

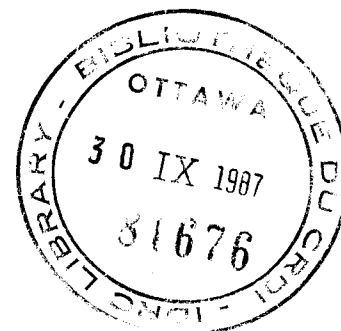
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**SWEET POTATO, SMALL FARMERS AND NEED FOR COOPERATIVE RESEARCH**

by Kenneth T MacKay\*

Paper presented at the International Sweet Potato Workshop,  
ViSCA, Baybay, Leyte  
Philippines  
May 20-24, 1987



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(The views expressed in this paper are those of the author and not  
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# SWEET POTATO, SMALL FARMERS AND NEED FOR COOPERATIVE RESEARCH

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## INTRODUCTION

Sweet potatoes are the 4th or 5th most important crop in terms of production, economic value and contribution to calories and proteins. Although they originated in the Americas, they are now an Asian crop. Asian and Oceanic countries account for 92% of total world production, and China alone accounts for 82% of the total (Table 1). Five other countries: Vietnam, Indonesia, India, Philippines and Papua New Guinea (PNG) all have sweet potato areas over 100,000 ha. There are wide differences between yields per ha from a low of 3 for Thailand to a high of 25 MT's for the Republic of Korea. The yield has increased considerably in China in the past 30 years. Xue and Shen (1987) show yield increases in China from 10 to over 20 t/ha primarily because of changes in cultural techniques, high ridges and wide rows resulting in increase in plant density. You will also notice discrepancies in Table 1 between the FAO Figures and those figures which will be presented at this meeting. There are considerable difficulties in collecting accurate data on a subsistence and neglected crop like sweet potatoes.

The area of sweet potatoes has decreased in the past 10 years while production has increased slightly. However, it varies with country (Figure 1). In China, the area and production increased after 1949 to a peak of over 9 million hectares during the 60's and 70's and has decreased since then to less than 7 million hectares. In Vietnam and Kampuchea, there have been recent large increase in area planted probably associated with economic and political disruption of other

agricultural activities. Figures for Sri Lanka (Jayawardena and De Silva, 1987) likewise show a large increase in production during 1973 to 1976 associated with acute food shortages. Production has decreased since as rice production and wheat imports increased. There are also suggestions from PNG that population pressure in the highlands and migration from the lowlands resulting in labour shortages have both resulted in increased production of sweet potatoes (Kanua and Rangai, 1987). In the Philippines, production appears to have increased in the past three years due to (1) short term food needs following typhoons, (2) increased crop diversification on sugar lands and (3) increased specialty marketing of new varieties.

In much of Asia, sweet potatoes are an emergency crop, and usually associated with hard times - wars, typhoons and other natural disasters, and economic disruptions.

Sweet potatoes are a crop of the smallest and poorest farmers (op cite; Jayawardena and De Silva, 1987; Rashid, 1987). Women are also very heavily involved in production, processing and marketing in PNG, Philippines and elsewhere. Table 2 gives preliminary data from a study carried out in the Philippines which shows the considerable involvement of women from planting to marketing.

Sweet potatoes are an ideal crop for small farmers. They are adaptable. In this meeting, we will hear reports of sweet potatoes being grown from 15° south to 45° north and from sea level up to 2,800 m. They are also adaptable to a wide range of moisture and fertility conditions and give adequate yields with very little fertilizer inputs. Yield varies from country to country (Table 1). In Bangladesh, yields in t per ha average 13.7 with no fertilizer (Rashid, 1987) whilst Kanua and Rangai (1987) report yields from the highlands of PNG of up to 21 using only farmers techniques of mulching, composting and ash fertilizer. Sweet potatoes are grown in a wide range of farming systems from lowland paddy after rice to upland slope. They are interplanted with a wide range of other crops, coconut, maize, cassava, sugar cane, legumes such as peanut and soybean, and even opium. They also have unlimited seasonality so they can easily be grown throughout the year.

Sweet potatoes have a wide range of uses. They are grown by many farmers as a subsistence food. They are particularly important in this Visayas region of the Philippines and New Guinea, both PNG and Irian Jaya, as a staple food; in Bangladesh as a dry season food when the rice runs out, and in China and Viet Nam where they are important staple after rice, maize or wheat. They are also an important vegetable crop, the most important vegetable in the Philippines. Their roots are often used in curries while the fresh tips are used as a green. However, in Thailand and South Asia the leaves are not consumed. Sweet potatoes are also an important confectionary food in Thailand, Malaysia and the Philippines. Sweet potatoes have potential for processing as we will hear during this meeting. However, there is limited commercial processing of sweet potatoes in Asia with the exception of Taiwan and Japan.

Sweet potatoes are an important animal feed. In Taiwan, 73% of sweet potato production is used for animal feed (Yeh, 1982). The vines are an important pig food in China, PNG and elsewhere. Small farmers use the stems and tubers to feed pigs and ruminants. Trials have been carried out using dry chips as feed ingredients in the Philippines and also in Taiwan, but they are not yet widely used because of the dominance of low cost imported maize in most prepared animal feeds.

Sweet potatoes are considered a traditional crop in Asia and Oceania. While there is a controversy (Yen, 1982) over the time and method of introduction of sweet potatoes to the region, the crops have been grown in most Asian countries for 200-450 years. Yet, it is considered a native crop and there are also considerable indigenous techniques for the production. In addition, in some countries there are religious beliefs associated with sweet potatoes. There is also a large germplasm availability, particularly in PNG and the Philippines which are considered to be secondary centres of variability.

In spite of the large differences in production techniques, cropping systems and utilization that we will hear about in these sessions, I will nevertheless attempt to generalise.

1. Sweet potatoes are produced by rural households on farms of less than 2 hectares with considerable involvement of women. A portion of the crop is eaten, probably stored in ground and often used during food scarcity. The surplus is sold for cash, usually for consumption by urban poor or landless labours. The tops, surplus and damaged tubers are fed to animals.
2. Sweet potatoes production uses no purchased inputs apart from seedlings (often produced on farm), family labour and land. Land is usually poor and marginal.
3. Farmers grow a mixture of cultivars, as many as 10 per farm, often with different micro-habitats and different tastes and uses.
4. Sweet potatoes are usually grown in intercrop.
5. The major pest problems are sweet potato weevils, rats and pigs.
6. Little or no research or extension assistance is available.

### Research Needs

I will not try to second guess your discussion on the next few days. However, I wish to point out some unique features of the research needed for a subsistence low-input crop for small farmers like sweet potatoes.

Genetic Diversity. There is a need to collect and preserve existing germplasm, particularly in Irian Jaya, PNG and the Philippines. In addition, the practice of many farmers to maintain considerable diversity by planting a number of different cultivars on their farms must be appreciated by breeders so that new varieties or cultivars are able to fit in the system. This is not easy as Kanua and Rangai (1987) point out "limited evidence suggests that the traditional system of mixed variety plantings has complicated the acclimatization process of newly bred or recommended sweet potato cultivars which are

usually selected in monoculture plantings (AFTSEMU unpublished). The local farmers often determine variety preference by taste, texture or colour and not necessarily by yield. This raises a number of problems for both the farmer and the researcher. Firstly, it implies practical difficulties for future adoption by farmers, of improved cultivars into their mixed variety planting system. Secondly, varieties selected for yielding ability in government research stations may not be acceptable to the farmers taste. Furthermore it complicates future research, in that variety screenings have to be carried out on mixed variety plots as opposed to the traditional monovariety plantings. Overall, to overcome these constraints future genetic research must select for specific local needs such as improved protein quantity and quality, taste and colour preference combined with yield. However this is not easy to achieve, particularly for a very highly variable crop like sweet potato."

Low Inputs. It is tempting to look at farmers yields vs research station yields which may be 600% greater and suggest that farmers should strive for them. However, most resource-poor farmers do not have cash, supply of inputs or credit, nor are there market systems in place to sell excess potatoes. In the short run, increases will have to come from simple low-input technologies and breeding advances. Jayawardena and De Silva (1987) point out that current practices in Sri Lanka have a very low cost of production and subsequently a high return for land and labour. They suggest "the main research objective should be to increase the farmers' income level and not the tuber yield per unit area. In this respect more research on cost reducing technologies must be carried out with the idea of reducing the need for weeding, chemical inputs and intensive cultural methods."

Intercropping. If farmers traditionally grow sweet potatoes in intercrop, then new cultivars and technologies must be tested under these conditions.

Weevil Control. In addition to breeding for resistance, it will be important to study the various cultural techniques that farmers are already using to control weevil.

Storage. It will be important to follow the experience of CIP in learning from farmers (Rhoades and Booth, 1982; Rhoades et al, 1985). What are the problems? Are they storage of marketable potatoes or seed? Should storage be in ground or in storage structures? What are the labour requirement for single harvest and storage versus in ground storage and multiple harvests?

Learn from Farmers. Sweet potato farmers (both men and women) have centuries of experience of growing, selecting and managing sweet potatoes. They and their ancestors are the ones who have selected and bred most of the cultivars they are using. It is therefore important to learn more about the farmers, their constraints and their traditional techniques. This can be done by formal and informal surveys, on-farm experiments and also informal experiments. It is perhaps instructive to follow the experience of the introduction of the new sweet potato varieties from ViSCA in this region in order to determine lessons that may have wider application. A recent evaluation of the ViSCA sweet potato research (Escalada and Lopez, 1986) indicated there had been widespread distribution of the VSP lines, the yield potential was appreciated by both small and large farmers and that farmsize was not a critical factor in adoption. The short maturity of the new varieties was most appreciated in the typhoon affected areas. The new varieties contributed to land intensification while the production increase generated local processing for snacks and delicacy items and had lowered the price to consumers. In addition, the officially released varieties were not necessarily the farmers' choice and there was a need for the release of regionally adapted varieties. Most importantly, the farmers fit the varieties and the new technologies to their conditions.

Lightfoot (1986) reported on informal on-farm experiments comparing farmers' varieties to the new VSP lines. I have summarized the data for two (of the 14) most popular farmers' varieties compared to VSP-1 and 2 (Table 3). It is apparent that the new lines are moister, have lower yields, poor vining (less weed competitors) and are more susceptible to weevils when grown under farmers' conditions. It is important that these comparisons are made in order to feed information back to the breeders to improve subsequent lines. This has been done to some extent at ViSCA and subsequent releases are dryer and offer better weevil resistance.

### Research Cooperation in Asia

This topic will be discussed in further detail during this workshop. However, I want to mention the following areas which I think may be important.

1. Information - meetings, newsletters and literature searches.
2. Germplasm - collection, storage, and exchange of disease-free materials of not only Ipomea batatas but also wild relatives. There is also a need for feedback on the testing of materials to determine its usefulness over wide ranges of environment.
3. Joint research projects on weevil resistance and control, and possibly scab and nematodes.
4. Regional training.
5. International agricultural centres. AVRDC, CIP and IITA have considerable expertise in information, germplasm, improved varieties and techniques for virus screening and indexing which is very useful for the region.

The International Development Research Centre (IDRC), a Canadian government funding organization has a mandate to support development research which benefits the rural poor. IDRC has given considerable support to root crop research and development. Previous projects from the Agricultural Division (AFNS) have supported root crops research in Malaysia, Thailand, India and Bangladesh. Currently IDRC is funding projects involving sweet potatoes in Sri Lanka, Indonesia (2), Philippines (2) and China, while the Information Division is supporting projects at AVRDC and PRCRTC here at ViSCA on Sweet Potato information and the Training Division (FAD) is supporting back-up training for ViSCA staff.



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Table 1. Asian Production of Sweet Potatoes Average for 1983-85 after FAO (1986). Figures in parenthesis represent data presented at this meeting.

|                           | Area<br>(x 10 <sup>3</sup> HA) | Yield<br>(MT/HA) | Production<br>(x 10 <sup>3</sup> MT) |
|---------------------------|--------------------------------|------------------|--------------------------------------|
| China<br>(Av 82-83)       | 5,098<br>(6,900)               | 18.4             | 94,033                               |
| Viet Nam<br>(1980-83 Av)  | 390<br>( 561)                  | 4.8<br>(5.6)     | 1,867<br>(3,142)                     |
| Indonesia<br>(Irian Jaya) | 275<br>( 50)                   | 8.0              | 2,200                                |
| India                     | 212                            | 7.4              | 1,565                                |
| Philippines               | 191                            | 4.6              | 873                                  |
| Papua New Guinea          | 102                            | 4.6              | 464                                  |
| Japan                     | 65                             | 22.0             | 1,435                                |
| Bangladesh                | 66<br>( 82)                    | 10.8<br>(13.7)   | 714<br>(1,200)                       |
| Korea Republic            | 39                             | 24.7             | 965                                  |
| Korea DRR                 | 31                             | 14.2             | 440                                  |
| Thailand                  | 40                             | 3.2              | 129                                  |
| Sri Lanka<br>(1980)       | 15<br>( 6)                     | 8.6<br>(10.3)    | 129<br>( 65)                         |
| Oceania (- PNG)           | 14                             | 6.9              | 96                                   |
| Malaysia                  | 3                              | 17.0             | 51                                   |
| Laos                      | 4                              | 9.4              | 38                                   |
| Kampuchea<br>(Av 80-82)   | 3<br>(14.8)                    | 9.4<br>( 3.8)    | 28<br>( 56)                          |
| Burma                     | 5                              | 4.8              | 24                                   |
| Total World<br>(1983-85)  | 8,026                          | 14.2             | 114,321                              |

Table 2. Percent (%) Involvement of Household Members in Sweet Potato Production and Marketing after (Escalada and Binongo, 1987)

|          | Obtaining Planting Material | Land Preparation | Weeding and Soil Cultivation | Pest Control | Chemical Fertilizer Application | Harvesting | Processing | Marketing |
|----------|-----------------------------|------------------|------------------------------|--------------|---------------------------------|------------|------------|-----------|
| Husband  | 66                          | 78               | 62                           | 3            | 34                              | 79         |            | 28        |
| Wife     | 48                          | 48               | 45                           | 3            | 26                              | 72         | 24         | 75        |
| Children | 59                          | 48               | 45                           | 3            | 17                              | 62         |            | 10        |

Table 3. Farmers Assessment of Sweet Potato Varieties

| Variety   | Taste | Storage In Soil | Maturity Period (month) | Yield Class | Vining (month) | Duration Harvest (month) | Tuber Size (cm.) | Pests Weevil |
|-----------|-------|-----------------|-------------------------|-------------|----------------|--------------------------|------------------|--------------|
| Kadulaw   | S/D   | Good, Poor      | 3-5                     | 1, 2        | 1-3            | 7-8, 12                  | 6-10             | Res          |
| Karingkit | S/D   | Good            | 4-7                     | 1           | 2              | 12                       | 10               | Res          |
| VSP-1     | S/W   | Good, Poor      | 2-3                     | 2, 3        | 0              | 1                        | 5-6              | Sus          |
| VSP-2     | S/W   | Good, Poor      | 2-3                     | 2-4         | 0              | 1, 2                     | 4-8              | Sus          |

Taste: S=Sweet, D=Dry, W=Wet.  
 Storage: Good/Poor=Easily Rotting.  
 Vining: Time to cover ground.  
 Tuber Size: Diameter.  
 Pests: Res=Resistant, Sus=Susceptible.

Figure 1. Changes in Area of Sweet Potato Production in Viet Nam, Kampuchea and China

(Data from papers or documents presented in this workshop)

