

Review Paper:

Novel techniques in promoting the production of high value low volume fruit crops

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Abstract

In the recent decades, a remarkable change has been observed in the pattern of production, consumption and trade in Indian agriculture from staple food grains to high value horticultural crops. High value crops are generally crops which give significantly higher value productivity or net income per unit of resource used for their production. These high value fruits crops have higher potential to generate higher income for small and marginal farm holders in India.

Promoting the high value low volume fruit crops increases the net return and improves the farmer standard of living. This study reveals about the recent and new technologies to promote the production of high value low volume fruits crops.

Keywords: High value low volume fruit crops, mangosteen, rambutan, carambola, karonda, noni.

Introduction

In the recent decades, a remarkable change has been observed in the pattern of production, consumption and trade in Indian agriculture. The changes in the production and consumption from food grains to high value agricultural commodities such as fruits, vegetables and livestock products are the major substantial changes in Indian agriculture. Nowadays people in urban as well as in rural areas started to adopt diversified diet rather consuming basic staples. In order to meet this changing demand, production systems are also moving toward the high value crops which improve the farmers economical status by generating higher income. In India, most of agricultural farms belong to small and marginal farmers. These high value crops have potential to generate the higher income for these small and marginal farm holders. Such kind of shifting agricultural resources to high value options has been the new strategy for agricultural development in the last decade.

High value crops are generally crops which give significantly higher value productivity or net income per unit of resource used for their production. High value crops are generally referred as non-staple agricultural crops such as fruits, vegetables and livestock products. Gross income from high value fruits is much higher than other agricultural crops but the initial capital investment will be higher.

However, the capital investment is steadily gained in successive production cycle. Hence, this study deals with

new technologies developed over promoting the high value low volume fruit crops such as mangosteen, rambutan, carambola, karonda, Indian mulberry etc.

Rambutan

Rambutan (*Nephelium lappaceum* var. *lappaceum*) or hairy litchi belonging to the family Sapindaceae is one of the major fruits in Indonesia, Malaysia and Thailand, widely cultivated throughout Southeast Asia. In India, rambutan cultivation is limited to southern parts including Thrissur, Pathanamthitta, Kottayam and Ernakulum districts of Kerala, Nager Kovil, Courtralam, Nilgiris districts of Tamil Nadu, Dakshina Kannada and Kodagu districts of Karnataka. The fruits of rambutan are similar to litchi except long hair like structures on fruits.

Rambutan seeds require adequate temperature of 25°C for better germination. The seeds can be stored up to six days and need to ensure that the seeds are not taken out of fruits till time of sowing. In case of vegetative propagation, grafting and layering techniques are used to raise the rambutan seedlings. Whip grafting technique is the best propagation method to obtain rambutan seedling both in winter/fall and summer/spring seasons. During winter/ fall period, whip graft is associated with biodegradable fiber and the leafless rootstock where as in summer/spring, whip graft with plastic ribbon and leafy rootstocks results in more satisfactory graft union.

Layering method of propagation is followed during spring but the layers take more time for acclimatization². The media substrate of air layers coir fibre treated with rooting hormone IBA at concentration rate of 2500 ppm (under an average temperature of 27.95 °C and RH 79.6%) gives higher rooting percentage of air layers of rambutan⁴. However, the cuttings techniques failed to be an efficient method to rise rambutan seedling².

One of the major diseases of rambutan is powdery mildew caused by the pathogen *Oidium nephelii*. The infected fruits are subjected to fruit drop and drastically reduce the yield. To overcome fruit drop due to powdery mildew, foliar application of chitosan fungicide, 40 ppm concentration at two week interval with two spraying at leaf flush stage, four spray at fruiting stage and one spray at day before harvest has shown mild disease severity on mature fruits and no discoloration abnormality of fruits even after ripening. In addition to chitosan fungicide (40ppm), wettable sulphur 80 WP (4000ppm) has equal potential in controlling of powdery

mildew as well as increasing number of fruits per bunch of Rambutan of var. Malwana Special⁸.

Mangosteen

Mangosteen (*Garcinia mangostana*) is also known as the finest fruit of the world or queen of fruits. Mangosteen is more popular in Indonesia, Philippines, Burma, Sri Lanka and Malaysia. In India, it is successfully grown on slopes of Nilgiris (Tamil Nadu), Malabar and Kanyakumari, Wayanad (Kerala) and Kodagu (Karnataka). The mature tree can grow up to a height of 10 to 15m with a dense pyramidal crown and glossy bright leaves. The fruits look like small-sized orange with a smooth reddish-purple cortex (rind) and the pulp is white, soft and juicy that it almost melts in mouth with an indescribably sweet and pleasant flavor.

Partial root zone irrigation method was one of the ideal irrigation methods for mangosteen where the soil moisture level is 50% of the field capacity. At this low soil moisture level, calcium content of leaf increases and synthesizes secondary metabolites such as octacosane, cysteamine sulfonic acid, propyl oleate, 1-nanodecene and 2-butyn-1-ol-4-methoxy. This type of irrigation is usually used to reduce the water requirement of mangosteen without compromising the plant growth and yield. This irrigation method can be implemented in area where water sources are limited¹⁰.

For flowering of mangosteen, a drought approximately for period of 21 days followed by rainfall or irrigation is required. To induce flowering in mangosteen, dry weather during January – March and June - August followed by irrigation for fruit set and development is needed. This suitable weather condition results in higher yield. When heavy rainfall occurs during November and December, it will lead to high fruit disorders. Low rainfall and high evaporation occur during fruit development that results in low yield of mangosteen. Likewise, rain in July – August after prolonged dry period leads to leaf flushing instead of flowering and fruit set³.

Soil drenching of tree trunk base with paclobutrazol at 4.25 g a.i. per tree (17 ml/tree) at two years interval helps to increase the yield of mangosteen. The application of paclobutrazol at lower dose as 50% recommended rate for root drenching of mangosteen at two years interval improves the yield performance as the cost-effective measures²⁴.

Karonda

Karonda (*Carissa carandas*) belongs to Apocynaceae and is found to grow at Western Ghats and several parts of our country. Karonda is a medium sized, wild, thorny shrub with rich source of iron and vitamin C. It is antiscorbutic and very useful for cure of anaemia. It is a very hardy, drought-tolerant plant that thrives well in a wide range of soils.

Karonda is propagated through seeds, cuttings, grafting, air layering and stooling. Karonda seeds are hard and have low germination percentage. Water soaking treatment for 8 hours

will increase the germination percentage up to 83.3%⁵. Following the seed treatment with 25% cow urine and soil inoculation with *pseudomonas* 6 ml/Kg of seeds, good seed germination percentage, seedling growth and vigor are achievable²⁰.

Karonda is propagated through stem cutting. The root can grow up to 6.58 cm when treated with IBA 8000 ppm concentration whereas when treated with 4% sucrose, the root grows up to 6.49 cm, thus treating the stem cutting with IBA 8000 ppm or with 4% sucrose leads to higher rooting percentage⁷. IBA treated stem cuttings (at 8000 ppm) have better sprouting ability, rooting of more secondary roots and root length²³.

Karonda prefers to grow well in organic source of nutrients rather than the inorganic fertilization. Annual application of cow dung manure gives various benefits for karonda in regards to growth and yield. Applying 4 kg cow dung manure per plant per year associated with foliar N/K ratio of 1.2 enhances the yields (around 3 Kg per plant) and maximizes the fruit weight with highest TSS (9°brix), reducing sugar and ascorbic acid content. In addition, the soil pH under organic fertilization tends to be in neutral state which is ensuring state for the availability of soil nutrients to plants²¹.

Likewise, the post flowering foliar sprays of 1% urea at fruit set and 0.5% mono-potassium phosphate at 20 days after fruit set enhance the fruit retention capacity, yield and quality of karonda with high TSS of 18.33° brix, reducing sugar of 8.85% and total sugar of 10.9%¹⁷.

Carambola

Carambola, *Averrhoa carambola* L. belongs to Oxalidaceae originated in Ceylon and the Moluccas. Carambola tree is slow growing, short-trunked with a much-branched, bushy, broad, rounded crown and reaches 20 to 30 ft. In nature, carambola shows cold resistance to some extent. Cold hardiness of carambola is age based. Higher is the age of carambola tree and shoot, higher is the resistance to cold¹¹. Carambola has high tolerance to boron up to 4 mg dm⁻³ (800% of the recommended boron dose of 0.5 mg dm⁻³)²⁶. Convective drying of seed at 38°C leads to improvement in germination percentage from 74% (by fresh seeds) to 98% (by convective dried seed). The dried seeds possess higher germination index and give rise to vigorous plants¹⁹.

For woody perennial crops like carambola, evapo transpiration (ET)-based irrigation scheduling systems such as the new real time smart technologies, are viable method of irrigation¹³.

In case of carambola orchard with gravelly loam soil, a reduced irrigation system in which above 17% soil water depleted irrigation is applied to have good tree growth without compromising the yield and produce quality carambola fruits¹.

Pruning of carambola trees (Arkin variety) during warm season (i.e. at July – September) stimulate the flowering action in pruned branches⁹. Application of ethrel stimulates flowering and enhances the yield of the crop to which is applied. Similarly, the post-harvest soaking of carambola fruits in ethephon (or ethrel) solution of 15 ml/L concentration has fast ripening quality and good color development as well as lower residual effects of ethephon on fruit surface¹⁵.

Noni

Noni (*Morinda Citrifolia*) Mulberry is considered to be originated in the border area of the Indo-Chinese region and distributed in the lower slopes of the sub-Himalayan zone up to an elevation of 3300 m²⁵. The major mulberry growing States in India include States of Karnataka, Tamil Nadu, Kerala, Uttar Pradesh, Bihar, Madhya Pradesh, West Bengal, Rajasthan, Himachal Pradesh and Assam¹⁴.

Noni requires partial and moderate sunlight. The highest fruit yield is obtained in the open field (17.75 Kg/Plant) followed by tree grown under coconut plantation (16 Kg/plant). But the plant grows higher (of plant height 3.89 m) in areca nut plantation than the open field condition (plant height 3.05 m) which is the clear evidence of shading effect¹².

Noni plants are propagated through seeds and tissue culture method. Seedling grows faster and attains highest plant height than tissue cultured noni plants at 6 years of planting. However, the tree spread, yield and quality of fruits are best with tissue cultured noni plants¹⁸. Application of fertilizer at the rate of 50:225:50 kg NPK ha⁻¹ (wherein bone meal is used as source of 50% or 100% recommended phosphorus) is proved to be the best for plant growth in terms of plant height, tree spread and yield of about 39.81 t/ha⁶.

Noni is one of the best intercrop for coconut. The nut yield of coconut found to be increased when intercropped with noni plants. The yield, net returns and benefit cost (B:C) ratio will gradually increase and will be profitable up to 40 years¹⁸. When the noni is cultivated as intercrop with coconut plantation, noni gets supplement from organic nutrient management of coconut which includes vermicomposting, vermiwash, *in situ* green manuring, husk incorporation and coconut leaf mulch. In this system noni yields around 6159 kg/ha/year, the net return of 108695/ha and good B:C ratio (1.31)¹⁶.

However severe shade will reduce the growth and fruit yield and hence appropriate sunlight maintenance is necessary through management of crown architecture of plantation¹². When compared to seedling, tissue culture noni plants have higher net returns in mixed cropping system with coconut. Comparatively the number of fruits per plant, fruit weight, juice content and TSS of tissue cultured noni plant are higher than seedlings. It also adds more leaf litter resulting in increased soil fertility of coconut garden²².

Conclusion

Adapting new technologies is smart idea to increase the farm production and productivity. However, researches on this high value low volume fruit crops are less and hence there is wide scope for research in these crops. Providing financial support to fruit growing farmers at initial stage of crops will encourages them to cultivate these crops. Promoting the high value low volume fruit crops increase the net return and improves the farmer standard of living.

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