

A METHOD OF OBTAINING FRUITS IN THE POTATO VARIETY RUSSET BURBANK¹

CECIL F. PATTERSON²

INTRODUCTION

Since difficulty in inducing plants of the Russet Burbank potato to set fruits and produce seed has been experienced by others, the author decided to describe briefly a method that has given satisfactory results in the Department of Horticulture, University of Saskatchewan, Saskatoon, Saskatchewan, Canada. This method was used in the Department for the first time in the year 1944. Each year since that time the method has been employed successfully. McLean and Stevenson (1) recently published an outline of the method used successfully by them in 1950 and 1951, which differs markedly from the one herein described.

Prior to 1944, numerous attempts had been made in this Department to obtain fruits from plants of the variety, Russet Burbank. Pollen of several varieties, among which were some producing highly fertile pollen, had been used. In some cases large numbers of flowers were worked. All such attempts were made with plants growing in the field. Without exception, every attempt failed.

TECHNIQUE USED

As a result of the repeated failures with plants growing in the open it was decided to try making the crosses indoors during the winter and early in the spring. Plans were made to provide a length of day similar to that provided by nature during the summer but to provide temperatures lower than those obtaining outdoors during the summer months.

Tubers that had been conditioned ("warmed up") were planted in eight-inch flower pots, one medium-size tuber in a pot, late in January. Ordinary greenhouse potting soil was employed. The tubers planted were covered with two and one-half inches of soil. The pots were placed on greenhouse benches of standard height. Growing temperatures of 68° — 70° F were provided the plants during the early stages of growth.

After the shoots began to appear the daylight was supplemented with artificial light. Two-hundred watt bulbs, placed approximately three feet above the tops of the pots, supplied the supplementary lighting. These were turned on at 11:00 p.m. and remained on until daylight the following morning. This made a total period of illumination of 18 to 19 hours, approximately, which was similar to that provided by nature during the month of July. The lights used were adjustable as to height and as the plants grew the lights were raised to avoid the undue heating of the tips of the shoots.

As soon as flower-buds were visible, the plants bearing buds were transferred to a compartment of the greenhouse where lower temperatures could be provided. From that time forward the plants were grown at temperatures between 50° and 60° F., except on occasional warm sunny days when higher temperatures around mid-day were unavoidable. The periods during which the plants were exposed to higher temperatures were of short duration, however.

¹Accepted for publication February 2, 1953.

²Professor of Horticulture and Head, Department of Horticulture, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.

Standard procedure was followed in the technique of crossing. Emasculation was carried out in the well developed bud stage. The aim was to emasculate the buds about one day before they were due to open. The pollen was applied to the stigmas immediately after the buds were emasculated. The pollen was usually applied by means of the thickened base of the tweezers used for emasculation. This base of the tweezers was brought in contact with the pollen in the pollen-dish and was then brought gently in contact with the stigma. Each stigma was well coated with pollen as could be easily seen with the naked eye. Sufficient pollen usually adheres to the base of the tweezers from one dipping, to cover two or three stigmas or more. All the pollinated flowers were left uncovered.

The pollen used was usually from one to three days old counting from the time the anthers were removed. Pollen grains up to seven days old have been used successfully, however, when merely a warm room was used as a storage. The anthers to supply the necessary pollen were removed from buds that were about to open and were placed shallowly in small petri dishes. The dishes were then kept in a warm room, at a temperature near 75° F., with the covers of the dishes removed. The pollen was usually available for use twenty-four hours after the anthers had been taken.

RESULTS

The results far exceeded expectations. From relatively few flowers of plants of Russet Burbank handled in this way, several fruits were harvested. These fruits were of good size and each fruit possessed a goodly number of plump seeds. An excellent germination of the seed harvested was obtained and approximately 125 selections were made the following year from the population of seedlings grown from the combination, Russet Burbank x Earlane, made in 1944. Other varieties used as female parents in 1944 responded well to this treatment and large harvests of fruits were obtained.

Since that time all the potato plants used for breeding purposes in this Department have been grown indoors and have been treated in a manner similar to that outlined above. The results obtained over the period of years since 1944 have been very satisfactory. Clusters with as high as a dozen fruits, each with a goodly number of seeds, have been harvested. Certain varieties, other than Russet Burbank, that are averse to the setting of fruits when the plants are grown outdoors, have responded favorably to this treatment.

DISCUSSION

Although unable to contribute much under this heading, the author is firmly of the opinion that high temperatures, in some way, speed up the abscission process in flowers of certain varieties of the potato. This opinion is based on observations made on plants growing indoors. Grown at temperatures above 65° F., plants of Russet Burbank and of certain other varieties usually drop their buds before bud-opening takes place. In some cases abscission takes place while the buds are very small and several days before normal opening would take place. Keeping temperatures below 60° F. permits the buds to develop fully and to open in a normal

manner. When fertilization is accomplished under these conditions normal fruits are likely to be harvested.

The contention of McLean and Stevenson (1) that the production of seed balls in Russet Burbank appears to be correlated with the non-movement of carbohydrates from the top of the plant to the part below ground is not supported by the observations of the author. Concomitant with the production of seed balls, in plants of Russet Burbank growing in pots at temperatures between 50°F. and 60°F., has been the development of substantial tubers below ground. This is true in certain other varieties also. Tubers produced by such fruiting plants have been equal in size to tubers produced by plants grown at higher temperatures and by plants which failed to set fruits.

The failure of the abscission layer to develop at the lower temperatures may be associated with a greater production or a greater retention of a growth hormone at such temperatures that does not favor the formation of an abscission layer in the pedicel. Or the materials that initiate the formation of the abscission layer may not be manufactured at the lower temperatures in the amounts necessary to effect abscission.

Another possibility in attempting to account for the behaviour of the plant being grown at the lower temperature is in the nitrogen level of its tissues. The tissues of plants growing at the lower temperatures probably have a higher nitrogen level than the tissues of plants growing at higher temperatures. At the lower temperatures the plant is making slower growth with the consequent lower demand for nitrogen. This would tend to result in a higher nitrogen level in the tissues of the plant. Raising the nitrogen level in the tissues of the plant through the application to the soil of fertilizers high in nitrogen, a short time before the flower buds open, is a common method of increasing the set of fruits in orchard practice. It is not unlikely that an increase in the nitrogen level in the plant during the period following bud formation, if not excessive, would have a similar effect on the fruit-set in the potato. This remains to be investigated.

SUMMARY

1. A simple method of inducing plants of Russet Burbank and plants of certain other varieties that usually fail to set fruits in the field is outlined.
2. An 18-hour day throughout the growing period and growing temperatures of 50°—60° F. after the buds form, favor the setting of fruits and the production of seed in such varieties.
3. This method was first used by the Department of Horticulture, University of Saskatchewan, Saskatoon, Saskatchewan, Canada, in 1944 and has been used successfully each year since that time.

LITERATURE CITED

1. McLean, John G. and F. J. Stevenson. 1952 Methods of obtaining seed on Russet Burbank and similar -flowering varieties of potatoes. *Amer. Potato Jour.* 29:206-211.