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P Venkataravana
Dean (Seri), College of Sericulture, Chintamani, Karnataka, India

Sivappa
Assistant Professor, College of Sericulture, Chintamani, Karnataka, India

Mahesh M
Assistant Professor, College of Sericulture, Chintamani, Karnataka, India

Priyadarshini SK
Assistant Professor, College of Sericulture, Chintamani, Karnataka, India

Corresponding Author:
P Venkataravana
Dean (Seri), College of Sericulture, Chintamani, Karnataka, India

GKVK-17: A new high yielding variety of Tamarind (*Tamarindus indica* L.) for Southern region of Karnataka

P Venkataravana, Sivappa, Mahesh M and Priyadarshini SK

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Abstract
Tamarind (*Tamarindus indica* L.) is an important fruit tree of tropics. It is originated in Madagascar and it finds extensive area under cultivation in India. It's a multipurpose tree, almost all the parts are used for medicinal or nutritional purpose. It's mainly valued for its fruit pulp. Leaves and flowers at tender stage are used as vegetables. Tamarind has high food value. Tamarind is cross pollinated and plants produced through seeds show high amount of heterozygosity. Thus in the present study 17 clones of Tamarind were evaluated for their yield performance over 11 years (from 2003-04 to 2013-14) and compared with check variety GKVK 6. Among the seventeen clones evaluated, The clone GKVK-17 showed superior performance consistently by recording cumulative yield of 1109 kg/tree with average yield of 100.81 kg/tree over the years followed by H-15 and H12 which recorded cumulative yield of 624 kg/tree and 584 kg/tree respectively and average yield of 56.72 kg/tree when compared to the standard check clone GKVK 6 which recorded cumulative yield of 383 kg/tree and 53.09 kg/tree average yield of 34.81 kg/tree.

Keywords: Tamarind, elite clone, GKVK – 17 and South Karnataka

Introduction
Tamarind, *Tamarindus indica* L. is one of an economically important but little studied tropical fruit tree. The seeds in its indehiscent pods are enveloped by dark brown pulp with a pleasantly sweet and acid flavour, much appreciated in condiments. Tamarind is belived to be native of Tropical Africa but now cultivated throughout South East Asia, Australia and America. In India, it is mostly grown under rainfed conditions, particularly in Karnataka, Tamil Nadu, Maharashtra, Andhra Pradesh, Madhya Pradesh and Orissa. It is also one of the most popular avenue trees which yield useful fruits and timber besides providing shade. India produces about 2.5 lakh tonnes of Tamarind pulp annually and its Pulp powder, juice concentrates have an export potential in European countries. Tamarind fruit is an important for condiments which is used as an acidic or flavouring agent in the Indian cookery. Tamarind pulp has an excellent keeping quality when dried properly with salt. Pulp is rich in glucose (47.7% of total sugar), D-manose (24.5%) and D-maltose (20.4%). The sour taste of the pulp is attributed to Tartaric acid (8-18%) together with malic and citric acids (2%). The fruit is good source of phosphorus, calcium and iron. (Lumen *et al*., 1986 [6]; Mateo *et al*., 1992 [7]; Bhattacharya *et al*., 1994 [2] and Grant *et al*., 1995 [5]. Tender leaves and flowers are also edible. Tamarind seeds yield a cheap substitute for cereal starch which finds its application in textile industry.
Tamarind tree has an acid climatic adaptability and can be grown in humid to dry hot regions. It is very sensitive to frost. The optimum rainfall requirement is 750-1900mm, but can thrive in region with low annual rainfall of 500-750mm. It can thrive on variety of soils but deep loamy or alluvial soils providing optimum condition for development of its long tap roots are ideal. It can tolerate slightly saline and alkaline soils. There are very few well recognized tamarind varieties. However, in the recent past few seedling selections have been identified on the basis of fruit quality and yield. Prathisthan is from Fruit Research Station, Aurangabad and PKM- 1 has been developed by Tamil Nadu Agricultural University, Coimbatore. In this regard an investigation was carried out to select a high yielding clone collected from GKVK and Hoskote plantations of Karnataka.

Material and Methods

An experiment was conducted to develop high yielding Tamarind clone through clonal selection method at Agricultural Research Station, Chintamani. Totally 17 tamarind clones which were selected from Hosakote (9 clones *viz.*, H-1, H-4, H-5, H-9, H-10, H-12, H-13, H-14 and H-15), 8 clones from GKVK (GKVK-1, GKVK-5, GKVK-7, GKVK-10, GKVK-11, GKVK-14, GKVK-15 and GKVK-17) along with existing standard check GKVK-6 were planted during 1995-96 with a planting distance of about 8x8 to 10x10m and pit size of 1x1x1m. Observations on different yield attributing traits were recorded from 2003-04 up to 2013-14. All agronomic practices were followed as per package of practices. These clones were evaluated for their yield performance over 11 years under rainfed conditions. In addition, other yield attributing characters *viz.*, pod weight (g), Pod length (cm), Pod width (cm), pulp weight (g), seed weight (g), pulp to seed ratio and average fruit yield were recorded on elite clones consecutively for eleven years along with physic chemical traits such as ascorbic acid and tartaric acid content in each clonal selection.

Results and Discussions

Yield data of seventeen tamarind clones were recorded along with standard check GKVK-6 at ARS, Chintamani under rainfed conditions as described in materials and methods. The cumulative yield data and average yield data on different clones are presented in Table-1. The clones selected from Hosakote and GKVK exhibited varied degrees of performance with respect to cumulative yield (119 to 1109 kg/tree) and average yield (18.09 to 100.81kg/tree). Among seventeen clones evaluated, the promising clone GKVK -17 recorded the highest cumulative yield of 1109 kg/tree and average yield of 100.81 kg/tree followed by H-15 and H-12 from Hosakote selections which recorded cumulative yield of 624 kg/tree and 554 kg/tree respectively, with average yield of 56.72 kg/tree and 53.09 kg/tree respectively. However the standard check the clone GKVK-6 recorded cumulative yield of 383 kg/tree and average yield of 34.81 kg/tree, the least cumulative yield of 119 kg/tree and average yield of 18.09 kg/tree has recorded in the clone H-5 of Hosakote selection. Based on these results GKVK -17 is considered as the elite high yielding clone which recorded superior and consistent yield over the years. Similarly Tania *et al.* (2018) [13] and Pooja *et al.* (2018) [11] were also evaluated tamarind varieties for their growth, flowering, fruit bearing and yield parameters.

The physico morphological characters of elite tamarind clones were evaluated and presented in Table-2 and Plate-1. The promising and elite clone GKVK-17 showed slight brown colour pulp with sickle shaped pods and fruit bearing habit was medium with an umbrella type of tree canopy compared to standard check GKVK-6 which showed reddish brown colour pulp with slightly flat shaped pods and low fruit bearing habit and cone type of tree canopy.

Plate 1: Promising elite clone GKVK-17 with heavy fruit bearing habit and an umbrella type of tree canopy.

The yield attributing characters of elite tamarind clones are presented in Table-3 and plate 2. Among the two clones evaluated for yield attributing characters, GKVK-17 recorded superior pod weight of 30.56g with pod length and width of about 21.70 x 9.95 cm, having dark brown colour pulp with 8.60 g weight, in addition it also recorded 7.18g of seed weight with 119 pulp to seed ratio compared to the standard check GKVK-6 which recorded lesser pod weight of 19.4g, pod length and pod width of 15.3 x 8.2 cm, having dark brown colour pulp with 6.89g pulp weight, seed weight of 6.80g and pulp to seed ratio of 101. These results are confirmative with findings of Divakara (2008) [4], Algabal *et al.* (2012) [1], Singh and Nandini (2014) [12], Bhogave *et al.* (2018) [3] and Mayavel *et al.* (2018) [8]. Similar results were reported by Nandini *et al.* (2011) [9], they also observed that tamarind, had some variations on length of pod, weight of pod, width of pod, weight of pulp, weight of seed and number of seed. The analysis was also similar to Okello (2010) [10] who reported that there were significant differences on breadth of pod, mass of pod, total seed number and total seed mass to among varieties on tamarind in Uganda.

Plate 2: showing promising elite clone GKVK-17 bearing sickle shaped fruit with dark brown colour pulp

The physiochemical properties such as ascorbic acid and tartaric acid content were also measured, the elite clone GKVK 17 recorded 6.0 mg of ascorbic acid /100g of pulp and 7.67mg of tartaric acid /100gm of pulp (Table-4). Similar results were reported by Mayavel *et al.* (2018) [8].

Table 1: Performance of different Tamarind clones (kg/tree) over the years

Sl. No.	Clone	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	Cumulative yield (kg/tree)	Average yield (kg/tree)
1	H-1	16	18	24	26	56	7.5	42	25	55	12	55	336	30.54
2	H-4	53	60	90	45	20	70	48	20	30	3	30	469	42.63
3	H-5	11	15	23	10	21	8	51	5	50	-	05	199	18.09
4	H-9	26	38	30	30	9	8	38	18	10	2	12	221	20.09
5	H-10	21	41	85	11	22	6	40	13	50	5	79	373	33.90
6	H-12	51	60	15	159	-	149	-	35	15	35	65	584	53.09
7	H-13	58	41	100	55	38	48	35	15	5	15	30	440	40.00
8	H-14	26	60	111	50	46	71	-	42	45	36	63	550	50.00
9	H-15	61	79	88	28	112	76	95	25	40	5	15	624	56.72
10	GKVK-1	8	18	45	8	15	-	30	35	35	10	91	295	26.81
11	GKVK-5	20	31	18	5	15	29	57	15	9	5	45	249	22.63
12	GKVK-7	18	51	64	5	22	18	-	15	10	6	-	209	19.00
13	GKVK-10	12	60	78	4	47	27	50	34	35	-	74	421	38.27
14	GKVK-11	6	30	55	30	32	27	-	48	90	16	65	399	36.27
15	GKVK-14	4	16	28	31	20	46	29	12	10	1	09	206	18.72
16	GKVK-15	5	16	33	19	15	91	70	25	17	48	65	404	36.72
17	GKVK-17	68	45	80	28	60	99	62	80	280	74	233	1109	100.81
18	GKVK-6 (Check)	40	35	23	22	40	14	46	42	12	35	74	383	34.81

Table 2: Characterization of different tamarind clones at ARS Chintamani

Sl. No.	Characteristics	GKVK-17	GKVK-6 (Check)
1	Colour of the pulp	Light Brown	Reddish brown
2	Pod shape	Sickle	Slightly Flat
3	Bearing habit	Medium	Low
4	Tree type	Umbrella	Cone

Table 3: Comparison of yield attributing characters of elite Tamarind clones

Clone / Selection	Pod weight (g)	Pod length (cm)	Pod width (cm)	Pulp weight (g)	Seed weight (g)	Pulp to Seed ratio
GKVK-17	30.56	21.70	9.95	8.60	7.18	119
GKVK-6 (Check)	19.4	15.3	8.2	6.89	6.80	101

Table 4: Physico – chemical characteristics of elite tamarind clone GKVK-17

Sl. No.	Chemical character	Quantity
1	Ascorbic acid content	6.0 mg/ 100g
2	Tartaric acid content	7.67 mg/100g

Conclusion

From the present study, it is concluded that, different degrees of variation observed among the genotypes with respect to yield and physico chemical parameters studied. However, the elite clone GKVK 17 has performed consistently by regular fruit bearing habit with umbrella type tree canopy combined with good yield attributing characters compared to standard check GKVK-6. Hence elite clone GKVK-17 has been recommended for the Southern regions of Karnataka based on its performance and regular bearing habit.

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