

ORIGINAL RESEARCH

Acquisition of Plantain Production Competencies by Senior Secondary Agricultural Science Graduates for Sustainability in Enugu State

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Abstract

The study determined the need for acquisition of plantain production competencies by Senior Secondary agricultural science graduates for sustainability in Enugu State. The study highlighted the importance/uses of plantain and the various products plantain can be processed into such as flour, chips, fried and roasted plantain among others. The study equally discussed the medical values of plantain in treatment of ulcer, diarrhoea, throat infections, asthma, low libido in man and purification of blood. The study discussed in details the plantain production competencies in the areas of planning, pre-planting operations, planting operations, post planting operations, harvesting operations processing operations and marketing of plantain products. Based on the competencies discussed, some recommendations were made such as; teachers of agricultural science should take students regularly to field trips and excursions; where plantain is grown, government should provide schools with adequate facilities and equipment for practical activities in plantain production; there should be establishment of young farmers' club in schools that do not have for the production of plantain as a project.

Keywords: Plantain Production Competencies, Sustainability, Extension Workers, Secondary Agricultural Science Graduates, Enugu State

Introduction

Plantain is a staple food cherished by many people especially in Enugu State. Plantain as one of the major staple food crops are grown vast in western and southern parts of Nigeria. Udofia and Nlebem (2013) opined that plantain is third staple food crop after cassava and yam grown by farmers. Plantain is a starchy food that is consumed by over 70 million people in different parts of Nigeria as ripped or unripped, prepared in different recipe (Food and Agricultural Organization, 2004).

Plantain (*Musa paradisiaca*) originated from Asia and belongs to the family Musaceae. It is a large perennial herb with an underground stem called corm which serve as a storage organ and the true stem of plantain plant (Ogwo, 2013). Okongwu (2011) noted that more than 60 plantain varieties have been identified. These varieties are giant French, medium types, small and dwarf plantain. The author further classified plantain into bunch type, floral size types based on their characteristics. In Enugu State, which is the area of study the false horn plantain which produces heavier bunches and greater number of fruits than others are grown.

Plantain can be put into different uses. Plantain fruit contains vitamins such as vitamin A, B, C; and very rich in minerals particularly iron. Adewole and Dunji (2010). The authors further noted that plantain is free from cholesterol, high in fibre and low in sodium. It can be used in making vinegar and wine. Okongwu (2011) noted that plantain can be produced as plantain flour and chips. It can be fried, roasted and used in baby food formulations. Plantain peels, leaves, fodder and fruits are used as feeds for animals. The leaves apart from its use as animal feed and mulching materials can be used in wrapping foods and for preservation of kolanut and bitter kola (Ugwuede, 2023). Kainga and Seiyabo (2012), pointed out that the peels and stalk apart from their use as animal feed can serve as raw materials in soap industry because of high potassium content.

Plantain has a lot of medicinal values. Okongwu (2011) noted that plantain is used in the treatment of ulcer, diarrhoea, throat infection, asthma, low libido in men and purification of blood. Olojede and Odoemelam (2018) supporting Okongwu (2011) stated that plantain is used to cure different diseases like cardio vascular and kidney problems, hydration in infants, arthritis, gastro-intestinal ulcer and diabetes. Based on the usefulness of plantain plant, there is need to prepare secondary school agricultural graduates in acquisition of plantain production competencies through training programme to enable them begin plantain production for food sustainability in Enugu State since due to the nature of their senior secondary curriculum, these students are not skilled in any particular area.

Production is the process of creating goods or services that have value. It involves converting inputs, such as raw materials, labour and capital, into outputs, which are the finished products or services. It is the process and methods used to transform tangible inputs into goods and services (Onoh, 2011). This implies that production is the process of combining various inputs, both materials and immaterial in order to create output which has value and contributes to the utility of individuals. With regards to this paper, for production to be effective and complete, the individual will have the necessary competencies needed for production to take place.

Competency serves as a motivated pattern of knowledge, skills and abilities to undertake a valued job. This was why Mbah (2012) described competencies as skills which an individual needs in a particular job or task. Onipede and Lawal (2018) saw it as a standardized requirement on which an individual performs a given task. This means that competency involves the acquisition of knowledge and attitude by an individual to perform successfully at a specified proficiency level in a given task. With reference to this paper, competency is value placed by secondary school graduates as exhibited in their zeal to acquire skills, knowledge and attitude for effectiveness in plantain production with regards to planning operations, pre-planting operations, planting operations, post planting operations, harvesting operation processing and marketing. Therefore, plantain production competencies could be defined as acquisition of knowledge, skills, abilities and attitudes to combine land, labour, capital and management by secondary school agricultural graduates to produce plantain for their economic sustainability and self-reliance.

Secondary school agricultural graduates are individuals who have completed their secondary school education and offered agricultural science as a subject during their senior secondary examination. These groups of students are youths who have completed six years at secondary education and have offered agricultural science as a vocational subject at senior secondary level and have not gained admission into higher institution (Nwosu, 2015). In the study area, which is Enugu State, exposing these graduates to plantain production competencies which involves the process of site selection, land preparation, planting field management, harvesting, processing and marketing of plantain products by the extension workers in skill acquisition centres would help these graduates acquire the necessary skills which will enable them become competent in producing plantain.

Agricultural extension workers are the trained personnel employed by the government with the aim of disseminating information and innovations on the improved techniques of training to farmers; improve their farming skills and general welfare and as well help them develop their leadership qualities (Nwosu, 2015). Extension workers help to educate farmers on the improved techniques of farming, with plantain production inclusive which can help to enhance their economic and general welfare (Ugwuede, 2023). This implies that extension workers can as well adopt better strategies for skill training of secondary school graduates who want to go into plantain production. If these competencies are identified, they could be packaged and used for retraining of secondary school graduates in plantain production for sustainability in Enugu State. This is because it has been observed that these students when they graduate roam about the streets aimlessly indulging in one form of crime or the other.

Sustainability refers to practices that meet current needs without compromising the ability to future generations to meet their own needs. Hornby (2015) defined sustainability as something that can continue or be continued for a long time. The author maintained that for something to be sustainable, it involves the use of natural products and energy in a way that does not harm the environment. In the context of this study, plantain production is a natural thing which utilizes energy in form of factors of production (land, labour, capital and management). If these factors of production are well utilized, it will not cause harm to the environment and plantain will continue to be in production. In addition, if these graduates acquire plantain production competencies, individuals, organizations and societies can ensure better future for generation to come in plantain production.

Plantain Production Competencies

Plantain production competency refers to the knowledge, skills and abilities required to effectively cultivate and manage plantains. These include planning operations, pre-planting operations, planting operations, post planting operations, harvesting operations, processing operations and marketing operations.

1. Planning Competencies

Planning guides the farmer on the effective way of utilizing available resources for its activities such as land, money and labour. Planning according to Aniagolu (2016) is the process of deciding how something will be done before doing it. Ekwueme, Mbah and Onoh (2018), described farm planning as a deliberate attempt by the farmer or teacher of agriculture to arrange and document farm activities in order before implementing them. Such planning operations competencies with respect to plantain production include formulation of specific objectives for plantain production, reviewing the objectives periodically based on changes in market demand and supply, drawing up programme plan for plantain production, and identifying sources of credit among others. Planning will enable the farmer carryout all the activities in plantain production effectively.

There are some steps which guide a farmer in planning for farm operations especially in plantain production. Such steps according to Asogwa (2009) includes choosing farm of sufficient size to support the objective of the farm, putting into consideration the capabilities, interest and knowledge of the farmer on the type of farm operations, drawing up programmes for the farm as long as possible; outing farming strategies around the existing special markets, using power and machinery that are necessary to make the greatest net profit; organizing farm production that will make efficient use of the labour force; drawing all farm operations to make the most efficient use of the available money, keeping a complete set of farm records necessary to make sound improvements and high profit from a farm; and studying the farm properly and allowing enough space in the plan for changes. Udensi (2014) puts it that if farmers are equipped with this competency it will guide the farmer on the effective way of utilizing available technology to meet market demand; make adjustment of the resources allocated to his farm activities such as the type and size of crops to grow or livestock to keep and allows the farmer to cope with the problem of risk and uncertainties in agricultural productions they affect the farm.

2. Pre-planting Operation Competencies

Pre-planting actions are carried out immediately after planning and before planting operations. Pre-planting operations in the view of Okongwu (2011) are all the activities carried out before the actual planting of seeds. In plantain production, this include site selection, land clearing, felling trees using axe or machines, packing residues and burning them, marking out the land and digging holes among others. Nwobi (2019) added field survey, mapping and land preparation.

In site selection, areas where dry season last longer than three to four months should be avoided. This is because plantain requires an evenly distribution of rainfall ranging between 120 – 160mm per month (International Institute for Tropical Agriculture (IITA, 2005). The institute added that since plantain plant have weak systems relative to the size of their aerial parts, areas sheltered from winds are preferred or alternatively there should be provisions for wind breaks. They went further to state that sites with sunny conditions are favourable because a high degree of sunlight is beneficial to growth and curtails the development of fungal diseases.

Olojede and Odoemelam (2018) added that planting site should have a high organic matter, nutrients and water supply with an average temperature of 25% - 30%; average rainfall of 120 – 150mm per month. Deep soil enhances root development and penetration while heavy soil with poor drainage or those which compact easily should be avoided. This implies that sandy loam and silt clay loam soils rich in organic matter are ideal for good growth and development. Pre-planting operations make it easier for the farmer to carry out the actual planting which involves the actual process of placing planting materials in the soil.

3. Planting Operation Competencies

Planting operations involve the actual process of placing planting materials into the soil. Such planting competencies according to Ugwuode (2023) includes; selecting healthy planting materials/suckers that is disease free with intact corms; removal of all the roots with a knife, removal of the stick marker in the middle of the hole and inserting the suckers. Nwobi (2019) opined digging holes of the right size of 30cm x 30cm x 30cm and adding organic matter and fertilizers, trimming the planting leaves, spacing the seeds/sucker correctly at 2 – 3 meters apart, covering the corm with soil and firming the soil around the plant, connecting a good irrigation system, treating the seed/suckers correctly to reduce pest and diseases. The author maintained that providing adequate water especially during the initial stages is vital for establishment and shades should also be provided. As a result of this, the author advised that with the forest, only the needed areas should be cleared for the planting holes so that the windows will act as shade. This implies that where irrigation water is not available, plantain should be planted at the onset of the rainy season to ensure optimal growing conditions.

4. Post Planting Operation Competencies

Post planting operations are the series of activities carried out in a farm management system between the period of planting and harvesting. Okongwu (2011) itemized post-planting operations in plantain production as weeding, trimming the leaves, mulching, propping, fertilization, crop pest and disease control and harvesting.

Weeding is the most important post-planting operations. If weeds are not removed from plantain farm on regular basis, the farm is likely to have a very low yield. Ogbodo (2016) noted that weeds are unwanted plants that grow alongside with crops. Anyanwu (2012) defined weed as a plant growing where it is not desired in a such a way that it constitutes a nuisance either to man, livestock or crops. This implies that weeds compete with plantain crops for nutrients, air, water, harbour pests and diseases and reduce the quantity and quality of the crops and its yield and as such constitute a nuisance to plantain plant. As a result of this weeds should be removed from plantain farm. This is because plantain finds it very difficult to outwit weeds. Weed removal may be in the form of manual, mechanical or use of herbicides such as parquat (2 0 4L/Ha) or Diuron. According to Ugwuode (2023), weeding should be done 2 – 3 times before harvesting. First weeding should take place 5 – 7 weeks after planting and the second weeding should take place 17 – 21 weeks after the first weeding. (IITA, 2007) added biological weed control which involves using dry grasses or growing leguminous shrubs which cover the soil to prevent weed growth. They maintained that integrated weed control which involves a combination of other weed control methods may also be used. Okongwu (2011) also pointed out that mulching can also be used to control weeds. This can be done immediately after planting the sucker/seed to a depth of 15 – 30cm, leaving about 10cm from the planted sucker. According to Okongwu, this helps to avoid too much heat that may be generated by the mulch around the plant and equally keeps the soil warm to the penetration of water to the lower layers.

During fruiting, tall varieties of plantain are supported with bamboo sticks in form of support. This is known as propping. Propping serves to prevent bearing plants from falling over due to the weight of the bunches (Eneh, 2017). Eneh stated that plantain being a shallow rooter with heavy fruit bunch tends to bend and experience tip-over, snap off and doubling especially with strong winds. Rasheed in Okongwu (2011) therefore suggested using “Y” shaped support stakes in such a way to hold the fruit at the peduncle and the stake foot firmly pushed into the soil for support.

Old dry leaves that hang down should be removed because they can harbour insects and pests. Weeds, dead leaves and other plant debris piling up at the base of the plantain should be removed in order to reduce root weevil and other insects that might harm the plant. Udofia and Nlebem (2013) called this trimming/pruning. The authors defined pruning/dripping in plantain production as regulating the number of suckers that grow to fruiting in order to reduce overcrowding and poor yield. Ojede and Odoemelam (2018) opined that pruning should be done about two or three months after the fruit has been harvested from the parent plant. The usual practice is to select two vigorous suckers, one on opposite side of the original corm to succeed the parent plant while the rest (3 – 5) are dug up with clippers or a digger or machete, either for sale or planting up in another part of the field. Okongwu (2011) opined that selective pruning is separating the surplus suckers from the parent plant using clippers or the sucker can be cut back to the ground with a machete. Selective pruning helps to maintain plant spacing to avoid uneven spacing, competition as well as avoid disturbance during maintenance operations.

Plantain require both organic and inorganic fertilizers to produce heavy bunches. Udoh (2013) recommended organic manures such as farmyard manures, and animal dungs. Ibezim (2013) added the use of inorganic manure (fertilizers) such as nitrogen, phosphorus and potassium in form of compound fertilizer (NPK 15:15:15) at the rate of 200 – 400kg/ha. This should be applied in ring form about 30cm away from the sucker and cover with soil. The last application should be immediately after flowering or just before flowering. Udofia and Nlebem (2013) pointed out that it is not necessary to apply fertilizer during the first year of production since nutrient deposited in the planting holes and deposited by mulch materials are usually enough to sustain plant yield during this first year; then as the year progresses, it is necessary to augment the organic matter content of the soil with split applications of chemical fertilizer.

Pests are small animals or insect which destroy crops or food supply. According to this work, plantain pests are those animals or insects that cause damage to plantain in the field (Ugwuode 2023). Ndubizu (2014) observed that nematodes, stem borers and plantain weevils constitute the most serious pests of plantain crops in Nigeria. Ndubizu added that nematode are non-segmented worms, some of which are macroscopic while many are microscopic. The author identified some as *Radopholus*, *Similis*, *Heterochora* spp, *Proatyunchus myscicola*, etc. Udofia and Nlebem (2013) recommended application of suitable nematicide such as Isazophos, carbonfuran, ethoprophos or phenmiphos at the area at the rate of 2.5 – 4.5gm per plant. Ndubizu (2014) equally pointed out that stem borer (*Cosmopolites sordidipes*) is about 1 – 1.5cm and black in colour. The Larvae attack the underground part of the plant, feeding on the corm and boring channels (tunnels) and causing death of the unopened leaf when the plant is approaching flowering stage. Eneh (2017) recommended that stem borer or plantain weevil can be controlled by leaving the land fallow for some time before putting it into cultivation, application of systemic insecticide such as carbofuran and application of Furadan at 2.5 – 3gm per plant at planting and 5 – 7 months after planting. The author also added the use of Aldrin dust as an alternative to Furadan.

For any agricultural activity to be effectively and successfully carried out and to prevent the crops from being damaged in the farm, the farmer needs to carry out post planting operations. Ugwuode (2023) added that a good post planting activities increases production and makes harvesting easy. Therefore, farmers have to carry out these activities to take adequate care of the plantain plantation farm.

5. Harvesting Operation Competencies

Harvesting in plantain production is the act of cutting and gathering of the matured fruits and trying not to damage the bunch. (Aniagolu, 2016). Harvesting marks the end of cultivation. As soon as the crop reaches the peak of maturity, it can be harvested. According to Dimelu (2015) the skills involved in harvesting plantain plant include the following:

1. Determination of maturity indices of plantain plant
2. Time of harvesting
3. Harvesting method for the plantain plant.

Ugwuode (2023) added that irrespective of the method of harvesting, care should be taken not to inflict any damage on other plantain plants. This will help to increase the shelf life of the plantain during processing, marketing and maintaining the quality.

Furthermore, Kainga and Seiyabo (2012), are of the opinion that the farmer before harvesting should check the following indices: shape and fullness of the fruit, the peel colour and ease of separation of the fingers or hands from the stalks. Okongwu (2011) pointed out that the maturity indices are based on the age of the bunch, the interval between flowering and harvesting (IFH), the filling of the fingers or the colour of the skin and pulp. According to the authors, the filling of fingers and the evaluation of the colour of the fruits are the visual criteria mostly used in plantain maturity, judgement. Matured plantain is harvested 3 to 4 months after flowering or 9 – 12 months after establishment (plantain). Udoh (2013) stated that the stage at which a bunch of plantain is cut depends on the cultivar, the farmers' desire and the intended use of the bunches.

There are different methods of manual harvesting plantain using sharp machet. Whichever method used, care must be taken to prevent sudden dropping of the bunch on the ground to minimize mechanical damage. Okongwu (2011) observed that two people work as a team to harvest plantain. One person stands underneath the bunch to catch it on a shoulder pad or padded platform. The other person removes the leaves near the bunch and cut a notch into the fruit stalk so that the bunch fall slowly onto the shoulder pad of the other worker. Then the plantain bunches are taken from the field to a collection area. The author maintained that the pseudo stem and leaves are then cut into pieces and spread all over the farm to serve as mulch and as well reconstitute the organic matter. Ibezim (2013) added that some farmers harvest their plantain bunches at two stages; first, a nick is made two-thirds of the way up the pseudo stem to enable the bunch drop under its own weight. The farmer then holds the rachis and cuts the peduncle some ways beyond, the first hand of the bunch with a sharp machet but care must be taken that the bunches do not drop suddenly to the ground when the pseudo stem is cut. Thereafter, the whole of the pseudo stem and the leaves are chopped and spread. It implies that mature plantain fruits are harvested with sharp machet by bending down to cut the pseudo stem, placed with fork or a helper to receive the bunch.

6. Processing Operation Competencies

Plantain is a perishable crop which deteriorates rapidly in quality after harvesting and as such, do not store for long periods and as a result should be processed immediately. Nwosu (2015) stated that processing involves the treatment given to crops immediately after harvesting but before they are transported to the market or storage sights. Ojo and Olatunji (2012) defined processing as the conversion of agricultural produce to finished products that can be stored for longer periods and have increased market value. Ugwuode (2023) opined that processing is transforming harvested crops into different foods edible by man. In the context of this study, processing involves changing plantain fruit into various products (forms) for consumption or for sale as well as improve palatability, usefulness and to make its transportation easy. Some of the products to which plantain can be processed into include plantain flour, chips, fufu, moi-moi, fried, plantain porridge, roasted and dodo ikire (Ugwuode, 2023). There different ways of processing these plantain products.

Dimelu (2015) observed that plantain flour is one of the few processed forms of green plantain fruit which require the following processing skills; soak the green plantain fruits in hot water for about 10 – 15 minutes to soften the skin for easy peeling, the peeled fruits are stored temporarily in a tank filled with water prior to slicing and dicing, the stored fruits are drained and sliced; the chips are moved to the dryer to reduce the moisture content to 7% - 10%; the dried chips are then milled until the desired particle size is achieved; the flour is sieved using 150 – 850 microns aperture sieve to obtain fine particles of plantain flour; this is then packaged in polythene bag and stored in a dry hygienic condition until they are required for use in the preparation of different food products.

Plantain can also be processed and fried as chips. Okongwu (2011) enumerated as follows: peel the unripe plantain fruit; slice the peeled pulp; fry the sliced pulp using cooking oil; place the chips on a draining table, salted, cooled and packaged in cellophane packs. To increase the stability and the shelf-life of the chips, antioxidants such as propylene glycol, butylated hydroxyanisole,

prophylgallate and citric acid are added. For immediate consumption, Dimelu (2015) enumerated other processing methods of plantain for immediate consumption which include plantain fufu, plantain moi-moi, roasted plantain, dodo, and plantain porridge.

7. Marketing Operation Competences

Marketing is the activity of deciding how to advertise a product, what price to charge for it, and availability of buyers. Marketing involves all those legal, physical and economic services that make it possible for products to get to the consumer in the form desired by the consumers and the entire price agreeable to producers and consumers for effecting a change of ownership/possession (Kainga and Seiyabo, 2012). As a result, Akintade, Okunlola, and Akinbani (2014) opined that plantain is extremely versatile in terms of number of products which can be derived from it that are marketable such as green plantain fruits (dodo), roasted plantain (boli), chips, flour among others. These products must be disposed of in order to earn some income with which the plantain farmers, can purchase other foods and services not produced by them.

Kainga and Sciyabo (2012) pointed out that there are marketing services which the farmer must be aware of and they are transportation, processing, storage, grading and packaging. More so, in the view of Okongwu (2011) plantain farmers need a broad range of skills to be successful in marketing. These skills are interpersonal skills, good oral and written communication skills, numeracy and analytical ability, creativity and imagination, influencing and negotiation skills, teamwork, organizational ability, IT skills, business and commercial acumen, drive and ambition skills. Some of these skills according to Onoh (2011) will be gained through non-work-related activities and opportunity but are usually given to farmers by the extension workers.

Conclusion

This study is of the opinion that secondary agricultural graduates have some basic competencies in plantain production from secondary school but lack professional skills for entering into plantain production, create jobs, or respond to the challenges of food security. This work reviewed some knowledge and skills needed to train the students in plantain production. If the teachers will use these identified skills in the area of planning, pre-planting, planting, post-planting, harvesting, processing and marketing operations in plantain production, the production of plantain will be sustained and its products will be used made available in Enugu State.

Recommendations

Based on the works reviewed, the researcher is making the following recommendations:

1. Teachers of agricultural science should take students regularly to field trips and excursion to agricultural farms where plantain is grown.
2. The government should provide schools with adequate facilities and equipment's for practical activities in plantain production.
3. There should be establishment of young farmers' club in schools that do not have them for the production of plantain as a project.

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