

Review

Integrated production and protection practices of cashew (*Anacardium occidentale*) in Nigeria

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The history of cashew in Nigeria dates back to 15th century. Then, it was mainly used in afforestation schemes for the control of erosion in the former Eastern Nigeria. However, commercial cashew plantations started in Nigeria in the early 1950s with the establishment of first commercial plantations at Oghe, Oji and Mbala by the defunct Eastern Nigeria Development Corporation (ENDC) and Iwo, Eruwa and Upper Ogun by the defunct Western Nigeria Development Corporation (WNDC). From these locations, the planting of the crop spread to other parts of Nigeria particularly the Central and Northern States of Nigeria. Cashew is an emerging commodity crop whose cultivation cuts across the seven agro-ecologies in Nigeria. In each of the 27 cashew producing states in Nigeria, the numerical strength of the farmers is astronomically increasing, while the crop's hectareage is correspondingly on the increase. Cashew was generally believed to be almost free from serious pest problems, until recently when large plantations were established, resulting in the discovery of many insect pest and diseases attacking different parts of the plant. This therefore, necessitated a comprehensive evaluation of cashew production and protection packages so as to ensure sustained interests in the crop's cultivation and to encourage the prospecting cashew farmers.

Key words: Insect pest, diseases, selections, apples, kernels, nuts, sinkers, floaters.

INTRODUCTION

Cashew is the common name for a tropical and subtropical evergreen tree, *Anacardium occidentale* L., in the flowering plant family Anacardiaceae. It is also the name for the commercially important kidney-shaped, nut-like seed of this plant, which is edible when roasted or cooked (New World Encyclopaedia, 2008). The plant is a native of Tropical Central and South America, notably North Eastern Brazil, from where the Portuguese explorers introduced it into Nigeria in the 15th/16th century (Ohler, 1967; 1979; Venkataramah, 1976).

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the defunct Western Nigeria Development Corporation (WNDC). From these locations, the planting of the crop spread to other parts of Nigeria particularly the Central and Northern States of Nigeria (Ohler, 1967; Venkataramah, 1976; Togun, 1977). Research on cashew production and its uses started at the Cocoa Research Institute of Nigeria (CRIN), Ibadan in 1971. The introduction of Brazilian cashew biotype with improved and desirable nut and kernel quality characteristics by CRIN has further increased the crops spread and popularity in Nigeria (Hamed et al., 2007).

The commodity of commercial importance is the nut, which contains 47% fat, 21% protein and 22% carbohydrate. It also contains vitamins, especially thiamine (Ohler, 1979; Nandi, 1998). Cashew nut proteins are complete, having all the essential amino acids and a kilogramme of the nut yields about 6000 calories compared to 3600 calories from cereals, 1800 calories from meat and 650 calories from fresh citrus fruit (Nambiar et al., 1990).

The cashew nut shell liquid (CNSL) is used widely in brake linings of motor vehicles, paints, varnishes and

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Table 1. Cashew nut production in Nigeria 1990 – 2006.

Year	Annual production 1000 (tons)	kg/ha	Harvested area 1000 ha	Price/ton (N)
1990	30.00	600.00	50.00	-
1991	45.00	600.00	75.00	10,700.00
1992	55.00	611.10	90.00	15,677.00
1993	75.00	625.00	120.00	24,753.00
1994	85.00	629.00	135.00	36,335.00
1995	95.00	612.90	155.00	62,415.00
1996	110.00	628.60	175.00	81,872.00
1997	125.00	514.40	243.00	88,601.00
1998	152.00	625.00	243.20	94,175.00
1999	417.00*	1,752.10*	248.00	92,662.00
2000	466.00	1,799.20	259.00	97,407.00
2001	485.00	1,830.20	265.00	124,698.00
2002	514.00	1,882.80	273.00	150,636.00
2003	524.00	1,891.70	277.00	180,011.00
2004	555.00	1,900.70	292.00	
2005	594.00	1,922.30	309.00	
2006	636.00	1,990.0	320.00	

laminated products (Murthy and Sivasambari, 1985). It is also used as a plywood adhesive (Akaranta et al., 1996) and as a material for increased the tensile properties, as flame retardants of natural rubber (Menon, 1997) and as a long-life, highly bioactive, antifouling coating for marine vessels (Panda and Panda, 1991). CNSL and other extracts from the shell are larvicidal (Carrara et al., 1984; Evans and Raj, 1988) molluscicidal (Casadei et al., 1984; Kubo et al., 1986; Laurens et al., 1987) and antifungal and antibacterial (Echendu, 1991; Weerasena et al., 1993).

The cashew trees are grown mainly for their kernels, which when roasted, have pleasant taste and flavour. A chocolate product called 'AMCHO' made at CRIN partly from cashew-kernel meal has been organoleptically assessed to be fair for consumers' acceptability (Ojeh and Falowo, 1983). An edible oil of excellent quality has also been processed from the kernel (Ojeh, 1985). The cashew apple is used for its juicy but acidic pulp, which can be eaten raw or used in the production of jam and various beverages. Also, depending on the local customs, its juice can be processed and distilled into local liquor or consumed diluted and sugared as a refreshing drink.

This paper therefore aims at summarizing the current status of cashew production and protection strategies cutting across field preparation, establishment and management of cashew plantations in Nigeria.

PRESENT STATUS OF CASHEW PRODUCTION

The total land under cashew tree cultivation in Nigeria by

1995 was estimated at about 40,000 hectares, of which about 60% of the holdings were owned by peasant farmers (Ayodele et al., 2001). Currently, the total land area under cashew cultivation has increased to 320,000 hectares (FAO, 2007). The cashew nut production has been on steady increase from 30,000 metric tonnes in 1990 to 636,000 metric tonnes in the year 2006 (FAO, 2007) (Table 1). This significant increase has been due mainly to the involvement of private entrepreneurs, Federal and State Governments, Cooperative societies and affluent farmers in cashew cultivation (Aliyu and Hamed, 2008). The introduction of Brazilian cashew biotype with improved and desirable nut and kernel quality characteristics by the Cocoa Research Institute of Nigeria (CRIN) has further increased the crop's spread and popularity in Nigeria (Hamed et al., 2007). Cashew is currently being produced in 27 states, which cuts across the seven agro-ecologies in Nigeria. According to FAO (2007), there has also been a tremendous price appreciation of Nigerian cashew nuts in the international markets with a tonne of cashew nuts, which sold for N24,753.00 in 1993 rising to N180,011.00 in 2003.

Varieties planted

In Nigeria, varietal classification of cashew is at infancy. However, intensive selections had resulted in the release of cashew materials that combine high yield with high quality characteristics, to the farmers, all over Nigeria, by CRIN. Most of the "selections" or "assessions" made so far were based on nut sizes (jumbo nuts, extra large nuts, medium and madras) with a mean yield of 8-10 kg per tree, which gives over 1 ton per hectare.

PLANTING MATERIALS

Cashew can be propagated by seedlings, air layers and softwood grafts. Since it is a cross-pollinated crop, vegetative propagation is recommended to obtain true-to-type progeny. Field establishment of air layers have been found to be poor. Hence softwood grafts, which give a high rate of establishment and early flowering, are recommended for planting. However, in Nigeria, majority of the plantations were established by raising the nuts in the nursery before transplanting into the field. Usually good, mature large or jumbo sized nuts are recommended for plantation establishment. The nuts should have been sundried to a moisture level of 8.5%. At this stage, the nuts give a rattling sound when knocked against one another. Soaking in water has been found to be an inappropriate method of germination test for cashew nuts, because, while the sinkers gave 98% germination, the floaters gave 87% (Adeyemi and Hammed, 2003).

ESTABLISHMENT OF CASHEW PLANTATIONS

Site selection

Soils with salinity, alkalinity or water logging should be avoided. Soil depth, slope, coarse texture, soil fertility and water availability seem to impose very little limitations, as cashew performs optimally with optimal levels of these parameters. It is generally believed in Nigeria that the crop thrives well where other crops have failed.

Planting season

The land preparation usually starts after the first rain with clearing of shrubs and vegetation before digging holes (60 x 60 x 60 cm) for planting. It is preferable to dig holes 15 to 20 days before planting to expose the holes to direct sunlight, which can help remove termite and other harmful insects that can damage young plants, if present. Transplanting of potted plants from the nursery is usually carried out between June and July.

Plant spacing

A planting spacing of 7.5 x 7.5, 8 x 8 or 9 x 9 m is recommended for cashew, which gives a tree density of 175, 156 and 123 per hectare respectively. High density planting is a recent technique recommended for enhancing early productivity of cashew plantations. This involves planting more number of seedlings at 4 x 4 or 8 x 4 m giving a tree density of 625 or 312 trees per hectare, respectively. However, this population can be retained for a period of 6 to 7 years depending on the canopy expansion rate before selectively thinning them

down in stages to reach a final spacing of 9 x 9 m. High density planting would be more useful in poor soils, where the rate of canopy expansion is low and it helps effectively to check weed growth in the inter space to a great extent. Also in addition to higher yields at early stages, substantial quantities of firewood can be obtained during thinning, which may fetch additional revenue to the farmers.

MANAGEMENT OF CASHEW ORCHARDS

Terracing and bunding

Cashew was planted in the 15th century in the Eastern States of Nigeria mainly to control erosion around Nsukka, Oghe, Udi areas due to their sloppy nature. A considerable amount of nutrient leaching and soil erosion are common in such areas. It is therefore necessary to construct terraces and contour pits to conserve runoff water. Terraces are made by removing the soil from the elevated portion above the tree trunks to create basins of 1.5 to 2 m. Contour drains are also constructed to collect rain water above the tree-line and prevent soil wash from the slopes.

Mulching

In low rainfall areas (Northern States), mulching around the base of trees with grasses or slashed weeds help in the control of weeds, retention of water and modulation of soil temperature, especially in dry season.

Weeding

Slashing of the under growth is very essential until tree canopies shade out the weeds. The areas around the cashew stand up to a radius of 2 m should be scrapped round with hand hoe. Weeds are known to harbour pests and also compete for nutrients with the cashew tree. The number and frequency of weeding varies each year depending on the rainfall pattern, which determines the growth rate of the weeds.

Pruning

The plants are trained to a single stem and branches are allowed to grow about 1 to 2 m from ground level. The cashew branches that are deformed by either insect pest or diseases are routinely removed from time to time. The tree canopies are kept under check by cutting off their secondary branches to avoid overcrowding. Pruning should be carried out at least once a year, preferably between May and July i.e. immediately after the seasonal fruiting. Excessive outgrowths are removed to provide adequate sunlight into the canopy. Besides, the adjacent

Table 2. Insect pests associated with cashew in Nigeria.

S/N	Pest species	Common name	Parts affected	Pest Status
1	<i>Analeptes trifasciata</i> Fabricius (Coleoptera: Carambycidae)	Cashew stem girdler	Stem	Major Pest
2	<i>Pachnoda cordata</i> Drury (Coleoptera: Scarabidae).	Fruit scraper	Fruits	Major Pest
3	<i>Selenothrips rubrocinctus</i> Giard (Thysanoptera: Thripidae)	Red-banded thrips	Shoot/leaves	Major pest
4	<i>Plocaederus ferrugineus</i> L. (Coleoptera: Cerambycidae)	Trunk and root borer	Trunk/roots	Major pest
5	<i>Zonocerosus variegatus</i> Linn (Orthoptera: Acrididae)	Grasshopper	Leaves/fruits	Minor pest
6	<i>Oecophylla longinoda</i> Latl. (Hymenoptera: Formicidae)	Tailor ants	Leaves	Minor pest
7	<i>Apis mellifera</i> (Hymenoptera: Apidae)	Honey bee	Flower/fruits	Minor pest
8	<i>Camponotus spp.</i> (Hymenoptera: Formicidae)	Ants	Leaves	Minor pest
9	<i>Atopomyrmex spp.</i> (Hymenoptera: Formicidae)	Ants	Leaves	Minor pest
10	<i>Macrotermes natalensis</i> (Isoptera: Termitidae)	Termites	Shoot/roots	Minor pest
11	<i>Nasutitermes spp.</i> (Isoptera: Termitidae)	Termites	Shoot/roots	Minor pest
12	<i>Acrocercops synagamma</i> Meyrick (Lepidoptera: Lithocolletidae)	Leaf miners	Leaves	Minor pest
13	<i>Euproctis fasciata</i> Wlk. (Lepidoptera: Lymantriidae)	Leaf roller	Leaves	Minor pest
14	<i>Achaea lienardi</i> (Lepidoptera: Noctuidae).	Fruit piercing moth	Fruits	Minor pests
15	<i>Dysdercus superstitionus</i> (Heteroptera: Pyrrhocoridae).	Cotton stainer	Fruits	Minor pests
16	<i>Drosophila spp.</i> (Diptera: Drosophilidae)	Fruit fly	Fruits	Minor pests

cashew trees will be well-spaced, thus, ensuring continued fruit production.

Inter cropping

Majority of the farmers in Nigeria combine cashew plantings with major commodity crops like cocoa, oil palm, rubber or kola in the Southern states, while cereals and pulses are planted beneath the cashew orchards in the Northern states (Aliyu and Hammed, 2008). However, less than 20% of available cropable lands are currently being used for both food and cash crops in most of these states (CRIN, 1995; 1999; Topper et al., 2001).

Pest protection

In Nigeria, the production of cashew is impaired mostly by problems associated with its pest complex. Cashew, like most tree crops, hosts a wide range of pests and diseases. These pests infest its various parts including roots, stems, twigs, branches, flowers and inflorescence and the pseudo-apple. Earliest work on cashew crop protection at the Cocoa Research Institute of Nigeria (CRIN), Ibadan, which began in 1971 involved the collection, identification and preservation of the insect pest and disease complex of the cashew plant (Tables 2, 3). This was followed by concerted efforts to understand their symptoms and formulate desirable practices aimed at reducing the menace of these pests.

HARVESTING OF NUTS AND CASHEW YIELD

The newly introduced Brazilian Jumbo sized-nut cashew plants commence fruit bearing between 18 to 24 months

of planting. The tree attains its full production by the 9th to 10th year, whilst the economic life of a tree is about 20 years. The trees usually flowers from September to December and the main harvesting season is from February to May. Some farmers harvest the cashew apple before they drop to prevent pilferage and apple bursting. However, this practice very often results in poor quality of the kernels. High quality nuts are obtained when nuts are separated from freshly fallen cashew apples and sundried to bring down the moisture content from about 25 to 8.5%. The drying process helps to retain flavour and quality of the kernels. Nuts are usually gathered every week during the harvest season. But, when the apples are for processing, harvesting is usually done before they drop.

MARKETING

The cashew farmers usually supply produce to rural markets, where small traders buy and supply the middle men or local buying agents in urban markets. These agents in turn supply big companies that export the produce to Asia and few processing plants within West African countries (Ghana and Benin Republic). In Nigeria, the quality standard definitions for exportable cashew nuts, according to FMC and I (2007), include -:

1. The cashew nuts must be thoroughly dried and plump.
2. It must be free from stone and extraneous matter.
3. It must be free from insect damage and immature nuts.
4. A bag of cashew nuts must not be more than 5% by weight of total defective nuts and other impurities in the final analysis.

Table 3. Diseases associated with cashew in Nigeria.

S/N	Pathogens	Common name	Parts affected	Status
1	<i>Lasiodiplodia theobromae</i>	Shoot die back	shoot	Major disease
2	<i>Botryodiplodia theobromae</i>	Shoot die back	shoot	Major disease
3	<i>Sclerotium rolfsii</i>	Damping off	Shoot/roots	Major Disease
4	<i>Fusarium</i> spp	Damping off	Shoot/roots	Major Disease
5	<i>Cylindrocladium scoparium</i>	Damping off	Shoot/roots	Major Disease
6	<i>Geotrichum candidum</i>	Fruit rot	Pseudo apple	Minor Disease
7	<i>Pestalotia</i> spp	Leaf blight	Leaves	Minor disease
8	<i>Pythium ultimum</i>	Root rot	Roots	Minor disease
9	<i>Curvularia senegalensis</i>	Leaf spot	Leaves	Minor disease
10	<i>Corticium salmonicolor</i>	Pink disease	Shoots	Minor disease
11	<i>Aspergillus</i> spp	Kernel rot	Nuts	Minor disease
12	<i>Penicillium</i> spp	Cashew nut rot	Nuts	Minor disease

5. The moisture content must not be more than 8.5%.
6. The lower the number of nuts per kilogramme, the better the price.
7. If a sample of 1 kg contains < 200 nuts, it is a high count cashew nut. However, if such sample contains >200 nuts, it is a low count.
8. The benchmark for passing or rejecting a consignment of a cashew nut lies on whether the total percentage defective (including impurities) is more or less than 5% of 1 kg sample. If it is more, the consignment is rejected.
9. The consignment is passed as having met the requirements for exportable quality, if the percentage defectives plus other impurities is less than 5%.
10. The standard weight for a bag of cashew nuts is 78 kg, giving 13 bags per tonne.

Currently, 75 to 80% of cashew nuts produced in Nigeria are exported, as only very few companies are involved in local processing of the produce (Aliyu and Hammed, 2008). The government liberalization policy on commodity crops has impacted significantly on the prices and demand for raw cashew nuts in the recent past (Ezeagu, 2002; Topper et al., 2001). However, Nigeria offers one of the cheapest sources of raw cashew nuts. Nigerian nuts have consistently served the Indian and Vietnamese cashew factories and in recent years have added the Brazilian market. The kernels are well accepted in the United States of America and Western Europe because of high quality of the produce (Aliyu and Hammed, 2008).

CONCLUSION

There is an urgent need for the injection of more funds by the Government into the Nigerian cashew processing sector in order to add value to the products such that processed kernels are exported. The Nigerian cashew nuts are of high quality and its processed kernels have

wide acceptability in European and American markets. The Government should reactivate its entire abandoned cashew processing factories and privatise them for efficient and profitable management. Besides, government should assist privately owned cashew processing factories because of their strategic roles in Nigerian economy. With good economic revenue-base guaranteed by full operation of the local cashew processing industries, the farmers' maximum production capacities will be harnessed. Finally, regional and international research collaborations is highly needed to guarantee adequate funding and expertise, which will facilitate the development and release of improved cashew varieties, which is long overdue in Nigeria.

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