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Sustainable Cassava Intensification And The Challenge Of Clean Planting Materials ("Seeds") In Southeastern Nigeria.

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Abstract
Cassava (Manihot esculenta Crantz) is a very important food crop that is propagated vegetatively by roots in most parts of the tropical and sub-tropical regions of the world. Africa produces over 54% of the world cassava and Nigeria is at the top of world production with 57 million tonnes. Like most Vegetative Propagated Crops (VPCs), this method of asexual reproduction makes them more vulnerable to pest and disease attacks. The bulkiness of cassava stems that serve as the planting materials (seed) together with low multiplication rate and perishability tend to affect negatively transport and storability. In Nigeria, the net cassava output of about 14 tonnes per hectare is so far below the global average. It has been strongly observed that this low productivity status is partly due to scarcity of market infrastructure that constrains farmers access to improved varieties that have physical, physiological and health qualities. Sustainable Cassava Intensification program involving routine production and marketing of clean improved varieties of planting materials has been suggested. A key program established for this purpose is the - The Building An Economically Sustainable Integrated Cassava Seed System (BASICS 1&2). The BASICS Project engaged by a consortium of CGIAR and other International bodies is aimed at; (I) creating at institutional level to sustainable means of producing quality and certified breeder, foundation and commercial seeds for distribution along the chain. (2) optimising the channels of seed and seed information distribution down to the right farmers and vice versa. It is expected that the BASICS model would forster the required economically viable and sustainable formal cassava seed system would launch the crop an engine of Africa s socio-economic growth.
Keyword: *Manihot esculenta, vegetatively propagated crops, sustainable intensification, market infrastructure, improved varieties.*

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I. Introduction

Cassava *(Manihot esculenta* Crantz) is an important food crop in the tropical and sub-tropical parts of the world where its use apart from subsistence living has potential use in industrial processing is fast gaining grounds. Cassava is believed to hold the key to future food security for Africa because of its broad adaptation to a variety of soil, climate, drought tolerance and ability to grow on marginal soil (Le *et al*. 2007, Abaca *et al*. 2021). Africa produces over 54% of the worlds cassava, with Nigeria leading globally with net production of over 57 million tonnes in 2018 (FAOSTAT 2018). About 6 million farmers grow cassava which as many as 190 million people depend on as staple food (Ezedinma *et al* 2004) (Fig1). Cassava as a crop has characteristics that makes it highly attractive to smallholder farmers in Africa. It is propagated from stem cuttings, the cost of the planting material is low and readily available though bulky and perishable. The plant physiology makes management less tasking, its highly tolerant to acidic soils and possess a common symbiotic association with soil fungi that help its roots absorb phosphorus and micronutrients needed for growth and optimal yield (Onyeka et. al, 2008). Cassava root is a rich source of dietary energy and it's energy yield per hectare is often very high and potentially much higher than that of cereals (FAO 2012). Apart from food and feed ,other industrial uses of the cassava root starch include food manufacturing, pharrmaceuticals, texiles, plywood, paper and adhesives and the production of ethanol biofuels (Iwe *et al*. 2014).

II. Cassava Production And Constraints

Most poor farmers find cassava production production easy and advantageous due to it's vegetative propagation by stem cutting. An average cutting of about 20 cm long can possess up to 4-5 nodes of viable buds.

Global average yield per hectare has increased up to 12.8 tonnes in 2011 but still far lower than cassavas potential (FAO 2014).Cassava like other Roots, Tubers and Banana (RTB) crops which are vegetatively propagated have perishable and bulky nature but also offer great potential for the rural as well as the growing urban population (Ezedinma *et al* 2004). Cassava production has been on the increase for the past 20 years both in area cultivated and in yield per hectare. Recent increase in production of cassava in Nigeria as well as in other Sub-Saharan Africa has been observed to be due to rapid growth in population, improved high yielding varieties and developed marketing infrastructure (Ezedinma *et al*. (2004). production increase has been primarily due to rapid population growth, large internal market demand, complemented by the availability of high yielding improved varieties of cassava, a relatively well developed marketing access infrastructure, Production in Nigeria is mainly within the cassava farms in the Southeast, Southwest and Middlebelt States where the crop is intercropped as main crop or major crop with maize, rice, legumes, melons, bananas and oilpalms (Onyeka et al 2008). Much successes have been recorded in areas of genetic improvements, agronomic practices, root storage and development of processing technology.

Despite the much strides recorded so far, a lot still need to be done in tackling cassava production constraints. These challenges include pests and diseases, on farm agronomic problems, maintenance of clean seeds or planting materials, unco-ordinated government policies, inefficient extension services and inadequate access to improved postharvest technology (Theierge1985,Ezedinma *et al.* 2004). Among the most important cassava field pests and diseases include; Cassava mosaic disease(CMD), Cassava anthracnose disease(CAD),Cassava bacterial blight (CBB) Cassava green mite (CGM) and Cassava mealybug (CM). Of all these plant pathogenic diseases,CBB,CMD and are considered very important but CMD is the most devastating cassava disease with a potential yield loss ranging between 20-90% (Yaninek,1994; Ogbe *et al* 2003; Ezedinma *et al.* 2004).Cassava root rot diseases caused by several pathogens in disease complex is common (Hillocks and Wydra 2002).Though not yet in West Africa, the dual pandemic of CMD with CBSD (Cassava Brown Streak Disease) is a potential threat. Improved crop and soil management coupled with the use of higher yielding varieties resistant to drought, pests and disease,cassava production in this area could reach an average of 23.3 tonnes per hectare (FAO 2018). Cassava production in Sub-Saharan Africa is mainly on little or no use of external input by low income farmers. However, with the increasing market demand for cassava home and abroad, traditional cassava cropping systems are being replaced worldwide by more intensive production(Legg et al 2011,Mallowa et al 2011). Cassava Sustainable Intensification with the main purpose of achieving higher yields on the same area of land is considered more profitable as opposed to expanding the harvested area which is not feasible in most countries (FAO 2012). Being an averagely long duration crop (8-24 months) and propagated asexually by stem cutting which exposes it to the attacks of numerous pests and diseases togethee with other climatic vagaries (Szyniszewka 2020). Most times, the control of these problems could e very expensive to the poor farmers and the impact of each untreated challenge shows up at last as very poor economic harvests. In this situation whereby the adoption of certified clean improved varieties of these cassava seeds,the easy availability of these planting materials is a major issue. In cases where they are found, their prices are out of reach to the poor farmers. As a result, most farmers resort to recycling seed from previous plantings. Over time the quality of these recycled materials degenerates. Causes of genetic immunity degeneration have been attributed to intense disease pressure, agronomic and other environmental factors (Gildenmacher *et al* 2011). the operation of seed system is always hampered by lack of deeper understanding of the dynamics in order to make such interventions more effective and to scale up the successes (Ezedinma *et al*. 2004).

III. Cassava Sustainable Intensification

Much improvements have been made in African agriculture which have not grossly changed the widespread hunger and poverty situation (Pretty et al 2011). Of the 1.02 billion people hungry between 2009 and 2010, 265 million came from Sub-Saharan Africa (FAO 2009). Most commentators have agreed that food productions would need to be increased exponentially on a global level (Pretty 2008, Wright 2010, Haggblade and Hazell 2009). Agriculture needs to be intensified from existing agricultural lands. According to Pretty (2008), Sustainable agricultural Intensification is producing more crop output from the same unit or land mass and at the same time reducing the negative impacts and at the same time increasing contributions to natural capital and the flow of environmental services. Several stakeholders have feared and therefore warned against unbalanced practice of agricultural intensification as encountered in the implementation of the Green Revolution program, An experience of decades of continuous cropping that led to depletion of fertile lands and groundwater, pest resurgence, pollution of water, water and air brings a quick check to the probable unrestricted practice of cassava intensification (Szyniszewka,2020). Cassava Sustainable Intensification Programme has been identified as a major tool of feeding the populace as well as generating income for both families and governments (Iwe *et al* 2014). To this end, the Food and Agriculture Organization of the United Nations, has adopted the SAVE AND GROW farming approach, thus helping the developing countries to avoid the risks of unsustainable intensification, while realizing cassava higher yield production, rural poverty alleviation and host country economic development (FAO 2012).

IV. The Challenge Of Clean Cassava Planting Materials (Seeds).

Based on the widespread need of cassava raw materials and products across different agroecologies, it’s expected that various cassava varieties adaptable to ecologies and diverse end user preferences be deployed. For example in Su-Sahara Africa, new elite varieties of cassava needed for cultivation as interest in the crop production expands into dry Savannah, semi Arid and Subtropical parts. The challenge of getting disease free planting materials ecomes a very crucial issue in cassava production (Szyniszewka, 2020, Lozano et al 1981). Cassava stem cuttings usually are known to be perishable, bulky and cumbersome to transport and require considerable storage space when considered for large scale production. For subsistence level of production cassava is harvested piecemeal and many do not have means of storing stems until next planting season, supplies are made from neighbours in local markets making quality assurance difficult. For effectiveness in sustainable intensification, a constant multiplication and distribution of clean cassava stems of improved varieties is required. Meanwhile, a new seed system- Building An Economically Sustainable Integrated Cassava Seed System, Phase 1& 2 (BASICS 1&2) program funded by the Bill & Mellinda Gates Foundation implemented by a consortium of international research bodies is being adopted (Bentley et al 2020). The BASICS project was approved in 2015 with the ultimate goal of developing a commercial model for a cassava seed system in Nigeria. According to FAO (2012), the system would provide cassava cultivars that are high yielding and niche adaptable cassava varieties preferred by various end users. The mission of this novel program is built around three important agenda viz: genetic resources conservation and distribution, variety development and the production and delivery to farmers of high quality, healthy planting materials. In respose to this need, the BASICS Project was designed with two key strategies in mind:

(a) Establishig institutional processes for sustainable production of certified breeder seeds, foundational seeds and commercial seeds.

(b) Enhancing the seed system and information flow to farmers to accessing improved seeds as well as receiving feedback from them. This enables the development of cassava varieties conforming with market preferences.

The Structure of the BASICS Project.

The project is organized around four core components: (fig 2)

1. Early Generation Seed (EGS):

This involves the production of breeder seeds and foundation seeds, supported by a system that enables the rapid multiplication of certified clean seeds.

2.Village Seed Entrepreneurs (VSEs):

This focuses on building a network of trained commercial seed producers to enhance marketing and dissemination of quality improved seeds.

3. Processor-led Model:

This aims to create systems in which medium and large scale processors establish their own seed supply systems using preferred varieties.

(4) Quality Seed Certification:

This involves the developing of a certification scheme for all seed classes to facilitate effective implementation of dissemination and use of healthy seeds.

V. Conclusion

Cassava production in the sub-Saharan Africa especially Nigeria has full potential in mitigating the foreseen food security crises. Sustainable cassava intensification incorporating seed system interventions would ensure routine multiplication and distribution of high quality planting materials that maintain genetic purity, disease and pest free. The BASICS program is rightly poised to achieving this purpose.

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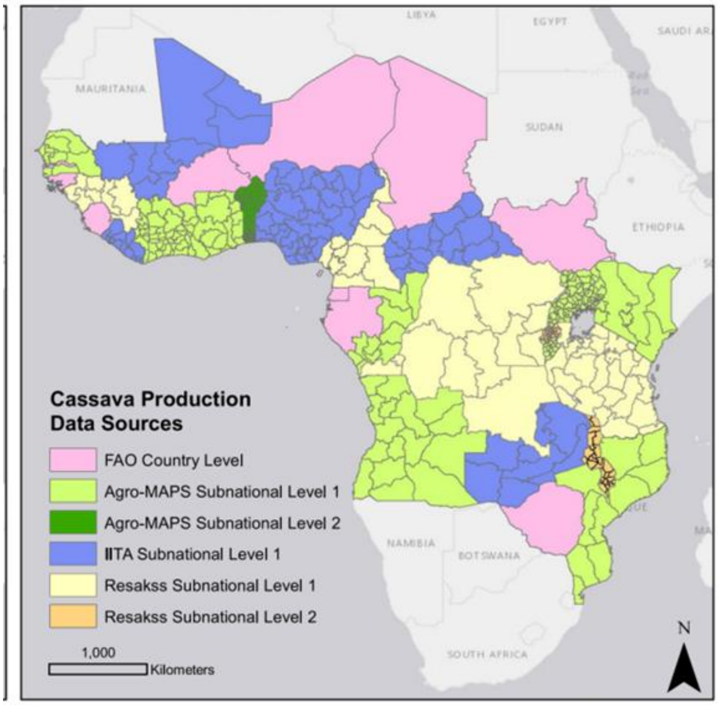

Fig. 1: Major cassava producing countries in Africa (Ezedinma*et al* 2004).

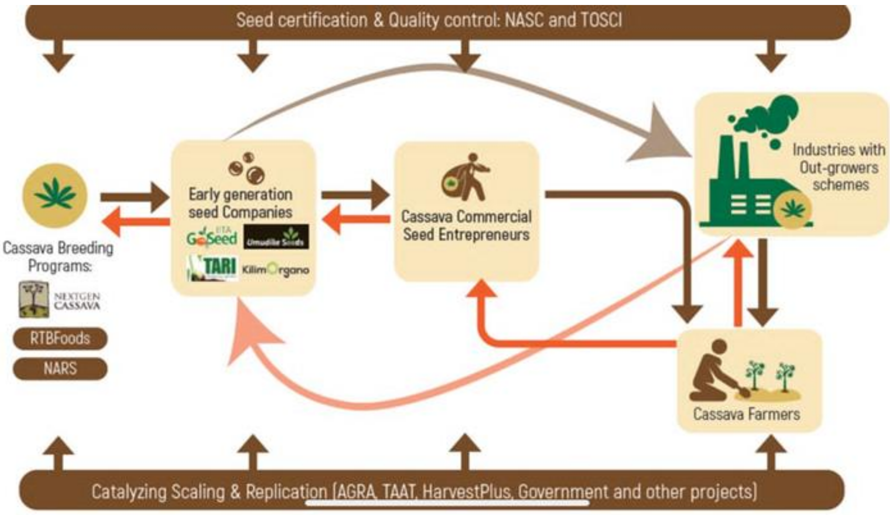

Fig. 2: The Structure of BASICS Project showing its Four components (FAO 2018).