Recommendations of the III Planning Conference on the Control of Virus and Virus-Like Diseases of Potato and Sweet Potato

Germplasm Transfer and Virus Elimination

1. For potato, established mechanisms for potato germplasm transfer, techniques for virus eradication, documentation, and export policies are adequate and should be continued unchanged.

2. Sweet potato germplasm should be transferred (import/export) either as true seed or as in vitro cultures.

3. Sweet potato clonal materials will be exported only as pathogen tested in vitro shipments, except for use in germplasm conservation and for pathogen eradication, with appropriate approval from recipients.

4. Current research should emphasize and result in the identification, detection and control of sexually transmitted seed borne diseases. In the meantime, true sweet potato seeds (TSPS) will be exported only from crosses made from pathogen-tested plants grown under controlled conditions. However, as an exception TSPS could be exported for conservation purpose, with appropriate approval from recipients.

5. Based on research results in item 4 (above), TSPS from parents tested for freedom of pathogen known to be seed borne could be exported. Seed lots will be tested for seed-borne pathogens when reliable testing methods are developed.

6. The documentation for export should include the following phytosanitary options:

   a. The mother plants tested and found negative to sweet potato feathery-mottle virus (SPFMV), sweet potato mild-mottle virus(SPMMV) and sweet potato latent virus (SPLV) (by serology), and to potato spindle tuber viroid (PSTVd) (by nucleic acid spot hybridization test-NASH). The mother plants also tested negative to the above viruses and other agents infecting the indicator hosts *Ipomoea nil* and *I. setosa*.

   b. True seed harvested from pathogen-tested parental plants and grown under controlled conditions.

   c. True seed harvested from mother plants tested and found free of sexually transmitted pathogens. A statistically valid sample of these seeds also tested and found free.

d. Other. (This option will be used to identify material of unknown health status).

Options (a) to (c) above will be redefined and described when the sexually transmitted pathogens are known and testing methods developed.

7. Research should emphasize methods to measure genetic variation in the process of virus eradication, in vitro conservation, and field propagation.

8. While the true benefits of thermoterapy remain questionable, CIP should continue to apply this virus eradication technique. Further research is needed on the improved sensitivity and scope of pathogen detection methods.

Breeding for Virus Resistance

General Recommendations

The development of priorities to introduce resistance to viruses into potato and sweet potato should be based on the overall mandate of CIP to improve the sustainability of potato and sweet potato.

Specific Recommendations

Potato

1. The important viruses/viroids of potato are PLRV, PVY, PVX, PVS, PVM, PVA, PVT, SB-22 and PSTVd.

2. The current program to incorporate resistance to PLRV in a background of PVY and PVX immunity should be continued.

3. The significance of PVS should be determined, particularly with regard to the breaking down of late blight resistance. Breeding efforts for resistance to PVS should be established, if the interaction is confirmed.

4. A policy statement should be developed to facilitate the development of resistance to viruses of local importance such as PVM.

5. PVT, SB-22 and PSTVd should be dealt with as quarantine problems, rather than as breeding problems.

6. Bioengineering will be of greatest benefit in introducing single-gene traits (X,Y) to widely adapted cultivars. The contribution of bioengineering will be to introduce traits to existing genotypes where conventional breeding would not maintain the desired qualities. Each stage in the construction of these varieties should be carried out by an institution with a comparative advantage.

7. Bioengineering techniques should be combined with conventional breeding for the development of PLRV resistance.
8. Testing and release of transgenic plants should follow the internationally accepted guidelines.
9. The early screening and evaluation of germplasm for resistance to viruses should be implemented in the regions.
10. Trials to assess the stability of resistance to viruses be extended to other regions.

Sweet Potato

1. Ongoing efforts to identify sources of resistance to SPFMV should be continued. Resistant genotypes will benefit from both breeding, and research on sweet potato viruses.
2. Resistance to other viruses and/or virus diseases should be undertaken only after:
   a. Identification and characterization of sweet potato viruses that cause economically important diseases.
   b. Thorough documentation of geographic distribution of these viruses.
3. We endorse the proposed project to determine if sweet potato viruses can be controlled by genetically engineered cross protection. CIP should attempt to maintain close cooperation, so as to obtain virus-resistant genotypes. These resistances will be retested at the greenhouse and in the field, following internationally accepted guidelines for testing of transgenic materials.
4. The potential of transformation with single gene traits is as important as that in potatoes. CIP scientists should be alert to any new development in this area.
5. CIP should assist NARS in developing testing procedures for the evaluation of advanced populations, lines, and the final release of new cultivars.

Virus and Viroid Detection

Recommendations

1. Identification and characterization of diseases

   Identification and biological investigations of viruses and their diseases of potato and sweet potato should be continued at CIP, possibly with the help of external collaborative research initiated and coordinated by CIP. Where regional disease problems prevent germplasm movement, CIP should take full advantage of local and nearby expertise, e.g. in the cases of "wild potato viroid", PVT and novel sweet potato viruses should be investigated. The identification of new strains of known pathogens should be continued with all suitable technologies.

2. Techniques and reagents for detection

Detectability with the presently available techniques (ELISA, NCM-ELISA, NASH) is satisfactory under optimal conditions and with the best available reagents. However, reagents have to be diversified and improved. Areas of improvement include the development of strain specific antibodies, antisera or molecular probes for PVT, PVX, PVA, PVS and, especially, PLRV. New approaches include the use of the hybridoma technology, anti-idiotyic antibodies, and peptides derived from viral genome sequences obtained from other laboratories (if possible, as collaborative research). The improvement of virus purification techniques should also be continued. The feasability of the polymerase chain reaction (PCR) for virus detection should be explored in collaborative research.

3. Appropriate technologies for CIP and NARS

Presently available techniques for virus and viroid detection are adequate for routine purposes. The capabilities of different national programs to use techniques such as NCM-ELISA, hybridoma technology, and virus purification methods should be updated and strengthened.

Collaborative help from other research institutes should be considered. The application of NASH within CIP's present concept is appropriate. Emphasis should be given to better sample preparation and possible adaptation for the use of the national programs.

Virus Control Approaches to Help NARS

Recommendations

1. We emphasize the importance of understanding the prevalent seed and propagation systems in developing countries. The knowledge of seed symptoms should include determination of incidence and economic importance of virus and viroid diseases, epidemiology, and currently practiced methods of crop production. We recommend that this information be used to evaluate the specific needs of each country, and recommend an integrated approach to improving potato and sweet potato production through control of virus diseases.

2. We agree with the current priorities of CIP, but emphasize that these need to be evaluated on the basis of information on the need of each country, as developed through recommendation No. 1.

3. The concept of NARS is not well understood and therefore NARS are less effective than they could be. CIP and NARS should develop strategies for awareness at the national and international level, of the identity and scope of the term NARS.

4. CIP, NARS, and each host country should interact to identify and transfer appropriate and sustainable technology for virus detection and control.

5. We recommend that CIP utilize scientist expertise that is currently available in developing countries/regions to help in transfer and application of technology.

6. Transfer is a dynamic process that needs to be paced with the capacity of each country to adapt technology. Mechanisms for transfer of new technologies should be developed along the model of antisera production.

7. We recommend to CIP use all available resources for training and technology transfer; for instance, CIP, CGIAR centers, NARS, the 5 intercountry networks, and other resources within each country, including the private sector.

8. NARS should be encouraged to identify areas that could best be served by the private sector.

9. We recommend CIP to identify areas for joint ventures in which CIP goals can be complemented by private sector, for example, utilizing expertise of private sector for the efficient production and distribution of user friendly kits with CIP participating in the area of antisera production.

10. We recommend exploring and improving all possible methods of increasing dissemination of information.