



INTERNATIONAL SOCIETY FOR HORTICULTURAL SCIENCE

Section Tropical and Subtropical Fruits

Newsletter No 19 July 2018

Dear Colleagues,

As Chair of the Section Tropical and Subtropical Fruits of ISHS, I am circulating this e-Newsletter for the last time.

I have taken over the responsibility of compiling and circulating this e-Newsletter from Late Dr. Jacky Ganry in 2010 and 8 years in position I have circulated 16 issues of e-Newsletter with your active support. I am thankful to all those who have helped by sending interesting articles and other information to circulate. I am sure this e-Newsletter will continue by someone who is going to take the responsibility of this Section in the years to come.

The Section is organizing II International Symposium on Jackfruit and other Moraceae, II International Symposium on Date Palm, VII International Symposium on Tropical and Subtropical Fruits, I International Symposium on Avocado and X International Symposium on Temperate Fruits in the Tropics and Subtropics during XXX International Horticultural Congress to be held at Istanbul, Turkey from 12 - 16, August 2018. We have many other important activities in the coming years (please see forthcoming events in this newsletter) and some other symposia of interest.

This e-Newsletter is yours and you are welcome to use it as a vehicle to disseminate information to other colleagues.

With regards,

S.K. Mitra
Chair

Section Tropical and Subtropical Fruits



Papaya (*Carica papaya* L.) Cultivation in Nigeria

Papaya (*Carica papaya* L.), commonly known as Pawpaw in Nigeria, is a short-lived perennial tropical fruit tree. In Nigeria, papaya features as one of the miscellaneous components of many low input traditional cropping systems (Akinyemi et al., 2006). Until recently, its cultivation as a commercial crop has not been well organized. Consequently, its production for local fresh fruit consumption and export has lagged behind other fruits. (Adeyemi and Ogazi, 1987; Akinyemi et al., 2006). In Africa, Nigeria is the highest producer of pawpaw with about 703,800 tonnes produced annually (FAOSTAT, 2012).

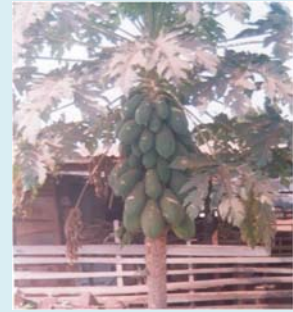


Fig.1. Papaya cultivation in Home Garden

In Nigeria, papayas are grown mainly in the southern states where mean annual rainfall of 900 mm to 1500 mm is typically needed for any significant fruit production. The bloom peak usually follows the replenishment of soil moisture after a period of drought. In south-west Nigeria, papaya can be grown in a wide range of soil types. Satisfactory yield, however, can be obtained in soils with pH ranging from 5.0 to 7.5, and the best yield, in the range of 5.5 to 6.5. For a successful papaya orchard, the soil should be well drained, sandy loam, rich in organic matter. Flat lands, sloping hillsides, and rolling terrain also favour papaya plantation. Although production, especially in tropical Africa including Nigeria, has hitherto been limited to volunteer crops located in home gardens or scattered in open fields (Olubode, 2010), recently there has been the planting of medium to large scale pawpaw orchards. These produce large consignments of fruit destined for urban centres such as Lagos and Port Harcourt in the south of Nigeria, Abuja and Kaduna in the North. Some of these fruits also contribute to Nigeria's foreign exchange and consequently the GDP (Adeyemi, 1987; Aiyelaagbe, 1988).

Varieties

Various accessions of land races and exotic varieties are available in Nigeria. The popular ones include: Homestead, Pink solo, Sunrise solo, Red royale, Large maradol, Kapoho solo and JS.22. The local market preference has to do with big size and high brix content. Since fruit size, shape, pulp colour, and time of fruiting differ, likewise preference within and outside the country. Then advice must be sought in selecting which variety to plant for which particular market and purpose.



Fig.2. Papaya-Plantain intercropping

Orchard management

Orchard establishment is usually carried out at the on-set of rains in March – April in the southern part of Nigeria in states where there is no excessive rainfall. As already stated above, pawpaw grows on a well-drained sandy loamy soils, it tolerate a wide





Fig. 3. Sole Papaya Orchard.

range of soils provided it is not waterlogged. Ploughing and harrowing are two important operations in crop cultivation, these are not popular among smallholder farmers that cultivate papaya, where it is done, it is due to accompanying crops in an intercropping systems. However, large scale farmers do carry them out. Raised seedlings are planted out in holes of 15-20 cm deep with 2 x 2 m spacing in monocrop but wider spacing is recommended in intercrop. In large planting

areas, after planting 10 rows, leave a corridor of 4 m to allow movement of equipment. When using a dioecious variety, 3 or 4 seedlings are planted per hole, to ensure a high female population. Generally, fruit yield in the range of 60-70t/ha can be obtained, though this declines considerably after the second harvest.

Cropping systems


Papayas are found in different cropping systems and in different associations. This is because farmers plant them for different purposes apart from fresh fruit consumption. Being a fast growing tall crop, papaya fits well into a multi-storey layer system in intercrop with Cocoa, where it contributes to shade provision in combination with plantain. At early stage of growth, it is usually intercropped with crops like maize, okra, leafy vegetable, melon, sweet potato, or pepper as these crops mature within three months before canopy closure. According to Agboola (2000), farmers in southern Nigeria have developed a sophisticated system of mixed tree and arable cropping that mimics the multi-storey vegetation found in a rain forest. Here the tree components in the mixture are usually not arranged systematically but are scattered and sufficiently widely spaced to allow introduction of arable crops. Hence, pawpaw is rarely grown in pure stands but usually found in mixtures with other crops of upper storey perennials, usually taller trees such as oil palm (*Elaeis guineensis* Jacq.), middle storey perennials such as Citrus spp., and lower layer annuals and biennials including okra (*Abelmoschus esculentus* (L.) Moench.), and pepper (*Capsicum frutescens* L.). Successful crop mixtures exploit variation between component crops by extending the sharing of available resources over time and space.

Weeding

Weeding of papaya orchards is usually done by hand on most farms by rural farmers. However, farm labour is becoming scarce and expensive due to migration of rural populace to urban areas. This is making the use of chemicals (herbicides) inevitable.

Pests and Diseases

Despite their importance, pawpaw suffers from numerous production constraints in Nigeria including specific problems due to climate, poor agronomic practices, pests and diseases. As with most fruits, pawpaw is faced with several disease attacks when proper control measures are not being applied appropriately. Some of these notorious pests include: Fruit flies (*Toxotrypana curvicauda*) which lay eggs into fruits causing premature fruit drop; Pawpaw webworm (*Homolalpalpia dalera*); Tiny pawpaw whitefly (*Trialeurodes variabilis*); Hornworms (*Erinnyis obscura*) and Red spider mite (*Tetranychus seximaculatus*).



Diseases play a major role in contributing to low output of pawpaw production in Nigeria with estimated losses as high as 30 to 40 percent. Major diseases seen in pawpaw include: Anthracnose disease caused by a fungus (*Collectotrichum glosporoides*). Amongst these diseases, viral pathogens of pawpaw have been reported to cause deadly epidemics worldwide (Bedasie-Joseph, 2008). These viruses affect many pawpaw cultivars at different levels. The most devastating pawpaw infecting virus worldwide is *Papaya ring spot virus* spread by green peach aphid (*Myzus persicae*). This viral disease causes progressive decline, diebacks and loss of fruit quality and yield (Bedasie-Joseph, 2008).

Harvesting

Pawpaw is harvested 9-10 months after being transplanted manually, depending on the size and the age of the tree using special instruments like sickles, knives or hand. The specialized implement ('Go-to-Hell' harvesters) for harvesting of fruit inaccessible by hand due to tree height, comprises of a long pole, a small circular hoop at the top, a small mesh bag attached to the hoop, and a horizontal blade above the hoop and the bag. The blade is positioned below the peduncle of the fruit and the pole moved upwards; the fruit is detached from the tree and then drops gently into the mesh bag below the hoop at the top of the pole. Pawpaw is usually harvested 3 to 4 times per week as their maturity stage is short-lived.

Fruit handling

There is still much to be done in the area of papaya fruit handling in Nigeria especially at the small and medium scale level. This is because the fruits are still being heaped on one another during transportation. To ensure that the fruit is preserved longer after harvest, the fruit should be placed in single layers of shallow, light-colored plastic field crates, preferably with a foam layer for proper cushioning. Field crates holding the fruits should be under shade protected from rain and sun while awaiting delivery/sales. There is the need for farmers to have access to cool room.

Processing opportunities for pawpaw

As with most fruit with high perishability, value addition of pawpaw is paramount to promote its viability. A number of processing opportunities are available to choice producers to boost the development of agribusiness for both local and international market for pawpaw.

Some of these opportunities include:

1. Juice (pawpaw wine)
2. Nectar (flavored yogurt)
3. Pawpaw pulp
4. Fruit cocktails (Dried papaya slices)
5. Sauce
6. Jam/Jelly

These opportunities have not been fully exploited in the country despite the huge production, though the technology for these value addition are available on the shelves in some research institute, within the country.

Uses

The pawpaw fruits can be consumed fresh, juiced or processed (Bedasie-Joseph, 2008). They are well known for their vitamin C content, but are also good sources of vitamin A, folic acid, and dietary fiber (Bedasie-Joseph, 2008). The leaf bark and twig tissues possesses both highly anti-tumor and pesticidal properties. Useful enzymes, particularly papain, contained in the fruits have been shown to reduce dyspepsia under experimental conditions (Nwofia and Okwu, 2012). Papain is also utilized for the clarification of beer and as meat tenderiser (Ayoola and Adeyeye, 2010). The unripe fruit is used as a remedy for ulcer and impotency. They help clean bacteria from the intestines and encourage the absorption of vitamins and minerals. The tea prepared with the green pawpaw leaves promotes digestion and aids in treatment of ailments such as chronic indigestion, obesity, high blood pressure and heart aches (Oniha et al., 2015).

Conclusion

The country has the capacity to be the highest producer and exporter of looking at all the factors that favour its production (Climate, land & human resources, etc). To attain this however, there is need for the adoption of new production strategies to improve productivity and profitability. Improving the poor produce quality and financial losses that result from produce spoilage along the production chain, encountered mainly by the rural farmers, who produce one-third of the world



production, will need direct government intervention (Olubode et al., 2016). Produce spoilage could be temporarily delayed and/or significantly reduced before delivery to destination points. Farmers need exposure to modern production techniques and direct government intervention. By improving rural extension services, farmers will be introduced to improved production techniques that will ensure high grade produce for increased local and international market. Direct purchase, proper distribution of quality harvested produce, and the provision of modern storage facilities for prolonged shelf life is also possible through organised sharing of manageably sized storage facilities, using larger communal groups and/or agricultural cooperatives/units.

Literature Cited

- Adeyemi S.O.A., (1987). Keynote address at 9th Annual Conference of the Horticultural Society of Nigeria (HORTSON), Federal University of Technology, Owerri, Nigeria 8-13th November, 1987, pp. 1–3.
- Adeyemi, S.A.O. & Ogazi, P.O. (1987). Export potentials for fruits grown in Nigeria. In *Proceedings 9th Annual Conference of Horticultural Society of Nigeria*. Federal University of Technology, Owerri, Nigeria. 8-13th November 1987, pp. 4-II.
- Agboola A.A.,(2000) Farming system in Nigeria. In: Akoroda MOA, editor. *Agronomy in Nigeria*. Ibadan (Nigeria): University of Ibadan, 2000, pp. 24–34.
- Aiyelaagbe I.O.O.,(1988). The response of Homestead selection papaw (*Carica papaya* L.) to soil moisture stress. Ph.D. Thesis, Department of Agronomy, University of Ibadan, Ibadan, Nigeria, 1988, pp. 77–125.
- Akinyemi S.O. Sunday, Josephine O. Makinde , Isaac O.O. Aiyelaagbe, Folashade M. Tairu & Olayinka O. Falohun (2006) Growth, Yield and Productivity Response of ‘Sunrise Solo’ Papaya to Weed Management Strategies, *Biological Agriculture & Horticulture*, 23:4, 383-392.
- Ayoola, P. B. and Adeyeye, A. 2010. Phytochemical and nutrient evaluation of *Carica papaya* (papaw) leaves. *International Resources of Agricultural Sciences* 5 (3): 325-328.
- Bedasie-Josheph, S. 2008. *Papaya production, a producer's manual*. Ministry of Agriculture land and marine resources, Trinidad and Tobago. pp 1-18.
- FAOSTAT (2012) Production data. <http://agribiz.info/agriwiki/article/pawpaw-value-chain>
- Nakasone, N.Y. & Paul, R.E. (1998). Papaya. In *Tropical Fruits*, pp. 239-269. CABI International; Wallingford, U.K
- Nwofia, G. E. and Okwu, Q. U. 2012. Studies on nutritive characteristics and variability in papaya (*Carica papaya* L.). *Pakistan Journal of Nutrition* 11 (10): 859-864
- Olubode O.O. (2010), Productivity of papaw/vegetable intercrop supplied with organo-mineral fertilizer. Ph.D. Thesis, Department of Horticulture, Federal University of Agriculture, Abeokuta, Nigeria 2010.
- Olubode O. O., O. M. Odeyemi, I. O. O. Aiyelaagbe (2016) . Influence of environmental factors and production practices on the growth and productivity of papaw (*Carica papaya* L.) in south western Nigeria – A review. *Fruits* 71 (2016) 341–361.
- Oniha, M. I., Egwari, L. O., Ogunbunmi, I. and De, N. 2015. Field and post-harvest requirements for optimizing *Carica papaya* L. fruit yield. *International Conference on African Development Issues (CU-ICADI) 2015*. pp 6-8.

Sunday O. S. Akinyemi (Ph.D)

Director (Research), Fruits and Spices Department
National Horticultural Research Institute,
P.M.B. 5432, Idi-Ishin, Jericho, Ibadan, Nigeria.

Aonla (*Emblica officinalis* Gaertn.) –an Unique Tropical Fruit Rich in Nutritional and Medicinal Properties.

Aonla belonging to the family Euphorbiaceae is a deciduous tree small to medium in size, the average height being 5.5m. Flowers are unisexual, pale green, 4-5mm in length, born at the leaf axils of clusters of 6-8 staminate flowers, tubular at the base having a very small stalk. The pistillate flowers are fewer having a gamopetalous corolla and a two-branched style. The productivity of cultivar depends upon the percentage of female flowers on the branches. This phenomenon of flowering required cross pollination, thus, fruit set depend upon pollenizer. Occurrence of self incompatibility is also reported in some cultivars which suggest for mixed planting of cultivars to have better fruit set (Singh, 2003).

Aonla is said to be indigenous to tropical south-eastern Asia, particularly in central and south India. The tree is also found in other countries like Sri Lanka, Cuba, Puerto Rico, USA (Hawaii and Florida), Iran, Iraq, Pakistan, China, Malaysia, Thailand, Vietnam, Philippines, Trinidad, Panama and Japan.

The fruit is nutritive and is the richest source of vitamin C among fruits except Barbados Cherry. The ascorbic acid and other constituent are well retained in dried aonla fruits. Potassium and iron content are appreciably high in the fruit (Table 1).

The fruit contains very high amount of ascorbic acid is analgesic, anti-inflammatory and antipyretic. Besides, this compound is antihepatotoxic, antinephrotoxic, antioxidant and imparts chromosomal stabilization. The fruit contains as much as 28% tannin compounds of which ellagic acid, gallic acid, corilagin etc. are important. Ellagic acid is antimutagenic and anticarcinogenic. Gallic acid scavenges free radicals generated by various metabolic processes. The fruit contains (-) epicatechin which is hypoglycaemic, anti-inflammatory. The fruit contains appreciable amount of linoleic acid which imparts immunomodulation in human body. Ingestion of linoleic acid by the patients having multiple sclerosis reduces the frequency and intensity of heart attack. The fruit contains kaempferol, quercetin and rutin. All these compounds are partial cardiotoxic. It also contains phyllembin which regulates blood pressure and respiration in normal tune.

The root bark is astringent and is useful in gastric ulcer. The bark is astringent and useful in jaundice, diarrhea and myalgia. The flowers are cooling and aperient. The leaves are useful in conjunctivitis, inflammation, dyspepsia, diarrhoea and dysentery. Seeds are reported to be useful in asthma, bronchitis and biliousness. The seeds contain a fixed oil, phosphoids, and a small quantity of essential oil with a characteristic odour. The fixed oil (16%), is brownish yellow in colour and contains linolenic (8.78%), linoleic (44.0%), oleic (28.4%), stearic (2.15%), palmitic (2.99%) and myristic acid (0.95%).

Aonla fruits because of high acidity and astringent taste, is not a palatable fruit for direct consumption. It is consumed mainly in the processed form. The excellent nutritive and therapeutic values of fruit offer great potentiality for processing into several quality products. In general, aonla fruits are utilized for three purposes

- (a) Food item: RTS, nectar, squash, jam, preserve, candy, pickle, sauce, chutney, dehydrated shreds etc.
- (b) Ayurvedic preparation: Chavanprash, trifla, amlakai girth, trifla churan, trifla prash, tablets.
- (c) Cosmetic preparation: face pack, hair oil, shampoos, tooth powder.



The rich genetic bio-diversity of Indian gooseberry (aonla) is widely distributed in Uttar Pradesh, Madhya Pradesh, Chattisgarh, Maharashtra, Gujarat, West Bengal and Himalayan regions of the country. The genetic variability available in different agro-ecological/ bio-diversity regions exhibited to variable genetical characters in respect to flowering, fruiting fruit quality and fruit maturity, which are still unexploited for their commercial utilization and conservation. Significant contributions made by Narendra Deva University of Agriculture and Technology, India for development of improved varieties of aonla originated from Chance seedlings viz. Kanchan, Krishna, NA-6, NA-7, and NA-10, which have been found to be most suitable for their wider adaptability and high yield potential.

Aonla has long been raised through seeds and by inarching. From seed propagation, there is prolonged juvenility and wide variability, while only a limited number of scion shoots are available for inarching owing to its upright tree habit. Now aonla is successfully propagated through patch/modified ring budding between May and September (Ram and Pathak, 2003). Six months to one year seedlings obtained from 'Deshi' aonla tree are being used as rootstock. Seeds are extracted after drying the fruits and shown in raised bed/polythene packet for subsequent budding.

Healthy grafts or budded plants are planted in early monsoon at a distance of 10m x 10m. The plants are trained to modified leader system. The framework should be developed by encouraging the growth of four to six well spaced branches with fairly wide angles. The plants need to be fertilized with 10kg organic manure, 125g N, 50g P₂O₅ and 50g K₂O per one-year-old plant. The dose should be increased every year in the same proportion up to the age of 8 years (80kg organic manure, 1000g N, 400g P₂O₅ and 400g K₂O tree⁻¹) after which the fixed dose should be applied each year, in two splits during September-October and April-May.

Flower appears in the last week of March and the blooming period lasts for 3 weeks. Male flowers appear in cluster in the axil of leaf all over the branchlet while the female flower on the upper end of a few branchlets only. Aonla is a cross-pollinated crop; wind, honey bees and gravity all play an important role in effective pollination. The cause of poor fruit set (12-18%) is due to high percentage of staminate flowers. Budded plant starts bearing after 4-5 years. The fruits are light green at first, when mature the colour becomes dull, greenish-yellow or rarely brick-red (Mitra, 2006). The best time of harvesting is February when the fruits have maximum vitamin-C content. If the fruits are allowed to remain on the tree till the next flowering takes place (in late March), it gives a false impression that these fruits are from the current season's flowering. The mature fruits are hard and unyielding to the touch and so are well suited for bulk harvesting as well as distant transportation and marketing. A full-grown aonla tree with good bearing habit yields from 200-300kg fruits tree⁻¹ year⁻¹.

Aonla fruit can be stored at 0°C to 1.7°C and 85% to 90% relative humidity for 8 weeks. The pathogens identified for causing decay of aonla fruits in storage are *Aspergillus* sp., *Colletotrichum* spp. and *Penicillium* spp.



Fig. 1. Aonla orchard at bearing



Fig. 2. Aonla fruit ready to harvest



Literature Cited

- Ram, R.A. and Pathak, R.K. (2003). Modernization of plant multiplication techniques in aonla (*Emblica officinalis* Gaertn.). Abst. Nat. Sem. on Prod. and Utilization of Aonla, Salem, India.
- Singh, H.P. (2003). Augmentation of production and utilization of aonla. Abst. Nat. Sem. on Prod. and Utilization of Aonla, Salem, India.
- Pathak, R.K., Srivastava, A.K., Dwivedi, R. And Singh, H.K. (1993). Aonla Descriptor. Department of Horticulture, Narendra Deva University of Agriculture and Technology, Faizabad 224229, India. pp. 24.
- Mitra, S.K. (2006). Underutilized tropical fruits in India. Tropical Fruit Newsletter, 6: 20-22.

S.K. Mitra
Chair, Section Tropical and Subtropical Fruits
International Society for Horticultural Science

Table 1: Nutritive values of aonla fruit (100g⁻¹ edible portion)

Moisture (%)	:	81.9
Protein (g)	:	0.5
Fat (g)	:	0.1
Carbohydrates (g)	:	13.7
Energy (Kcal)	:	58
Calcium (mg)	:	50
Phosphorus (mg)	:	20
Iron (mg)	:	1.2
Vitamin C (mg)	:	500

FORTHCOMING EVENTS, 2018-2020



Forthcoming Events

II Int. Symp. Flowering, Fruit Set and Alternate Bearing
(November, 2020, Montpellier, France)

Int. Symp. Trop. & Subtrop. Hort. In Mediterranean Climate
(September 7-10, 2020, Palermo, Italy)

X Int. Pineapple Symp.
(April 13-19, 2020, Punta Cana, Dominican Rep.)

VI Int. Symp. on Lychee, Longan and Other Sapindaceae Fruits
(June 15-19, 2019, Hanoi, Vietnam)

XIII Int. Mango Symp.
(26-29 October, 2020, Malaga, Spain)
VI IS on Papaya,
(20-23 October, 2020 Almeria, Spain)

XXX-IGC 2018
(August 12-16, 2018; Istanbul, Turkey)
VII IS Trop. & Subtrop. Fruits
II IS Jackfruit & other Moraceae.
I IS Avocado
II IS on Date Palm
X IS Temperate Fruits in Tropics and Subtropics

Int. Symp. Trop. Subtrop. Viticulture
(Jan., 21-24, 2020, Bagalkot, India)

VII Int. Symp. On Persimmon,
(October 11-15, 2020, Nara, Japan)





Other Symposia of interest

6th International Trade Show for Horticultural and Floricultural Production and Processing Technology

22 August 2018
AMBER 3, BITEC
Bangkok, Thailand
For more information: <https://www.hort-asia.com>

International Conference on Tropical Fruits Pests and Diseases

25-27 September, 2018
Sabah, Malaysia
For more information: <https://www.itfnet.org/troped2018>
Or mail to troped@itfnet.org

Postharvest management for better food security

Hanoi, Vietnam
05-07 November, 2018
For more information: www.postharvestvnua.org/

International Symposium on Horticulture

27-30 November, 2018
Kuta, Bali, Indonesia
For more information: <https://www.ish2018.hortind.net>
Or mail to: ishti.2018@gmail.com