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POST ENTRY PLANT QUARANTINE STATION, SIDNEY, B.C.

Facilities and Procedures

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Cover: **General view of the Post Entry Plant Quarantine Station.**

POST ENTRY PLANT QUARANTINE STATION, SIDNEY, B.C.

Facilities and Procedures

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Plant Quarantine Advisory Committee

The Post Entry Plant Quarantine Station was established to allow Agriculture Canada to receive valuable plants with unknown health status safely into Canada from other countries. Tests are performed at the Quarantine Station to determine whether the imported plants are free from dangerous diseases and pests so that healthy plants that otherwise might have been refused entry can be released for general use. The Quarantine Station, located on Vancouver Island at Sidney, B.C., about 22 km north of Victoria, is isolated enough from commercial tree fruit and grape plantings to prevent possible spread of infection, yet the climate and soil are suited to the culture of all Canada's fruit crop plants. The Station is operated jointly by the Research Branch and the Production and Marketing Branch of Agriculture Canada. Technical advice is supplied by the Plant Quarantine Advisory Committee.

FUNCTIONS

Originally, the Quarantine Station was responsible only for quarantine of tree fruits, grapes, and related woody ornamentals. Since its establishment, its functions have been expanded considerably and now include:

- testing for virus infection all imported tree fruit, grape, and small fruit plant materials that are not accompanied by acceptable certification of good health by the exporting country;
- testing promising selections from Canadian tree fruit and grape breeders to ensure that original releases to industry are free from detectable viruses;

- eliminating virus infections from valuable fruit and grape clones by heat therapy;
- verifying the reliability of recognized foreign certification programs for fruit nursery stock by testing plant samples from imported commercial shipments for virus infection (Audit Program);
- providing virus-free tree fruit and grape cultivars to regional certification programs;
- establishing plantings of valuable virus-free tree fruits and grapes as a repository for Canadian fruit industries and research programs;
- cooperating with horticulturists to ensure that clones kept in the repository are true to variety and type.

The Quarantine Station is occasionally given other related assignments when special needs are demonstrated. Recently, woody ornamentals in the genera *Malus* Mill., *Prunus* L., *Cydonia* Mill., and *Chaenomeles* Lindl. were added to the program because they can host many of the viruses that cause disorders of tree fruits. The Station is also prepared to handle small fruits other than grapes should this service become necessary.

HISTORY

Many pests and diseases that do not exist on this continent are serious problems in other parts of the world. Restrictions and inspection procedures in force in Canada from 1900 until 1965, when the Quarantine Station was established, provided reasonably adequate safeguards against them. However, some plant viruses can occur in some tree fruit and grape cultivars without visible symptoms. They are especially difficult to detect in dormant plants or plant parts. The Little Cherry virus, which was imported into North America as a symptomless disorder in ornamental cherries in 1900, is one of these. The virus became a serious threat to Canadian orchardists when it spread into fruiting cherries.

Testing of fruit trees and grapes newly imported from Europe and Asia at the Quarantine Station has disclosed several virus infections not found in Canadian orchards. Serious tree fruit virus diseases that demand continued exclusion from Canada are Sharka (plum pox), which has rendered millions of plum and apricot trees unproductive in Europe; apple proliferation and yellow leafroll of peach and apricot, which are serious in several European countries; and leafroll, fanleaf, flavescence dorée, and several other diseases of grape that are common in European vineyards but have rarely been found in Canadian plantings.

FACILITIES AND STAFF

Land and facilities at the Agriculture Canada Research Station, Sidney, B.C., were set aside for the Post Entry Quarantine Station in 1965. The

area of 16 ha allows for separation of the testing plots and the permanent repository planting. Irrigation and plot maintenance are provided by the Research Station. The Quarantine Station utilizes 325 m^2 of greenhouse space and 195 m^2 of screenhouse and shadehouse area. Specialized equipment was purchased to improve operations in the offices, laboratories, fumigation chambers, cold storage rooms, and heat-therapy and growth chambers. There are also storage areas, a headerhouse, potting shed accommodation, and a fireproof vault for records.

The quarantine program is administered by the Plant Quarantine Advisory Committee, composed of representatives from the Plant Quarantine Division and the Research Branch. Members include plant protection regulatory officials, plant pathologists, and horticulturists. The Plant Quarantine Division provides the Officer-in-Charge and an assistant officer as professional staff, supported by a technician, two propagators, stenographic service, and summer student help.

RESEARCH SUPPORT

The Quarantine Station maintains a close association with the research stations at Vineland Station, Ont., and at Summerland, Sidney, and Vancouver, B.C. Scientists at these stations provide information on indexing and heat therapy procedures for tree fruits, grapes, and related ornamentals, as well as assistance in interpreting the results. They also provide virus identification, serology, and electron microscopy, as refinements of the indexing program. The Research Station at Sidney is exploring the roles that meristem culture may play in virus elimination and germ plasm storage. Pomologists at several research stations assist in the confirmation of cultivar identities and in assigning priorities for the treatment of domestic clones.

COOPERATION WITH OTHER AGENCIES

The Plant Quarantine Advisory Committee has established solid working relationships with the tree fruit and grape certification programs in several regions of Canada. Each year the meeting of the Committee includes a session open to anyone concerned with plant importations or certification procedures. Participants include representatives of nurserymen's and fruit growers' organizations, of the federal research stations and regulatory services, of provincial departments of agriculture, and of universities. From time to time, members of these agencies serve in consultant roles. Internationally, close liaison is maintained with the IR-2 Interregional Tree Fruit Repository, Prosser, Wash., and with the U.S. Plant Introduction Station, Glenn Dale, Md. The acquisition of virus-indexed tree fruit clones is often expedited by interchange of materials among the three stations.

PROCEDURES FOR TESTING

Virus testing

At the point of importation, a sample is taken and forwarded to the Quarantine Station for virus testing. On arrival at the Quarantine Station, each tree fruit cultivar or clone is propagated on virus-free understocks; grape imports are rooted directly. At the same time, the testing for freedom from viruses, the so-called "indexing," begins. The principle of this process is simple: because it is difficult to detect viruses directly on the imported material, and because some cultivars can look healthy even when they are infected, buds or scions are budded or grafted onto so-called "indicators." These are plants that have been selected over the years because they develop strong symptoms fairly promptly when inoculated with specific viruses.

At Sidney, both herbaceous and woody indicators are used, and the tests proceed simultaneously.

The most commonly used indicators are cucumber, squash, and the goosefoot or lamb's-quarters species, *Chenopodium quinoa* Willd. They are inoculated by rubbing the leaves with juice from the plant being tested (Fig. 1). If viruses are present, symptoms appear on the leaves or growing plants in several days to 3 weeks (Figs. 2 and 3).

Indexing on woody indicators is used to detect additional viruses (Fig. 4) and to confirm the results of tests on herbaceous hosts. The testing of each tree fruit accession requires at least 21 rootstocks and 84 separate

Fig. 1. Inoculation of indicator plant with juice from the plant being tested.

Fig. 2. Symptoms of prune dwarf on a herbaceous host, Mexican sunflower.

Fig. 3. Herbaceous host being examined for symptoms by Don Bertoia, Officer-in-Charge, Plant Quarantine Station.

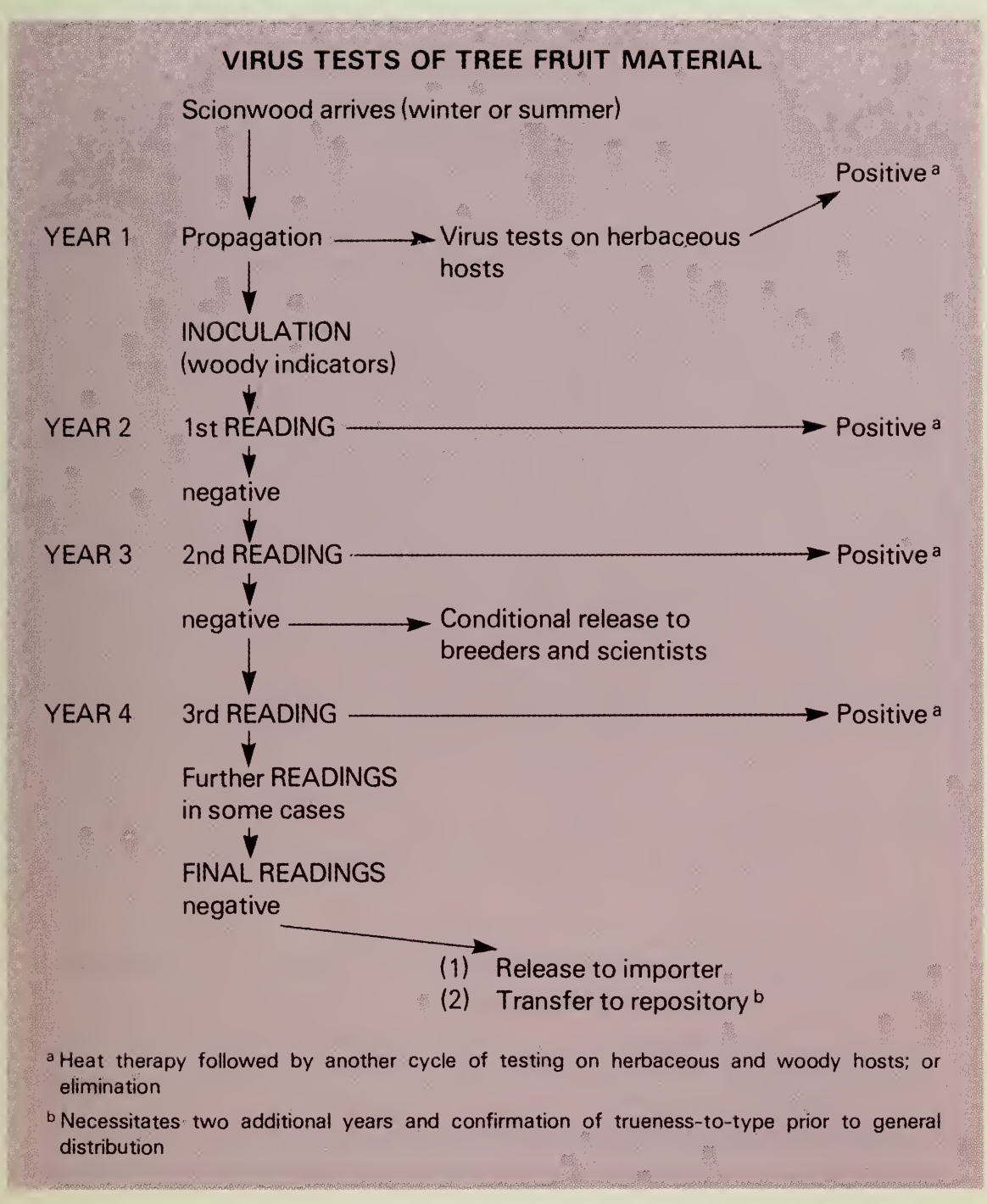
budding operations. Some viruses induce symptoms on woody indicators within a few months, but others act more slowly and it may take up to 5 years before definite conclusions can be drawn. This is the main reason for the unavoidable delays encountered in testing tree fruit importations.

For each kind of fruit, ornamental plant, or vine that enters the program at Sidney, there is a basic list of the most suitable indicators. This list,

Fig. 4. Woody indicator symptoms: *above*, Little Cherry virus in the sweet cherry variety Sam, and *below*, leafroll in the grape Pinot Noir.

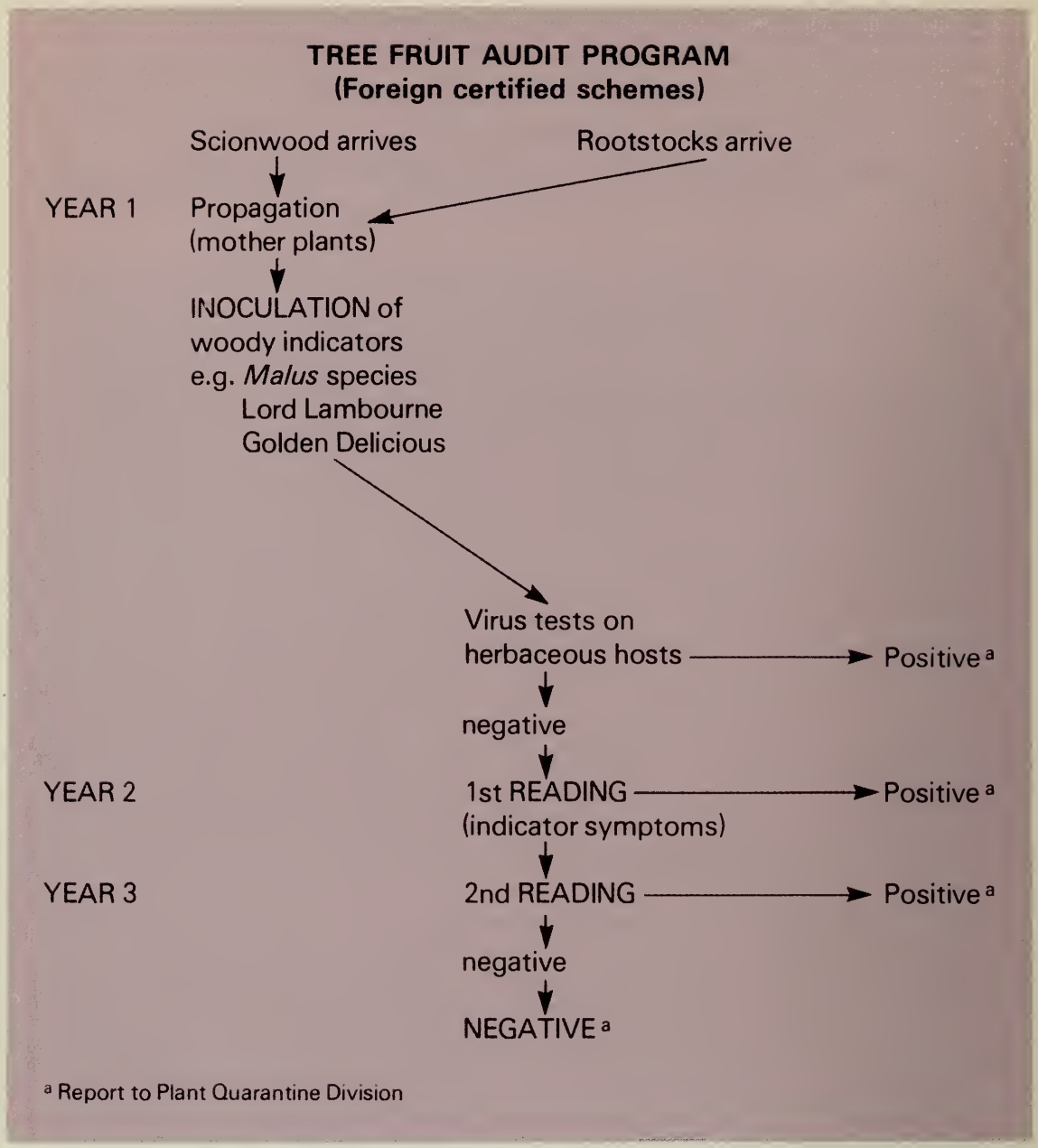
developed in cooperation with the IR-2 Interregional Tree Fruit Repository at Prosser, Wash., and with grape specialists at Davis, Calif., is used for domestic material and for plants imported from the USA. For material originating in other countries, further specific indicators are added so that viruses that occur in these countries but not in North America can be detected. The flow charts demonstrate further details of the indexing process.

When the virus testing has been completed, the original importer is notified concerning the results.



[a] Heat therapy followed by another cycle of testing on herbaceous and woody hosts; or elimination

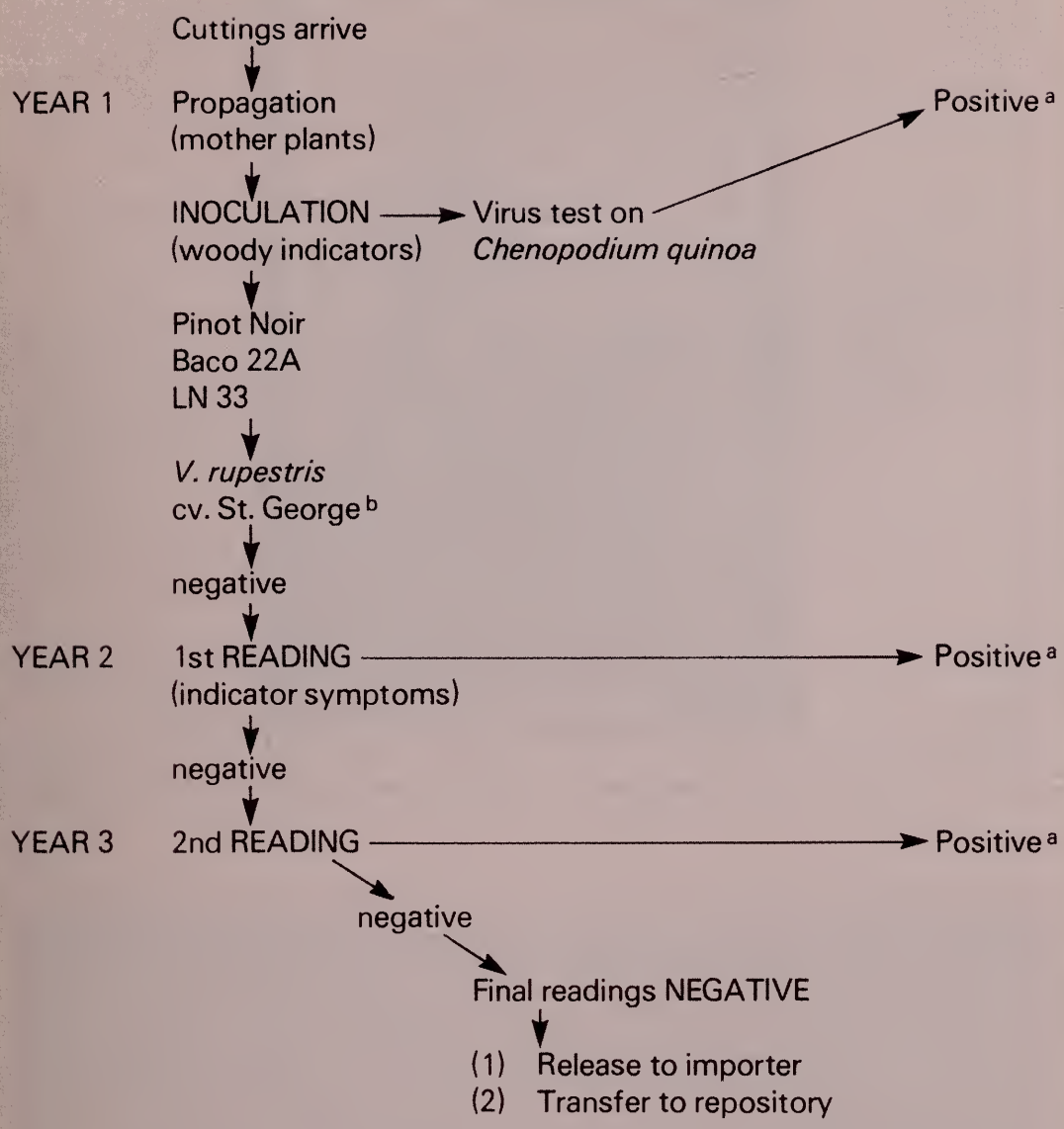
[b] Necessitates two additional years and confirmation of trueness-to-type prior to general distribution



Heat therapy

Imported material that is found to be infected with one or more viruses may either be discarded or be heat-treated to eliminate the infection. If the importer considers the material to be sufficiently important to his work, and if the Advisory Committee agrees that it is of potential importance to Canadian agriculture, it is subjected to heat treatment.

The only known means by which virus-affected material can be made healthy is by exposing young potted trees or vines to continuous dry heat at a temperature of about 38°C. The plants are placed in a chamber at this temperature for several weeks (Fig. 5). The tips are then removed from the heated plants and wedge-grafted onto virus-free rootstocks (Fig. 6). Only a



[a] Heat therapy followed by another cycle of testing on herbaceous and woody hosts; or elimination

[b] St. George indicator read in greenhouse

few grafts grow into virus-free plants, and they can be detected only by additional virus testing. Thus, heat therapy is a lengthy and expensive procedure, often requiring 5–7 years from the time of accession until freedom from virus infection can be confirmed.

Repository

When an accession, other than stock in the Audit Program, is demonstrated to be free from recognizable viruses, it is assigned to the tree fruit

Fig. 5. Plants being treated in a heat-therapy chamber.

Fig 6. Tip from a heat-treated plant wedge-grafted on a virus-free rootstock.

or grape repository. One plant is potted and retained in an insect-proof screenhouse (Fig. 7). Two plants each of grape and apple and one each of stone fruits and pear are also placed in a field planting. Material in the repository is available for distribution to university and government institutions, as well as nurseries and plant breeders. In addition, the repository preserves genetic stocks for future plant breeding.

Verification of trueness-to-type

Trees in the field repository are allowed to fruit and are then checked for trueness-to-type by local and visiting pomologists. When plants of an accession are placed in the repository, arrangements are made for the return of propagating material to the importer with the request that its continuing trueness-to-type be verified.

IMPORTING AND SUBMITTING MATERIAL

Imported clones

For plant importations from countries other than the USA, an import permit is required. The permit may be obtained by submitting an application form, available at district offices of the Plant Quarantine Division, to the

Fig. 7 Screenhouse repository for pome fruits.

Permits Officer, Plant Quarantine Division, Production and Marketing Branch, Agriculture Canada, Ottawa, Ont. K1A 0C5.

For importations from all countries including the USA, the foreign exporter of the material is required to provide a certificate of sanitation indicating the level of health certification that can be provided by the officials of the country of origin. To facilitate the processing of an application for an import permit, it is advisable to have the foreign exporter provide the certificate in advance. It can then be submitted to the permits officer and be accompanied by information on the potential value of the material to Canadian agriculture.

Commercial shipments of trees and grape vines are allowed entry only if they have been produced under an approved foreign certification program. These plants may be released directly to the importer, but a small sample from each shipment must be submitted to the Quarantine Station for auditing, that is, indexing to confirm the validity of the foreign certification.

Experimental use

Material from foreign countries intended for scientific or experimental use must be shipped to the Quarantine Station for indexing and, if necessary, heat therapy. Occasionally clones are released to the importer for retention in suitable post-entry private quarantine until indexing at the Quarantine Station has been completed. A sample is usually retained by the Station for eventual inclusion in the repository.

Domestic clones

Plant breeders and research workers who wish to have tree fruit and grape clones indexed for freedom from viruses, or submitted to heat therapy for elimination of virus infections, must apply to the Quarantine Station to have their materials tested.

Private individuals or business concerns must apply through a representative of the federal or provincial department of agriculture in their region, in order to avoid duplication of requests.

When submitting budwood or scionwood, the originator must complete a form on which he records information about the source of the clone. He is also required to mark and maintain the source tree or vine.

Application for virus testing of clones is made by letter to the Chief of Plant Inspection, Plant Quarantine Division, Agriculture Canada, Ottawa, Ont. K1A 0C5, detailing the value of the clone and the justification for treatment. A decision to accept the application or not is made in consultation with the Research Coordinator (Production) of the Research Branch. When a cultivar is already in the repository or is being treated, additional clones of this cultivar will be permitted only if evidence is given that they differ significantly from the first accession.

Release of accessions

Accessions imported by private individuals or business firms are released to them as soon as the virus-testing process has been completed, and when it has been determined that the material is found to be virus-free. However, this material cannot be listed for general distribution for another 2 years, and until trueness-to-type has been established.

Private individuals other than the importers of clones must apply for material through government agencies, universities, or certification programs in their region. Each applicant is supplied with a maximum of six budsticks from each tree fruit clone and six cuttings from each grape clone. The recipients are expected to increase the material for their own use or for regional distribution. The deadline for requests for dormant grape cuttings and tree fruit scions is February 1, and for summer budwood July 15.

The lists of tree fruit and grape clones available for distribution each year are prepared in December or January and are supplied to the offices of the federal and provincial departments of agriculture, universities, regional certification programs, and nurserymen's associations. Requests to be placed on the mailing list should be addressed to the Officer-in-Charge, Post Entry Quarantine Station, 8775 East Saanich Road, Sidney, B.C. V8L 1H3.

All recipients of scions, clones, cuttings, or cultivars are asked to sign a disclaimer releasing the Quarantine Station from responsibility for cultivar and type identity of clones. Every effort is made to confirm trueness-to-cultivar and type, but such confirmation can seldom be obtained for imported clones or for domestic clones by the time of the first release.

Reports to importers and originators of accessions

Reports are supplied annually to importers and to originators of domestic accessions, recording the results of indexing. When a clone is found to be virus-infected, the importer or originator is asked to decide if the clone is of sufficient value to justify the costly, laborious, and time-consuming procedure of heat therapy to eliminate the virus infections. Priorities for entry of meritorious clones to heat therapy are assigned by the Advisory Committee in consultation with the Officer-in-Charge.

General information

Shipment of budwood cuttings to the Quarantine Station. For each accession, send budwood cut as 30 cm scionsticks or cuttings from a vigorous single tree or vine of a superior clone. Remember to ship them in a plastic bag without added moisture or damp toweling.

Time of year. When possible, submit scions or unrooted cuttings during the winter and early spring. The Station accepts materials at any time of

the year, but the indexing period can often be shortened by a year if the material is received in the winter.

Coded accessions. Imported and domestic clones designated by codes can enter the Station's program only if adequate descriptions are provided.

Patents and other restrictions. The Station has no obligation to handle clones that cannot be made available for general distribution because of patents or any forms of contractual restriction.

Charges. No charges are made to the importer or domestic originator of the stocks for testing services or for maintaining plants in the Quarantine Station repository.

ACCOMPLISHMENTS

During its 10 years of service from 1965 to 1975, the Station has received 2600 accessions. One-third of these have been audit samples from shipments of nursery stock produced under foreign certification programs. The rest have been imported and domestic clones of grapes and tree fruits, in roughly equal numbers, and a small number have been related ornamentals.

Virus infections have been found in 30–40% of tree fruits and grapes, and in 2–4% of the audit samples. Among the viruses that have been detected in imported tree fruit clones are those causing Sharka (plum pox), Little Cherry, European rasp leaf of cherry, apple stem grooving, chat fruit, pear decline, and a number of viruses that occur commonly as latent infections. In grapes there have been interceptions of viruses causing leafroll, diseases in the fanleaf group, corky bark, and fleck; and of the bacterium causing esca. The interceptions and tests have thus prevented the importation of these potentially disastrous diseases into Canada. The program has also served to identify fruit tree and grape cultivars that are free from all detectable viruses, and these plants have been used as the initial stock for several virus-free budwood and grape programs across the country.

Two hundred and fifty of the virus-infected clones have been given heat-therapy treatment in order to eliminate the virus infections. The numbers of clones found free from virus infection, placed in the repository, and currently offered for distribution are:

apples	117
pears	23
stone fruits	95
grapes	100

Some clones are still passing through the heat treatment and virus-testing programs. Others have been destroyed on instructions from the importers, the domestic originators, or the Advisory Committee.

STAFF

Don R. Bertoia	Officer-in-Charge
Josiane M. Bethune	Administrative clerk
Christine Pollard	Agricultural officer
Bernard Silvergieter	Plant propagator (grapes)
Peter J. Berben	Plant propagator (tree fruits)
Joseph M. Cabecinha	Plant propagator

MORE INFORMATION

For further information concerning policies and procedures, you may contact the Officer-in-Charge, Post Entry Plant Quarantine Station, 8775 East Saanich Road, Sidney, B.C. V8L 1H3. Telephone (604) 656-5717.