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Production Challenges of Cassava and Prospects

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Abstract
Cassava is one of the most productive crops in the world. It continuously provides a sustained food supply when other crops fail thereby alleviating famine conditions. Cassava is relatively drought tolerant. Some improved cassava varieties combine weed suppression with high yields; others as well show resistance to diseases and insect pests, while some have good qualities for consumers' acceptance and low cyanide content. Biological control will continuously be exploited to control cassava pests. Prussic acid content in cassava tubers hampers its utilization in unprocessed state. When planting commences as soon as land preparation had taken place, there is reduced initial weed pressure on the crop. Inclusion of cover crops like melon or cowpea reduces the excessive need for weed control. Indications abound that tillage activities such as ploughing and harrowing enhance the effectiveness of especially pre-emergence herbicides. A significant contribution towards increased cassava production would be the provision of disease resistance, low cyanide content and high yielding cassava stems for distribution to farmers at appropriate times and at affordable prices.
Keywords: Cassava production, weed control, soil conditions, diseases and pests

1. Introduction

Cassava plant, originally from Brazil in South American, is very important in most of sub-Saharan Africa. Humid West Africa enjoys a tropical climate that is conducive not only to indigenous species, but also species from two other key centre of crop origin- Tropical Asia (South Asia/South-tropical Asia) and tropical American (Brazil to Mexico). It is no surprise that crops such as cassava and cocoyam (*Colocasia esculenta* and *Xanthosoma spp*) have taken root in this zone and are now among the most important AIVS (Maundu *et al.*, 2009).

In Benin Republic, the leaves of cassava represent an important vegetable for communities throughout the country. Cassava leaves are the dominant vegetables in the Democratic Republic of Congo). The leaves are the most important vegetable in the Congo Basin, where they are known by the name *pondu*. In several other areas, including Tanzania, Malawi, Mozambique, Cameroun, Nigeria and Senegal, the leaves are degree (Maundu *et al.*, 2009).

Cassava root leads all other starchy food in importance in the Democratic Republic of Congo. Cassava roots and leaves form the staple food for many communities in Congo. Dry cassava leaves are made by pounding leaves and letting them dry in an open area for about six days. The leaves are used but to a lesser degree in several other areas, including Tanzania, Malawi and Mozambique and parts of West Africa including Senegal. In Benin, the leaves are used in all communities from south to north. Leaves of cassava is nutritious and relatively high in B-carotene and iron content (Yang and Keding, 2009).

The leaf of cassava was listed among the vegetable leaves that deserve greater promotion for household consumption. Cassava leaves among other leaves like *Moringa* leaves have been reported to be highly nutritious and they have high B-carotene and iron content (Yang and Keding, 2009).

2. Current Production Trend

Few production skills and limited inputs are required for cassava. Land should be prepared very close to the time of planting to prevent weed from getting an advantageous head start before the crop.

2.1 *Land preparation*

The usual practice is to plant on unploughed land. Planting on mound is also practiced according to Takyi (1974), horizontal planting seems to yield best result in un-ploughed land; however, planting at an angle of 30^0 - 45^0 is a common practice. Improved varieties are already being adapted by farmers but they are not readily available.

For large scale production, deep cultivation by tractor loosens the soil to about 50 cm depth. All crop stubble or vegetation is ploughed in to improve the level of organic matter and the soil ridged as high as possible (Williams *et al.,* 1979). From observations, wind has constantly been bending over cassava planted on ridges and mounds.

2.2 *Planting*

Cassava spacing is 80 -100 cm apart and within row, the exact spacing used depends on the cultivar and growing conditions. Cultivars that have spreading habit like TMS (Tropical Manihot Species) 30555 and TMS 30572 may be spaced further apart than those that are erect types like TMS 30001. Cuttings are taken from disease free or resistant plants when plating is as close as possible. Cuttings used for planting has at least three nodes (Krochmal, 1959) and range between 15 and 30 cm in length. But longer cuttings of 60 cm have been reported to

give high yields (Komolafe *et al.*, 1979). Williams *et al.* (1979) recommended planting at an angle for heavy soils and very wet conditions, but if the soil is correctly prepared, horizontal planting is the best.

2.3 *Intercropping*

In traditional agriculture in the tropics, cassava is planted in the mixture with other crops such as maize and melon; cassava is brought in as one of the last crops in a growing season towards the end of the rainy season or immediately after yam has been harvested when yam is already undergoing tuberisation.

In some farming communities, cassava stem cuttings are placed in the ground at an angle of about 40^0. The side towards the terminal bud is about one-third the length above the ground level. Upside down planting lessens yield. Due to the predicament of identifying which end of the stem cutting is to be placed above the soil, most mechanical planters currently in use are manufactured to lay the stem cuttings horizontally.

3. Challenges of Cassava Production

The production of cassava is hampered by pests and diseases, low yield and weed interference.

3.1 Low Protein content in cassava

Protein content is low in cassava and this limits its food and feed values.

3.2 Prussic Acid Content

Cassava has high prussic acid content in the un-processed state; this is of a big concern to nutritionist. Cassava grown in soils low in potassium or high in nitrogen has been documented to have high prussic acid. Also cassava in wet regions has higher prussic acid than the ones grown in drier regions.

3.3 Climatic Conditions

Even though open environment is required for cassava, strong wind is known to affect it, the case is severe if they were planted in loose soils in the mounds or in ridges. In harsh cases the stems are bent over or broken, resulting in the exposure of tubers to rodents attack. Cassava is extremely sensitive to excessive water. It may die if it is in water for only a few days; tops of the plant will wilt and the roots become rotten. No wonder Komolafe *et al*., (1979) reported that cassava tubers tend to decay in badly drained, swampy soils which must therefore be avoided.

3.4 Soil Conditions

Under conditions of very high fertility, cassava tends to produce excessive vegetation at the expense of tuber formation (Onwueme, 1978). On clay or poorly drained soils, root growth is poor, so the tuber-to-shoot ratio is considerably decreased and encourages tubers to rot. Gravely soils tend to hinder root penetration and are therefore unsuitable. Saline soils are unsuitable.

Cassavas growing in soils low in potassium or high in nitrogen have high prussic acid concentration in their tuber. Cassava grown in wet regions has higher prussic acid content than that grown in drier regions (Sinha and Nair, 1968).

3.5 Diseases and Pests

Cassava yield in Africa is as low as 6 tonnes per hectare (IITA, 1983). Certain varieties recommended by National Root Crops Research, Umudike in Nigeria are capable of yielding up to 50 tonnes per hectare (Komolafe, *et al.*, 1979). This low average yield has been attributed primarily to cassava mosaic disease, cassava bacterial blight and more recently to cassava mealybug and green spider mite. Cassava mealybug and cassava green spider mite are believed to have been introduced from Latin America (IITA, 1983). Cassava mealybug (*Phenacoccus manihoti* (MAT-FERR), is a pest which caused an average of 60 % reduction in yield for the roots and up to 100% for leaves. Cassava is attacked throughout the year and more especially in the dry season (IITA, 1982).

Zonocerus variegatus (grasshopper) feeds on leaves of young plants and causes serious damage. Pests not only damage cassava while in the field, insect pests and various kinds of beetle attack dried cassava products **during** storage.

Cassava leaf spot, caused by fungus, also causes yield reduction. It is controlled by application of fungicides for example, Bordeaux mixture. Symptom is pale brownish spots on leaflets which later turn brown; the infected parts become necrotic (Akinsanmi, 1975).

IITA (1983) citing International Meloidgne Project, estimated that about 6% of the world's annual cassava production – representing 6 million tones of carbohydrate is lost annually to nematode attack; it is also known to reduce plant height and stock weight, thus resulting in the production of inferior stem cuttings for subsequent plantings.

Cassava mosaic disease (CMD) is transmitted by whitefly (*Bemisia tabaci)*, yield losses from the disease in Africa ranges from 20 to 90% (IITA, 1985). The disease reduces starch formation hence tuber yield (Komolafe *et al*., 1979).

3.6 Weed Control

Yield reduction in cassava due to uncontrolled weed growth in Nigeria is as high as 65% (Akobundu, 1980) and

about one third of farmers' time in cassava farms is spent on weeding. Traditionally, the use of cutlass and hoe is the standard method for weed control. In the use of hoe, some farmers heap up the soil at the stem base. Akobundu (1987) recommended that hand-weeding should be done three times for cassava at 3, 8 and 12 weeks after planting.

3.7 Storage

Sweet cassava tends to have a short growing season, their tubers mature in 6-9 months, and deteriorate rapidly if not harvested soon after maturity. The bitter cassava on the other hand, requires 12-18 months to mature, and will not deteriorate seriously if left un-harvested for more than about a year in the humid Tropics, the tubers start to become woody and starch content decreases (Williams *et al.*, 1979).

Sweet cassava tends to have a short growing season, their tubers mature in 6-9 months, and deteriorate rapidly if not harvested soon after maturity. It is therefore recommended that sweet cassava should be harvested at between nine and twelve months after planting to allow for optimal yield and at the same time prevent the tubers from staying too long in the farm to undergo deterioration.

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4. Prospect of Cassava Production

4.1 Protein Content in Cassava

To increase the protein content in cassava lies in selection of planting materials from the cultivars that show relatively higher protein content in them coupled with other breeding processes. Biotechnology has a prospect of infusing genes for protein improvement from other organisms of plant or animal origin.

2.2 Prussic Acid Cassava

Hardly is cassava used for human consumption without undergoing processing, and processing reduces the prussic acid content in cassava product. There is need to intensify breeding for low prussic acid contents in cassava.

Breeding for low prussic acid content in cassava should be intensified. A significant contribution towards increased production would be the provision of disease resistant and high yielding cassava stem cuttings for distribution to farmers at appropriate times and affordable prices.

3.3 Climatic Conditions

Cassava does best when rainfall is 100-150cm per year and well distributed. Cassava can be profitably grown in areas where the annual rainfall is as low as 50cm (Onwueme, 1987). Kanuani (a variety used in Zaire) recorded acceptable yield when it was flooded three times with water stand three to five days (yield was 30.8 tonnes per hectare (IITA,1985). It is only during the first few weeks after planting that cassava plant is able to tolerate drought to an appreciable extent (Onwueme, 1987). Cassava remains relatively drought tolerant surviving four to six months dry weather, and it adapts to diverse environments and farming systems.

3.4 Soil Conditions

Cassava can grow and yield reasonably well on soils of low fertility where production of most other crops would be uneconomical (Onwueme, 1978). Heavy soils should be well cultivated and build into high ridges or mounds to improve yield.

Organic matter improves most soils for tuber growth. Within the humid tropics, peats are especially suited for cassava growing if limed to raise the pH above 4.5. Peat soils are very light and make for easy harvesting (Williams *et al*., 1979). Magnesium limestone could be used to lime soils with pH below 4.5.

A light, sandy loam soil of medium fertility is the best for the cultivation of cassava (Onwueme, 1978.

Application of nitrogen to cassava has proved to be economical in densely populated parts of south-eastern Nigeria (Irving, 1954). Improving the soil fertility especially with potassium fertilizers help to boost yield. With appropriate fertilizer application coupled with other good management practices, yield of up to 30 tonnes per hectare could be obtained. Soils containing less than 0.06 % exchangeable potash should be supplied with 90-120kg of K_20/ha (Ngozi *et al* 1976).

3.5 Diseases and Pests

3.6 Weed Control

Planting when done promptly after land preparation at a minimum population of 10 000 plants per hectare gives the cassava a good start before weeds. Melon planted at 20 000 plants per hectare reduces the frequency of weeding. Ekpo (2011) noted that effective weed management in cassava production can be achieved with integrated use of akidi (40 000/ ha) with priextra (2.0 kg a.i./ha). The system suppressed weed satisfactorily and enhanced the growth and yield of cassava. National Advisory Committee on Weed Control (NACWC) recommended three hoe-weeding at 3, 8, and 12 weeks after planting. Fluometuron used at 2.0 kg, primextra at 3.0 kg and atrazine at 2.5 kg a.i./ha have been reported to give appreciable weed control in cassava.

Spreading types of cassava such as TMS 30572 build up its canopy quickly but ultimately capture much less light than the upright types. The spreading types have low light transmission, therefore they smother weeds. At the early cassava growth stage when the canopy is not fully formed, a fast growing cover crop such as *akidi* may use the early high amount of light transmitted and could help to cover the ground before cassava canopy is entirely covered. Harvested crop of *akidi,* adds income to the farmer**.**

Planting should be done promptly after land preparation to give the cassava a good start before the weeds. Plots should be kept weed-free for the first three months (Onochie, 1975, Onwueme, 1978).

When using a farm land that has undergone five to six years period of fallow, weeds are not often much of a problem at the onset. In such cases, weeding can be carried out only once before the full canopy formation of cassava. Plant population is generally 10, 000 /ha at a spacing of 1m x 1m. By planting melon as intercrop with cassava at 20, 000 plants/ha, better weed control can be obtained and hand weeding frequency can be reduced to two times. When cassava is planted in rows, mechanical cultivation is done about 4 weeks before cassava plants become too high for mechanization.

Due to the labour cost, time and drudgery involved in manual control of weeds, efforts are being made either to reduce the frequency of weeding such as by planting cover crops for example, melon at 20, 000 plants/ha, as recommended Akbundu (1987) or by the use of herbicides. In planting melon to supplement pre-emergence herbicides, the suggestion of Akbundu (1987) about the use of chloramben at 1-3 kg/ha active ingredient (a.i.) in maize/cassava mixture can be used. Duuron at 1.6 kg a.i. per hectare is reported by Onwueme (1978) to be widely recommended. If applied pre-emergence, one manual weeding is necessary before the canopy closes. Most results of herbicide trails in cassava production indicate that tillage activities such as ploughing and harrowing enhance the effectiveness of especially pre-emergence herbicides. 2 kg a.i. /ha of flumeturon is recommended.

Primextra is useful in cassava/maize mixture (Akobundu, 1987. Primextra at 3 kg a.i/ha will be effective. Atrazine 3 kg a.i./ha may be useful only that cassava planting has to be delayed until at least three weeks after pre-emergence application in order to drastically reduce herbicidal toxicity on cassava. If no pre-emergence application of herbicides is used, directed spray of gramuron at 4-6 weeks after planting will suffice.

3.7 Storage

Fresh cassava roots can be stored for up to eight weeks in boxes containing moist sawdust or in clamp. The storage is preceded by curing the tubers at 30-35^{0}C and 80 -85 % relative humidity (CLAT, 1972).

If a large expanse of cassava farm is to be planted, both sweet and bitter cassava cultivars should be planted at the same time. Harvesting is to be commenced with sweet cassava at about nine months after planting so that as the harvesting progresses it will coincide with the time of maturity of bitter cassava which is 12 to 18 months.

3.8 Varieties

Varieties of cassava differ in the time they take to mature and in the quality of their tubers and yield. Yield, according to Williams *et el.,* (1979), varies from as low as 5 tonnes to more than 60 tonnes per hectare. Varieties recommended by the National Root Crops Research Institute, Umudike in Nigeria are 53101 for farmers in the western areas, 60444 for the eastern areas and 60466 and 60506 for the northern areas of Nigeria. The four varieties as reported by Komolafe *et al.*, (1979) give yields of 30,120 to 35,643kg per hectares but are capable of yielding up to 50,198kg per hectare. They mature in nine to twelve months and have low hydrocyanic glucoside and are resistant to cassava mosaic diseases.

TMS 30555, TMS 91142 and TMS 50395 have poor quality bread (IITA, 1985). TMS 30001 and 60447 which have high maximum paste viscosities values produce normal crumb structure.

3.9 Intercropping of Cassava

Cassava is mostly grown in mixtures with other crops, the other crops are frequently short duration crops such as maize (*Zea mays* L), cowpea (*Vigna unguiculata* L. Walp), akidi (*Vigna unguiculata subsp. Sesquipedalis* (L.), and *egusi*-melon *Citrulus lanatus*; therefore any investment opportunities in cassava production does not need a very long waiting period before the dividends start coming in once there is a companion crop grown along with it. The accompanying crops may be harvested in just about three months; as the reaping is started on the additional crop so would returns on investment on the main crop which is cassava indirectly commence. Most of the other crops require two hoe-weeding, therefore cassava may require only one additional weeding to realize good. In the cases where cover crops are grown together with cassava, the third weeding may not be necessary because the leguminous cover crops suppress weeds and improves soil nitrogen content for good performance of cassava.

4. Purposeful Programmes

Programmes should be set up and the ones already in place ought to be invigorated to boost the search for cassava cultivars that produce high stable yields, carry resistance to economically important diseases and insects,

and are adapted to a wide range of environments and production methods, as well as have better storability and improved quality in terms of low cyanogenic acid contents coupled with high nutritional value. The desired cassava varieties have to to possess certain other useful characteristics.

To get wide dissemination of improved varieties, a large number of demonstration trials on farmers' field should be put in place. Several agricultural and rural development agencies like Seed Service, Accelerated Food Production Project (AFPP) Women should be involved.

5. Conclusion

Cassava ranks among the most productive crops in the world. It is useful as food for man and feed for livestock and source of raw material for industries. However, it has low protein content,. A significant contribution towards increased cassava production would be the provision of disease resistant and high yielding cassava stem cuttings for distribution to farmers at appropriate times and at affordable prices.

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