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Tropical root crops: Opportunities for poverty alleviation through sustainable development

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Abstract. Tropical root crops (TRC) provide unique opportunities for the sustainable development of around 600 million rural poor people in the tropical and subtropical regions of Africa, Asia, South Central America, and Oceania. Many of these rural poor have few practical choices to improve their livelihoods, in particular their long-term social and economic wellbeing. Producing enough food to live well and the ability to exchange the surplus for cash or kind is a critical requirement for long-term poverty alleviation no matter where people live. For the rural poor in the equatorial region of Africa the daily food energy supply from TRC is probably about 65-75% of the requirements and is around 6,500-7,500kj. For this group of rural poor the TRC is their lifeline for survival and a basis for improving their welfare. To assist their long-term poverty alleviation we need to focus more on increasing the supply of TRC and reducing its volatility throughout the year. In the South Pacific TRC already enable significant numbers of rural poor to attain a state of subsistence affluence. TRC, more than any other staple foods produced in the tropics and subtropics, provide great opportunities for long-term rural poverty alleviation through sustainable development. It is generally accepted that economic growth is the key contributor to poverty alleviation in the long-term, provided sensible social and economic policies enable the poor to access the benefits of growth. The rural poor, however, are in a weak position. They usually have restricted access to credit, markets, property rights, infrastructure, technology, and health and education systems. Underpinning these constraints is the poor people's inability to chip away at the effects of weak governance and poor accountability of public institutions so that their aspirations for a better life largely go unrealised. How can the merits of TRC, such as cassava, sweetpotato, yams, taro, and potatoes, be harnessed to assist poverty alleviation in a sustainable way? This challenge faces all of us in different contexts of our work in TRC and is a worthy cause for our efforts. Long-term poverty alleviation results from the development and maintenance of self-sustaining systems and processes generated from within the affected communities. The first need of the poor is enough life-sustaining food and that it be available safely every day. No poverty alleviation strategy will work if the food issue is not first addressed. Because most TRC consumers are also the producers on their own farms in sometimes very remote rural settings, it makes eminent sense to focus the long-term sustainable development strategies of these people around TRC. This is because the poor in remote rural settings are usually by-passed by the mainstream economic growth that may occur and benefit those in the non-agricultural sectors. This condition where economic growth benefits some and not others magnifies the disparity in income distribution and may even increase poverty for the poorest.

Sustaining livelihoods of the rural poor. Sustaining the livelihoods of poor TRC producing communities is about sustaining the flow of benefits that can arise out of producing TRC. Producing more TRC can

arise in two ways – through increasing yield and through increasing production area. For most poor TRC farmers access to additional cultivable land to increase their production area is restricted. Therefore the only practical alternative left is through increasing yields. The potential for increasing yields is largely dependent on on-farm resources, technologies practised, and access to knowledge. Increasing yields would enable increasing per capita availability of food but the problem is much more complex because of population growth.

Production growth versus population growth. Population growth is the critical factor inhibiting per capita increase in TRC availability in the producing regions and thereby the communities' ability to improve food security in a sustainable way. If the rate of population growth is higher than the rate of TRC production growth then there is a fundamental problem for alleviating poverty on a wide scale. In many regions where TRC are produced and consumed the rate of population growth usually averages around 2-2.5 per cent per annum, whereas the rate of production growth averages around 1-1.5 per cent per annum. Obviously over the long-term there is a problem of food security for the rural poor in these regions.

Where population growth is over one per cent higher than production growth, which is the case in several countries and regions of Africa, Asia, South Central America and Oceania, in time food poverty increases and sustainability declines. It is a conundrum that areas where TRC are the main staple foods are also where rural population growth is rapid, thereby threatening the food security. Conversely these are also the areas where alternatives to TRC as staple foods are also limited. Over long-term this condition of increasing negative gap between production growth and population growth results in declining per capita availability of TRC. This threatens community food security and may even lead to starvation. Providing food aid as a short-term measure in such situations may save lives but is not a long-term sustainable answer to food security. Food aid also creates dependence on imported food and if it continues for long, it imposes a high and unsustainable economic cost to the society. Therefore the negative gap between production growth and population growth remains a counteracting factor to realising the full potential of TRC in assisting sustainable poverty alleviation on a wide scale in poor rural settings where TRC are the main staple foods.

Additional conditions that would assist poverty alleviation. Increasing the per capita availability of TRC is not enough to achieve poverty alleviation. The poor, depressed areas where TRC farmers eke out a living need additional conditions and supporting resources for improving people's livelihoods. These include greater access to clean water, improved health and education services, better roads and rural transport infrastructure, improved housing, better access to utilities, and increased employment opportunities. The future development of poor TRC farmers is constrained by the lack of these basic needs. Despite these additional constraints to assisting the sustainable development of poor TRC farmers, our main efforts should still be on increasing yields and minimising their volatility, as at least this would help to feed the rural poor, create surplus for exchange and trade, and provide a base from which to improve their wellbeing. This is the challenge that faces us as TRC workers. This is where the efforts of ISTRC and other related institutions should be concentrated in the immediate future.

Production. TRC are important staple foods in the tropical and subtropical regions of the world. Table 1 shows the production of cassava, sweetpotato, yams, taro and potatoes by the major world regions. The world production of cassava is around 173mt, with Africa producing nearly 92mt or 53% of this, with Nigeria responsible for most of this with 33mt. Sweetpotatoes are the next

important TRC with the world production at around 141mt, with Asia dominating with about 129mt or 91%. China is the main producer of sweetpotato at 121mt. The world production of potatoes is around 311mt but only around 20% or about of this is produced in the tropics and the subtropics. Therefore most of the staple production of potatoes is concentrated in the poor and remote highland regions of Asia, North Central America and South America. The fourth most important TRC is yams with the world production of about 38mt, of which 36mt or 96% is produced in Africa. Nigeria produces 26mt, and is the main producer of yams. Taro is the least important TRC with a world production of about 9mt. Africa dominates taro production with 7mt or 78% of the world production. Nigeria is also the main producer of taro with about 4mt produced annually.

Consumption. The consumption of TRC by the major world regions is shown in Table 2. Africa's per capita consumption of TRC totals 200kg with cassava (116kg) and yams (46 kg) being the most important. South America's consumption of TRC is 138kg per capita with cassava at 89kg and potatoes at 44kg. Asia's root crop consumption is 80kg per capita with sweetpotato dominating at 35kg, and potatoes a close second at 31kg. In Oceania the root crop consumption is 106kg per capita. In the tropical regions of Oceania the consumption of cassava, sweetpotato, yams and taro is fairly evenly distributed and all important, totalling 46kg per capita. In Europe and North Central America the per capita consumption of root crops is 194kg and 67kg respectively, which is almost entirely contributed by potatoes.

Table 1: Root crop production (1000t) in 2000.

	Cassava	Sweetpotato	Yams	Taro	Potatoes
Africa	91,849	9,114	36,335	6,666	10,110
North CentralAmerica	853	1,112	463	23	30,179
South America	30,759	1,222	496	4	15,144
Asia	49,081	128,812	230	1,873	113,256
Oceania	194	596	292	303	1,830
Europe	-	46	2	-	140,769
World	172,737	140,903	37,818	8,870	311,288

Source: FAO Production Yearbook, 2000.

Table 2: Root crop consumption (kg/capita) in 2000.

	Cassava	Sweetpotato	Yams	Taro	Potatoes
Africa	116	11	46	8	13
North CentralAmerica	2	2	1	-	62
South America	89	4	1	-	44
Asia	13	35	-	1	31
Oceania	6	20	10	10	60
Europe	-	-	-	-	194
World	29	23	6	1	51

Source: FAO Production Yearbook, 2000.

Importance of tropical root crops in feeding the world. Some general points can be drawn from the world production and consumption data of TRC. TRC are produced and consumed throughout the world although the dominance of particular root crops varies from region to region. People of many different cultures and traditions rely on TRC as their main staple foods. TRC are common foods in the tropics and subtropics where many of the world's rural poor of around 600 million people live. Africa is the continent where most TRC are produced and consumed, with Nigeria dominating. If it is assumed that only 20 per cent of the world production and consumption of potatoes occurs in the tropics and the subtropics (around 10kg per capita), then TRC contribute around 69kg per capita in feeding the world. This is a significant amount relative to other staple crops produced in the world. When projected on to the consumption of TRC by the rural poor in the tropics and subtropics, then TRC become extremely important since their survival is dependent on these staple foods. It is this group of rural poor people that need immediate and significant development effort in improving their welfare through increasing yields of TRC.

Tropical root crops in Africa. Rural poverty in many parts of Africa is high, especially in countries around the equatorial region where TRC are the main staple foods. What can be drawn from the nexus between these areas of rural poverty and the people's ability to lift themselves out of poverty through the very staple foods that they rely on for survival – the TRC?

Africa is the most important continent in the production and consumption ot TRC. Africa produces around 159mt of TRC or 38% of the world production. Nigeria alone accounts for about 64mt. Africa also has a large population, which totaled 794m in 2000 with 441m or 56% deriving their livelihood from the agricultural sector.

Africa exhibited a remarkable growth in per capita consumption of TRC between 1990 and 2000. There has been reduction of the gap between production growth of TRC and population increase. During this period the production of TRC increased from 113mt to 159mt, an increase of 41%. At the same time the population increased from 619m to 794m, an increase of 28%. The per capita consumption of TRC therefore increased from 183kg to 200kg in the same period.

However, such macro statistics hide regions where there has been a significant widening of the gap between production and population growth. An example is Tanzania where the FAO data shows that the production of TRC declined from around 8.167mt in 1990 to 6.498mt in 2000. During the same period the population increased from 26m to 35m. Interestingly during that decade the population in the agricultural sector increased from 21m to 27m. What factors have caused this apparent massive decline in per capita consumption of TRC from 314kg in 1990 to 186kg in 2000? There are several possibilities and these need further investigation.

Food value of tropical root crops in Africa. For the rural poor in Africa TRC provide an excellent support base for long-term poverty alleviation since they are already entrenched staple foods. Table 3 shows the food value of TRC in the five largest producers of TRC in Africa. These are Nigeria, Congo Democratic Republic, Ghana, Uganda and Tanzania, which together produce 68% of the 159mt of TRC produced in Africa. These countries are also representative of the main TRC producing zone of Africa – two are from west Africa, two from east Africa, and one from central Africa. An analysis of the per capita availability of TRC and their daily supply of food energy in these five countries shows some interesting results.

There is considerable variation in the amount of kj/capita/day supplied from TRC in the five countries. The supply of kj/capita/day from TRC varies from a high of 9,060 in Ghana, followed by 7,650 in Nigeria, 4,570 in Uganda, 4,460 in Congo Democratic Republic to 2,510 in Tanzania. These figures are

Table 3: Food value of tropical root crops in selected countries of Africa in 2000.

	Nigeria	Congo, Dem Rep	Ghana	Uganda	Tanzania
Production (1000t)	64,236	16,748	12,892	7,842	6,498
Population (1000)	113,862	50,948	19,306	23,300	35,119
Agricultural Population (1000)	37,921	32,202	10,848	18,404	27,454
Kg/capita	564	329	668	337	185
Kj/capita/day	7,650	4,460	9,060	4,570	2,510

Source: Calculated from data in FAO Production Yearbook, 2000

substantial when compared with the average daily kj requirement for an adult at around 10,000kj. The supply of kj/capita/day from TRC for the whole African population is around 2,710kj.

The significance of TRC in supplying the daily food energy is even more important in the rural population. The supply of kj/capita/day from TRC in the rural person's diet is probably more than twice as important as that of urban dwellers. The urban population has both a greater choice and a greater ability to pay for their daily kj requirements than the rural population. For the rural poor in the equatorial region of Africa the kj/capita/day supplied from TRC is probably around 65-75% of the total requirements. Therefore for this group of rural poor people TRC is their lifeline. To assist their long-term poverty alleviation we need to focus both on increasing the supply of TRC and reducing its volatility throughout the year. This is a key challenge for TRC workers.

Food value of tropical root crops in the South Pacific. Even in the small island states of the South Pacific and Papua New Guinea, TRC play an important role in the daily food energy supply. Table 4 shows the food value of TRC in five large producers in the South Pacific. These are Papua New Guinea, Fiji, Solomon Islands, Samoa and Tonga. The data also shows that the supply of kj/capita/day from TRC in the diets of the Pacific islanders is significant.

Detailed studies of the nutritional values of TRC have been carried out in Fiji. In one village in the Sigatoka Valley, Fiji it was found that TRC supplied around 5,994kj/capita/day, comprising of cassava 3,613kj, sweetpotatoes 1,553kj, taro 410kj, yams 343kj, and potatoes 75kj. This represented 51% of the daily kj requirement of an adult Fijian of 11,750kj (Chandra, 1982). Around 91% of the total daily kj requirement was produced on the consumers' farms.

Attaining subsistence affluence through tropical root crops in the South Pacific. Subsistence affluence is a concept developed from the observation of subsistence producers and consumers in the South Pacific where TRC are major staple foods. It means that even in a subsistence context people can have a relatively happy and rewarding life if their daily food needs are easily satisfied by the productive resources available to them (a state of bliss with plenty of time left over to undertake leisure activities) (De Boer and Chandra, 1978).

In the South Pacific TRC play a very important part in creating subsistence affluence because of their ability to generate high amounts of food energy per unit of effort. In some areas of Fiji, Samoa and Tonga where subsistence affluence is high, efficiency ratios of 70-85 are commonly attained for cassava, sweetpotatoes, and yams (Chandra *et al.*, 1974). The efficiency ratio for taro is lower but still significant at around 20-25. In the South Pacific, TRC enable large numbers of rural poor people to achieve food security than would otherwise be possible without TRC.

Table 4: Food value of tropical root crops in selected countries of the South Pacific in 2000.

	Papua New Guinea	Fiji	Solomon Islands	Samoa	Tonga
Production (1000t)	1,261	72	134	41	92
Population (1000)	4,809	814	447	159	99
Agricultural Population (1000)	3,707	325	327	-	-
Kg/capita	262	88	300	258	929
Kj/capita/day	3,560	1,200	4,070	3,500	12,600

Source: Calculated from data in FAO Production Yearbook, 2000.

Notes:

(1) In Fiji imports of potatoes probably accounts for another 1,200kj/capita/day, mostly consumed by the Indian population who have a high dietary preference for potatoes, and who form around 46 per cent of the population or 370,000 people.

(2) For Tonga the high level of kj/capita/day is probably due to a much larger fraction of the total production of TRC being exported from this small island nation.

Development lessons for communities relying on tropical root crops. These examples of the impact of TRC in supplying a large share of the daily kj requirements, and creating better lives for the rural poor in Africa and the South Pacific, have a number of useful lessons and propositions for the future development of TRC. First, let us not forget to use existing staple foods as a vehicle to assist poverty alleviation of the rural poor. History has shown that societies that depend on imported staple foods for a large share of their food needs are often vulnerable to the vagaries of world events and they could pay a high social and economic cost in maintaining their living standards. Second, developed nations developed as a consequence of secure staple food sources, and they started producing a significant surplus for trade or export. The industrial revolution was powered by an agricultural revolution that preceded it. Third, culture, traditions and food preference do matter. TRC have been produced and consumed by societies in different parts of the world for eons. They have proven to be reliable in producing some food in the harshest of conditions by the simplest of technologies with the least amount of purchased inputs. Fourth, the long duration of on-farm availability of the edible parts of the root crop plant makes it one of the most reliable sources of human sustenance and food security. Considerably more people in the tropics and subtropics would be poverty-stricken if TRC were not produced there. Millions more would have suffered deprivation and even starvation, if it were not for the TRC embedded into the lives of the rural poor.

Conclusions

TRC provide unique opportunities for the sustainable development of around 600 million rural poor people in the tropical and subtropical regions of Africa, Asia, South Central America, and Oceania where TRC are produced and consumed as the main staple foods. In these regions the rural poor have few practical choices for improving their welfare. For them TRC provide a way not only to generate more food with least risk to their meagre resources, but also to enable them to attain a higher degree of subsistence affluence in the future. Food value data from the largest producers in Africa and the South Pacific show that TRC supply a large share of the daily food energy requirements of vast numbers of rural poor people. TRC, more than any other staple foods produced in the tropics and subtropics,

provide great opportunities for the long-term rural poverty alleviation through sustainable development. This is a challenge that faces us as TRC workers, and is where the efforts of ISTRC and other related institutions should be concentrated in the immediate future.

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