

The Agricultural Experiment Station

OF THE

Colorado Agricultural College

THE FORCING OF STRAWBERRIES

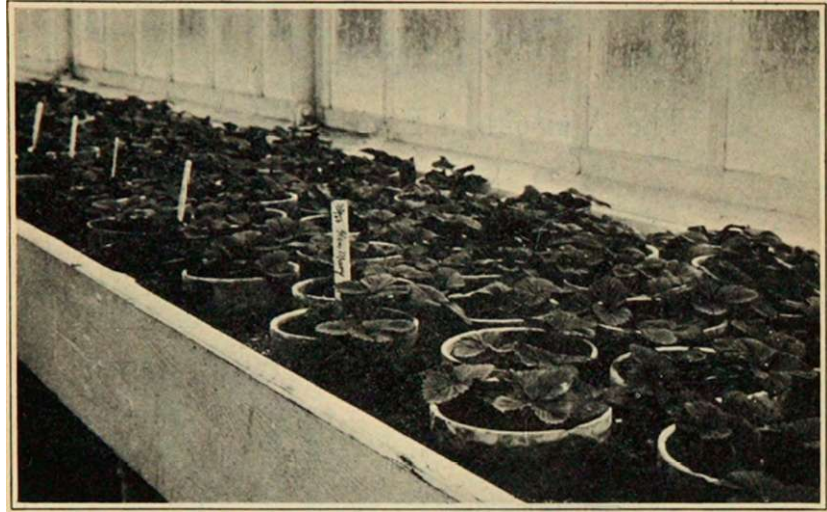
BY

By FLORENCE I. KINNISON

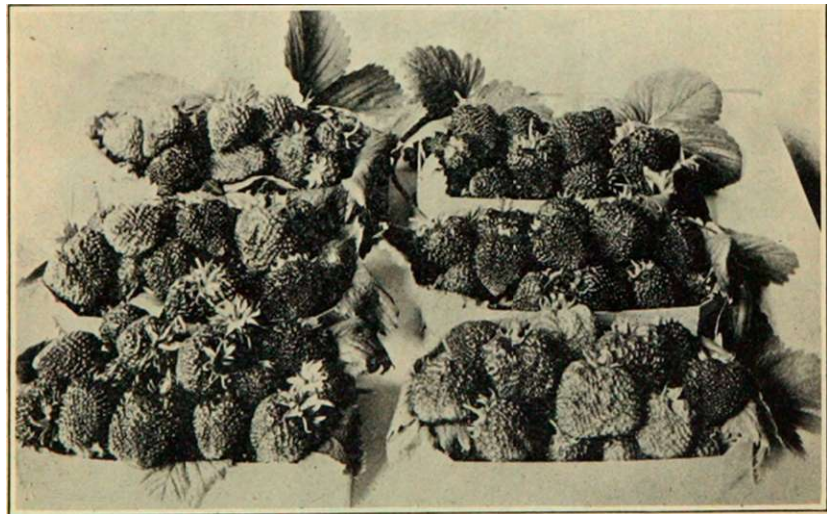


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Appearance of Plants When First Placed In Cool House



Forced Fruit of the Marshall Strawberry

THE FORCING OF STRAWBERRIES

By FLORENCE I. KINNISON

The forcing of vegetables and some of the small fruits has a great future before it in Colorado. The climatic conditions, abundant sunshine and the dry atmosphere are great assets, as the crops will grow more rapidly, mature more uniformly, and there is a relative freedom from diseases and insect pests.

The cheapness of fuel is another item of importance in the economical production of the crop. At present, the forcing business is confined to the large cities, such as Denver, Colorado Springs, and Pueblo, where a good local market is obtainable. The industry in these cities is well established and is of sufficient magnitude to supply the local demand.

The forcing industry is necessarily restricted in its development by the lack of a wide local market, as the cost of transportation of perishable products makes it difficult for the growers to compete with other centers where the industry is more established and where the population is much greater.

However, little effort has been made to enlarge the market outside of Colorado for vegetables grown under glass, tho there is no reason why the Colorado growers should not compete successfully in many sections where the conditions for the growing of these crops are less favorable, and expensive.

While the forcing of vegetables is a relatively old industry and is well understood, the forcing of small fruits, especially strawberries, has not heretofore been undertaken, and little is as yet known of the commercial possibilities in this line.

In order to study cultural methods and to discover the best varieties for forcing, an experiment described in the following pages was planned and executed.

PLANTS FOR FORCING

The following varieties were used in the experiment: War- field, Early Ozark, Senator Dunlap, Haverland, Bubach, William Belt, Marshall, Glen Mary, and Aroma.

The plants were selected from the first runners of mother plants which had been set out in the early spring. These runners were led over 5-inch pots which were plunged into the bed so that the rim of the pots were even with the soil. The soil in the

pots consisted of one-third garden loam, one-third leaf mold, and one-third clean sand. Bone meal was added to this soil at the rate of 30 pounds to each 500 pounds of soil. Drainage was provided for by placing pieces of broken pots in the bottom of each pot. After the runners had become firmly established in the pots, they were detached from the mother plants. They were kept watered and in good growing condition until the middle of August when they were brought up to the greenhouses and shifted into 7-inch pots, after which they were placed in a cold- frame and plunged into sand up to the rim. The same kind of soil, with the same fertilizer, was used as in the first potting. In the coldframe the plants were watered and the runners removed as soon as they appeared. The plants were in most excellent condition, and when freezing weather came, the coldframe was covered with a layer of leaves to protect the crowns from freezing and thawing during the early winter months. By this time; the pots were well filled with roots, and the crowns were large and plump.

To test whether the year-old plants were better for forcing than the young plants, a number of old plants were planted in pots at the same time that the runners were taken, and were treated exactly in the same manner as the young runner plants, but only two varieties of old plants were used, namely, Marshall and Glen Mary.

FORCING THE PLANTS

The pots were left in the coldframe until the latter part of January, having remained in a frozen condition during part of November, December and January. The plants were uncovered and the sun permitted to act on the coldframe until the pots could be loosened from the frozen bed; then they were taken into a cold cellar where the dead leaves and rubbish were removed, the pots washed and prepared for the greenhouse. They were left in the cold cellar for ten days to permit the soil to thaw out and to gradually start the root system into activity. The temperature of the cellar was from five to ten degrees F. above freezing. If they are removed to the greenhouse immediately after being taken out of the frozen soil, the crowns develop more rapidly than the root system, and the result is a poor crop and weak plants, while if left in a low temperature for a week or ten days the crown remains dormant while the root system starts its activity and is able to supply the plant food when the plant is placed in a higher temperature. Before final removal of the plants to the forcing house, each plant was thoroly sprayed with Bordeaux mixture to

prevent the attack of fungous diseases. The plants were then moved into the forcing house and placed upon a bench. The different varieties were arranged in groups to vacillate pollination and record-keeping. The temperature of the forcing house was kept at 40° to 50° F., the object being to develop a strong root system with a more gradual development of leaves. The bed on which the plants were placed had a layer of fine sand into which the pots were partially embedded. This prevented a rapid drying out of the plants and retained the moisture, which is an important element in our dry atmosphere.

After two weeks, the temperature of the house was raised from 50° to 65° F., and the plants began to show signs of putting out flower stems. At this time, it is important that the greenhouse be kept relatively dry to insure a more perfect pollenization.

POLLINATION

When the flowers were ready to be pollinated, the temperature was raised to 70° and 75° F., and kept at this temperature as nearly as possible for the balance of the flowering period. Pollenization began March 8 and was completed March 15. During this time we had a bright sunshine and practically no cloudiness, which resulted in perfect setting of the fruit. The process of pollination is the most important thing in raising a perfect crop. If this is not done carefully and thoroughly, lop-sided and knobby berries result. Each pistil has to receive a pollen. The pollen were first collected in a watch glass by the use of a fine camelhair brush, and then transferred from the glass, by the aid of the brush, to the pistillate flowers. The operation was performed during the middle of the day, from ten o'clock, a. m., until two or three o'clock in the afternoon. The pollination was aided considerably by the presence of a large number of bees which gained an entrance to the greenhouse thru the ventilator. The pollination was continued every day until every blossom had been pollinated several times. After this work has been accomplished, the thinning of the fruit set is important. The individual plant will set more fruit than it can properly mature without sacrificing size and appearance. For this reason, each plant was limited to 8 or 12 fruits, the number depending upon the vigor of the plant.

THE FEEDING OF THE PLANTS

After the fruit was well set, the feeding of the plants began. This is the most critical period in forcing strawberries, as there is considerable danger from disease and insect attacks. The watering must not be overdone, yet the plants should not suffer

from lack of water. The red spider is the worst pest to contend with in forcing strawberries. It is prevented by frequent sprinkling of water on the leaves, previous to flowering to have the leaves as free as possible from this insect, as, during the flowering period little or no sprinkling can be done without injury to the process of pollination.

In this experiment, the red spider was entirely eliminated by the early treatment and did not interfere with the progress of the work. The plants were given a dressing of bone meal at the rate of one-half ounce to each plant. It was worked into the soil. In addition, one application of liquid manure was made, also an application of nitrate of soda in liquid form at the rate of 2 grams to 100 c. c. of water. This constituted the fertilizers applied to the plants after the fruit was set. Too heavy application of fertilizers at this time is apt to produce tasteless fruit, and fruit too soft for handling.

FRUITING PERIOD

The development of the fruit and the coloring was very rapid, as the weather conditions were exceptionally favorable.

It is important that the forcing house be kept dry during the ripening period. The flavor, as well as the keeping quality of the berries are impaired by too much moisture.

To keep the fruit clean and above the soil in the pots, screens made out of wire gauze or netting were used. The netting was cut into squares and a slit made from the edge to the center of the pieces, and these slipped around the crown of the plants, covering the top of the pot completely. This gave a clean place for the berries to rest upon.

By keeping the temperature and moisture conditions in the forcing house even, the crop ripened very uniformly, and there was very little difference in the time of ripening of the different varieties in the experiment. The time that intervened between the ripening of the first berries and the last, was 14 days.

HARVESTING THE BERRIES

While the ripening process was fairly uniform, several pickings were necessary. The fruits were clipped off, leaving about one-half an inch of the stem adhering to the berry. Half-pint raspberry boxes were used and a few green leaves placed with the berries to make them attractive. The fruits should not be handled, except by the stem. Ready sales were found at twenty-five cents per half-pint box.

YIELD OF DIFFERENT VARIETIES

Number of Pots	Variety	Weight in Grams
10	Warfield	327
10	Early Ozark	647
10	Senator Dunlap	497
10	Haverland	633
20	Bubach	1000
23	Wm. Belt	740
50	Marshall (old and new crown).....	2053
100	Glen Mary (old and new crown)	6064
10	Aroma	217

It will be noticed that Early Ozark gave the highest yield per pot; Haverland second highest; Glen Mary third; Marshall fourth; Senator Dunlap fifth; Bubach sixth; William Belt seventh; Warfield eighth, and Aroma ninth. Eliminating the old plants of the Marshall and Glen Mary from the total number. Glen Mary is the highest yielder in weight and marketable fruit, followed by Marshall. While the Early Ozark gave a high yield, the fruit was small, soft and of rather poor quality. The same was true of the Warfield. This variety bore the largest number of fruits, but the fruit is too small. Haverland gave a large yield, but the fruit was poorly colored and too soft for handling. Bubach gave a fine yield, but the fruit was somewhat irregular and not up to the standard. William Belt produces the largest berries, but this variety has a decided tendency to produce double fruit, and does not ripen evenly. Senator Dunlap produced fine fruit, but not of sufficient quantity. Aroma proved to be a very poor yielder, and gave the lowest results of all varieties. The old plants both of Marshall and Glen Mary produced small and inferior fruits. The vigor and general appearance of the plants were poor.

CONCLUSIONS

Marshall and Glen Mary proved to be the best two varieties for forcing in Colorado. The fruit produced is large, fine color, firm and of excellent quality. Marshall does not yield as heavily as the Glen Mary, but compensates for this deficiency by producing an extra high quality of fruit. The chief reason for using Marshall in forcing is because of its ability to produce an abundance of pollen, while Glen Mary produces few, if any.

New crowns are preferable to old ones, as they produce a heavier yield and larger and better berries.

The secret of success in forcing strawberries depends upon the following points :

First.—Strong, vigorous plants!

Second.—Proper resting period, which should be about three months.

Third.—A dry, well-ventilated forcing house.

Fourth.—Slow starting of the plants to permit a strong development of the root system before the leaves expand.

Fifth.—Frequent sprinkling of the foliage previous to flowering to keep away the red spider.

Sixth.—Special care and thoroughness in the pollination, to insure a perfect setting of fruit.

Seventh.—Carefulness in picking and packing.

Due to the shortness of time required for the crop of strawberries, the crop can be made a paying one at twenty-five cents per half-pint.

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