
Presidential Address: Tropical Root Crops in the Eighties

Author: Donald L. Plucknett.

On the occasion of the 6th International Symposium on Tropical Root Crops it might be useful to examine the present status of research and development in tropical root crops and to discuss briefly the role of the International Society for Tropical Root Crops (ISTRC) in that work. Sixteen years have passed since the first symposium was held in Trinidad. Since then a number of activities and promising developments have occurred that affect interest in, and production of, tropical root crops.

Our past President, D.G. Coursey, will present a history of the first 13 years of the ISTRC at the banquet later this week, so I will not review that history, but I will say a few words about the status of the Society, its activities and some recent developments that may be of interest.

It is a great privilege to meet in Peru, a major center of origin for the potato, and in Latin America, the continent that is the home of so many tropical root crops, e.g., cassava, sweet potato, Xanthosoma, and the less well-known Andean tuber-bearing crops. We are also privileged to have as our host the Centro Internacional de la Papa (CIP), the international center devoted to improvement of the potato. We are grateful to CIP for their hospitality and hard work in arranging the sixth symposium.

Present Status of the Tropical Root Crops

Changes are evident in tropical root crops. In general, with the exception of the Near East, root crop production has expanded in the last 15 years or so. In developing countries, production of all root crops increased by 44% during the 15-year period 1961/65 - 1979 (CIP, 1982). This increase in production is rewarding, but all of us know of places where root crops production has declined because of devastating diseases and insects, marketing problems, or other reasons.

Root crops are still staple foods for many people, particularly in developing countries. I don't have to remind you that often the populations most dependent on root crops are the very poor, and research focused on their problems can yield significant benefits.

New Developments Affecting Root Crops

There is increasing interest in root crops in some quarters because of some new developments. The research for "energy" crops has included a new look at roots and tubers. Best-known is the interest in cassava as a source of alcohol. But other crops such as sweet potato and taro have also received attention. This interest will probably slow somewhat in the near future because of current low prices of petroleum, but should oil prices rise again, interest may quicken once more. I suspect the cost of production of root crops must be reduced considerably

before energy uses of root crops will become important, but it is too early to know.

Root crops are also receiving attention because several can tolerate marginal or difficult land conditions. Pressures for land and increased food production have caused farmers to move onto marginal lands with difficult soil, weather or other environmental conditions. Cassava is valued because it can tolerate drought and high aluminum soils. Taro has always received interest because it can be grown in hydromorphic soils or under flooded conditions. Xanthosoma can grow in some hydromorphic soils, but it can also tolerate quite dry conditions and a wide range of soils, from those with high aluminum content, as well those composed mostly of coral rock. The potato is adapted to cool or cold high elevations, lands where few other crops could survive. I consider the tolerance of many root crops to marginal land conditions to be a major factor in better land use, and we root-crop scientist should do all we can to understand the degree of tolerance as well as the reasons for it and to exploit it for the good of man.

In some quarters there is new interest in root crops or root-crop by-products as animal feed. There has also been increasing interest in improved processing and storage of tropical root crops.

The movement of people as refugees of war or for other reasons is also changing the markets for root crops and in some cases is making certain tropical root crops available in markets where they were unknown before. In my own country the new Cuban populations in Florida have created new markets causing Xanthosoma and cassava to be grown as field crops; taro is marketed regularly on the West Coast for the use of Pacific Islanders who have migrated there; and several root crops used in Southeast Asia are now marketed in locations across the United States because of demand caused by refugees from Indochina. Such movements of people may bring about new markets for root crops.

Major Weaknesses or Problems of Root Crops

All of us probably know the major root crop limitations, but it is useful to review them from time to time. Vegetative propagation is probably the most important single limitation because:

- (1) it causes high seed costs;
- (2) it increases labor and handling costs;
- (3) it can present special storage or multiplication problems;
- (4) it causes major disease and quarantine problems.

The order of priority of the other limitations is not as easy to judge as vegetative propagation, but other limitations include: high costs of production and hence very high fresh product prices, perishability, long crop duration, diseases and pests, and uncertain markets.

Poor crop statistics are a severe limitation. Most of us believe root crop statistics are understated and therefore lower priorities for research support are given to these crops.

The Crops

An important development during the past two decades has been establishment of the international agricultural research centers (IARCs). Several tropical root

crops are now included in the mandates of four IARCs. These will be covered briefly on a crop by crop basis, as well as some of the major strengths and weaknesses of each crop, from my personal perspective.

1. Potato. The potato is the most important root crop in the world, ranking fourth among all crops. CIP was established in 1972 to improve potato production in developing countries. The World Potato Collection is a major germ plasm resource for the world. Seed production and virus diseases still are major limiting factors, while susceptibility to high temperatures and bacterial wilt limit potato production in the humid tropics. The use of true seed (TPS) for planting could markedly reduce seed costs as well as certain virus disease problems.

2. Cassava. Cassava is a major world crop, ranking sixth in total production. CIAT has a major cassava program and maintains the world germ plasm collection. IITA is responsible for cassava improvement in Africa. Cassava research has increased dramatically around the world, due to the efforts of CIAT, IITA and financial support by IDRC. National programs are stronger. Tissue culture is being used increasingly for rapid multiplication, for germ plasm preservation, and to clean up viruses in cassava tissues. Insects and diseases have caused severe damage to cassava crops in Africa. Cassava chips for livestock feed face an uncertain market in Europe. The perishability of cassava is still a problem although there is much information available on processing. There is much research information and new technology that needs to be utilized.

3. Sweet potatoes. Sweet potato is a major world crop, ranking seventh among all crops in total production. The People's Republic of China is the largest producer. IITA has responsibility for breeding sweet potato in Africa. Most of the IITA program is focused on weevil resistance. AVRDC works to improve sweet potato production in Asia. Short-crop duration, generally low fertilizer requirements, and tolerance to low-moisture conditions are major strengths. Sweet potato is usually a low-cost food, but its sweetness is a drawback to its use as a staple food.

4. Yams. IITA has responsibility for improved yam production. IITA's achievement in obtaining flowering and seed set in yams provided a basis for yam breeding. A major limitation is still the large amount of planting material required. Another major limitation is the requirement for staking in some cultivars. Demand for yams is still high in many places.

5. Taro. IITA has responsibility for taro, but its aroid program is small. The major strengths of taro are tolerance to flooding and hydromorphic conditions, plus possibly some salinity tolerance. Yields can be high. Taro can be devastated by some diseases, notably taro blight. Lethal viruses in Melanesia cause concern in movement of germ plasm. Taro prices are often too high to maintain its role as a staple food, unless it is grown as a subsistence crop. The International Foundation for Science (IFS) has provided much needed financial support for aroid research in developing countries.

6. Xanthosoma. IITA has responsibility for cocoyam. IITA has worked mostly on diseases and production problems of West Africa. Xanthosoma is tolerant of certain difficult soils and is less susceptible to diseases than taro. For that reason Xanthosoma is replacing taro in some areas.

Root Crop Germ Plasm

Germ plasm conservation for root crops is difficult because of heavy dependence on vegetative propagation. Potatoes and cassava germ plasm can be maintained as true seed, but the fear of virus transmission still exists. In general, germ plasm conservation for potato, cassava and sweet potato is improving and may be satisfactory; however, for the other root crops the situation is, at best, mixed and probably inadequate. Except for potato, cassava, and sweet potato, root crops usually have not been assigned high priority in germ plasm efforts by the International Board for Plant Genetic Resources (IBPGR). Instead, most are given secondary status or are assigned regional priorities.

Conservation of root crop germ plasm must be a high priority for root-crop scientists, and we must do all we can to convince our administrators to take on responsibility for the root crop genetic resources in our respective locations. This means field space, labor, and supervision must be provided to grow the germ plasm in glasshouses or field nurseries. If this is not done, many cultivars and land races will be lost.

Breeding

Plant breeding efforts are well established in cassava, potato and sweet potato and both IARCs and national programs are involved in breeding these crops. Breeding in yams is still in its infancy and should receive more attention. In taro and Xanthosoma, breeding has begun, but I fear that little collection and evaluation of cultivars has been done, and that breeding objectives are as yet too little understood.

Agronomic Research

Good agronomic trials of most root crops are still lacking. Agronomic research should be based on an understanding of the physiology of the crop to make best use of existing cultivars or the improved varieties being produced by breeding programs.

The wide range of conditions in which our crops grow, from flooded to arid, demands better understanding of crop response to environment. Good agronomic research can help to ensure that better understanding.

The role of root crops in farming systems must be understood better, especially since root crops can play an important role in improved land use. Some root crops can tolerate partial shading and are, therefore, satisfactory understory intercrops for three crops.

Impact of Research

Root-crop researchers must be concerned about the rather poor rates of adoption of new technology and research results. There are exceptions of course. Some national programs are having a degree of impact, CIP has seen 17 varieties named by national programs from its genetic materials and African farmers have adopted some of IITA's cassava varieties. But in general, adoption has been less than would be desired, and the Society may wish to do something about it. Probably the need for vegetative propagation of the root crops may be the major factor limiting adoption. Perhaps the Society may wish to form a special working

group on this topic, or a future symposium should address it by organizing a special program to address it.

The International Society for Tropical Root Crops

Our Society has much cause for pride. We have a constituency of almost 1,000 and a membership of more than 300. We have organized five symposia since our formation in 1970 and provided a basis for communication among root crop scientists. I believe we can justifiably claim some credit for the increased interest in root crop research and production. The Society has experienced growing pains, including financial stringency, delays in publication of two symposium proceedings, and inadequate communication with the membership. But we have established that there is an interest in such an international society, both in the developing and in the developed world. I believe this interest augurs well for the future.

We can claim several achievements. All of the proceedings of the past symposia have been published. Regional meetings have been held. An African branch of ISTRC has been organized and is now planning for its second meeting. The proceedings of its first meeting have been published. A Pacific Region taro workshop was held in Fiji in 1981, and a regional taro workshop was just completed in Costa Rica. These are just examples of some activities that have been held during the past 3 years.

At the Manila meeting the Council established six Working Groups: Root Crop Statistics, Taxonomy and Nomenclature; Non-Food Utilization; Plant Quarantine/Tissue Culture/Germ Plasm Exchange; Research Cooperation and Priorities; and Germ Plasm Preservation and Utilization. Members of the Council have been assigned responsibility for a Working Group. Some Working Groups have been active and will report briefly at our business meeting later this week. More could be organized if the membership should want them. But Working Groups will only be successful if they function and receive support. I encourage all members to participate in one or more of the Working Groups that have been set up to deal with several important problem areas.

Our Newsletter has experienced problems. It has not been as regular in publication as is desired; it costs more to produce and mail than we can afford; and an inadequate number of news items and articles is sent to the Editor. We thank the University of Hawaii for its help and support in publishing and mailing the Newsletter.

We have attempted to keep our dues low so more people would be able to join. This means, however, that our finances are short. We have received gifts from a number of companies and organizations in the past. We are very grateful for this assistance. A list of sustaining members and donors over the past several years will be published in the proceedings of this symposium.

It is with great pleasure that I can announce that one of our members, Dr. S.K. Hahn, was honored twice in 1982 for his research achievements. He received the Guinness for Scientific Achievement Award for his contributions to tropical agriculture through his research on cassava and sweet potato, and was honored by the Government of Korea with one of its highest medals for individual achievement. I want to extend on behalf of the Society our heartiest congratulations to Dr. Hahn for this deserved recognition.

It is my pleasure to announce that the ISTRC has received a gift to establish a scientific achievement award for excellence in research on tropical root crops. Part of this gift will be used to provide an Outstanding Paper Award at this symposium. During the next year nominations will be received, and the first Scientific Achievement Award will be made. The award will be made thereafter at each symposium. The Outstanding Paper Award will also continue. Your Council hopes this award will help to stimulate excellence in research on tropical root crops, as well as to provide a measure of recognition for our colleagues who have devoted so much effort to the improvement of these important food crops.