

Production of Virus-Free Seed in British Columbia

N.S. Wright

C.D.A. Research Station, 6660 N.W. Marine Drive, Vancouver 8, B.C.

It is common knowledge that most, if not all, of the potatoes grown in North America are infected with potato virus S [PVS], potato virus X [PVX] or both. Some of our major varieties such as Netted Gem [Russet Burbank] and White Roxe are infected with both of these viruses. Under good growing conditions neither one seems to cause obvious symptoms on North American varieties and it is unlikely that they seriously affect yield or quality. Opinions differ widely on this matter but, in the absence of virus-free samples of most varieties, the effect of these viruses remains more or less unknown. During the past two years Miss Frances Mellor and Dr. Richard Stace-Smith, plant pathologists at the C.D.A. Research Station in Vancouver have developed a technique to eradicate PVS and PVX. They have been able to eliminate these viruses from all the varieties which are grown in British Columbia and their treated plants are being increased within the framework of an existing Elite Seed Program. I have been asked to tell you how they eliminated PVS and PVX, to list the varieties which have been treated, and to describe how our Foundation Seed growers hope to replace present stocks with virus-free clones.

In the present Elite seed program in British Columbia all tubers used for clonal increase are free of the viruses which cause diagnostic symptoms on potato and are free of mild strains of leaf roll virus and spindle tuber virus. The virus-free clones are free of these viruses and are also free of PVS and PVX. Although one or more potato viruses may still be discovered and may be present in the so-called virus-free stocks, it is correct to say that the tubers used to initiate clones of virus-free stocks are free of all known viruses.

Eradication of PVS and PVX. Sprouting tubers or recently-rooted potato cuttings were grown in a chamber where they were subjected to diurnal light, to air temperature of 33-37°C [92-98°F] and to soil temperature of 30-32°C [86-90°F]. Plants were grown under these conditions for at least eight weeks. After that time very small buds or immature stems which measured 0.3 to 1.0 mm. in length were removed aseptically from the points where leaf petioles joined the main stems. These buds were transferred to tubes containing nutrients and were incubated under lights at room temperature. Roots and stem appeared in 2 to 8 weeks. When these were 2 to 3 cm. long the plants were transferred to soil in the greenhouse and held under mist for a day. Plants became established quickly and grew well. Some of them were free of PVS and PVX. Initial indexing for PVX was done when the plants were transferred from the culture tubes. A small leaflet from each plant was macerated in a drop of water in a porcelain spot plate and used to inoculate Gomphrena globosa L. Plants that caused no reaction on G. globosa were test-

ed by electron microscope examination of a leaf dip preparation. Flexuous rod-shaped particles were assumed to be PVS. Plants that appeared to be free of PVX and PVS were tested at intervals by the tube precipitin serological test. This test consists of mixing the juice extracted from a test plant with the blood serum of a rabbit which has been given one or more injections of purified virus. These tests are quite specific; if a precipitate occurs it means that the virus used to make the antiserum is present in the test plant. This test, using PVX and PVS specific antiserum, was applied to the apparently virus-free plants at regular intervals during the time they were growing in the greenhouse and in the field. Needless to say, any infected plants were discarded.

Varieties. Virus-free tubers or plants of the following varieties are available: Netted Gem [Russet Burbank], White Rose, Red Pontiac, Warba, Epicure, Kennebec, Norgold Russet, Early Rose, Norland, Canus, Cariboo, Green Mountain, Fundy, Sebago, Red La Soda, and Irish Cobbler. In 1967 emphasis was placed on the increase of Netted Gem and White Rose. This year we plan to place major emphasis on the increase of virus-free Kennebec, Red Pontiac, Norgold Russet, Early Rose, Norland, and Warba.

Initial increase by stem cuttings. During the early months of 1967 when the first virus-free clones were available it was reasoned that the best way to avoid contamination in the field would be to plant the clones in Pemberton, one of our best seed producing areas, in a plot which would be given as much isolation as possible. To avoid spreading viruses by means of contaminated machinery it was decided that the plot should be cared for by hand during the season. Fortunately, Mr. Clifford Ronayne, an Elite seed grower, agreed to work with us. It seemed desirable to produce in the greenhouse as many plants as possible so that the field plot would be a reasonable size. In fact we hoped to produce enough virus-free seed of Netted Gem and White Rose to allow Mr. Ronayne to dispose of all of his infected stock and plant only virus-free stock in 1968. Mr. E.F. [Ted] Cole, an official of the C.D.A. Plant Protection Division and Mr. Fred Groessner, one of our greenhouse men, undertook to propagate the virus-free clones by stem cuttings. When the first virus-free plant of each variety was 10 to 12 inches tall the tips were removed to stimulate axillary growth of stems. When these reached 5 inches in length their tips, about 3 inches long, were removed and set in washed, sharp sand. A rooting hormone was usually used but was not essential. In approximately 10 days the cuttings had rooted and were transplanted to a greenhouse bench. As successive crops of cuttings grew they were removed and rooted. Cuttings rooted in greenhouse flats of sand were transported over 100 miles by truck for field planting.

In the field, cuttings were planted in the bottom of a shallow trench and watered lightly. Survival was close to 100%. As the plants grew, soil was added to the trench to bury more and more of each stem. After hilling, the base of the cutting and the original roots of a fully grown plant were 6 to 8 inches below the soil surface. The cuttings produced vigorous and uniform

plants and a good yield of tubers. From a single White Rose plant which was transplanted from test tube to soil in January, 1967, a total of over 2,000 rooted cuttings were planted before the end of June and these yielded 4,860 lb. of tubers. A similar increase was made with Netted Gem of which a total of 4,300 lb. of tubers are on hand. We achieved our objective and this year Mr. Ronayne's entire potato acreage will consist of virus-free clones.

Avoiding contamination. To avoid contamination from volunteers and from virus-infected crops and to ensure that the best use is made of the limited quantities of virus-free potatoes available at this time an agreement on procedure for virus-free seed potato production in B.C. for the period 1967-1969 has been drawn up. The principal features of the agreement are as follows:

1. All virus-free potatoes produced from cuttings and tubers supplied by the C.D.A. Research Station become the property of Mr. Clifford Ronayne, Pemberton.
2. None of the potatoes produced in 1967 will be sold or given away by Mr. Ronayne.
3. Arrangements for sales and distribution of tubers produced in 1968 are the responsibility of Mr. Clifford Ronayne but are subject to approval of the Pemberton Seed Control Area Committee and seed potato certification officials in Vancouver.
4. Growers whose farms are located within the Pemberton Seed Control Area or the Cariboo Seed Control Area will be given first choice for the seed available for 1969 planting.
5. Growers wishing to obtain virus-free stock for 1969 planting must apply for same on or before July 2, 1968.
6. Growers who apply for virus-free seed for planting in 1969 must agree
 - [a] to plant the virus-free seed in a field in which potatoes have not been grown since 1965 or in a field which was summer fallowed in 1968 and which was inspected for control of volunteer potatoes;
 - [b] to plant only virus-free potatoes on the farm;
 - [c] to dispose of all infected tubers, peelings, sprouts and other refuse other than by feeding to livestock, unless there is no risk that one or more of such potatoes will be carried in manure or by other means to a field to be used for growing virus-free potatoes;
 - [d] to avoid using tractors, sprayers, cultivators, diggers, or other machinery in a field of virus-free potatoes after the same equipment has been used in a

field of other potatoes, unless the equipment is thoroughly cleaned and disinfected.

7. Fields which qualify as Foundation Seed and in which no plants are found to be infected with potato viruses S or X, and which, in the opinion of the inspector, have not been exposed to contamination by any means, will be eligible for virus-free status. The produce of such fields, after passing prescribed tests for viruses and contingent upon the crop meeting all requirements of Foundation Seed, may be tagged "virus-free" by the Seed Control Area Committee.