

There are several methods for virus eradication, but thermotherapy is most widely used. Thermotherapy is not always difficult, and can be done in a remarkably inexpensive enclosure. Such heat treatment is more necessary with some species than others. Currently virus-infected fruiting varieties of *Malus* and *Pyrus* are most likely to be encountered. Originally the percentage of infected pome varieties received by IR-2 was so high that it became necessary to change our procedures. Now all are heat treated before becoming candidate clones for the repository. Consequently we now have over 100 each of *Malus* and *Pyrus* cultivars that apparently are freed from infecting viruses, but are not yet on the distribution list.

Many beneficial side effects of an active repository occur that cannot be

anticipated. For example, through the combined knowledge and experiences of the IR-2 technical committee and the project, two widely used, index-host series for detection of all viruses that infect *Prunus* and latent viruses of *Malus* were developed.

At first the size and cost of a repository similar to that just sketched may appear unworkable and excessive. This may not be true since many procedural and cost cutting techniques used by various disciplines could be incorporated into a program. However, neither can be estimated until they are studied and debated in some detail. Then decisions can be made and an outline developed. From this the size and cost can be estimated and a source of funding approached.

Preservation of Small Fruits Germplasm For Germplasm Work Shop

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INTERPRETATIVE SUMMARY

There is no large collection of cultivars and species of small fruits in the United States. As old cultivars are discontinued for commercial use they are discarded and no longer available for breeding. There is a need to preserve the germplasm to avoid genetic vulnerability. A proposal is made to make plans to establish a germplasm repository of small fruits cultivars and species in a greenhouse until such time that meristem cultures can be developed.

small fruits research was replied and several points indicated. All were in favor more national germplasm. Most people were in favor genotypic germplasm which rules out seed stock there are no homozygous of the small fruit crops. 7 of research stations in States with 50 or more selections per crop are blackberries 3, blueberries, raspberries 4, strawberry and only 1 station had a

lections of species are very limited, with only a few species represented in the collections. The need for a repository is very evident as new work is undertaken on breeding for resistance to diseases, insects or to adapt to new cultural needs. The questions are how to obtain funds for a program and how to handle the material once funds are available.

There was nearly unanimous agreement that federal funds should be supplied for such work since it should be a national program. One person suggested that we find a "sugar daddy" and that raises a question of whether a foundation such as Ford Foundation or Rockefeller Foundation might supply funds. It is a point worth investigating.

Assuming that funds are available for germplasm preservation, several questions and policies must be decided: how extensive the collection should be (include many clones of species as well as cultivars[?]), where the repository should be located, who should be responsible for the material, and how should the material be preserved.

Ideally, the repository would consist of meristem cultures or cell cultures that could be stored for several years as in the case of strawberry meristems that have now been maintained 4½ years in storage.* Boxus (1) has shown that strawberry plants can be propagated rapidly from in vitro meristems by adding 1 ppm of benzylaminopurine to the culture solution. Jones and Vine (4) and Putz (5) have cultured meristems of gooseberry and raspberry. However, not all of the small fruit crops can be meristem-cultured at the present time and an alternate method is to grow the plants in pots or containers in a greenhouse with automated equipment (watering,

venting, and heating) so that daily care would be minimal. First let's understand that the repository is for preservation of germplasm and not a source of quickly available foundation stocks for breeders and nurserymen. Foundation stocks where propagations would be available at nearly all times could be a spin off, but should not be a primary concern as such an arrangement would be very expensive and difficult to manage. Material in the repository would be available to breeders upon specific request but there would be a time lag long enough for new plants to be propagated from the repository plants. The time lag might be 6 months to a year, but, since 10 to 15 years are needed for origination of new varieties, the year delay in obtaining material would not be a severe handicap. The greenhouse should be located at a research center where summer temperatures are relatively cool and winter temperatures are mild but cool enough to provide chilling without extreme sub freezing temperatures. Two possible locations are Corvallis, Oregon, and Puyallup, Washington, but other places may be equally good.

Some will question the need for a greenhouse instead of growing the material in a nursery or in a screenhouse. One reason is to protect the material from unfavorable weather and another reason is to provide a place that will accommodate crops that have wide differences in winter hardiness among cultivars and species. For example, some species of *Vaccinium* and *Rubus* will not tolerate low winter temperatures, but other species in the same genera require prolonged periods of chilling to satisfy rest periods. These protective conditions can be provided in a greenhouse so that all material can be grown at one place. Pest control is also simpler

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in a greenhouse than in a screenhouse or nursery, especially when fumigation is used for insect control.

Fortunately, all small fruits plants require much less space than tree fruits and, therefore, several hundred can be grown in a greenhouse in a relatively small area. How much space would be required? The space will depend upon how much species material will be included in the repository. A rich and varied assortment of species exists in small fruits at present, but it is disappearing. Wide variation occurs among clones of some species such as *Fragaria chiloensis*, *F. virginiana*, *Vaccinium australe* and others. Perhaps 100 or more clones should be saved in some species, depending upon the variation within a species. This is something to be decided by specialists working with the different crops.

To gain some idea of the space needed for preservation of cultivars, I checked the lists of cultivars given in Brooks and Olmo (2) and Fletcher (3). The following numbers of cultivars were listed in Brooks and Olmo: blackberries 65, blueberries 65, cranberries 8, red currants 5, gooseberries 15, raspberries 130, and strawberries 356. Fletcher described about 2000 strawberries in 1916, but I noted only 5 that may still exist (Gandy, Howard 17, Klondike, Marshall, and Missionary). Scanning the lists indicated that probably a total of about 200 cultivars of blackberries, blueberries, cranberries, currants, gooseberries, and raspberries are still in existence and could be put in a repository. Probably about 200 named strawberry cultivars would be available. If 2 plants of each cultivar were placed in the repository and each potted plant occupied 2 square feet, a total of about 800 square feet would be needed for the cultivars. If an equal space were devoted to clones of species plus an additional 800

square feet for breeding selections and new cultivars, the entire space required would be 2400 square feet. Such space could be provided by a standard sized greenhouse 100 feet long x 35 feet wide. A well known greenhouse manufacturer quotes the price of such a greenhouse at about \$42,000 and construction would be about \$17,000. With automated irrigation the recurring cost should not be more than 0.3 man year at an estimated \$3500 per year plus materials of about \$2000 for a total of \$5500 per year.

Since there is no plan for germplasm preservation in small fruits at present, action should be initiated toward that end. I recommend that the Fruit Breeding Committee of the ASHS appoint a committee to formulate plans for a germplasm repository of small fruits. Such an action would be in line with the proposal made in the special report of the Ad Hoc Subcommittee of the Agricultural Research Policy Advisory Committee (6).

Literature Cited

1. Boxus, P. 1973. La production de plants sain de Fraisières, *Acta Hort.* 30:187-192.
2. Brooks, Reid M. and H. P. Olmo. 1972. Register of New Fruit and Nut Varieties. 2nd Ed. Univ. of Calif. Press, Berkeley.
3. Fletcher, S. W. 1916. North American varieties of the strawberry. *Va. Agric. Expt. Sta. Tech. Bul.* 11.
4. Jones, O. P. and S. J. Vine. 1968. The culture of gooseberry shoot tips for eliminating virus. *J. Hort. Sci.* 43:289-292.
5. Putz, C. 1971. Obtention de Framboisiers (Var. Bois Blanc) sans virus par la technique des cultures de meristems. *Ann. Phytopathol.* 3:493-501.
6. Ad Hoc Subcommittee of the Agricultural Research Policy Advisory Committee. Nov. 1973. Recommended actions and policies for minimizing the genetic vulnerability of our major crops. U. S. Department of Agriculture and the National Association of State Universities and Land Grant Colleges Cooperating.