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Lakshamana: New tamarind selection for improving rural livelihood

Tamarind is a nutritious crop which has been growing in India since centuries. The tree is of widespread occurrence growing on marginal lands in semi-arid and sub-humid tropical climates, making it highly valuable in ensuring food security for rural poor. Given the great potential of this neglected and underutilized species to address global challenges such as hunger, poverty and climate change adaptation, there is a need to revisit research and development priorities in its favour and to develop strategies together with stakeholders to increase its use.

TAMARIND (*Tamarindus indica*) is an evergreen tree legume, distributed all over the world in tropical and sub-tropical countries. The tree produces fruits in pods which consist of a brittle outer shell encapsulating the pulp and enclosed seeds. Once established, the tree develops a large tap root which protects it from strong winds and cyclones, making it well suited to the region prone to such weather phenomena. It is also considered to be a suitable tree for inter-planting with other commercial forest species. Tamarind starts bearing from 6-8 years and has productive life of 50-70 years after which it declines. The normal life span of the tree is 150 years. A typical established tree yields between 50-100 Kg of collectable fruit which is harvested during multiple picks over an 8-10-week period between February and April. Apart from tamarind pulp other by-products such as seed, shell, fiber is also useful for various purposes. Tamarind comes in two main types; sweet and sour. Sweet tamarind is harvested ripe and usually consumed fresh, while the sour tamarind is processed into a range of value-added products. Some of the most common products produced from tamarind include juice, pulp, powder, chutney, pickles, sauces, sugar coated candies and tamarind kernel powder (TKP). TKP is an important sizing material for the jute and textile industry and tamarind seeds are gaining importance as a rich source of proteins and valuable amino acids. India is the world's largest producer of tamarind; it is estimated that 300,000 tonnes are produced annually. It is also an exporter of tamarind, mainly to Europe and Arab countries.

Recently, there has been an increased interest in finding alternative, potentially high-value cash crops to improve the income of small farmers who are currently depending upon growing and selling traditional cereal crops. Tamarind has a wide range of genetic variation in India, which could facilitate identification of superior and desirable types. It has innumerable types, categorized according to the phenotype and genetic characteristics contributing

Close view of tamarind tree and grower

to diverse land races available in wild. Being a highly cross-pollinated crop, and propagated from time immemorial by seeds, considerable amount of variability exists in the trees growing in different regions. Selection is the crop improvement method widely adopted in tamarind and varieties are being released using this method in India. The consumer preference is for traits such as broad, brown pulp with good pulp recovery which is currently not being met by the few released varieties. The present study was undertaken keeping in view the emerging importance of the crop with the objective of identifying superior quality combined with higher pulp recovery. In this context, a survey was undertaken in Tumkur district of Karnataka to characterize the variability available for pod and tree characters and identify superior trees using horticultural traits. *In situ* analysis of the samples collected from this region was done at ICAR-Indian Institute of Horticulture Research, Bengaluru and an elite tamarind variety was identified having broad pods with good pulp colour and recovery. Farmer's tamarind selection "Lakshamana" emerged from participatory breeding research having significantly better traits compared to local tamarind.

Lakshamana

This is an accession identified in Nandihalli village of Tumkur district of Karnataka, having coordinates latitude 13.52° N, Longitude-76.74° E and 860 m MSL growing in field of Shri Laxmannappa. It was found to be superior with better yield and pod characters compared to local and registered mean annual yield (4 years from 2016-2020) of 251.4 kg/tree as against 165.0 kg/tree in local trees.

Table 1. Economic traits of promising selection Lakshamana

Sl. No.	Trait	Lakshamana
1.	Fruiting season	Feb-March
2.	Fruit bearing position	Terminal
3.	Fruit clustering habit	Cluster of 2-3 or solitary
4.	Fruit shape	Long, curved
5.	Pod length (cm)	25.4
6.	Pod breadth (cm)	3.8
7.	Number of pods/kg	24
8.	Number of seeds/pod	8.2
9.	Shell wt. (g/kg fruits)	250 (25%)
10.	Pulp wt. (g/kg fruits)	430 (43%)
11.	Seed wt. (g/kg fruits)	270 (27%)
12.	Fiber wt. (g/kg fruits)	50 (5%)
13	Yield per plant (kg per tree)	251.4

Lakshamana is a 40-year-old, regular bearing tree. It commences flowering in September-October, matures in February-March and harvesting can be done in March-April under Tumkur conditions. This is a lean period in this region when there is less agricultural activity. The farmers can use this time to process and pack the tamarind to get better price in market. The pulp of "Lakshamana" is of superior quality having light brown colour, it is broader in shape which is desirable for marketing and has less fiber content. The inner cavity is silvery and this encloses the seeds. The pulp recovery is high (43%) as against 28% in local tamarind trees.

Biochemical composition of promising selection identified

The pulp of Lakshamana has been characterized for nutritional traits (acidity and sugars) and total acidity and total sugar was found to be 20% and 29.78%, respectively. It was also profiled for sugar through liquid chromatography with tandem mass spectrometry (LC-MS/MS) and organic acid by high-performance liquid chromatography (HPLC). Glucose and fructose are the major sugars and account for 96.8% of the total sugar content. Beside that small amount (<1%) of mannose, ribose, arabinose, rhamnose, myo-inositol, sucrose and maltose were also found. Among organic acid tartaric acid content was highest (18.61%). Although tartaric acid occurs in other sour fruits, but tamarind fruits are reported to be the richest natural source of tartaric acid. Tamarind is known to be simultaneously the most acidic fruit with the sweetest taste because of presence of high levels of reducing sugars (glucose and fructose) and tartaric acid. Combination of organic acid and reducing sugar gives sweet-sour taste to this fruit.

Table 2. Sugar and organic acid profile of Lakshamana

S. No	Nutritional trait	Lakshamana (g/100 g)
i	Glucose	20.53
ii	Fructose	10.64
iii	Mannose	0.66
iv	Ribose	0.06
v	Arabinose	0.05
vi	Rhamnose	0.02
vii	*myo*-Inositol	0.06
viii	Sucrose	0.004
ix	Maltose	0.006
x	Tartaric acid	18.61
xi	Malic acid	2.88

Harvesting and processing of Lakshamana pods starts from February and lasts up to mid-June. The tree has drooping architecture which makes harvesting easy. The pods fall down on own or the branches are shaken with help of long poles or a person climbs and shakes the branch to break free the pods. The pods are collected and left out to dry in sun for a few days. Processing which involves breaking the shell and removing seeds is carried out to secure better market value. One person can process 15-20 kg pods per day and earn around ₹ 400/day. The whole family of Shri Laxmannappa gets involved during this period for processing thus employment is generated.

View of tamarind Pods, pulp and seed

After the shell is removed, the pulp is inverted to discard the seeds. It is stacked in ring shape in bamboo basket with capacity of 50 kg. Each basket fetches ₹ 1500. The seed is also sold at rate of ₹ 17/kg and the shell chips at ₹ 2.50/kg. The seeds of "Lakshamana" tamarind are bold type and 1 quintal of pulp produces approximately 40 kg seeds. Thus, primary processing and value addition activities have potential of improving livelihood. Collective marketing and little primary processing can significantly improve family income from this accession.

In recent decades, scientific and economic interest has emerged to promote and commercialize the tamarind products. The primary reason for this is that the crop is well suited for the backyard, dry and waste land farming. Hence, identification of this potential accession besides increasing the area and production could also address the issue of sustainability as the crop is climate resilient and profitable. Further, it also contributes towards rural livelihood security and employment for women when there is less agricultural activity. There exists ample scope for area expansion under tamarind with superior fruit types all over India.

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