

THE ROLE OF SEED TECHNOLOGY IN THE DEVELOPMENT OF ROOT AND TUBER CROPS SECTOR AND POVERTY ALLEVIATION

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ABSTRACT

Seed technology is the method through which the genetic and physical characteristics of seed could be improved involving such initiatives as variety development, evaluation, seed testing quality control and release amongst others. It is also a basic tool for food security if properly utilized. This technology has not been fully applied in the root and tuber crops possibly because of the limited use as a tropical crop compared to the temperate crops. It has been shown that root and tuber crops can sustain the life of both animals and humans. Root crop based institutes like the National Root Crops Research Institute Umudike realized of late the inclusion of the programme in their research agenda for increased food production hence the necessity to emphasize its role bring it to the front burner. This paper therefore highlights the role of seed technology on the development of the root and tuber crops for increased food production poverty alleviation with emphasis on both major and minor root crops, the seed systems and their ability to alleviate hunger and poverty. It concluded that it is evident that a well-structured root and tuber seed technology programme with modern facility can alleviate poverty since poverty may actually not be totally eradicated.

Keywords: Seed technology, Roots and Tubers and increased food production

Introduction

Conventionally, seed is defined as generative or vegetative part of the plant used as a propagating material. But appropriately the word seed refers only to the plant part that developed from the flower after fertilization (True seed) while any plant part used to grow a crop, be it seed, root, tuber or stems is regarded as a propagation material (Conny *et al* 1999). High quality seeds lead to excellent seedling performance in the field. It is the ultimate bases of successful companies that breed crop plants for seed production. Seed quality is a complex trait that is determined by interaction between multiple genetic factors and environmental condition. Seed technology according to Feistritzer (1975) is the method through which the genetic and physical characteristics of seed could be improved. It involves such initiatives as variety development, evaluation and release, seed storage and seed testing, quality control seed certification marketing, and distribution research on seed production handling based on modern

botanical and Agricultural sciences. It is a multidisciplinary science with a range of disciplines such as : Development of superior qualities, Evaluation, Release, Processing and Storage, Testing, Certification and Quality control, Marketing, Pathology, and Entomology. Rapid multiplication to increase agric product, timely supply of new seeds with vigor and viability all at a reasonable price to reach the average farmer are some of the goals. It is a carrier of new technology a basic tool of secured food supply. This principle means to secure crop yields in less favourable production areas. A modern and rapid rehabilitation of agriculture in cases of natural disaster. Technology is the application of the body of knowledge or all those methods of production which have been developed with the existing state of scientific knowledge. Some also put it as the application of knowledge to practical tasks of life, in other words technology extends to all skills – knowledge, process and procedures, used to carry out man's activities (Stewart

1977). Characteristically it must be sustainable and non-detrimental to the environment, ecosystem and the people. It must be reproducible. Furthermore it must be within the economic means of the community. Technology should help the farmer to achieve goals better at a lower cost (Mba *et al.*, 2015). A standard seed technology programme should involve multidisciplinary collaborative research and extension outreach in the areas of seed science and seed technology. Oxford Dictionary defines poverty as the state of being extremely poor wherein one lacks the basic human needs such as food, water, sanitation, clothing, shelter, health care and education. The concept of poverty is a multi-faceted concept. Poverty can be said to be the state of being poor in other words the lack of means of providing material needs or comforts. But poverty is not only about lack of material goods but also lack or denial of opportunities for a certain sector of the society. The problem is that hungry people are trapped in severe poverty. They lack the money to buy enough food to nourish themselves. Being constantly malnourished, they become weaker and are often sick. This makes them increasingly less able to work, which then makes them even poorer and hungrier. This downward spiral often continues until death for them and their families. The National Root Crops Research Institute Umudike came into being by 1st of April 1976 after passing through several transformations from 1923 to ensure efficient and effective delivery services, the Institute is structured into divisions namely Root Crops Research, Tuber Crops Research, Planning Monitoring and Evaluation, Research Support Services, Farming Systems and Extension, Administration and Accounts; with a mandate to conduct research into the genetic improvement, production, processing, storage, utilization and marketing of root and tuber crops of economic importance and other root crops. It is surprising that such an important programme (seed technology) was only set up in 2012 shortly after the establishment of minor root crops programme. The programme is charged with the following objectives.

- Develop an effective seed programme for the production of quality seed in root and tuber crops.
- Collaborate with breeders in commodity crop programmes within the institute and

National Seed Council to produce breeder, certified and foundation seeds in root and tuber crops.

- Develop a good management and control measure for disease of root and tuber crops seed production.
- Apply modern agricultural biotechnology and other techniques for rapid cleaning and multiplication of seed in root and tuber crops.
- Develop an effective post-harvest management of seed of root and tuber crops.

The Seed Technology Programme can effectively address these objectives if all the needed equipment, human and material resources are provided. Within the short period of her existence and the facilities available the programme has ensured certification of all the Institute's crops to ensure that pure and healthy breeder and foundation seeds of the institutes mandate crops reach the farmers. In liaison with the breeders many several varieties have been released and many more are in process of evaluation in preparation for release. It has also resulted in increase in demand for the roots and tuber crops from the institute, documentation of the annual production data for planning. This is the anchor of several externally funded programmes in the roots and tuber crops to address hunger and poverty in the third world countries.

Root and Tuber Crops

Root and tuber crops are the main food of about 400 million people living in the tropics. In Africa, they provide about one third of all food. Root and tuber crops (cassava, sweet potato, yams and aroids) are the second group of cultivated species in terms of importance after cereals, in tropical countries. They are produced with very low inputs, are consumed by the poorest, contribute significantly to food security and are also used for animal feed or as raw material for processing industries (Lebot, 2009). The principal root and tuber crops of the tropics are cassava (*Manihot esculenta* Crantz), yam (*Dioscorea* spp.), sweet potato (*Ipomoea batatas* L.), potato (*Solanum* spp.) and edible aroids (*Colocasia* spp. and *Xanthosoma sagittifolium*). Root and tuber crops have not been improved much by selection and breeding. There is still much scope for

improvement. Already they yield as well as most cereals or grain legumes farmed in the humid lowland tropics, especially in the forest zones. Botanically, they belong to a number of different plant families. They all have underground organs, i.e. parts of the plant for storing energy in the form of starch, sometimes sugar. These storage organs may be swellings on the roots (cassava), whole underground stems or stem tubers (cocoyam and xanthosoma where they are called corms and cormels) or a portion of the underground stem as in the case of yams and Irish potatoes. The edible roots and tubers contain much starch, little protein, hardly any fat, few vitamins, and much water. Cassava is particularly poor in protein, and if it is used as the main staple food people may well suffer from lack of protein. On the other hand, cassava leaves are very rich in protein so that a diet consisting of garri and cassava leaf soup comes close to being a balanced diet, at least as far as starch and protein is concerned. Others define the root and tuber crops as belonging to the class of food that basically

provide energy in the human diet in the form of carbohydrate. The term belongs to any growing plant that stores edible material in subterranean root, corm or tuber. Historically, very little attention has been paid to root crops by policy-makers and researchers as most of their efforts have been concentrated on cash crops or the more familiar grains. Root crops were regarded as food mainly for the poor and have played a very minor role in international trade. This misconception has lingered for so long because of the lack of appreciation of the number of people who depend on these root crops, and the number of lives that have been saved during famine or disasters by root crops. It was cassava that fed and saved the Biafrans during the Biafran war in Nigeria in 1966-69. . The table below sourced from FAO, (1993), shows quantity of the root and tuber crops produced in the developing countries far back 1993 excluding china and this may have tripled by now. This emphasizes how much life the root and tuber crops sustain in the developing countries

Table 1: Production of root and tuber crops in developing countries in 1993 (million tons)

Crop	Africa	Latin America	Asia	Oceania	Total	% of total
Cassava	74.8	28.5	50.2	0.2	153.7	51.7
Potato	7.5	12.9	70.0	1.48	91.8	30.9
Yam	26.8	0.8	0.2	0.2	28.1	9.5
Sweet potato	6.3	1.7	9.3 ¹	0.6	17.9	6.0
Taro	3.5	0.04	1.8	0.3	5.6	1.9
Total	118.9	43.9	131.5	2.8	297.1	100.0

¹ The 105.2 million tons produced by China are not included in the total for Asia.

Source: Adapted from FAO Production Yearbook, Vol. 47, 1993

Minor Root and Tuber Crops

These are the root crops that are apparently neglected and underused. They are domesticated plant species that have been used for centuries or even millennia for their food, fibre, fodder, oil or medicinal properties, but have been reduced in importance over time owing to particular supply and use constraints. These constraints include, poor shelf life, unrecognized nutritional value, poor consumer awareness and reputational problems (famine food or "poor people's food"). Some crops have been so neglected that genetic erosion of their gene pools has become so severe that they are often regarded as lost crops .Many of these species have the potential to contribute to food security, nutrition, dietary and culinary diversification, health and income generation. In

National Root Crops Research Institute here the Minor Root Crops Programme is currently working on such under-utilized roots crops as Turmeric (*Cucuma longa*), Sugar beet (*Beta vulgaris*), Hausa potato (*Solestemon rotundifolius Poir*), American yam bean, (*Pachyrhizus ahipa*), Rizga, Polynesian arrowroot, locally called *Amora* (*Tacca leontopetalloides* L. Kuntz) etc creating the necessary awareness . As the demand for plant and crop attributes changes (reappraisal or discovery of nutritional traits, culinary value, adaptation to climate change, etc) also change, neglected crops can overcome the constraints to the wider production and use. Many formerly neglected or underutilized crops have been found to be of relevance in terms of medicinal and nutritional values. It is difficult to

precisely define which attributes make a crop "underutilized", but often they display the following features outlined by Hammer *et al* (2009):

- Linkage with the cultural heritage of their places of origin
- Local and traditional crops whose distribution, biology, cultivation and uses are poorly documented
- Adaptation to specific agro ecological niches and marginal land
- Weak or no formal seed supply systems
- Traditional uses in localized areas
- Produced in traditional production systems with little or no external inputs
- Receive little attention from research, extension services, policy and decision makers, donors, technology providers and consumers
- May be highly nutritious and/or have medicinal properties or other multiple uses

Minor root and tuber crops are primarily grown by traditional farmers. These species may be widely distributed beyond their centres of origin but tend to occupy special niches in the local production and consumption systems. They are important for the subsistence of local communities, yet remain poorly documented and neglected by the mainstream research and development activities.

The Seed System

Seeds are the delivery system for agricultural biotechnology. Seed system represents new thinking on the role that agriculture needs to play in building resilience. Development of seed system provides security situation in any nation for example in Ethiopia, where consequences of the most severe drought and disease are still unfolding farmers do not cite seed unavailability as a reason for planting late. This is as a result of an efficient seed system. Some of the notable challenges of the seed industry may include, dearth of plant breeder, seed technologists, inadequate seed testing facilities and infrastructure for seed processing, storage and handling, slow development and promotion of hybrid in most crops and lack of Intellectual Property Right (IPR) to encourage private plant breeders to develop and release new varieties. In Nigeria, the National Agricultural Seed Council is the Agency charged with the overall

development and regulation of the National seed industry. Some of her functions include, analysing and formulating programmes, policies and actions regarding seed development and seed industry in general, including research issues relating to seed testing, registration, release, production, marketing, distribution, certification, quality control, supply and use of seed, importing and exporting of seeds amongst others.(NASC, 2012). This agency has relatively done well in the areas of grains and pulses and not in the root and tuber crops. Particularly in the establishment of seed companies, cassava which is known to produce over 200 different products (Eluwa *et al*, 2015) processing companies are not as numerous and available compared to other companies for the grain and pulses. Despite being the largest cassava producer in Africa, Nigeria's average yields of 14 tons per hectare are less than half of what may be realistically attainable. This is because farmers do not have access to improved varieties due to inefficient seed system. However, thanks to such newly introduced basic seed entrepreneur which is aimed at building an economically sustainable cassava system, this problem will soon be over in Nigeria .The project aims to help Nigerian producers reach this potential through developing a commercially sustainable cassava seed value chain based on the purchase of quality seed by farmers provided by vibrant and profitable village seed entrepreneurs and basic seed production linked to cassava processors. These seed businesses will provide healthy seed of more productive cassava varieties leading to adoption of new varieties to improve productivity and food security, increase incomes of cassava growers and village seed entrepreneurs and enhance gender equity. The three seed systems namely formal, informal or traditional and the semi-formal should be fully applied to the root and tubers. The formal seed system is regulated by government and to some extent also by industry providing new and improved varieties of certified seeds of consistent quality and relative high priority. The informal is semi structured and operates mainly at the individual or community level and the semi-formal is a blend of the formal and informal systems. Farmers and community based organizations multiply and sale small quantities of quality declared seeds of improved varieties to other farmers within a restricted zone with minimal formal quality control (Francis *et al*, 2014).

Poverty and Hunger Alleviation

Failure to provide an effective seed programme for the production of quality seed in the root and tuber crops of the Agricultural sector predisposes people to poverty. In the same vain failure to develop good management and control measure for disease and pests can also cause poverty. So also is the failure to apply modern Agricultural biotechnology and other techniques for rapid cleaning and multiplication of seed in root and tuber crops. For much of history, poverty was considered largely unavoidable as traditional modes of production were insufficient to give an entire population a comfortable standard of living. Aristotle has said in his masterpiece-Politics that, 'Poverty is the parent of revolution and crime.' Poverty creates an imbalance in the equality of the society, resulting in population explosion, unemployment, child labour and a rising graph of crimes. Employment, productivity and economic growth have the indirect potential to alleviate poverty, as a result of a simultaneous increase in employment opportunities and increase labour productivity. Building opportunities for self-sufficiency and making employment opportunities available are just as important as increasing income and access to basic needs. This situation can be ameliorated or totally eradicated by creating root and tuber crops seed based companies that apply simple technology to mass produce clean seed accessible to the poor and eliminate unemployment. Increasing the supply of planting material of root and tuber crops through rapid multiplication techniques can dramatically reduce food shortages in modern times by boosting yields and previous constraints. This will reduce pressure on white collar jobs and diversify the country's economy

Conclusion

It is evident that a well-structured root and tuber seed technology programme can alleviate poverty since poverty may actually not be totally eradicated. There are enormous potentials in both major and minor root and tuber crops. Their production involves low input technology with high yield and many value added products are available. Given the notion that it is for the poor, when fed the poor gets to the next level but the notion is currently changing especially in Nigeria

where the cost of the grains are extremely high. In fact seed security is food security, for seed technology programme to play this role certain conditions need to be in place. There is need for a good laboratory with efficient hands to work in liaison with resource persons and extension outreach centers. A good seed system also needs to be in place so that they can be at par with grains and pulses. There is need to step up research in the minor or the under-utilized root and tuber crops involving breeders assisted by private seed companies and intellectual property rights upheld.

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