packed,
30 pounds, is a more desirable size. Table V shows the results of ship-
ning and marketing eggplant in 1914.

Table V, showing results of marketing eggplant in small lots throughout
the Northwest.

<table>
<thead>
<tr>
<th>Place</th>
<th>No. of Crates</th>
<th>Express</th>
<th>Price Received</th>
<th>Average Return per Crate above Express</th>
</tr>
</thead>
<tbody>
<tr>
<td>La Grande, Ore.</td>
<td>1</td>
<td>.42</td>
<td>20.38</td>
<td>1.20</td>
</tr>
<tr>
<td>Baker, Ore</td>
<td>12</td>
<td>5.72</td>
<td>3.30</td>
<td>.41</td>
</tr>
<tr>
<td>Portland, Ore.</td>
<td>3</td>
<td>2.07</td>
<td>4.83</td>
<td>.89</td>
</tr>
<tr>
<td>Seattle, Wash.</td>
<td>2</td>
<td>2.75</td>
<td>3.30</td>
<td>.41</td>
</tr>
<tr>
<td>Spokane, Wash.</td>
<td>1</td>
<td>.81</td>
<td>1.20</td>
<td>.20</td>
</tr>
<tr>
<td>Butte, Mont.</td>
<td>1</td>
<td>1.09</td>
<td>2.20</td>
<td>.91</td>
</tr>
<tr>
<td>Missoula, Mont.</td>
<td>1</td>
<td>.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anaconda, Mont.</td>
<td>1</td>
<td>1.05</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Express rates are too high to permit of small quantities being sent
to distant points unless high prices are assured. Irregularity in meth-
ods of handling eggplant, and lack of knowledge on a part of the grow-
ers of the market demands, indicate the small extent to which it is
handled. The smallest demand for eggplant is in the most remote cities
from where it is produced. Dealers in such places do not care to handle
it on this account.

Where eggplant is known to the trade, as it is in many eastern cities,
there is a great demand for it and prices are such that the producer gets
fair returns for his crop.
The principal problem in developing an industry in eggplant production in the Northwest is that of educating the people to its use and the consequent development of a larger demand.

**Muskmelons.** Thirty-six varieties have been grown, of which 33 were tried in 1914. Twenty-two of these were chosen from seed catalogs and the remaining 14 were procured from the Office of Seed and Plant Introduction, of the U. S. Department of Agriculture. The average date of planting for all varieties during the several years of the experiment has been about May 15. Earlier planting frequently results in loss on account of poor germination caused by the ground being cold. A fair stand of plants was secured from all but the Government seed. Table VI gives the results of the tests.

Table VI, giving the variety, number of weak and vigorous hills, and yield in number of marketable fruits produced by each variety.

Calculated acre yields upon the basis of the actual, and a 100 per cent stand are given. Each of the hills occupied 20 square feet of space.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Number of hills</th>
<th>Number of weak hills</th>
<th>Number of strong hills</th>
<th>Yield of marketable fruits</th>
<th>Average number of fruits</th>
<th>Calculated acre yield</th>
<th>Calculated acre yield of 100 per cent stand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acme</td>
<td>13</td>
<td>10</td>
<td>25</td>
<td>2.5</td>
<td>756</td>
<td>5445</td>
<td></td>
</tr>
<tr>
<td>Admiral Togo</td>
<td>9</td>
<td>14</td>
<td>46</td>
<td>3.3</td>
<td>1291</td>
<td>7143</td>
<td></td>
</tr>
<tr>
<td>Burrell's Rustless</td>
<td>9</td>
<td>6</td>
<td>32</td>
<td>5.4</td>
<td>963</td>
<td>11761</td>
<td></td>
</tr>
<tr>
<td>Bur Melrose</td>
<td>15</td>
<td>10</td>
<td>44</td>
<td>4.4</td>
<td>1331</td>
<td>9583</td>
<td></td>
</tr>
<tr>
<td>Ey. R. R. Hybrid No. 2</td>
<td>22</td>
<td>8</td>
<td>26</td>
<td>4.3</td>
<td>736</td>
<td>9065</td>
<td></td>
</tr>
<tr>
<td>Ey. Green Nutmeg</td>
<td>13</td>
<td>19</td>
<td>37</td>
<td>2.0</td>
<td>1119</td>
<td>4464</td>
<td></td>
</tr>
<tr>
<td>Emerald Gem</td>
<td>10</td>
<td>34</td>
<td>84</td>
<td>2.5</td>
<td>2541</td>
<td>5445</td>
<td></td>
</tr>
<tr>
<td>Hoodoo</td>
<td>20</td>
<td>19</td>
<td>51</td>
<td>4.3</td>
<td>2450</td>
<td>9583</td>
<td></td>
</tr>
<tr>
<td>Hackensack</td>
<td>20</td>
<td>20</td>
<td>51</td>
<td>2.6</td>
<td>1542</td>
<td>5662</td>
<td></td>
</tr>
<tr>
<td>Jenny Lind</td>
<td>27</td>
<td>13</td>
<td>25</td>
<td>1.9</td>
<td>756</td>
<td>4138</td>
<td></td>
</tr>
<tr>
<td>Megy's Favorite</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1.0</td>
<td>151</td>
<td>2178</td>
<td></td>
</tr>
<tr>
<td>Montreal Market</td>
<td>17</td>
<td>11</td>
<td>51</td>
<td>4.8</td>
<td>1542</td>
<td>10013</td>
<td></td>
</tr>
<tr>
<td>Montreal Nutmeg</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>1.0</td>
<td>151</td>
<td>2178</td>
<td></td>
</tr>
<tr>
<td>Osage</td>
<td>9</td>
<td>12</td>
<td>29</td>
<td>2.4</td>
<td>877</td>
<td>3227</td>
<td></td>
</tr>
<tr>
<td>Petosky</td>
<td>26</td>
<td>15</td>
<td>57</td>
<td>3.8</td>
<td>1734</td>
<td>3276</td>
<td></td>
</tr>
<tr>
<td>Rocky Ford</td>
<td>18</td>
<td>13</td>
<td>49</td>
<td>3.7</td>
<td>1436</td>
<td>8033</td>
<td></td>
</tr>
<tr>
<td>Rust-Resist'nt P. Green</td>
<td>20</td>
<td>15</td>
<td>67</td>
<td>4.4</td>
<td>2026</td>
<td>9583</td>
<td></td>
</tr>
<tr>
<td>Rust-Resist. P. Salmon</td>
<td>10</td>
<td>5</td>
<td>12</td>
<td>2.4</td>
<td>362</td>
<td>6227</td>
<td></td>
</tr>
<tr>
<td>Triple Hybrid No. 3....</td>
<td>8</td>
<td>2</td>
<td>12</td>
<td>6.6</td>
<td>362</td>
<td>13063</td>
<td></td>
</tr>
</tbody>
</table>

The following numbered varieties received from the Department of Agriculture did not succeed on account of the seed being of poor quality.

S. P. I. No. 27799  S. P. I. No. 29234  S. P. I. No. 29459
S. P. I. No. 27805  S. P. I. No. 29235  S. P. I. No. 30642
S. P. I. No. 28965  S. P. I. No. 29237  S. P. I. No. 30643
S. P. I. No. 29231  S. P. I. No. 29239  S. P. I. No. 32143
S. P. I. No. 29233  S. P. I. No. 29332

Part of the varieties in Table VI were grown previously with very similar results. Blyns Rust-Resistant, Fordhook, and Ryan's Early Watters have been previously tried without success.
From Table VI it will be seen that the calculated acre yields average low, though a number are quite good. The yields of different varieties are shown to vary a great deal. The last column, showing yields calculated on the basis of 100 per cent stand, indicates the crop that would result from a successful stand of plants. Getting a stand is more or less a general problem, while the performance of the normal plants shows the ability of the varieties to produce fruit, under given conditions of soil and treatment.

The heaviest producers are Burrell's Rustless, Hoodoo, Montreal Market, Rust-Resistant Pollock Green Flesh and Triple Hybrid No. 3. Although giving lighter yields, the Emerald Gem and Hackensack are very promising varieties. Petosky and Rocky Ford produce hardy vines and should be very desirable varieties for moderately heavy soils.

From the combined characters of quality, size, uniformity and yield, the varieties appear to range in order of importance as follows: Hoodoo, Petosky, Hackensack, Early Green Nutmeg, Emerald Gem, and Montreal Market.

For the successful production of muskmelons the soils of this district need to be well fertilized. Although the land upon which these tests were run has been under a careful and liberal process of fertilization for six years it has not reached a satisfactory condition for the production of this crop. Protection from the wind is also necessary to prevent having the runners tossed about which results in destroying the blossoms, small fruits and foliage.

Many of the plants were attacked by a fungous disease (Fusarium) by which their growth was seriously checked. An idea of the prevalence of the trouble can be gained by observing the number of weak hills shown in Table VI and also Figure 6 which shows the dwarfish appearance of affected plants.
From the success met with in running these tests, and by observations made about the district, it has been found that the commercial production of cantaloupes, or muskmelons, can be established upon well-fertilized and carefully-handled land. The vigor and quality of certain varieties indicates that there is a good future for this crop. Some time will be necessary to develop it, however, as small areas of plants should be grown and their needs carefully studied before launching out into extensive production.

Growing Muskmelons Under Frames. Muskmelons planted March 21 and grown with the protection of garden frames produced earlier fruit than those not having protection; but they required, of course, considerably more attention. The results derived from growing plants with glass and burlap-covered frames, with and without manure, are summarized in Table VII.

Table VII, showing performance of protected and unprotected muskmelon plants.

<table>
<thead>
<tr>
<th>No. hills</th>
<th>Glass and manure</th>
<th>Burlap and manure</th>
<th>Glass, no manure</th>
<th>Burlap, no manure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>First ripe</td>
<td>7-24</td>
<td>7</td>
<td>7-21</td>
<td>7-30</td>
</tr>
<tr>
<td>Salable Fruits</td>
<td>37</td>
<td>2</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>No. Fruits</td>
<td>138</td>
<td>12</td>
<td>80</td>
<td>16</td>
</tr>
</tbody>
</table>

The best germination and most rapid growth occurred under the protection of the glass, Figure 2. The plants over manure did best from the beginning. Of those covered with burlap, the ones over manure made the strongest early growth but were badly injured by hot weather. A warm spell of weather in late July (7-20-1912) severely injured all the plants in this experiment. Their growth was checked and a number were killed. As a result, the first mature melons appeared but 7 days before those in the open field. The later melons, however, did not sustain as severe a set back by the hot wave and regained normal vigor more quickly, thus giving them a decided advantage.

Onions. Onion culture offers good opportunities. A number of varieties can be grown to advantage; but the Yellow Globe Danvers, on account of its quality and hardiness, is preferable.

Onions succeed well upon damp or fine-textured soils, and grow to fairly good advantage on the coarser types, especially when manure is applied liberally. The finer types of soil, and seepage lands, of which there is a considerable quantity, are particularly well adapted to onion culture.

There are a number of possibilities in growing this crop. The first and at present the most promising, is that of producing market onions from seed. Green onions, grown from sets and from seed, offer a limited chance for profitable endeavor, though distance from markets and keen competition influence it to considerable extent. The production of onion sets should prove successful and remunerative. This is a well-
developed industry of limited proportions in the State at present. On account of the tendency of onion plants to set heavily with seed, there appears a possibility of a substantial seed industry being established here, as climatic conditions are suitable for full maturity, and proper harvesting of the crop.

Methods of culture are very simple. The seed should be planted in the fall or spring in a carefully prepared seedbed. Distance between rows should range from a foot to 16 inches, and the rows, in fields that are somewhat exposed, should be run at right angles to the direction of the prevailing wind. Weeds should be kept out and the plants thinned sufficiently to prevent crowding, as a desirable percentage of salable onions will not be produced in crowded rows.

Heretofore onions have been grown in considerable quantity, but not extensively enough for economical shipment. To make a success of onion culture in this locality cooperation in growing and marketing is absolutely necessary. Local demands are easily met, and for marketing an extensive crop, a product having uniform grade and quality must be handled in consignments not smaller than a car load each. Standardization and marketing of onions, onion sets, and seed can not be accomplished without the growers working together.

Although climatic conditions appear ideal for curing onions, there is liability of second growth occurring unless the process is very carefully manipulated. Storage also requires close attention owing to the danger from heating during periods of warm weather. A cooperative storage plant suitable for onions and other vegetables, located at, or near the railroad, is almost a necessity for economical and successful handling of such a crop.

Parsnips. The growth of parsnips should be restricted to fine soils or damp locations. On account of the manner in which this crop succeeds in regions having heavier soils than those prevailing here there is not a great opportunity for growing them commercially at a profit. There is, however, a local demand that should and can be met. Any of the more common varieties listed in seed catalogs give satisfaction.

Peas. Peas succeed quite well when started early in the spring, March 15 to April 15, on well-fertilized soil. Varieties that mature at different times should be planted, or the date of seeding so arranged that the crop will mature through a long period. Peas can be grown to advantage for home use and to supply local and near-by markets. The common varieties such as Alaska, Telephone, and Improved Strategem are desirable.

Potatoes. A three-year test of potatoes, in which 18 varieties were used, gave similar results from the respective varieties each year. The varieties that are most generally used gave the highest average yields. The most vigorous growth and the heaviest yields were derived from American Wonder, Netted Gem, Early Ohio, Pearl, Rural New Yorker, and Burbank. One season Burbank went near the bottom of the list,
see Table V II. Irish Cobbler, Early Rose, and Triumph gave good satisfaction.

The yields were generally light, ranging from 140 bushels an acre down. The soil is unsuitable for satisfactory potato culture, although a great deal of care has been taken in its improvement and in growing the crops. On finer soil, and in damp locations, potatoes of standard varieties such as Early Rose, Early Ohio, Burbank, American Wonder, and Netted Gem produce well. These tests are of greater importance than if conducted under ideal conditions owing to the rigorous conditions under which they were made. Although maximum yields were not derived, the comparative hardiness and value of the varieties was brought out very plainly.

Table VIII. Showing result of potato variety test in 1914.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Source</th>
<th>Hills Planted</th>
<th>Hills Grown (percent)</th>
<th>Total Yield (pounds)</th>
<th>Marketable (percent)</th>
<th>Acre Yield Marketable (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Wonder</td>
<td>Local</td>
<td>238</td>
<td>93</td>
<td>283</td>
<td>55</td>
<td>8547.0</td>
</tr>
<tr>
<td>Burbank</td>
<td>UE -2</td>
<td>122</td>
<td>49</td>
<td>37</td>
<td>57</td>
<td>2177.7</td>
</tr>
<tr>
<td>Early Ohio</td>
<td>USDA-UEF</td>
<td>115</td>
<td>84</td>
<td>100</td>
<td>64</td>
<td>6556.8</td>
</tr>
<tr>
<td>Early Ohio</td>
<td>UE -2</td>
<td>98</td>
<td>69</td>
<td>63</td>
<td>70</td>
<td>4562.8</td>
</tr>
<tr>
<td>Early Ohio</td>
<td>USDA</td>
<td>87</td>
<td>79</td>
<td>91</td>
<td>63</td>
<td>6533.1</td>
</tr>
<tr>
<td>Early Rose</td>
<td>UE</td>
<td>128</td>
<td>29</td>
<td>17.5</td>
<td>45</td>
<td>881.4</td>
</tr>
<tr>
<td>Czech Mountain</td>
<td>USDA-UEF</td>
<td>140</td>
<td>3</td>
<td>2</td>
<td>25</td>
<td>51.9</td>
</tr>
<tr>
<td>Green Mountain</td>
<td>USDA-UEF</td>
<td>126</td>
<td>14</td>
<td>11</td>
<td>45</td>
<td>518.5</td>
</tr>
<tr>
<td>Irish Cobbler</td>
<td>USDA-UEF</td>
<td>235</td>
<td>39</td>
<td>31</td>
<td>48</td>
<td>3110.0</td>
</tr>
<tr>
<td>Irish Cobbler</td>
<td>USDA</td>
<td>41</td>
<td>96</td>
<td>30</td>
<td>74</td>
<td>4851.7</td>
</tr>
<tr>
<td>Irish Cobbler</td>
<td>USDA-UEF</td>
<td>128</td>
<td>55</td>
<td>106</td>
<td>73</td>
<td>7851.1</td>
</tr>
<tr>
<td>Potatoes Extra Early</td>
<td>Local</td>
<td>231</td>
<td>57</td>
<td>57</td>
<td>43</td>
<td>2383.6</td>
</tr>
<tr>
<td>Reddish</td>
<td>USDA-UEF</td>
<td>122</td>
<td>1.6</td>
<td>21</td>
<td>51</td>
<td>1451.5</td>
</tr>
<tr>
<td>Pearl</td>
<td>USDA-UEF</td>
<td>33</td>
<td>33</td>
<td>40</td>
<td>88</td>
<td>762.3</td>
</tr>
<tr>
<td>Pearl</td>
<td>USDA</td>
<td>123</td>
<td>7</td>
<td>10</td>
<td>75</td>
<td>777.8</td>
</tr>
<tr>
<td>Rural New York</td>
<td>USDA-UEF</td>
<td>41</td>
<td>100</td>
<td>46</td>
<td>55</td>
<td>685.3</td>
</tr>
<tr>
<td>Somers Extra Early</td>
<td>USDA-UEF</td>
<td>122</td>
<td>30</td>
<td>25</td>
<td>55</td>
<td>1451.5</td>
</tr>
<tr>
<td>Somers Extra Early</td>
<td>USDA</td>
<td>47</td>
<td>87</td>
<td>11</td>
<td>40</td>
<td>1166.6</td>
</tr>
<tr>
<td>Up-to-date</td>
<td>USDA-UEF</td>
<td>117</td>
<td>35</td>
<td>44</td>
<td>55</td>
<td>2461.9</td>
</tr>
</tbody>
</table>

Local — Seed sired locally in 1913.
USDA-UEF — Seed from USDA in 1912 and grown on Umatilla Exp. Farm in 1912.
USDA — Seed from USDA in 1913.
UEF — Seed grown on Umatilla Experiment Farm in 1912.
UEF-2 — Seed grown on Umatilla Experiment Farm in 1911 and 1912.

Selection of Seed. After reading the explanatory note below Table VIII a study of this table will show the value of potatoes grown for seed on the Experiment Station when compared with seed produced on heavier soil. It is plainly shown that seed grown here has not given results comparable with those obtained at other places. This is principally due to the fact that the Station seed was poorly grown. It was small and lacked the firm, crisp, and starchy characters of well-grown and properly matured tubers.

The selection of potato seed should not depend upon where it is grown, but upon the condition of the potatoes. Locally grown and
properly matured tubers kept in proper storage should give as good results as imported seed provided they are of the same quality. In case of doubt as to the quality of home-grown seed, other potatoes of best quality should be secured.

**Early Potatoes.** When early crops are desired, such varieties as Early Ohio, and Early Rose should be planted in a warm exposure in February, or the first part of March.

Sprouting potatoes before planting should assist in hastening maturity. This is done by placing the tubers stem end down and one layer deep in shallow trays. The trays are placed in racks in a well-lighted room and kept at a moderate temperature. They should be handled so that the sprouts will grow short and thick and be colored a dark shade of green. When ready to plant, the potatoes are cut in two lengthwise and the pieces laid in the furrow with the cut surface down.

All seed, whether home-grown or imported, should be carefully examined for evidence of disease infection. A number of serious potato diseases are prevalent throughout the country and are readily transmitted with seed. Once established in the soil these pests are very difficult to get rid of. The way to keep soil free from such infection is to treat all seed thoroughly before planting. Either the formalin or corrosive sublimate treatment should be used. Although the latter is the most difficult to apply properly, it is preferable on account of its ability to kill all harmful diseases, while formalin is not considered thoroughly effective against rhizoctonia.

**Location for Potatoes, and Their Care.** Potato culture on the sandy soils not influenced by ground water should be restricted to early var-

![Figure 7. Field of potatoes showing missing hills that resulted from chance irrigation between the time of planting and the appearance of the plants. September 23, 1914.](image-url)
ieties for early trade. Late potatoes do not stand the heat of summer in such locations while on damp land they flourish. The production of potatoes, both early and late, should be greatly increased. There are numerous places about the ponds and seepage spots that are now idle where potatoes can be successfully grown with little effort.

Irrigation should not be applied to potato land between the time of planting and the appearance of the plants, as this usually results in a poor stand. Fige 7 shows the effect of irrigation water getting onto a potato field at this time. By dropping the seed immediately after irrigating, the plants usually make their appearance before they are in need of water.

If warm weather continues after potatoes mature, they frequently give up a portion of their moisture, become soft and wilted in appearance and do not keep well. To avoid this, they should be taken out of the ground as soon as matured and placed in proper storage. As the potato industry grows, substantial storage houses will need to be provided for successfully keeping the crop in late summer and during periods of low temperature. Potatoes can be cheaply and effectively stored in hills, or pits, during cold weather, but frequently, on account of unfavorable weather conditions, they cannot be taken out at the time they should be sold.

**Mulching Potato Ground with Straw.** To determine the success of this practice, which was discussed to considerable extent throughout the district at one time, a small experiment was carried out.

It was claimed that to cover land planted to very early potatoes, with a coating of straw, would hasten their appearance and maturity. This was done, with the result that the portion of a plot not covered with straw came up long before the covered part, and potatoes planted at the time the uncovered portion came up made their appearance before those that were covered. Besides this, the stand on the covered area was not as good as on the other parts of the experiment.

**Growing Two Crops in One Season.** To determine if it is possible to grow two crops in one season, for the primary purpose of having late-matured and firm seed of early varieties, a small experiment was conducted. Well-matured Early Rose tubers from an early crop were laid in a dry place in the shade for 10 days to ensure maturity; they were then cut and planted. The result was that only a few plants, four or five out of 100 hills, made their appearance, and these not until late in the fall. The period between time of planting and appearance of the plant was 51 days.

**Sweet Corn.** A test of the most common varieties of sweet corn was made to determine which are best to use for home and commercial purposes. The experiment included seven varieties as follows:

- Black Mexican
- Country Gentleman
- Early Corey
- Golden Bantam
- Golden West
- Peep-o-day
- Stowells Evergreen
Country Gentleman, Golden Bantam, and Stowells Evergreen succeed best. Country Gentleman is a tall late variety that is hardy and produces corn of very good quality. Golden Bantam is a dwarf variety that comes on very early, and is one of the most promising sorts with which to establish a market for early roasting ears. Stowells Evergreen is a large, late variety that produces an abundance of corn of excellent quality. One of its principal values is its habit of maturing ears through a long season. It is frequently injured to considerable extent by the corn-ear cutworm.

Peep-o-day is of value in raising a succession of early corn, as it is medium early and quite prolific. The ears were small and many of them poorly filled. When grown on more favorable soil, it should do quite well. Portland Market, a variety that was not included in these tests, but one that has been much praised of late, is also very desirable. It is considerably earlier than the Golden Bantam.

For the production of early corn, the Portland Market, Golden Bantam, and Peep-o-day should be planted, as they usually mature in the order named and will yield a continuous supply of green corn for a long period. The season can be extended through almost the entire summer by adding Country Gentleman and Stowells Evergreen to this list.

By beginning with the earliest possible varieties and having others to follow up during the entire season a good opportunity is afforded for building up a substantial demand for products of this kind. On account of the strong demand for early corn of guaranteed quality there is a splendid opportunity for advancement by utilizing the early season and warm soil of this district. For this purpose, however, it will be necessary for growers to cooperate in growing a uniform product and marketing it in a systematic manner.

Early planting is necessary for best results in producing early corn. By planting early in April considerable risk is run from loss by frost, but such chances must necessarily be taken in order to get an extra early product whenever it is possible to do so.

The corn-ear cutworm, which causes considerable damage to corn, affects late or midseason varieties worse than those that mature early. This condition favors early corn. The control of this insect is a difficult matter. Its ravages can be partly avoided by growing varieties that mature when it is not present in large numbers, but to combat it is a difficult matter. Cultivation of corn land in the fall and early spring help to keep it down. It is also desirable to select a field for corn as far as possible from idle land, as the insect breeds in such places.

Watermelons. The soil upon which the watermelon tests were conducted was not in a high state of fertility. Neither was it properly protected from the wind. The results show quite definitely, however, the comparative value of the varieties.

The work has been in progress for 4 years, during which time 24 varieties have been grown. The trials in 1911 and 1912 gave similar results to those made in 1913 and 1914. Tables IX and X show the re-
Table IX. Showing number of hills planted, number bearing fruit, the date of ripening of the first fruit, the number of marketable melons produced, and the average weight of the melons produced by each variety, 1913.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Hills planted</th>
<th>Hills matured</th>
<th>1st melons ripe</th>
<th>Number melons</th>
<th>Average weight lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angelino</td>
<td>70</td>
<td>25</td>
<td>8-8</td>
<td>9</td>
<td>12.3</td>
</tr>
<tr>
<td>Chilian</td>
<td>70</td>
<td>22</td>
<td>8-11</td>
<td>12</td>
<td>10.4</td>
</tr>
<tr>
<td>Coles Ey.</td>
<td>70</td>
<td>22</td>
<td>8-8</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Cuban Queen</td>
<td>70</td>
<td>25</td>
<td>8-8</td>
<td>12</td>
<td>10.75</td>
</tr>
<tr>
<td>Florida Favorite</td>
<td>70</td>
<td>27</td>
<td>7-31</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>Fordhook Early</td>
<td>70</td>
<td>29</td>
<td>8-14</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>Georgia Rattlesnake</td>
<td>70</td>
<td>31</td>
<td>8-5</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td>Halbert Honey</td>
<td>40</td>
<td>22</td>
<td>8-8</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Iceberg</td>
<td>40</td>
<td>17</td>
<td>8-3</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>Kleckly Sweet</td>
<td>40</td>
<td>8</td>
<td>8-8</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Jodi</td>
<td>40</td>
<td>20</td>
<td>8-15</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Pom Watson</td>
<td>40</td>
<td>24</td>
<td>8-5</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>S. P. I. 2825B</td>
<td>40</td>
<td>21</td>
<td>8-5</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>28271B</td>
<td>40</td>
<td>6</td>
<td>8-7</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>21788</td>
<td>40</td>
<td>9</td>
<td>8-26</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>21787</td>
<td>40</td>
<td>7</td>
<td>8-4</td>
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<td>40</td>
<td>1</td>
<td>8-26</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>21913</td>
<td>40</td>
<td>1</td>
<td>8-26</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
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<td>6</td>
<td>8-26</td>
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<td>11</td>
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<td>30370</td>
<td>40</td>
<td>5</td>
<td>8-26</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>32217</td>
<td>10</td>
<td>2</td>
<td>8-26</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

* Represents varieties from the Office of Seed and Plant Introduction, U. S. Department of Agriculture.

Table X. Showing number of hills that came up, the number that fruited, date of first notes on maturity with number ripe at that time, number melons produced by each variety and their average weight, 1914.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Number hills</th>
<th>Hills fruiting</th>
<th>I first gathered</th>
<th>No. melons</th>
<th>Average weight lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angelino</td>
<td>23</td>
<td>23</td>
<td>9-5</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Chilian</td>
<td>25</td>
<td>21</td>
<td>9-5</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Coles Early</td>
<td>32</td>
<td>22</td>
<td>9-5</td>
<td>11</td>
<td>26</td>
</tr>
<tr>
<td>Florida Favorite</td>
<td>23</td>
<td>12</td>
<td>9-5</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Kleckly Sweet</td>
<td>35</td>
<td>22</td>
<td>9-5</td>
<td>8</td>
<td>37</td>
</tr>
<tr>
<td>Mammoth Iron Clad.</td>
<td>41</td>
<td>15</td>
<td>9-5</td>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td>Red Seeded Russian</td>
<td>47</td>
<td>15</td>
<td>9-5</td>
<td>47</td>
<td>94</td>
</tr>
<tr>
<td>Tott Watson</td>
<td>41</td>
<td>22</td>
<td>9-5</td>
<td>7</td>
<td>45</td>
</tr>
<tr>
<td>&quot;Triumph&quot;</td>
<td>34</td>
<td>22</td>
<td>9-5</td>
<td>6</td>
<td>65</td>
</tr>
<tr>
<td>S. P. I. 27887 U. E. F.**</td>
<td>53</td>
<td>17</td>
<td>9-5</td>
<td>3</td>
<td>106</td>
</tr>
<tr>
<td>28244 U. E. F.**</td>
<td>47</td>
<td>17</td>
<td>9-13</td>
<td>5</td>
<td>94</td>
</tr>
<tr>
<td>27887</td>
<td>2</td>
<td>2</td>
<td>9-13</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>29244</td>
<td>1</td>
<td>1</td>
<td>9-13</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>30890</td>
<td>2</td>
<td>1</td>
<td>9-13</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

* Represents varieties received from the Office of Seed and Plant Introduction, U. S. Department of Agriculture.
** Represents seed from these varieties grown one year on the Farm.
sults of the last 2 years work. Table XI shows computed acre yields on a basis of the number of hills maturing fruit, and upon the basis of 100 percent stand of fruiting hills, also the pressure withstood by melons or different varieties before they cracked or collapsed.

The number of melons gathered September 5 and 18 shows indirectly the date of maturity of the respective varieties, as those from which the large numbers were gathered began to mature first. This is true excepting in the case of the Mammoth Iron Clad which does not begin maturing as early as either Kleckly Sweet or Florida Favorite.

The size of melons as shown by the average weight column in tables IX and X gives the manner in which they meet the demand of the retail trade, when it is known that those weighing less than 15 lbs. are not desirable, and all under 10 lbs., are not salable. The smallest melons were not considered in making these computations.

Table XI. Showing the acre yield of watermelons based on crops produced in the variety test, the yield based on a 100% stand of bearing plants, and the pressure test of melons showing the average pressure withstood by a number of each variety before cracking or collapsing.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Calculated Acre Yield</th>
<th>Lbs. pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual production</td>
<td>100 per cent stand*</td>
</tr>
<tr>
<td>Angelino</td>
<td>6522</td>
<td>12947</td>
</tr>
<tr>
<td>Chilian</td>
<td>5779</td>
<td>22853</td>
</tr>
<tr>
<td>Cole's Early</td>
<td>5616</td>
<td>14278</td>
</tr>
<tr>
<td>Cuban Queen</td>
<td>5013</td>
<td>9075</td>
</tr>
<tr>
<td>Florida Favorite</td>
<td>5356</td>
<td>23353</td>
</tr>
<tr>
<td>Fordhook Early</td>
<td>11472</td>
<td>207</td>
</tr>
<tr>
<td>Georgia Rattlesnake</td>
<td>11472</td>
<td>138</td>
</tr>
<tr>
<td>Holbert's Honey</td>
<td>4998</td>
<td>363</td>
</tr>
<tr>
<td>Ice Burg</td>
<td>5440</td>
<td>11011</td>
</tr>
<tr>
<td>Ice Cream</td>
<td>6986</td>
<td>159</td>
</tr>
<tr>
<td>Kleckly Sweet</td>
<td>6986</td>
<td>11011</td>
</tr>
<tr>
<td>Lodi</td>
<td>6986</td>
<td>150</td>
</tr>
<tr>
<td>Mammoth Iron Clad</td>
<td>12809</td>
<td>47190</td>
</tr>
<tr>
<td>Red Seeded Russian</td>
<td>11102</td>
<td>41140</td>
</tr>
<tr>
<td>Tom Watson</td>
<td>9741</td>
<td>24905</td>
</tr>
<tr>
<td>Triumph</td>
<td>12751</td>
<td>32307</td>
</tr>
<tr>
<td>S. P. I. No. 2798</td>
<td>11988</td>
<td>2646</td>
</tr>
<tr>
<td>S. P. I. No. 2934</td>
<td>17252</td>
<td>56570</td>
</tr>
</tbody>
</table>

* Figured on a basis of the numbers and average weights given in Table X, with hills 6x6 ft. apart.
** Average of two determinations in different years.

The stand of plants and growth was very irregular with every variety tried, although care was taken to replant whenever necessary and to have the soil in the best possible condition. A considerable number of plants remained dwarfish in character during the entire season and did not fruit, Figure 8. Considerable injury resulted to the plants from severe winds, a fact, which renders protection necessary for best results. Careful attention in cultivation and irrigation was given each of the trials.
The following brief description, given in alphabetical order, indicate the varieties considered worthy of more extensive trial.

**Angelino.** Flesh red, deep, has fine texture, flavor fair. Shape almost spherical, uniform; size and yield medium; rind thin but tough.

**Chilian.** Flesh light pink, deep, crisp with fine texture, flavor good. Shape oval, variable; size and yield medium; rind comparatively tender.

**Florida Favorite.** Flesh light pink, deep, coarse texture, shape oval, irregular; size and yield medium.

**Kleckly Sweet.** (Monte Cristo.) Flesh bright pink, deep, crisp, texture very fine, highly flavored and sweet. Shape oval, regular; size and yield medium; rind thin and brittle. On account of excellent quality this is the best variety, although it requires careful handling and does not produce as heavily as a number of others.

**Red-Seeded Russian.** Flesh pink, deep, crisp and rather highly flavored. Shape oval, somewhat bottle necked, uniform; size small and yield heavy. This variety is of importance on account of its very early maturity.

**Tom Watson.** Flesh deep pink, deep, rather coarse, compact. Shape oval, irregular; size small to large, very irregular; yield light; rind very tough. Has been grown once, only, and appears deserving of extensive trial.

**Triumph.** Flesh light pink, rather coarse, crisp, deep, and of good flavor. Shape elliptical, irregular, rough; size large; yield heavy, and rind toughest of any under trial, Table XI.

**S. P. I. No. 29244.** Flesh pink or yellow, deep, very fine and crisp, sweet, but not highly flavored. Shape spherical, uniform; size medium, variable; yield heavy; rind very tough. Is hardly as nice a texture as No. 27987 but hardier and more productive.
The Georgia Rattlesnake and Mammoth Iron Clad are very similar in appearance and performance. Both are undesirable, although attractive in appearance, regular in shape, and very heavy producers. The objections are inferior quality, and large hollow spaces about the seed that render them light and difficult to gather at the right time.

Forcing Watermelons. A number of hills of watermelons were grown under glass in the field, some with manure under the hills and others without. The seed was planted March 11. All plants not having protection were destroyed by frost. Those fertilized with manure were more vigorous than the ones not receiving it. The first mature melons appeared August 1, about ten days before those from the general field planting of the same variety.

The culture of watermelons has been fairly successful and can well be materially increased. Care should be taken to use the best soil obtainable for this crop. Although it succeeds on comparatively new land much better results are derived from the finer soils and more highly fertilized areas than from coarse or new land.

MINOR TRUCK CROPS.

Crops of minor importance, owing to their being poorly adapted to the district, or those of secondary commercial importance, are discussed in alphabetical order under this heading.

On account of improper adaptability to conditions of soil and climate, a number of crops that might be marketed to advantage have been found of little value, though most all of them can and should be grown for home use. Of the crops that can not be marketed to advantage there are a number that succeed quite well. Of this class several are desirable for food for livestock and should be extensively grown for this purpose.

Beans. Beans, as a rule do not succeed under open field conditions. Where they are on highly fertilized land and well protected, the hardier varieties do quite well, but this is usually in very limited areas. Unless careful preparation is made success will not be met with in their growth upon the coarser soil types. They do much better, however, and might be grown successfully in open fields on the finer types of soil. This is especially true where the water table is close enough to the surface to maintain a uniform moisture condition in the soil.

The trials were made on a soil that had one application of stable manure and two cover crops of rye and vetch worked into it. Unsatisfactory results were derived from the following varieties:

<table>
<thead>
<tr>
<th>Variety</th>
<th>Seed Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fordhook Lima</td>
<td>White Navy</td>
</tr>
<tr>
<td>Pole Lima</td>
<td>Early Red Valentine</td>
</tr>
<tr>
<td>Early Refugee</td>
<td>White Teparies</td>
</tr>
<tr>
<td>Golden Wax</td>
<td></td>
</tr>
</tbody>
</table>

Kentucky Wonder and Red Mexican succeeded much better than the others, made a fair growth and produced a small amount of seed. White
Teparies, a variety of beans native to the Southwest, were planted with the Red Mexican bean to determine the comparative value of each.

Figure 9 shows the manner in which they succeeded. The beans grew vigorously and to considerable size, but produced no seed. The Teparies were very small and matured unevenly, Figure 9. Seed of both crops was planted April 2 and by August 2 the teparies had begun to mature. The earlier plants ripened a small amount of seed and died, while others continued to mature in like manner until fall frosts occurred. Neither the Teparies nor Red Mexican beans were successful in this experiment, though it appears that if put on a finer and more uniformly moist soil the beans should succeed fairly well.

Beets. A number of the common varieties of table and stock beets, including mangels and sugar beets, have been tried with poor results. Beets are not adapted to the light character of soil that prevails here; they are grown, however, with varying degrees of success, on the finer and more moist soils of the district. Their production is quite limited, being mostly confined to moist and heavy fertilized land, principally in well-protected gardens. Beets are of little value commercially, especially at this stage of development of the country.

Carrots. Of the several common varieties of table and stock carrots tried, most all grew satisfactorily. The tests were unsuccessful, however, on account of the difficulty in getting a stand of plants. Incomplete germination of the shallow-planted seed resulted from the difficulty in keeping it sufficiently moist. Many young plants were destroyed by erosion of sand set in motion by the wind. On fine sand and sandy loams carrots do quite well. They are very successful on seepage land.
This crop should be much more extensively grown by farmers who are not prepared to build silos and fill them with corn. The chief value in carrots as a winter feed for livestock is the succulence they furnish. They can be successfully and economically kept by hilliing up and covering with soil, as is the usual practice with potatoes.

A limited market should be established for table carrots, on account of the early time at which they can be brought to salable size under usual warm spring conditions. Half-long varieties are preferable for table trade as they mature quickly. The long varieties which produce more abundant yields are desirable for stock feed.

Celery. Celery is a crop that is very exacting in its requirements of soil, moisture, and cultural treatment. As conditions are not suited to its growth, it has not been tried at the Station.

To be salable, this crop must be grown in a vigorous manner without interruption. If at any time its growth is checked, the product becomes tough, stringy, and unsalable. To learn how to handle it properly, moreover, considerable time and experience are required.

Several attempts at growing celery on the light and comparatively infertile soil of this locality have been almost devoid of success. Some of the trials were made by persons who had been apprised of the difficulties which they would be likely to meet, and practically all were made by individuals entirely unfamiliar with the exacting demands of the plant.

Celery, in short, is not generally adapted to this district, though it can be grown to a limited extent in a number of moist places, if carefully handled.

Citron or Preserving Watermelons. This melon resembles a mottled watermelon in external coloring, but is almost spherical in shape. It is hard and keeps well. It is chiefly valued for making preserves, but is also used as feed for livestock.

There is only a limited demand for it in the market. The plants are quite hardy, and though they make fair growth on new land, they succeed best on fine or well-fertilized land.

Cabbage. Cabbage is seriously injured by the cabbage aphis and cabbage worm. Its slow growth is partly responsible for the damage resulting from the attack of these insects.

As cabbage likes a damp soil, its culture is restricted to damp and rich lands. It should have careful attention in order to keep the insects off and to protect it from severely warm sunlight and from the wind.

The difficulties met with in growing cabbage are numerous, and its success so uncertain that nothing has been determined of the preference of varieties. Cabbage as a commercial crop has but slight possibilities in this district.

Similar conditions surround the culture of cauliflower, brussels sprouts, and other closely related plants.
Cucumbers. Cucumbers, like watermelons and cantaloupes, require a highly enriched soil. More congenial conditions are necessary than for the melons. Planting should be restricted to the richest and best protected land available. Common varieties, such as White Spine, and Long Green, give satisfaction.

On account of their need of highly fertilized soil, a liberal supply of stable manure should be placed under the hills as described for muskmelons. If satisfactory growth does not occur, frequent applications of liquid manure should be made by sprinkling, or spreading it onto the soil about the plants.

Cucumbers offer very slight opportunities for commercial production, but can be grown to sufficient extent for home use and to supply the local demand.

Jerusalem Artichoke. Artichokes were tried on new land only. Germination was prompt, but growth was slow. The yield was light, being approximately 1,687 lbs. per acre.

Slightly improved irrigated land, or soil of fine texture, are fairly well suited to their culture. On seepage or subirrigated land they flourish and produce abundant yields. The prevailing long seasons are very congenial for this crop.

The use of artichokes is limited to furnishing succulence and a small quantity of feed for livestock. Hogs do well on them and harvest their own feed. Artichokes are desirable for cows and can be kept in the same manner as potatoes and carrots.

This crop is valuable for hog raisers, and for dairymen who have damp soil upon which to grow it, but is of little commercial importance.

Ground Cherry. Following some enquiries as to the success of this crop, a trial was made. It was found to be quite successful, the ground cherry responding readily to an increase of fertility in the soil. The plants begin bearing while small and continue to blossom and set fruit as they grow, until checked by frost.

The ground cherry is of little market value, yet it is frequently seen in market places. It can be easily grown in sufficient quantity for family use. On account of early maturity a limited market can doubtless be found for an early product.

Kale, or Borecole, and Thousand Headed Kale. Kale, or borecole, can be grown for home use. It does not grow rapidly enough to be of value for marketing only under ideal conditions of soil and moisture, which, for this plant are very limited in this locality.

Thousand-headed kale grows quite well and can be used to advantage for greens. It is also very desirable for livestock, especially for milch cows and chickens. It can be fed from the field until cold weather occurs. The plants are hardy and are seldom injured by temperatures above 16 to 20 degrees F.

It can be started in the hotbed, coldframe, or in the field. On account of the longer season afforded it by starting early, the plants should be propagated in hotbeds or coldframes, and transplanted as
soon as conditions are suitable for them in the field. As the plants are quite large, they should be placed two to three feet apart in the rows and the rows should be 40 inches to 48 inches apart. Since kale can not be stored to advantage it is not as desirable for stock feed as carrots, or turnips.

**Lettuce.** Early lettuce can be had by planting seed in the fall, sufficiently early to permit the plants to grow three or four leaves before severe weather occurs. It should usually be planted during September. If seed is allowed to mature and shatter in the field many small plants spring up. By transplanting these into rows in the spring much earlier lettuce can be had than from spring-planted seed.

At least two or three seedings should be made to lengthen the season. Head varieties should be used, as they yield a more tender and better product than other varieties.

Lettuce can be grown successfully for home use where some attention is given to fertilizing the soil, and watering the plants. It is not of commercial importance for this locality, unless produced in a minor way under very unusual conditions.

**Okra.** Two varieties, White Velvet and Dwarf Density, were grown on a comparatively well-fertilized plot of land. A poor stand of plants resulted. Growth was slow and the maximum height of plants, which were of the white velvet variety, was 12 inches. The first fruits were ready to gather July 12, after which time a number came on but all were small and the yield was very light. This crop does not appear to be at all successful on sandy soil, not sufficiently successful, at least, to give promise of commercial importance.

**Peanuts.** Several varieties of this crop have been grown with varying degrees of success. The principal limiting factors preventing it becoming of commercial importance are shortness of the season, and high cost of production.

The varieties with calculated yields per acre were as follows:

- **African** .................................................. 625 lbs.
- **Jumbo** .................................................... 595 lbs.
- **Spanish** .................................................. 325 lbs.
- **Valencia** .................................................. 225 lbs.
- **Virginia Bunch** ......................................... 175 lbs.

The African is a large vigorous-growing sort that begins blossoming early and sets an abundance of pods. It matures earlier than either of the others and is generally superior.

The Jumbo is very large. The kernels do not fill the pods, but are of good size. The yield of meat is not as large in proportion to that of bulk as in either of the other varieties.

The Spanish is somewhat dwarf in character. It is hardy and produces an abundance of pods which are quite small. It fills well but does not reach full maturity.

The Valencia and Virginia Bunch grew nicely, but blossomed late and did not reach maturity. Had the crop that set on the plants fully
matured, the yield would have been much larger. In districts where peanuts are extensively grown, the yield ranges from 650 to 1000 lbs. per acre and averages about 30 bushels, or 900 lbs.

Peanuts respond to soil fertility and cultivation as do other crops. They should be planted in May after the soil has become thoroughly warm and when the weather is settled. The distance between rows should be 36 to 40 inches and between plants in the rows about 18 inches.

Although of little commercial importance, this crop should be grown quite generally for family use.

Pepper. A number of varieties of pepper were tried on a comparatively new soil, yet one to which two light applications of manure had been made, and upon which two crops of vetch had been grown and worked in. Of the eight varieties used, Ruby King and Chinese Giant were the most successful and desirable. Neapolitan, Large Bell, Golden Dawn, Sweet Spanish, Chili, Elephant Trunk and Cayenne succeeded in order as named.

The plants need to be started in hotbeds or coldframes, preferably the hotbed, and should be well hardened off before transferring to the field. They should be set out as early as the ground becomes warm and danger of frost is past.

The plants of almost all these varieties of pepper have a small number of leaves. Frequently the leaves were less numerous than the pods. Peppers of good quality were produced, but the care necessary in growing them and light yields obtained render the crop undesirable commercially. On highly fertilized and well-protected garden plots they should succeed quite well, and can be grown to good advantage for home use.

Radishes. Radishes succeed wherever given a chance, and should be grown in abundance during early spring for every home. The common varieties succeed quite well. Short varieties should be planted for earliest use, as they mature more quickly than the long type. Later varieties should be planted at the same time to have them come on after the earlier sorts are gone.

The seed should be put in as early in spring as weather conditions become settled as the young plants are capable of standing considerable cold. If they do not succeed, the area, being small, can readily be replanted. Loss from early planting is not great, therefore the risk of frost should be run to hasten maturity of the crop as much as possible.

Radishes can be had in the fall of the year by planting in a protected place in August or early September. The young seedlings are easily destroyed by hot sunlight and should be partly shaded until warm weather is past. The ground should be well fertilized, and it should be kept quite moist to hasten the growth. Radishes grown in this manner can be used, with a little care in covering, for considerable time after severe frosts occur.

Rhubarb. Though rhubarb does not thrive on the predominating types of soil, it does quite well on protected and highly fertilized land. There is little prospect of it becoming a commercial crop on sandy soil,
but with liberal fertilization should do quite well on the silt and sandy loams.

Five varieties have been tried with about equal success. Either Crimson Winter, Dodges Prolific, Linneaus, Mammoth, or Victor are desirable varieties, Dodges Prolific being quite extensively used.

Every garden should contain a few rhubarb plants, as they do not require a great deal of care after becoming properly established, and yield a large quantity of a very desirable food.

Extreme care is necessary in starting the plants. Large holes should be dug and partly filled with well-decayed manure before the plants are put in. They should be placed in such a manner that the crowns, or buds, will remain about six inches from the surface of the ground. A liberal application of manure should be applied to the bed every fall, as heavy fertilization with organic fertilizer is necessary for success. Shade should be afforded the plants during the few hottest weeks in summer.

Squash. Squash and pumpkin do not succeed well on new land unless it is subirrigated. Moist land and heavily fertilized areas of coarse soils grow a few hardy varieties quite satisfactorily. Extensive planting should be restricted to damp, or fine-textured soils.

As there is little demand for squash, its production should be confined to supplying feed for livestock and to the demands of the district and surrounding country.

Cultural treatment is the same as in other localities. A liberal application of manure to the soil results in a greater percentage of successful hills, and in more vigorous growth.

Tomatoes. A large number of varieties were tried under various conditions to determine their comparative value and degree of resistance to the blight trouble which is prevalent. Numerous trials have been made to determine with what degree of success tomatoes can be grown under field conditions, the purpose being to endeavor to find if commercial production were possible.

The varying success of individuals in growing a few plants in shaded and protected places rendered work under such conditions unnecessary. The growth of tomatoes under the most nearly ideal conditions obtainable was only partly successful.

The soil upon which the trials were made is a medium sand that was not disturbed by grading, and had applied to it two coatings of stable manure, and from one to three crops of vetch, depending upon the year in which the work was done. Extreme care was taken to keep the land well moistened by applying water frequently. As the plot was partly protected, moderate winds did little damage to the plants, but severe winds injured them to considerable extent.

This work covers a number of distinct experiments which are enumerated below with a brief statement of the results derived from each.
No. 1. To determine the condition of hotbed and coldframe best suited for the propagation of plants.

The best plants can be grown in a short time by starting them in a hotbed and transplanting to a coldframe when about 1 1-2 inches tall. They should be given considerable space in the coldframe and allowed to remain there until about 3 inches high. Sufficient air should be admitted to the coldframe to cause a strong and stalky growth.

No. 2. A determination of the size and condition of plants that stood transplanting best.

Plants that were taken directly from the hotbed to the field did not, as a rule, succeed as well as those that were grown to larger size and hardened up by being transferred to coldframes for a period.

No. 3. A variety test including 36 varieties, some of which were grown for three years.

The varieties used were as follows:

- **Beauty**
- **Blue Ribbon Pioneer**
- **Bonney Best**
- **Buckeye State**
- **Buists Florida Shipper**
- **Chalks Jewel**
- **Coreless**
- **Cream City**
- **Disco**
- **Dwarf Champion**
- **Earliana**
- **Early Detroit**
- **Early Michigan**
- **Florida Gold Mine**
- **French Marvel**
- **Globe**
- **Gold Ball**
- **Golden Yellow Trophy**
- **Grape**
- **Landreth's Earliest**
- **McGee**
- **Morning Star**
- **New Rose Peach**
- **Ponderosa**
- **Red Rock**
- **Select Beauty**
- **Smooth Red Tree**
- **Sparks Earliana**
- **Stone**
- **Success**
- **Thornber**
- **Triumph**
- **Upright, or Tree**
- **White Apple**
- **Yellow Pear**

No difficulty was experienced in growing satisfactory plants from all varieties in the coldframes, but upon their being placed in the field a slight difference was noted in the extent to which a few varieties resisted blight. This disease, which is commonly known as Yellow Blight of the Tomato*, is caused by two species of Fusarium.

After being placed in the field the plants usually grew nicely, and continued to do so until the occurrence of a warm spell of weather. At this time they would begin to show signs of blight. The leaves on individual plants or groups of plants throughout the patch would begin to curl, take on a purplish appearance, and become quite brittle. Gradually others would become affected in this manner until practically the entire lot would be destroyed.

The French Marvel, Stone, and Yellow Pear showed greater power of resistance to the trouble than did any of the other varieties. Some plants attained considerable size, but died out until only two each of the Stone and Yellow Pear and one of the French Marvel survived one season. Neither of the Stone plants bore fruit, one of Yellow Pear bore two or three fruits but the seed in them was not developed. The French Marvel plant bore a number of excellent fruits most of which had some

* Washington Experiment Station Bulletin No. 115.
good seed. Plants grown from this seed the following year did not survive longer than the plants from the original seed.

Since the plants grew well until warm weather occurred and the blight made its appearance, it is evident that the failures are largely due to this trouble. The soil, however, is not sufficiently productive to cause a hardy growth, and the plants are therefore doubtless more susceptible than if growing with perfect vigor. Of the most hardy varieties obtainable none were found to have more than slight resistance to the disease under normal field conditions, though considerable difference was noted in the length of time some varieties withstood it. From this it appears that a successful variety is not likely to be found or originated soon.

No. 4. Vigorous plants were placed in the field under identical conditions with seed, at the time it was planted, and at the time the seedlings made their appearance.

Shortly after the seedling plants appeared, they began to weaken, and soon died out. The seed and plants were of the Stone variety, one of the most hardy sorts. The transplanted plants held out only a few days.

No. 5. Plants of nineteen varieties were taken directly from the hotbed, and an equal quantity from the coldframe, to the field.

Although some plants had the advantage of greater size, resulting from lack of crowding while in the coldframe, the period of vigorous growth in the field was practically the same. All died out soon after warm weather occurred.

No. 6. Twelve plants each of Stone and French Marvel were taken direct from the hotbed to the field, and the ground about them covered with a coating of coarse manure. Their performance was practically the same as of others described.

No. 7. Twenty-four plants each of these two varieties were covered with lattis, at an elevation of two feet, giving them half shade. No benefit was seen to result from this protection.

No. 8. Eighty-four plants of the same two varieties were covered with a heavy canvas at a height of two feet. No benefit was seen to result from this treatment.

No. 9. One hundred plants of these varieties, half from the cold-frame and the remainder from the hotbed were heavily coated with Bordeaux Mixture, twice, as a means of shade. Neither were beneficial results derived from this treatment.

No. 10. Forty-five plants from coldframe were placed over a liberal supply of partly decayed manure. These plants grew more vigorously than those not so treated, but survived but a short time after the occurrence of warm weather.

No. 11. Fifty plants of the two hardiest varieties were grown in pasteboard cartons and placed in the field without the roots being disturbed. Part of them were under canvas, part under lattis, part were treated with Bordeaux mixture and the remainder left in the open field.
No difference could be determined in their performance under the various treatments. Neither did they succeed better than plants taken directly from the hotbed rows.

From the above experiments, in which a large number of plants have been used, it is very plain that the failure of tomatoes in this district is largely due to the fungous disease known as fusarium. It appears to be more serious on light than on heavy soils, and is therefore very destructive to tomato plants on the sandy soils of the Columbia River basin.

Tomatoes cannot be grown extensively here, but they can be produced in very limited quantities on highly fertilized damp soils that are well protected from the wind. They should also have partial shade.

**Turnips and Rutabagas.** Turnips and rutabagas can be grown either in spring or fall, best success, however, is obtained from fall planting. The seed should be planted in August or February. Spring planting should be restricted to a very limited area for home use, while the fall planting can be made quite extensive and a large amount of feed grown for winter succulence for live stock. The fall seeding can be broad-cast as neither cultivation nor irrigation are necessary if a clean damp location is chosen.

These crops prefer a moist soil and succeed well on subirrigated land. The production can well be increased for feed. Market possibilities are very limited on account of the ease with which they are grown.

**COOPERATION AND MARKETING**

Transportation facilities for handling vegetable products are suitable, but the distance to large markets is rather great.

Cooperation in growing and marketing produce of this kind is important. This is especially true since the country is new and markets are yet to be developed for its products.

**Transportation.** Facilities of transportation for sending produce out from here are very good, rail and steamboat service being available to the Coast cities, and railroad transportation to all inland places having desirable markets. The principal disadvantage in transportation is that of distance, it being 200 miles or farther to either of the larger cities of the Pacific Northwest.

**Markets.** Available markets for produce from this region are in two general lines. One possible market of small extent is close at hand, and but little developed as yet. It depends upon the distribution of produce by farmers, or farmers organizations throughout neighboring grain and stock-raising districts. There is a chance for the profitable disposition of considerable quantities of vegetables throughout this country, provided the trade is solicited and systematically handled. Systematic distribution will do more to establish trade of this character than effort along any other line.

The most remote, but ultimately the largest market for the vegetable produce of the nature that can be extensively sent out from this
district, is to be created in the cities and towns along the coast, and at high elevation inland. Early products should be successfully placed upon the markets of inland cities and towns, and such products as eggplant, asparagus, etc., that mature earlier, and can be much more successfully grown here than in the milder climates of the humid belt, should be marketed to advantage in the coast cities, once a demand is created for them.

One of the problems in successfully marketing the products of this locality is that of placing well-standardized produce upon the larger markets in attractive and systematic manner, and in the most nearly continuous succession that it is possible to maintain. This cannot be done without cooperation among producers.

**Organization and Cooperation.** Where conditions are such that each producer can take or send his produce to a ready market, there is not as great a need for cooperation and well-directed effort in handling it as under conditions such as exist here. The sparse settlement of the West renders marketing of vegetables much more difficult than in eastern districts. In the first place, transportation over long distances must be considered, and in the second place keen competition has to be met in disposing of practically all kinds of vegetables.

On account of the numerous and perplexing problems to be overcome in successfully establishing and maintaining markets for new products, and for the crops of new and unrecognized districts, close cooperation of the producers is necessary through a well-formed and properly supported organization. Proper analysis of marketing conditions can be accomplished in no better way. Neither can proper standardization of products, and the maintenance of standard grades be accomplished without cooperation. It is also necessary to maintain a constant and uniform supply of produce of standard grade to meet the market needs.

Successful distribution of large quantities of produce for which there is but a limited demand, cannot be accomplished by individuals working independently, but can be much more nearly accomplished by organized effort.

Cooperation in the growth of crops is necessary to insure the production of the best paying sorts in such a manner that the quantity, quality, and time of maturity will best fit the market demands.

By a close arrangement of cooperation between the farmers of a district having peculiar and rather unusual possibilities in the production of crops, such as exist here, well-directed effort should result in the establishment of extensive markets in certain specialities.

An excellent possibility is that of developing a market for eggplant. But a few years ago this vegetable was practically unknown in this country, but of late has come to occupy quite a prominent place on many tables. Its value as a staple vegetable, together with the ease and success with which it can be grown under prevailing conditions, render possibilities for its development rather unusual. The greatest handicap it now has is that of not being known by the mass of people.
There are also opportunities for exploiting the excellent and early asparagus that can be grown here, as well as potatoes, onions, etc.

While many of these conditions will be successfully met in time without special effort, their early accomplishment can only be effected by systematic and careful manipulation which can be done more successfully by well supported organizations than by any other means.