

POOR MAN'S FRUIT: A COMPREHENSIVE REVIEW ON JACK

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Abstract: Jack is a fruit yielding tree species found in tropical, sub-tropical and humid areas of India. However, as an underutilized crop, jackfruit has escaped attention from intensive production and proper marketing. The efforts were taken to synthesize the detailed information on distribution and diversity, management practices, intercropping, jack production, medicinal and culinary uses, marketing and value addition techniques. This paper also stresses on intensive jack production and promote for wide uses. However, species should be treated as candidate fruit crop.

Keywords: Jack, Intercropping, Production, Phyto-chemistry; Marketing channel

INTRODUCTION

The genus *Artocarpus* belongs to the family Moraceae and is distributed across India. There are 18 *artocarpus* species found in India (Ahmedullah and Nayar, 1986). However, the name *Artocarpus* is derived from the Greek words *artos* (bread) and *carpos* (fruit) (Bailey, 1942). The jackfruit is also called jack, an English adaptations of the Portuguese jaca (Popenoe, 1974). The common name of "jackfruit" used by the physician and naturalist Garcia de Orta in his 1563 book *Colóquios dos simples e drogas da India* (Anon, 2000). In Hindi called Kathal, Malayalam Chakke, Kannada Halasu, Malayalam Chakke, Marati Phanas. It is native to South and Southeast Asia. Originated in the southwestern rain forests of India (Yule, 1863). *Artocarpus* is one of the major keystone species in Western Ghats (Nayar, 1996; Isaac and Nair, 2005). Due to increasing importance of domestic use the genus has been introduced to other parts of the tropics in Caribbean, Central and South America, Africa (Ragone, 1997). The genus is receiving increasing importance for agroforestry, plantation forestry and afforestation programmes due to wide range of utilities like fruits and timbers, ayurvedic, culinary uses, etc. However, very limited studies are available in jackfruit, production, marketing and value addition (Chowdhury *et al.*, 2012; Sharma *et al.*, 2013). Still, Due to great diversity of clones in Western Ghats of India may call the home of jack; this offers large scope for studying the variability and improvement of this crop by clonal selection (Guruprasad, 1981; Samaddar, 1985). Langford (2014) also reported that jackfruit could be a replacement of wheat, corn and other staple crops which are threatened by global warming and unpredictable rainfall.

Habitat

The trees can be grown under varying habitat condition. Young trees require some shade, but mature tree grow in full sunlight. The mean annual

temperature for its growth varies between 19 to 29°C and rainfall between 1000 to 2400 mm. p^H of the soil should be 4.3 to 8. However, jack is intolerant to frost and susceptible to prolonged drought (Duke, 1989). It is commonly grown in polycultures systems in homesteads, road side plantations and hilly tracts (Elevitch and Manner, 2006). Stem is straight rough while bark is green or black, about 1.25 cm thick, exuding milky latex. The leaves broad obovate, elliptic, decurrent, glabrous, entire inflorescence solitary axillaries, cauliflorous and ramflours on short leafy shoots (Prakash *et al.*, 2009). Male head is sessile or on short peduncles receptacles. Female head is oblong ovoid receptacle, syncarpus, cylindric (Rowe-Dutton, 1985). The trees are monoecious producing enormous multiple fruits (Jagadeesh *et al.*, 2006; Jarrett, 1959). Pollinated by wind, insect and is generally require cross-pollination for satisfactory fruit production. It grows best in deep alluvial soil (Haq, 2006). Fruit bearing season varies between April to August. Establishment of jack requires good planting stock and proper management.

Distribution and diversity

The tree attains height of about 45 m and girth up to 4.5 m. Distributed at an altitude of 1600 m above Mean Sea Level. Though, wide range of genetic and morphological variation has been reported in jack (Azad *et al.*, 2007; IPGRI, 2000; Jagadeesh *et al.*, 2006) nonetheless attention must for proper documentation of genetic diversity of indigenous jack (Shyamamma *et al.*, 2008; Ullah and Haque, 2008). Several varieties are already been propagated across the country viz., Gulabi, Champa, Hazaric, Rudrakshi, Ceylon jack, etc. Jagadeesh *et al.*, (2013) studied the jackfruit diversity in Western Ghats of India and they reported jack as treasure house of wide diversity. Coastal belts of Karnataka found to have two famous varieties called bakke and imba. APAARI (2012) report stressed that a few selections, namely, NJT1, NJT2, NJT3 and NJT4 produce large fruits and excellent quality of pulp for table purpose,

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while types like NJC1, NHC2, NJC3 and NJC4 were found better for culinary purpose. Varietal improvement in jackfruit is so far limited to selection of high yielding, better quality genotypes. Srinivasan, (1970) described a variety called Muttam Varikka which produced fruit of 7 kg each. Varikka, Koozha, Navarikka types jackfruit strains are available in Kerala, Tamil Nadu, Karnataka with maximum diversity in Wayanad Plateau (NBPGR, 1978). In south India called Rudrakshi it comes fairly true to type when grown from seed, but its fruit is smaller and of poor quality (Ray, 2002). Aligiapillai *et al.*, (1996) selected a clone "PPI-1". It is "Kazhukupala" type, high yielding and comes to first fruiting in 5 years. Ray (2002) described 12 genotypes and reported KJF 3 as the highest yielding (60 fruits/tree) and sweetest fruit. Biotechnological approaches like hybridization, organelle transfer, genetic transformation, protoplast fusion, anther culture and embryo culture should employ to produce both intra and inter specific hybrids. However, some tissue culture techniques have been developed for faster multiplication of improved genotypes using nodal segments (Roy *et al.*, 1990).

Management practice

Jack a multipurpose fruit tree found in all locations might provide the basis for nutritional strength and food security in India. However, after care and management are ut-most important. Jackfruit may be propagated by seed, grafting and cuttings (Jonathan *et al.*, 2013). The vegetative propagation is most successful. Soft wood grafting on 2 months old seedlings with scion of 3-4 months old provide good results (70 -80%) (Abd El-Zaher, 2008). The viability of seeds are very low and should be sown immediately after extraction to raise root stocks (Priya Devi, 2014). Haripriya, (2014) recommended 8 m x 8 m spacings for grafted trees and 10 m x 10 m to 12 m x 12 m for those raised from seeds. Application of farmyard manure at 10 kg per plant in first year, 0.15:0.08:0.1 kg of N:P:K per plant per year in the first year and in the sixth year an increased dose of 0.75:0.4:0.5 kg of N:P:K per plant per year found to increase growth, flowering and fruiting in jack (Hasan, 2008; Haripriya, 2014). The commonly found pests are shoot and fruit borer (*Deaphania caesalis*) and brown bud weevil (*Ochyromera artocarp*). The soft rot or fruit rot (*Rhizopus artocarp*) is an important disease. However, integrated pest and disease management with proper mechanical, chemical and biological practices are necessary (Chandurkar, 2003). Haq (1995) reported that important features of jack is "ideotype" that are easy to manage and require less pruning for fruit production. The advantage of long straight trunks help for crop diversification and agroforestry practices.

Jack based agri-horti-silvi systems

Jack has been managed under different agroforestry practices across the India. It is intercropped with mango and citrus in Uttar Pradesh (Singh *et al.*, 2011). In young orchards of jack has been intercropped with annual cash crops such as banana, sweet corn, groundnut, peas, etc. in Chhattisgarh (Magcale-Macandog, 2010). Other studies also reported that bamboo+jackfruit+maize+pineapple is best intercropping practice in Tripura (Kanfade, 2014) and jackfruit+rubber+cashew nut+mangosteen system in Kerala (Joshi *et al.*, 2006; John, 2014). Nair and Sreedharan (1986) reported that four-tier structure is common in southern states. However, intensive land-use practices of jack in homestead farming were increasingly popular among majority of the marginal farmers (John, 2014). The agricultural universities and other research institutes already undertaken proper investigations on agroforestry based value chain systems of jackfruit in rural areas for upliftment of poor farmers. However, intensive studies further required for better tree-crop combination for jack based system.

Medicinal importance

The Artocarpus species have been used by traditional folk medicine in India. It is having immense medicinal value and is considered a rich source of carbohydrates, minerals, carboxylic acids, dietary fiber and vitamins such as ascorbic acid and thiamine (Lin *et al.*, 2000). Manganese and magnesium (Barua and Boruah, 2004), potassium, calcium and iron (Goldenberg, 2014) elements are found in seed. Seeds contain two lectins namely jacalin and artocarpin (Theivasanthi and Alagar, 2011). Jacalin has been proved to be useful for the evaluation of the immune status of patients infected with human immunodeficiency virus (Haq, 2006). Seed nanoparticles were effective against *Escherichia coli* and *Bacillus megaterium* bacteria (Theivasanthi *et al.*, 2011). It also have antioxidant activity (Biworo, 2015). Act against inflammation, malarial fever and skin disease (Khan *et al.*, 2003), anti-bacterial and anti-helminthics (Soeksmanto *et al.*, 2007). Jack leaves commonly used as healing for ulcer. Its leaves have the potential of curing diabetics due to the presence of hypoglycemic and hypolipidemic substances (Prakash *et al.*, 2009). The leaves and stem also have saponin, cycloartenone, cycloartenol, β -sitosterol and tannins (Sathyavathi *et al.*, 1987). The latex yield artosteron mixed with vinegar promotes healing of glandular swelling and snake bites (Devaraj *et al.*, 1985 and Mukherjee, 1993). Root extract is remedy for skin disorder and asthma (Ferrao, 1999). The wood has sedative property and believed that it may cause promotion of abortion (Morton, 1965), cure diarrhea and fever (Samaddar, 1985). Fruits and roots used for tapeworm infection (Patil *et al.*, 2002; Su *et al.*, 2002; Khan *et al.*, 2003).

Jack Production

The NTFPs of jack mainly come from wild-harvest as well as from cultivated sources. In Asia-pacific, India is the largest producer followed by Bangladesh and Thailand. Technological development and intensification of jack based production is most important due to ever increasing demand-supply gap. Jack provide wide array of fruit sources. However, as an underutilized crop, jackfruit has escaped attention from intensive production. Jack distribution in India is estimated to be 102,000 ha. with annual production of 1436000 tonnes and productivity of 11.42 t/ha (Haq, (2006); Ghosh, (1996) and AEC, (2003)). Jackfruit (*Artocarpus heterophyllus* Lam.) about 50-80 tons can be harvested from a hectare of land. However, because of large production and widely used by economically weaker sections. It is popularly known as poor man's fruit of India (APAARI, 2012).

Culinary uses and value addition

The jack is a multi-purpose species provide food, timber, fuel, fodder, medicinal and industrial products. Both immature and mature fruits are used (APAARI, 2012). The fruit contains free sugar (sucrose), fatty acids, ellagic acid and amino acids like arginine, cystine, histidine, leucine, lysine, methionine, theonine, tryptophan etc. (Pavanasivam and Sultanbawa, 1973; Swami *et al.*, 2012). Seeds are rich with starch (Singh *et al.*, 1991). Amit and Ambarish (2010) reported that the maximum alcohol content in jack wine was 10% (v/v), with 14% of total sugar solids. However, due to large scale availability, number of recipes has been prepared in India. Swami *et al.*, (2012) reported that the various products developed from jackfruit in Karnataka are candy, finger chips, fruit bars, fruit leather, halvah, papad, ready-to-serve beverages, toffee and milk-based srikhand, ice cream and Kulfi. Haridoss (2009) also prepared recipes like chips, sambar, and kadabu that are useful Malenadu recipes during the jackfruit season. College of Forestry, Sirsi was conducted training under RKVY project and was prepared value added products like jack juice and syrup. Jack also used as cooking delicacies like idlis and vada (Holst, 2011). A Jackfruit seminar organized by BSKKV, Dapoli Maharashtra and demonstrated a production of value added jackfruit drink, named as 'Mondys'. UAS Bangalore was organized an International Jackfruit Conference and provided wide array of information on jack cultivation, management and post-harvest management techniques.

Phyto-chemical constituents

The heartwood of jack contain varying constituents of moisture (6.7%), glucosides (38.0%), lipids (0.7%), protein (1.7%) and cellulose (59.0 %) (Perkin and Cope 1895). Flakes of ripe fruits are rich with nutritive value; every 100 g of ripe flakes contains 287-323 mg potassium, 30.0-73.2 mg

calcium and 11-19 g carbohydrates (Elevitch and Manner, 2006). Bark from main trunk contains betullic acid and a flavone pigment, cycloheterophyllin ($C_{30}H_{30}O_7$) (Chawdhary and Raman, 1997). Lycopene also found in jackfruit pulp (Setiawan *et al.*, 2001). There are 18 carotenoids were successfully separated, identified and quantified and 14 were detected in jackfruit (De Faria *et al.*, 2009). The leaves and stem show the presence of sapogenins, cycloartenone, cycloartenol, β -sitosterol and tannins show estrogenic activity. A root contains β -sitosterol, ursolic acid, Betulinic acid and cycloartenone (Dayal and Seshadri, 1974). Jack seed flour contains a thin brown spermoderm, the crude fiber (2.36 %) (Singh *et al.* (1991; Swami *et al.*, 2012). However, the composition of flour depends on nature of seed.

Marketing

India is producing large varieties of fruits accounting 10 per cent of world total fruit production with an annual production of 50 million tonnes (Singh *et al.*, 2006). However, data on production and export of jack not yet been documented properly. Although its wide range of uses and high nutritive value (MART, 2007), very little is known about marketing of jackfruit. For proper marketing of jack there should be an urgent policy regulations to de-regulate (UNESCAP, 2007) the wholesale principles of third party interference. However, in access to this the government has to provide channels for direct farmer-consumer contact system. For proper marketing of jack requires thorough understanding of jack marketing and value addition. However, the role of women's in production and marketing of jack is crucial. The overlooked (women's) peoples of the society should be merged. It is essential for technological transfer of knowledge and skills on jack fruit value addition and bringing jack enterprise to the farm women's and Self Help Groups. In addition there should also be a jackfruit policy proposal for production, value addition and market channel so that poor farmers can avail the production benefits.

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