

## PROPAGATION OF PRUNUS SPECIES AND VARIETIES

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Studies on the propagation of *Prunus* at the Canada Experimental Farm, Morden, Manitoba, have been concerned with methods for the multiplication of both the fruit and ornamental varieties of this genus and specifically for varieties which have been introduced or are being developed by breeding programs, for use on the Canadian Prairies. The lack of knowledge on methods for the propagation of some of the introductions, hybrids and selections has seriously hampered their commercial production and final acceptance by the gardening public.

The background of the *Prunus* varieties with which we are working is, for the most part, quite different from that of those which are grown in the more favored areas of this continent. We have problems in common with the States which are situated in the Northern Great Plains area, only ours on the Canadian Prairies are slightly more accentuated. Some of you who know Morden, I expect are ready to challenge that statement. By virtue of the fact that Morden is situated at the base of the eastern escarpment of the Pembina Hills, which form part of the first Prairie Steppe, the climate of the surrounding area is atypical of the Canadian Prairies in general. We can grow many plants which do not thrive elsewhere in the Prairie Provinces. However, our field of service in horticultural research is the Canadian Prairies and it is to this larger area that I refer.

Last winter, tables, showing the results obtained from the various combinations of rootstock and scion variety used in budding and grafting of *Prunus* at the Morden Farm, were prepared. These tables are a composite of all experiments conducted on the graftage of *Prunus* from 1934 to 1956 inclusive. Since these figures encompass experiments on techniques as well as compatibility studies, they are lower than those which can be normally expected. They are, however, indicative of the success with which various combinations of rootstock and scion variety can be made.

A summary of the results on some of the more important rootstocks for plums and sandcherry — plum hybrids has been published in the Proceedings of the Fourteenth Annual Meeting of the Western Canadian Society for Horticulture.

Open pollinated seedlings of *P. nigra* and *P. americana* varieties along with seedlings of *P. Besseyi* have been used almost exclusively as hardy rootstocks for both plums and sandcherry-plum hybrids. The figures indicate that there is no significant difference in results obtained between the species *P. nigra* and *P. americana* but that there is a very significant difference in the results obtained with varieties within these two species. Seedlings of Assiniboine, which is a *P. nigra* variety, when used as a stock, gave an average stand of 56 percent while a 55 percent stand resulted from the use of the *P. americana* variety, Wastesa. Seedlings of the variety Zekanta (*P. americana*) gave a 44 percent stand, Cheney (*P. nigra*) a 31 percent stand, and so on down to Olson (*P.*

*nigra*) which yielded an average stand of 17 percent. Seedlings of Pembina and Cree which are both *P. nigra* hybrids with Japanese (*P. salicina*) blood gave 51 percent and 45 percent average stands, respectively. These figures indicate that more care should be exercised in the selection of varieties from which seed is obtained for the production of seedling rootstocks. I can foresee that the time may come when it will pay commercial propagators to obtain seed for seedling rootstock production from a known variety, which has proven itself superior for this purpose.

Seedlings of *P. Besseyi* commonly known as the sandcherry have been used extensively as a rootstock for both plums and the sandcherry-plum hybrids. In our trials, however, their use resulted in only a 23 percent average stand. Other serious objections to the use of this species as a rootstock include its prolific suckering habit and the poor anchorage afforded by its root system.

The propagation of hardy apricot varieties has presented us with problems. Apricots on plum and sandcherry rootstocks form an incompatible union which very soon breaks apart.

Apricot seedling rootstocks, widely used elsewhere, have not proven reliable under our climatic conditions. They suffer severe injury from prolonged spells of wet, cool weather, which we frequently encounter. Seedlings of *P. mandschunica* have given us slightly better average stands than have seedlings of *P. sibirica*. Very poor stands have resulted from the use of seedlings of the hardy *P. armeniaca* of Russian origin.

We have been investigating the use of an intermediate stock to overcome the incompatibilities between the plum rootstock and the apricot. Two hybrids are presently under test for this purpose. The variety Yuksa, a hybrid between sandcherry and European apricot, is a contribution from the work of the late Dr. N. E. Hansen of South Dakota and M-800 which is a Morden hybrid between sandcherry and the Siberian apricot. Both of these hybrids appear to be quite compatible with either plum or apricot.

The normal procedure for the introduction of an intermediate between rootstock and scion variety is to bud the intermediate one season and the scion variety in the second year. By budding in the spring, the operation can sometimes be completed in one season. We have been experimenting with the double-shield bud technique combined with spring budding to further reduce the time and labor which it takes to produce an apricot tree.

In the autumn of 1955, Dr. D. V. Fisher who is Head of the Pomology Section of the Summerland Experimental Farm, visited Morden on his return from an extensive European tour. Among other things discussed, he told us of a method being used by Mr. R. J. Garner of the East Malling Station in England, of budding intermediate and scion variety in one operation. This technique was being used to bridge an incompatibility between Quince 'A' stock and Bartlett pear. Apparently this method has been employed by European gardeners for many years, and has been one of those secrets of the trade which has been passed along from generation to generation. The procedure is very ably described in detail by Drs. Mahlstedt and Haber in their most excellent book, "Plant Propagation."

We first used the double shield bud or Nicolieren technique in the Spring of 1956 and secured a 55 percent stand, which made well branched 3 foot young trees by the fall of the same season. Seedlings of *P. americana* were used as a rootstock, Yuska as the intermediate and several varieties and selections of hardy apricots as scion varieties.

Another approach which we are preparing to explore is the use of these sandcherry-apricot hybrids as clonal stocks. They can be propagated by layering quite readily as demonstrated by preliminary tests undertaken at Morden.

Early attempts, to find a hardy sour cherry that would grow and produce fruit on the Canadian Prairies, centered around the hardy Russian varieties of *P. cerasus* such as Shubianko, Vladimir, Bessarabian and Koslov. None of these have proven satisfactory. Horticulturists have now shifted their attention to the dwarf bush cherry, *P. fruticosa* and to a lesser extent to the Nanking cherry, *P. tomentosa* as being the most promising sources of hardiness for a cherry which can be grown on the prairies.

Seed of *P. fruticosa* first came to us from the Tcheljabinsk Fruit Breeding Station in the Ural mountain region of western Asia, in February 1938. Seedlings of this species have been widely distributed and we now know that it can be grown successfully in most regions of Prairie Canada. Selections have been made for fruit size and quality both at Morden and at Ottawa. Distribution and testing of these selections has, however, been hampered by difficulties encountered in their propagation. Seedlings of *P. japonica* gave only mediocre results when used as a stock for these selections. Plants which were established on this stock made poor growth and it is suspected that the few which did not eventually succumb, had become established on their own roots.

A new, rather complex hybrid, *P. dropmoreana* holds the most promise of being a suitable hardy rootstock for the *P. fruticosa* selections as well as the standard varieties of sour cherry. *P. dropmoreana* is a product of Manitoba's renowned plant breeder Dr. Frank L. Skinner. Its parentage is (Koslov-Morello x *P. pennsylvanica*) x *P. maacki*. Plants which have been established on this stock are vigorous and the union is excellent. We have been a little disappointed in the stands which we have secured in our limited tests with this new stock. Our lack of success has been attributed to the fact that the stock is a vigorous grower with an exceptionally thin bark which opens up around the newly placed bud before a proper union can be achieved. There has also been some breaking over of the tops in heavy winds at the point where the top of the "T" cut is made. We suspect that our date of budding, late July and early August, may be too early in the season.

In discussing this matter with Mr. Les Sjulín, of Inter-State Nurseries, Hamburg, Iowa, a year ago, he suggested that we try budding later in the season. Inter-State have also been doing considerable experimenting with this stock.

Beginning on August 23, 1957 and at weekly intervals thereafter, until September 20, 1957, buds of one of our *P. fruticosa* selections were placed on *P. dropmoreana*. Examination of these buds in the early winter revealed that those placed during the first half of September appeared to have made an excellent union with no opening of the bark

on the stock. Unfortunately we had a winter with no snow accompanied by severe soil drifting conditions which resulted in a very poor stand of all our *Prunus* buds.

Most of the Nanking cherry which are grown are produced from seed. For the few varieties and selections, which we have, seedling plum rootstocks have proven the most suitable.

Rootstocks for ornamental *Prunus* have received much less attention than those for fruit of this group. *P. tomentosa* seedlings have proven to be the most satisfactory rootstocks, under our conditions, for *P. triloba multiplex* and *P. 'Prairie Almond.'* The latter is a Morden introduction resulting from a cross between *P. pedunculata* and *P. triloba multiplex.*

*P. padus* seedlings are used for Shubert chokecherry, a purple leafed sport of *P. virginiana.* Seedlings of *P. virginiana* are sometimes used as a stock but should be avoided because of its objectionable suckering habit.

Plum seedlings are used as rootstocks for Muckle plum (*P. nigra* x *P. tenella*), Cistena sandcherry (*P. pissardi* x *P. Besseyi*) and Manitou (*P. tenella* x *P. persica*).

For the last 10 to 12 years growers have complained concerning the poor stands they have been getting in their *Prunus* budding and grafting operations. Summer budding in late July and early August and bench grafting in February have been the most common methods of propagation. A few growers have reported good results from spring budding, that is budding shortly after growth commences in the spring. Dormant budwood, collected earlier and held under refrigeration is used. A three year comparison of these methods gave us the following figures at Morden:

Spring budding — 61 percent stand

Summer budding — 41 percent stand

Bench grafting — 21 percent stand

It has been frequently observed that although summer-placed buds seem to be in excellent condition when they go into the winter, many of them fail to grow the next summer. The winter of 1957-58 was particularly severe and only 23 percent of the buds placed in the summer of 1957 resulted in plants. The same varieties were rebudded on the same rootstocks in the spring of 1958 and resulted in a 64 percent stand. In most seasons the spring placed buds result in plants that are ready to lift in the fall of the same season. One of the serious drawbacks with spring budding is that the plants keep on growing late into the fall. The result being that we often encounter rather severe "kill back" during the first winter out-doors. Cellar storage circumvents this problem.

The feasibility of the production of "own root" plants by means of layering is also being investigated. As a group, the sandcherry-plum hybrids have responded quite well to this method of propagation. In the Spring of 1956 we harvested 1,480 well rooted layers from a row of 65 mother plants. Seven varieties were included in the row, five sandcherry-plum hybrids and two straight sandcherry selections. This is an average of 23 new plants from each mother plant. The same mother plants yielded an average of 36 rooted layers in the Spring of 1958. Under our conditions we can only harvest a crop of layers in alternate

years. One season is required to produce the whips for layering the following spring. If a yearly supply of plants is required, two sets of mother plants are maintained. With favorable growing conditions the young plants secured by layering, will make marketable size in one season. It would appear that layering is an alternate method of producing sandcherry-plum hybrids that is economically feasible. We are extending our layering tests to include other species and hybrids of *Prunus*.

To avoid the possibility of mixtures occurring, as the result of the growth of rootstocks in our layering experiments, we use only plants which have been previously established on their own roots. The most successful technique, that has been employed at Morden to secure plants on their own roots, is by means of an inverse root graft. The method is the same as is used in normal bench grafting except that the scion is inserted in the distal end of the root instead of the apical end, or the inverse to normal procedure, hence the name. The restriction, which results from the reversal of the rootstock piece, stimulates the development of roots on the scion just above the graft union. The rootstock does not grow to any extent and can be readily removed when the plants are lifted. This method has given us a consistently higher percentage of own root plants than any other technique which we have used. A modified lateral graft sometimes referred to as a nurse graft has also been tried. This is a graft in which the scion is attached to the side of the root at about the midway point. This method gave us approximately the same percentage of own root plants as the normal method.

Comparisons of the three methods over a three year period gave us the following percentages of "own root" plants. inverse 15.8 percent, nurse 6.5 percent and normal 6.1 percent.

An extension of the production of *Prunus* varieties on their "own roots" is the testing of those which are easily propagated, as clonal stocks. Earlier in this paper I briefly mentioned the possibility of using sandcherry-apricot hybrids as clonal stocks for apricots. Varieties like Mansan which is an upright growing sandcherry-plum hybrid may have possibilities. Results of earlier experiments on topworking this variety indicate that it is compatible over a wide range. Last spring it yielded 520 rooted layers from 10 mother plants. These young plants were lined out for budding along with a number of other varieties which are now under test as clonal stocks.

Some of the *Prunus* can be propagated quite readily from root cuttings. Most of our work in this field has been confined to *P. fruticosa* because we were particularly interested in finding alternative methods of increasing our selections of this species, so that they could be sent out for wider adaptation trials. At first we attempted to use roots dug from around the original plants of the selections, and results were far from encouraging. In a publication from the East Malling Station, concerning the propagation of clonal rootstocks, they reported very marked improvement in the production of plants when the roots were taken from one or two year old trees as compared to those taken from older trees. We can now report that roots taken from one year old plants have given us much more encouraging results.

Our procedure is to dig the young plants in the fall and cut the roots up into 3 or 4 inch lengths. These root pieces are packed into

boxes with slightly damp peat moss and placed in storage at a temperature of from 34° F. to 38° F. If they are to be started in the greenhouse in February, the boxes containing the roots are held at room temperature for a week to ten days before the actual planting. This warming up period is sufficient to start adventitious buds to form and makes it possible to discard those which show no signs of development. From our experience we would recommend that cuttings which have been started in the greenhouse should be kept actively growing until danger of outside frost has passed, at which time they can be transplanted into outdoor frames. We have not tried planting the stored root cuttings directly out-doors in the spring, but I see no reason why it should not be satisfactory. In limited tests fall planting under our conditions was a practical failure. Other species with which we have had measure of success, in propagating them from root cuttings, include varieties of *P. nigra* and *P. salicina* (Manchurian), and *P. dropmoreana*.

We have encountered difficulties in the propagation of *Prunus* from softwood cuttings but apparently we are not alone in this respect. The following remarks are only suggestions, for we realize that our program has been limited and much more research is necessary. Among the varieties which will root fairly readily are Dura, Sapa and Opata (Sandcherry x plum), *P. Cistena* (*P. pissardi* x *P. besseyi*), Muckle (*P. nigra* x *P. tenella*), Drilea (*P. tomentosa*) and selections of *P. tenella*. Intermediate in their rooting response were Prairie Almond (*P. pedunculata* x *P. triloba*), *P. triloba multiplex*, Coronation (*P. cerasus*), *P. maacki* and selections of *P. fruticosa*. Varieties of *P. nigra* which have been so far tested refused to root. Treating the cuttings with a hormone such as I.A.A. or I.B.A. (1/1000) has proven helpful in inducing root formation. As a carrier we use Bentonite, a locally produced inert clay product. Lateral growths with a heel attached have given us better results than terminal growths. Untrimmed cuttings or at the most a very minimum of trimming also resulted in better rooting. The main difficulty with softwood cuttings of *Prunus* is, of course, in getting them transplanted and re-established after rooting has taken place. Except for very special and valuable stock, the practice of potting up the cuttings and carrying them on in a greenhouse is economically unsound under our conditions.

In our search for a way around these difficulties a number of exploratory techniques have been tried. One of the best of these is to leave the plants undisturbed in the frame in which they were propagated for the winter and the following summer. This of course implies the use of outdoor propagating frames and their loss as such for one season. If a sterile medium is used for propagation, the application of fertilizers is also necessary. Another fairly satisfactory method is to leave the cuttings in the outside propagating frames overwinter and transplant them the following spring, when growth is well started again, into frames which can be shaded for the first few weeks. Following this procedure releases the propagating frames for use again in the same season.

Where permanent structures are used for propagating and in areas where successive crops are possible, these methods cannot be put into practice. In such cases a third method is suggested. Cuttings are tak-

en as early as possible in the season. When rooting is well underway the cuttings are carefully transplanted into well protected frames, where every precaution is taken to keep them "growing on" vigorously. The young plants are left in these frames over winter and throughout the next growing season. The success of this method depends on providing a long growing period in the first season, hence the emphasis on taking the cuttings early. Frames in which plants are being overwintered should be well protected with a coarse mulch. Heaving with the attendant breaking of tender young roots often causes serious losses when winter protection is inadequate.

As a general rule, under our climatic conditions, seed of *Prunus* should be sown as soon after harvest as possible. It should not be allowed to dry out anymore than is necessary to make it easily handled. For those species which require a long after ripening period, mulching in the late fall extends the time in which the soil temperatures remain at the proper level. Wide boards are useful for this purpose.

Drying out seems to be particularly injurious to seeds of *Prunus fruticosa* which lose surprisingly large amounts of water when allowed to dry. Mr. C. R. Ure, who heads the Fruit Crop Section at the Morden Farm, in studying the relationship of seed weight to whole fruit weight, found that there was a loss in weight between freshly cleaned pits and dried pits of from 24 to 41 percent. This may at least partially explain why we have obtained such markedly superior germination from seed which is never allowed to dry out. There would also appear to be a delayed dormancy factor involved in seed of *P. fruticosa*. We have some evidence that this is more pronounced in selections which ripen their fruit early than it is in later ripening selections. Our studies on seed of this species are being continued.

Dried seeds of plum, apricot and sandcherry, when soaked in water 2 days at room temperature, stratified in moist sand for about 120 days at a temperature between 34° and 38° F, and sown in the early spring have given us reasonably good stands.

An accelerating interest, by workers in the more favored regions of this continent and even in Europe, in the hardy species and hybrids with which we have been working, has been quite apparent within the last few years. Interest is not usually concerned with the fruit produced by these varieties, but rather in their use as hardy rootstocks, intermediate stocks, or as new germ plasm for their breeding program.

We are always happy to be of service to fellow horticulturists and in a small way reciprocate the many courtesies which have been extended to us.

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MODERATOR HALWARD: Thank you very much, Bill. This paper completes the program on *Prunus* this morning.

Our next paper is concerned with the propagation of the flowering cherries from cuttings. Mr. David Paterson, Longwood Gardens, Kennett Square, Pennsylvania will discuss this subject for us.

Mr. Paterson read his prepared address on "Flowering Cherries from Cuttings" (Applause)