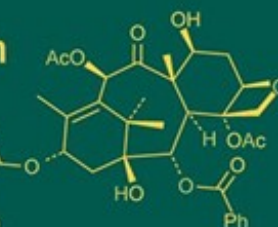
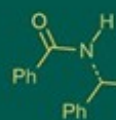


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Varsha Minz

Ph.D. Scholar, Department of
Fruit Science, College of
Agriculture, IGKV, Raipur
(C.G.) 492012, India

H. K. Panigrahi

Associate Professor,
Department of Fruit Science,
College of Agriculture, IGKV,
Raipur (C.G.) 492012, India

Prabhakar Singh

Professor, Department of Fruit
Science, College of
Agriculture, IGKV, Raipur
(C.G.) 492012, India

Nandan Mehta

Principal Scientist,
Department of Genetics and
Plant Breeding, College of
Agriculture, IGKV, Raipur
(C.G.) 492012, India

Study of variability in pod characteristics of indigenous tamarind (*Tamarindus indica* L.) genotypes

Varsha Minz¹, H. K. Panigrahi², Prabhakar Singh³, Nandan Mehta⁴

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ABSTRACT

A total of 42 indigenous tamarind (*Tamarindus indica* L.) genotypes were thoroughly assessed across various villages in seven blocks of Surguja district of Chhattisgarh, during the year 2022–23 and 2023–24. The objective of the study was to determine the degree of variation present in pod characters among the genotypes, in order to identify elite accessions worth pursuing for improvement and conservation program. A Randomized Block Design (RBD) comprising four replications was used for the study and the resulting data were subsequently analysed. Results revealed that STAM-9 recorded the highest mature pod weight (32.88 g), mature pod length (16.85 cm) and pulp weight per pod (16.86 g), reflecting its superiority for improving overall pod yield. The widest pod was recorded in STAM-40 (2.84 cm), whereas STAM-15 exhibited the maximum pod thickness (1.8 cm). Minimum shell weight per pod (1.41 g) was noted in STAM-1, and the lowest fibre weight per pod (0.18 g) was recorded in STAM-26.

Keywords: Tamarind, Pod, Variability, Genotypes

RESEARCH PAPER**Introduction**

Tamarindus indica L. commonly known as tamarind, is a slow-growing, multipurpose, evergreen, tropical tree species, widely distributed across the tropical and subtropical regions of the world. Tamarind is a hardy monotypic tree which belongs to the family Leguminosae and has chromosome number, $2n = 24$ (Pursglove, 1981). The word 'tamarind' is believed to have originated from the Arabic phrase "*Tamar-e-Hind*" meaning "Date of India" (Morton, 1987; Mishra, 1997) [2, 1]. Tamarind is native to the tropical regions of Africa, with its natural distribution extending from Sudan, Ethiopia, Kenya, and Tanzania in the east, across the sub-Saharan belt, to Senegal in the west (Brandis, 1921; Ridley, 1922; Dalziel, 1937; Irvine, 1961) [3, 4, 5, 6]. Tamarind cultivation in India is predominantly concentrated in the states of Tamil Nadu, Andhra Pradesh, Kerala, Chhattisgarh, and Madhya Pradesh. Tamarind demonstrates a high degree of adaptability to diverse soil conditions. In India, it exhibits considerable tolerance to sodic and saline soils and also plays a role in controlling soil erosion (Das et al., 2001) [7]. In most countries where tamarind is cultivated, the harvesting season generally spans February to April, with occasional extension up to June. The fruit takes the form of a pod, 5–16 cm long and about 2 cm broad, oblong in shape, curved or straight and rounded at the ends. It is enclosed by a light grey or brown, scaly epicarp, within which lies a firm but soft, thick, reddish-brown pulp. The pulp is traversed by seed cavities containing the seeds and comprises tough, branched fibres running along its outer surface from base to apex. The seed consists of two main components, the seed coat and the kernel (George et al., 1993) [8]. Among the various parts of the tamarind tree, the fruit pulp holds the greatest economic value, finding wide application in domestic and industrial food processing as well as in medicinal use. The ripe pulp, especially of the sweet-type tamarind, is commonly eaten in its fresh form, whereas both sour and sweet pulps serve as key ingredients in numerous processed products such as desserts, pickles, jams, candies, juices, porridges and drinks (Jayaweera, 1981) [9].

Despite being an economically significant tree crop of India, tamarind has received relatively limited research attention aimed at its scientific understanding and improvement as a commercial crop. At present, tamarind is cultivated across the country, with the majority of trees being of seedling origin. Being a highly cross-pollinated and seed-propagated species, tamarind exhibits considerable variation within its populations. Individual trees frequently display marked genetic diversity even within the same population, underscoring the heterogeneous nature of the crop (Rajamanickam, 2020) [10]. The extensive variation evident in characters such as foliage, flowering, pod production and timber quality indicates considerable potential for genetic improvement of the crop. Such improvement is fundamental to increasing the productivity and yield of tamarind and involves developing genotypes that combine desirable traits, including growth habit, high yield potential and resistance or tolerance to major pests, diseases and drought stress (Radhamani et al., 1998) [11]. This variability may arise from genetic causes, environmental factors, or a combination of both.

Corresponding Author:
Varsha Minz

Ph.D. Scholar, Department
of Fruit Science, College of
Agriculture, IGKV, Raipur
(C.G.) 492012, India

Estimating the level of variability for each trait, in quantitative terms, helps in understanding the potential of a given tree and the feasibility of improving desirable and economically valuable characters through selection. Insights into the nature and extent of variation, together with the association between different traits and yield, are useful tools for identifying and selecting superior tamarind genotypes.

Materials and methods

The present investigation comprised 42 tamarind (*Tamarindus indica* L.) genotypes procured from seven blocks of Surguja district, Chhattisgarh, namely Ambikapur, Batauli, Lakhanpur, Udaipur, Lundra, Mainpat and Sitapur. Geographically, Surguja district is situated in the northern part of Chhattisgarh between 22°19' N to 24°06' N latitude and 81°34' E to 84°4' E longitude, at a mean altitude of 623 m above mean sea level. Genotypes exhibiting distinct morphological variation and fruiting characteristics were purposively selected for evaluation. The experiment was laid out in a Randomized Block Design (RBD) with four replications. Characterization of the genotypes was carried out following the standard descriptors developed by the Central Horticultural Experiment Station (CHES), ICAR-IIHR, Godhra (2017). Fruits were sampled randomly from each genotype and subsequent laboratory analyses were performed at the Horticulture Processing Laboratory, Department of Fruit Science, College of Agriculture, IGKV, Raipur, Chhattisgarh.

Result and discussion

Variability in pod characteristics

Mature pod length (cm)

Significant variations were found between the tamarind genotypes marked in the current study based on observations of mature pod length (cm), which are compiled in Table 1 and visually depicted in Fig. 1.

In the first year of the study, it was enumerated that the mature pod length of tamarind genotypes ranged from 3.65 cm (STAM-26) to 16.63 (STAM-9). The genotypes STAM-26 & STAM-20 and STAM-34, STAM-30 & STAM-36 and STAM-32 & STAM-38 and STAM-18, STAM-41, STAM-17 & STAM-27 and STAM-22, STAM-15 & STAM-4 and STAM-3 & STAM-10 and having the respective fruit length of 3.65 & 3.69 and 4.83, 4.95 & 4.97 and 5.31 & 5.58 and 5.83, 5.8, 6.11 & 6.13 and 7.27, 7.32 & 7.52 and 8.16 & 8.29 cm were found statistically *at par* with each other under the present experiment. Whereas, the genotypes STAM-35, STAM-33, STAM-40, STAM-14 & STAM-9 with the respective mature pod length of 4.35, 9.58, 12.69, 14.58 & 16.63 cm were found significant differences among each other at 5% level of significance under the present trial.

The mature pod length of the tamarind genotypes differed from 3.27 cm (STAM-26) to 17.06 cm (STAM-9) during the second year of the study. According to the results of the present experiment, the genotypes STAM-26 & STAM-20 and STAM-34, STAM-30, STAM-36, STAM-32 & STAM-35 and STAM-38, STAM-41 & STAM-18 and STAM-22, STAM-17 & STAM-27 and STAM-15, STAM-6, STAM-4 & STAM-19 and STAM-16, STAM-10 & STAM-24 had fruit length of 3.27 & 3.59 and 4.29, 4.39, 4.59, 4.91 & 4.91 and 5.16, 5.36 & 5.61 and 6.19, 6.31 & 6.63 and 7.04, 7.13, 7.22 & 7.37 and 7.94, 7.95 & 8.07 and cm was found statically equivalent to each other at 5% level of significance.

In pooled analysis, significant variations were verified under the different genotypes tested under the present investigation. The maximum mature pod length (16.85 cm) was recorded under the genotype STAM-9, which was found significantly superior from rest of the other genotypes. Moreover, the genotypes STAM-26 & STAM-20 and STAM-34, STAM-35, STAM-30, STAM-36 & STAM-32 and STAM-38, STAM-41 & STAM-18 and STAM-17, STAM-27 & STAM-22 and STAM-15 & STAM-4 and STAM-19, STAM-6, STAM-10, STAM-16, STAM-3 STAM-24 & STAM-39 having mature pod length of 3.46 & 3.64 and 4.56, 4.63, 4.67, 4.78 & 5.11 and 5.37, 5.58

& 5.72 and 6.21, 6.38 & 6.73 and 7.18 & 7.37 and 7.84, 7.92, 8.12, 8.27, 8.33, 8.41 & 8.42 cm showed non-significant differences to each other. However, the genotypes STAM-34, STAM-17, STAM-19, STAM-5, STAM-2, STAM-40, STAM-37 & STAM-9 having the respective mature pod length of 4.56, 6.21, 7.84, 8.93, 10.45, 11.97, 14.38 & 16.85 cm was observed significant differences among each other under the present investigation. Whereas, the minimum mature pod length (3.46 cm) was registered under the genotype STAM-26.

It is evident from the result obtained under the present investigation that the various genotypes showed variation with respect to mature pod length of tamarind. Among the various genotypes, the maximum mature pod length (16.85 cm) was measured under the genotypes STAM-9, while the minimum mature pod length (3.46 cm) was recorded by STAM-26 in pooled analysis under present investigation. Diversity in mature pod length in tamarind genotypes might be due to genetic factor which govern fruit development and efficiency of nutrient translocation during pod formation. Such kinds of differences in fruit length reported by Shukla (2006) [12], Praveenakumar *et al.* (2020) [13] and Mishra (2021) [14] in tamarind genotypes.

2. Mature pod width (cm)

Significant variations were found between the tamarind genotypes observed in the current study based on observations of mature pod width (cm), which are compiled in Table 1 and visually depicted in Fig. 2.

Throughout the first year of the study, it was registered that the mature pod width of tamarind genotypes ranged from 1.9 cm (STAM-15) to 2.85 cm (STAM-40). The genotypes STAM-19, STAM-32, STAM-31 & STAM-36 and STAM-20, STAM-1, STAM-28, STAM-8, STAM-42 & STAM-26 and STAM-11 & STAM-38 and STAM-39, STAM-3, STAM-34, STAM-10 & STAM-25 and having the respective mature pod width of 2.14, 2.15, 2.16 & 2.17 and 2.19, 2.23, 2.23, 2.24, 2.26 & 2.27 and 2.33 & 2.33 and 2.34, 2.35, 2.35, 2.36 & 2.36 cm were found statistically *at par* with each other under the present experiment.

The mature pod width of the tamarind genotypes differed from 1.86 cm (STAM-15) to 2.83 cm (STAM-40) during the second year of the study. According to the results of the present experiment, the genotypes STAM-19 & STAM-32 and STAM-20, STAM-28, STAM-8, STAM-42, STAM-1, STAM-26, STAM-31 & STAM-36 and STAM-11, STAM-38, STAM-39, STAM-34, STAM-25, STAM-6 & STAM-29 had mature pod width of 2.11 & 2.13 and 2.21, 2.21, 2.22, 2.24, 2.25, 2.25, 2.2 & 2.2 and 2.31, 2.31, 2.32, 2.33, 2.34, 2.35 & 2.35 cm was found statically equivalent to each other at 5% level of significance.

In pooled analysis, significant dissimilarities were verified under the different genotypes tested under the present investigation. The maximum mature pod width (2.84 cm) was recorded under the genotype STAM-40, which was *at par* STAM-16 (2.81 cm). Moreover, the genotypes STAM-19, STAM-32 & STAM-31 and STAM-36 & STAM-20 & STAM-31 and STAM-28, STAM-8 & STAM-1 and STAM-42 & STAM-26 and STAM-11, STAM-38 & STAM-39 and STAM-34, STAM-25, STAM-3, STAM-6, STAM-29, STAM-2, STAM-10 & STAM-18 and having mature pod width of 2.14 & 2.14 and 2.19, 2.20 & 2.20 and 2.22, 2.23, 2.24, 2.25 & 2.26 and 2.32, 2.32 & 2.33 and 2.34, 2.35, 2.36, 2.36, 2.36, 2.37, 2.37 & 2.37 cm showed non-significant differences to each other. Whereas, the minimum mature pod width (1.88 cm) was registered under the genotype STAM-15.

It is evident from the result obtained under the present investigation that the various genotypes showed variation with respect to mature pod width of tamarind fruits. Among the various genotypes, the maximum mature pod width (2.84 cm) was measured under the genotypes STAM-40, while the minimum mature pod width (1.88 cm) was recorded by STAM-15 in pooled analysis under present investigation. The difference in pod width among the genotypes might be due to genetic factors controlling fruit shape and fruit development. Differences in cell division and expansion during pod growth also contributes to pod width variation. The results are in close agreements

with the findings of Biradar (2001) [15], Prabhushankar (2001) [16] and Mishra (2021) [14] in tamarind genotypes.

3. Thickness of pod (cm)

The observations regarding thickness of pod (cm) of tamarind genotypes showed significant differences among the different genotypes observed under present investigation, which are summarized in Table 1 and graphically shown in Fig. 3. During the first year of research, it was noticed that the

During the first year of research, it was noticed that the thickness of pod of tamarind genotypes ranged from 1 cm (STAM-42) to 1.8 cm (STAM-15). The genotypes STAM-30 & STAM-33 and STAM-1, STAM-6, STAM-21, STAM-28 & STAM-41 and STAM-18, STAM-25, STAM-26 & STAM-39, STAM-3, STAM-17 & STAM-22 and STAM-2, STAM-5, STAM-9, STAM-23, STAM-27 & STAM-8 having the respective thickness of pod of 1.22 & 1.25 and 1.34, 1.34, 1.35, 1.36 & 1.36 and 1.38, 1.38, 1.39, 1.39, 1.40, 1.40 & 1.41, 1.42, 1.42, 1.42, 1.42 & 1.43 cm were found statistically *at par* with each other under the present investigation.

The thickness of pod of the tamarind genotypes varied from 0.94 cm (STAM-42) to 1.8 cm (STAM-15) during the second year of the study. Conferring to the results of the recent experiment, the genotypes STAM-42 & STAM-30 and STAM-28 & STAM-21 and STAM-1, STAM-3, STAM-6, STAM-18, STAM-26 & STAM-39 and STAM-2, STAM-9, STAM-17, STAM-27, STAM-41 & STAM-22 and had thickness of pod of 0.94 & 0.96 and 1.32 & 1.33 and 1.36, 1.36, 1.36, 1.36, 1.37 & 1.37 and 1.38, 1.38, 1.38, 1.38, 1.38 & 1.39 cm was found statically equivalent among each other at 5% level of significance.

In pooled analysis, significant variations were recorded under the different genotypes tested under the present investigation. The maximum

thickness of pod (1.8 cm) was recorded under the genotype STAM-15, which was found statistically superior from all the other genotypes. Moreover, the genotypes STAM-21, STAM-28, STAM-1, STAM-6, STAM-18, STAM-41, STAM-3, STAM-26 & STAM-39 and STAM-17, STAM-25, STAM-2, STAM-9, STAM-22 & STAM-27, STAM-5, STAM-23, STAM-8 & STAM-14 having shell thickness of 1.34, 1.34, 1.35, 1.35, 1.37, 1.37, 1.38, 1.38 & 1.38 and 1.39, 1.39, 1.4, 1.4, 1.4, 1.4, 1.41, 1.41, 1.42 & 1.44 cm showed non-significant differences to each other at 5% level of significance. Additionally, the genotypes STAM-42, STAM-30, STAM-33, STAM-37, STAM-29 & STAM-15 having the respective thickness of pod of 0.98, 1.08, 1.25, 1.62, 1.64 & 1.66 cm was found significant differences between each other under the present exploration. Whereas, the minimum thickness of pod (0.97 cm) was registered under the genotype STAM-42.

As per the data obtained in Table 1, it can be concluded that various genotypes showed variation with respect to thickness of pod of tamarind fruits. Among the various genotypes, the maximum thickness of pod (1.8 cm) was measured under the genotypes STAM-15, while the minimum thickness of pod (0.97 cm) was recorded by STAM-42 in pooled analysis under present investigation.

Variation in the thickness of pod in tamarind genotypes might be due to the genetic factors influencing pod wall development and lignification. Pod thickness depends on the degree of cell wall expansion and hardening during the fruit maturation phase. Environmental factors such as soil nutrient levels and water availability also affect pod formation and pod thickness. Such kinds of differences in thickness of pod seems to be associated with the results as reported by Algabal (2012) [17] and Bhogave (2018) [18] in tamarind genotypes.

Conti...

Table 1. Variability in mature pod length (cm), mature pod width (cm) and thickness of pod (cm) of tamarind genotypes

Genotypes	Mature pod length (cm)			Mature pod width (cm)			Thickness of pod (cm)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
STAM-1	8.94 ^l	8.58 ^{ij}	8.76 ^{ij}	2.23 ^{nop}	2.25 ^q	2.24 ^{rs}	1.34 ^o	1.36 ^{nop}	1.35 ^{tu}
STAM-2	10.66 ^h	10.24 ^{ef}	10.45 ^f	2.38 ^{ijk}	2.36 ^{klmnop}	2.37 ^{mnopq}	1.42 ^{ijkl}	1.38 ^{mno}	1.4 ^{qrst}
STAM-3	8.16 ⁿ	8.5 ^{ijk}	8.33 ^{ijkl}	2.35 ^{ijkl}	2.37 ^{klmno}	2.36 ^{nopq}	1.4 ^{klmn}	1.36 ^{nop}	1.38 ^{stu}
STAM-4	7.52 ^o	7.22 ^l	7.37 ^m	2.43 ^{ghij}	2.41 ^{ijk}	2.42 ^{klm}	1.47 ^{fghi}	1.49 ^{efgh}	1.48 ^{klm}
STAM-5	8.89 ^l	8.97 ^{hi}	8.93 ⁱ	2.39 ^{ijk}	2.41 ^{ijk}	2.4 ^{klmno}	1.42 ^{ijkl}	1.4 ^{klmn}	1.41 ^{pqrs}
STAM-6	8.71 ^{lm}	7.13 ^{lm}	7.92 ^{kl}	2.37 ^{ijk}	2.35 ^{lmnop}	2.36 ^{nopq}	1.34 ^o	1.36 ^{nop}	1.35 ^{tu}
STAM-7	15.76 ^b	14.02 ^{bc}	14.89 ^b	2.43 ^{ghij}	2.41 ^{ijk}	2.42 ^{klm}	1.61 ^b	1.57 ^d	1.59 ^{efg}
STAM-8	11.1 ^{fg}	10.24 ^{ef}	10.67 ^{ef}	2.24 ^{no}	2.22 ^q	2.23 ^{rs}	1.43 ^{ijkl}	1.41 ^{klmn}	1.42 ^{nopqrs}
STAM-9	16.63 ^a	17.06 ^a	16.85 ^a	2.61 ^{de}	2.57 ^{de}	2.59 ^{ef}	1.42 ^{ijkl}	1.38 ^{mno}	1.4 ^{qrst}
STAM-10	8.29 ^{mn}	7.95 ^k	8.12 ^{kl}	2.36 ^{jk}	2.38 ^{klmn}	2.37 ^{mnopq}	1.64 ^b	1.78 ^d	1.71 ^b
STAM-11	11.52 ^f	10.64 ^e	11.08 ^e	2.33 ^{klm}	2.31 ^p	2.32 ^q	1.46 ^{ghij}	1.48 ^{fghij}	1.47 ^{ijklmn}
STAM-12	10.96 ^{gh}	10.54 ^e	10.75 ^{ef}	2.79 ^{bc}	2.7 ^b	2.75 ^b	1.51 ^{cdefg}	1.49 ^{efghi}	1.5 ^{ijkl}
STAM-13	10.23 ⁱ	9.45 ^{gh}	9.84 ^g	2.74 ^{ab}	2.58 ^d	2.66 ^{bc}	1.47 ^{fghi}	1.45 ^{ghijk}	1.46 ^{klmnop}
STAM-14	14.58 ^d	14 ^b	14.29 ^c	2.63 ^{de}	2.67 ^{bc}	2.65 ^{cd}	1.45 ^{hijk}	1.43 ^{ijklm}	1.44 ^{mnopqr}
STAM-15	7.32 ^o	7.04 ^{lm}	7.18 ^{mn}	1.9 ^r	1.86 ^s	1.88 ^v	1.8 ^a	1.8 ^a	1.8 ^a
STAM-16	8.6 ^{lmn}	7.94 ^k	8.27 ^{ijkl}	2.8 ^{ab}	2.81 ^a	2.81 ^a	1.56 ^c	1.58 ^d	1.57 ^{fg}
STAM-17	6.11 ^p	6.31 ⁿ	6.21 ^p	2.43 ^{ghij}	2.45 ^{hi}	2.44 ^{ijkl}	1.4 ^{klmn}	1.38 ^{mno}	1.39 ^{rstu}
STAM-18	5.83 ^{pq}	5.61 ^o	5.72 ^q	2.38 ^{ijk}	2.36 ^{klmnop}	2.37 ^{mnopq}	1.38 ^{lmno}	1.36 ^{nop}	1.37 ^{stu}
STAM-19	8.31 ^{mn}	7.37 ^l	7.84 ^l	2.14 ^q	2.11 ^r	2.14 ^u	1.51 ^{cdefg}	1.49 ^{efgh}	1.5 ^{ijkl}
STAM-20	3.69 ^v	3.59 ^t	3.64 ^u	2.19 ^{nopq}	2.21 ^q	2.2 st	1.53 ^{cde}	1.51 ^{ef}	1.52 ^{hij}
STAM-21	15.86 ^b	14.05 ^b	14.96 ^b	2.49 ^{fgh}	2.47 ^{gh}	2.48 ^{ij}	1.35 ^{no}	1.33 ^{op}	1.34 ^u
STAM-22	7.27 ^o	6.19 ⁿ	6.73 ^{no}	2.57 ^{ef}	2.53 ^{ef}	2.55 ^{fg}	1.41 ^{ijklm}	1.39 ^{lmn}	1.4 ^{qrst}
STAM-23	10 ^{ij}	8.88 ^{hi}	9.44 ^{gh}	2.5 ^{fg}	2.48 ^{gh}	2.49 ^{hi}	1.42 ^{ijkl}	1.4 ^{klmn}	1.41 ^{pqrs}
STAM-24	8.75 ^{lm}	8.07 ^{jk}	8.41 ^{jk}	2.68 ^{cd}	2.64 ^c	2.66 ^c	1.56 ^c	1.54 ^{de}	1.55 ^{ghi}
STAM-25	16.49 ^a	14.06 ^b	15.28 ^b	2.36 ^{jk}	2.34 ^{mnop}	2.35 ^{opq}	1.38 ^{lmno}	1.4 ^{klmn}	1.39 ^{rstu}
STAM-26	3.65 ^v	3.27 ^t	3.46 ^u	2.27 ^{lmn}	2.25 ^q	2.26 ^r	1.39 ^{lmno}	1.37 ^{nop}	1.38 ^{stu}

(continued on next page)

Genotypes	Mature pod length (cm)			Mature pod width (cm)			Thickness of pod (cm)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
Genotypes	Mature pod length (cm)			Mature pod width (cm)			Thickness of pod (cm)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
STAM-27	6.13 ^p	6.63 ^{mn}	6.38 ^{op}	2.63 ^{de}	2.59 ^d	2.61 ^{de}	1.42 ^{ijkl}	1.38 ^{mno}	1.4 ^{qrst}
STAM-28	9.95 ^{ijk}	8.47 ^{ijk}	9.21 ^{hi}	2.23 ^{nop}	2.21 ^q	2.22 ^{rs}	1.36 ^{mno}	1.32 ^p	1.34 ^u
STAM-29	11.36 ^{fg}	10.48 ^e	10.92 ^{ef}	2.37 ^{ijk}	2.35 ^{lmnop}	2.36 ^{nopq}	1.66 ^b	1.78 ^a	1.72 ^b
STAM-30	4.95 st	4.39 ^{rs}	4.67 st	2.46 ^{ghi}	2.44 ^{hij}	2.45 ^{ijk}	1.22 ^p	0.96 ^r	1.09 ^w
STAM-31	9.54 ^k	9.42 ^{gh}	9.48 ^{gh}	2.16 ^{opq}	2.2 ^q	2.2 st	1.49 ^{efgh}	1.47 ^{fghij}	1.48 ^{klm}
STAM-32	5.31 ^{rs}	4.91 ^{pqr}	5.11 ^{rs}	2.15 ^{pq}	2.13 ^r	2.14 ^u	1.65 ^b	1.63 ^{bc}	1.64 ^{cd}
STAM-33	9.58 ^{jk}	9.72 ^{fg}	9.65 ^{gh}	2.42 ^{ghijk}	2.4 ^{ijkl}	2.41 ^{klmn}	1.25 ^p	1.27 ^q	1.26 ^v
STAM-34	4.83 ^t	4.29 ^s	4.56 ^t	2.35 ^{ijkl}	2.33 ^{nop}	2.34 ^{pq}	1.52 ^{cdef}	1.5 ^{efg}	1.51 ^{ijk}
STAM-35	4.35 ^u	4.91 ^{pqr}	4.63 st	2.4 ^{ijk}	2.38 ^{klmn}	2.39 ^{lmnop}	1.61 ^b	1.59 ^{cd}	1.6 ^{def}
STAM-36	4.97 st	4.59 ^{qrs}	4.78 st	2.17 ^{pq}	2.2 ^q	2.19 st	1.5 ^{defgh}	1.44 ^{hijkl}	1.47 ^{jklmno}
STAM-37	14.96 ^{cd}	13.8 ^{bce}	14.38 ^c	2.55 ^{ef}	2.51 ^{fg}	2.53 ^{gh}	1.65 ^b	1.67 ^b	1.66 ^c
STAM-38	5.58 ^{qr}	5.16 ^{opq}	5.37 ^{qr}	2.33 ^{klm}	2.31 ^p	2.32 ^q	1.55 ^{cd}	1.57 ^d	1.56 ^{fgh}
STAM-39	8.31 ^{mn}	8.53 ^{ijk}	8.42 ^{jk}	2.34 ^{klm}	2.32 ^{op}	2.33 ^q	1.39 ^{lmno}	1.37 ^{nop}	1.38 ^{stu}
STAM-40	12.69 ^e	11.25 ^d	11.97 ^d	2.85 ^a	2.83 ^a	2.84 ^a	1.47 ^{fghi}	1.43 ^{ijklm}	1.45 ^{lmnopq}
STAM-41	5.8 ^{pq}	5.36 ^{op}	5.58 ^{qr}	2.41 ^{hijk}	2.39 ^{ijklm}	2.4 ^{klmno}	1.36 ^{mno}	1.38 ^{mno}	1.37 ^{stu}
STAM-42	15.02 ^c	13.32 ^c	14.17 ^c	2.26 ^{mn}	2.24 ^q	2.25 ^r	1 ^q	0.94 ^r	0.97 ^x
SE (m) ±	0.15	0.19	0.26	0.05	0.06	0.07	0.03	0.03	0.03
CD @ 5%	0.41	0.54	0.6	0.13	0.18	0.19	0.09	0.07	0.07
CV (%)	3.23	4.41	4.51	4.02	5.32	5.52	4.59	3.45	3.41

- (1) The superscript letters signifies that the treatment means with similar letters are at par at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

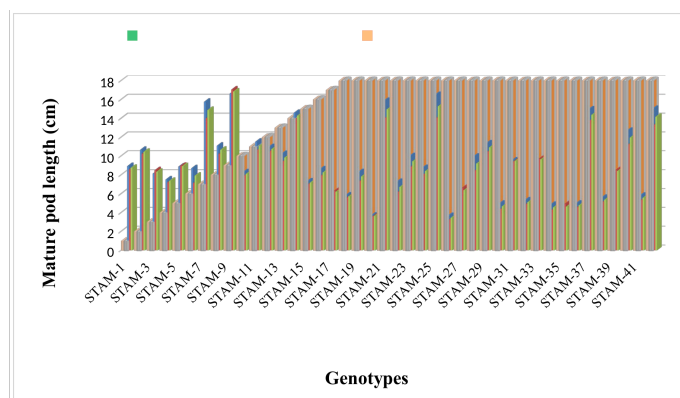


Figure 1. Variability in mature pod length (cm) of tamarind genotypes

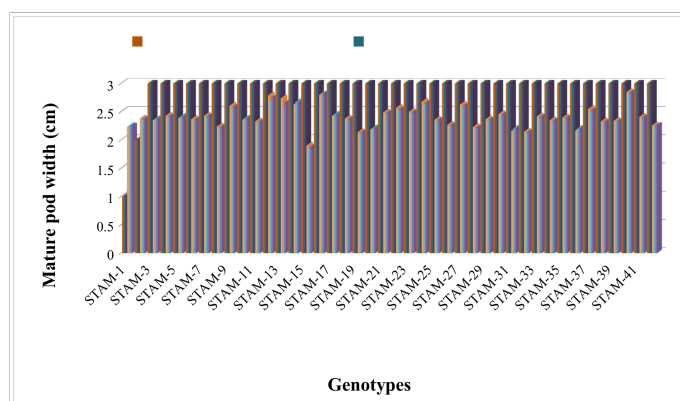


Figure 2. Variability in mature pod width (cm) of different tamarind genotypes

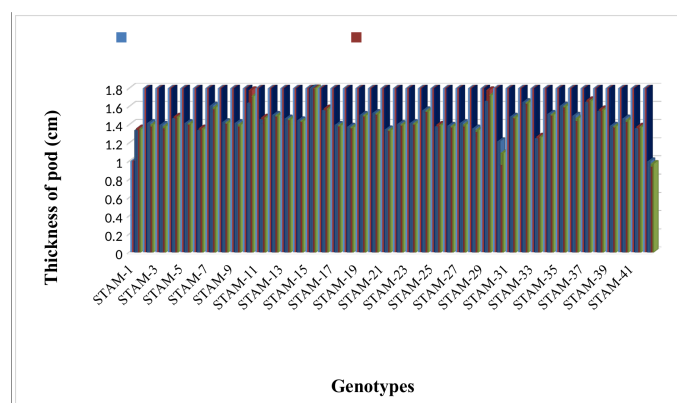


Figure 3. Variability in thickness of pod (cm) of different tamarind genotypes

4. Mature pod weight (g)

The observations regarding mature pod weight (g) of tamarind genotypes showed significant variations among the different genotypes observed under present investigation. The data observed in reference to mature pod weight has enumerated in Table 2 and graphically illustrated in Fig. 4. that the mature po During the first year of research, it was noticed that the mature pod weight of tamarind genotypes ranged from 8.99 g (STAM-26) to 33.47 g (STAM-9). The genotypes STAM-26, STAM-38, STAM-30, STAM-20, STAM-36 & STAM-32 and STAM-1 & STAM-41 and STAM-35 & STAM-34 and STAM-17, STAM-4 & STAM-22 and STAM-15, STAM-10 & STAM-19 and STAM-27, STAM-39, STAM-18, STAM-6 & STAM-16 having respective mature pod weight of 8.99, 9.37, 9.57, 10.03, 0.31& 11.15 and 11.74 & 12.43 and 12.91 & 13.4 and 14.58, 14.7 & 14.78 and 15.68, 16.4 & 16.79 and 17.93, 17.94, 18.71, 19.04 & 20.02 g, were found statistically *at par* with each other under the present investigation.

The mature pod weight of the tamarind genotypes varied from 8.31 g (STAM-26) to 32.28 g (STAM-9) during the second year of the study. Conferring to the results of the recent experiment, the genotypes STAM-26, STAM-38, STAM-36, STAM-20, STAM-32 & STAM-1 and STAM-30, STAM-35 & STAM-41 and STAM-34, STAM-4, STAM-17 & STAM-22 and STAM-19, STAM-15, STAM-10, STAM-

39 & STAM-27 having fruit weight of 8.31, 9.27, 9.51, 9.75, 10.29 & 10.42 and 10.79, 11.45 & 11.47 and 11.88, 13.04, 13.46 & 13.64 and 14.89, 15.06, 15.76, 15.9 & 16.55 g was found statically comparable among each other at 5% level of significance.

In pooled analysis, significant variations were recorded among the different genotypes tested under the present investigation. The maximum mature pod weight (32.88 g) was recorded under the genotype STAM-9, which was found statistically superior from other genotypes. Moreover, the genotypes STAM-26, STAM-38, STAM-20, STAM-36 & STAM-30 and STAM-32 & STAM-1 and STAM-41, STAM-35 & STAM-34 and STAM-4, STAM-17 & STAM-22 and STAM-15, STAM-19 & STAM-10 and STAM-39, STAM-27 & STAM-6 having mature pod weight of 8.65, 9.32, 9.89, 9.91 & 10.18 and 10.72 & 11.08 and 11.95, 12.18 & 12.64 and 13.87, 14.02 & 14.21 and 15.37, 15.84 & 16.08 and 16.92, 17.24 & 17.96 g showed non-significant differences among each other. Similarly, the genotypes STAM-18, STAM-16 & STAM-5 and STAM-24, STAM-3, STAM-23, STAM-33 & STAM-31 and STAM-13, STAM-28 & STAM-8 and STAM-12, STAM-29, STAM-11 & STAM-40 and STAM-2, STAM-42 & STAM-37 and STAM-21 & STAM-7 and STAM-14 & STAM-25 with mature pod weight of 18.34, 19.25 & 19.77 and 20.18, 20.78, 21.14, 21.16 & 21.43 and 22.16, 22.74 & 23.52 and 23.86, 24.15, 24.63 & 25.18 and 25.92, 26.21 & 26.83 and 28.03 & 28.58 and 29.64 & 30.59 g were found statistically *at par* to each other at 5% level of significance under the present investigation. Additionally, the genotypes STAM-26, STAM-1, STAM-6, STAM-21, STAM-25 & STAM-9 having respective mature pod weight of 8.65, 11.08, 17.96, 28.03, 30.59 & 32.88 g were found significant differences between each other under the present exploration. Whereas, the minimum mature pod weight (8.65 g) was registered under the genotype STAM-26.

As per the data obtained in Table 2, it can be concluded that various genotypes showed variation with respect to mature pod weight of tamarind. Among the various genotypes, the maximum mature pod weight (32.88 g) was measured under the genotypes STAM-9, while the minimum mature pod weight (8.65 g) was recorded by STAM-26 in pooled analysis under present investigation.

Variability in the mature pod weight of tamarind genotypes may be attributed to both genetic and environmental factors. Genetic differences among genotypes play a significant role, as each possesses unique traits influencing pod development. Additionally, variations in soil type, rainfall, temperature and other microclimatic conditions across the blocks contribute to differences in nutrient uptake and pod formation. Such kinds of differences in mature pod weight appears to be associated with the results as reported by Biradar (2001) [15], Shukla (2006) [12] and Praveenakumar *et al.* (2020) [13] in tamarind genotypes.

4. Pulp weight per pod (g)

The observations regarding pulp weight per pod (g) of tamarind genotypes showed significant differences among the different genotypes observed under present investigation, which are summarized in Table 2 and graphically shown in Fig. 5.

During the first year of research, it was noticed that the pulp weight per pod of tamarind genotypes ranged from 3.56 g (STAM-26) to 16.63 g (STAM-9). The genotypes STAM-26 & STAM-20 and STAM-34, STAM-35 & STAM-30 and STAM-32, STAM-38, STAM-1, STAM-18, STAM-41, STAM-36 & STAM-27 and STAM-17, STAM-4, STAM-22 & STAM-15 and STAM-10, STAM-19, STAM-16, STAM-6, STAM-24, STAM-3 & STAM-39 and having the respective pulp weight of 3.56 & 3.69 and 4.83, 4.91 & 4.95 and 5.31, 5.58, 5.75, 5.83, 5.8, 5.97 & 6.13 and 6.46, 7.03, 7.27 & 7.32 and 8.29, 8.31, 8.6, 8.71, 8.75, 8.92 & 8.93 g was found statistically *at par* with each other under the present investigation.

The pulp weight per pod of the tamarind genotypes varied from 3.27 g (STAM-26) to 17.08 g (STAM-9) during the second year of the study. Conferring to the results of the recent experiment, the genotypes STAM-26 & STAM-36 and STAM-20, STAM-34, STAM-35 &

STAM-30 and STAM-32, STAM-1, STAM-38 & STAM-41 and STAM-18, STAM-17, STAM-4 & STAM-22 and STAM-27, STAM-15, STAM-6, STAM-5 & STAM-19 had pulp weight per pod of 3.27 & 3.59 and 3.68, 4.29, 4.35 & 4.39 and 4.91, 5.09, 5.16 & 5.36 and 5.61, 5.96, 5.99 & 6.19 and 6.63, 7.04, 7.13, 7.14 & 7.37 g were found statically equivalent among each other at 5% level of significance.

In pooled analysis, significant variations were recorded under the different tamarind genotypes tested under the present investigation. The maximum pulp weight per pod (16.86 g) was recorded under the genotype STAM-9, which was found statistically superior from rest of the other genotypes studied under the present trial. Moreover, the genotypes STAM-26 & STAM-20 and STAM-34, STAM-35, STAM-30, STAM-36 & STAM-32 and STAM-38, STAM-1, STAM-41, STAM-18 & STAM-17 and STAM-27, STAM-4, STAM-22 & STAM-15 and STAM-19, STAM-6, STAM-10, STAM-16, STAM-24, STAM-39 & STAM-3 having pulp weight per pod of 3.48 & 3.62 and 4.56, 4.63, 4.67, 4.78 & 5.11 and 5.37, 5.42, 5.58, 5.72 & 6.21 and 6.38, 6.51, 6.73 & 7.18 and 7.84, 7.92, 8.12, 8.27, 8.41, 8.42 & 8.58 g showed non-significant differences to each other at 5% level of significance. Similarly, the STAM-5, STAM-28, STAM-23, STAM-31, STAM-33 & STAM-13 and STAM-8, STAM-12, STAM-29 & STAM-11 and STAM-40 & STAM-2 and STAM-42, STAM-14 & STAM-37 and STAM-7, STAM-21 & STAM-25 with pulp weight per pod of 8.93, 9.21, 9.44, 9.48, 9.65 & 9.84 and 10.67, 10.75, 10.92 & 11.08 and 11.97 & 12.28 and 14.17, 14.29 & 14.38 and 14.69, 14.96 and 15.28 g were found statistically *at par* to each other under the present investigation. Additionally, the genotypes STAM-26, STAM-35, STAM-13, STAM-2, STAM-42, STAM-25 & STAM-9 having the respective pulp weight per pod of 3.42, 4.63, 9.84, 12.28, 14.17, 15.28 & 16.86 g were found significant differences between each other under the present exploration. Whereas, the minimum pulp weight per pod (3.42 g) was registered under the genotype STAM-9.

As per the data obtained in Table 2, it can be concluded that various genotypes showed variation with respect to pulp weight per pod of tamarind fruits. Among the various genotypes, the maximum pulp weight per pod (16.86 g) was measured under the genotypes STAM-9, while the minimum pulp weight per pod (3.42 g) was recorded by STAM-26 in pooled analysis under present investigation.

Variations in the pulp weight per pod of tamarind genotypes are due to different genetic makeup of each genotype, this inherent genetic variation causes differences in pulp weight. Additionally, conditions like soil fertility, rainfall and temperature in different blocks of Surguja district nutrient absorption and this interaction between genetic potential and environmental conditions lead to variability in pulp weight per pod. Such kinds of differences in pulp weight also reported by Sharma *et al.* (2015) [19] and Mishra (2021) [14] in tamarind genotypes.

5. Shell weight per pod (g)

The data represent to shell weight per pod (g) of tamarind genotypes showed significant variation among each other under the present trial. The data observed in reference to shell weight per pod has been presented in the Table 2 and graphically depicted in Fig. 6.

From the Table 2, it was clear that the minimum shell weight per pod (1.48 g) was registered under the genotypes STAM-1. The genotypes STAM-1, STAM-26 & STAM-36 and STAM-30, STAM-10, STAM-38, STAM-19, STAM-20 & STAM-39 and STAM-32 & STAM-4 and STAM-41, STAM-34, STAM-35, STAM-17, STAM-27 & STAM-22 and STAM-15 & STAM-6 and STAM-33, STAM-37 & STAM-18 having the respective shell weight of 1.48, 1.49 & 1.78 and 2.00, 2.17, 2.18, 2.26, 2.27 & 2.29 and 2.68 & 3.04 and 3.29, 3.31, 3.34, 3.41, 3.56 & 3.68 and 3.97 & 4.18 and 4.7, 4.9 & 4.93 g was found statistically non-significant with each other at 5% level of significance under the present experiment. The maximum shell weight per pod was observed in the genotypes STAM-25 having 6.92 g during the first-year observation.

The shell weight per pod of the tamarind genotypes ranged from 1.33 g (STAM-1) to 7.29 g (STAM-25) during the second year of the study. According to the results of the current experiment, the genotypes STAM-1, STAM-36 & STAM-26 and STAM-30, STAM-38, STAM-39 & STAM-19 and STAM-10 & STAM-20 and STAM-4, STAM-34 & STAM-35 and STAM-41, STAM-17, STAM-27 & STAM-22 and STAM-6 & STAM-15 and STAM-33, STAM-31, STAM-37, STAM-28 & STAM-42 had shell weight of 1.33, 1.64 & 1.66 and 1.78, 2.02, 2.03 & 2 and 2.09 & 2.09 and 2.7, 2.93 & 2.96 and 3.03, 3.15, 3.28 & 3.4 and 3.7 & 3.81 and 4.34, 4.48, 4.52, 4.63 & 4.65 g was found statically parallel among each other at 5% level of significance.

In pooled analysis, significant variations were recorded under the different genotypes tested under the present investigation. The minimum shell weight per pod (1.41 g) was recorded under the genotype STAM-1, which was found statistically at par with STAM-26 (1.58 g) and STAM-36 (1.71 g). Moreover, the genotypes STAM-1, STAM-26 & STAM-36 and STAM-30, STAM-10, STAM-19, STAM-39, STAM-20 & STAM-38 and STAM-4 & STAM-34 and STAM-35, STAM-41, STAM-17, STAM-27 & STAM-22 and STAM-15 & STAM-6 and STAM-33, STAM-37, STAM-31 & STAM-18 having

shell weight of 1.41, 1.58 & 1.71 and 1.89, 2.13, 2.13, 2.16, 2.18 & 2.1 and 2.87 & 3.12 and 3.15, 3.16, 3.28, 3.42 & 3.54 and 3.89 & 3.94 and 4.52, 4.71, 4.77 & 4.83 g showed non-significant differences to each other. Besides, the genotypes STAM-1, STAM-38, STAM-6, STAM-33, STAM-11, STAM-2 & STAM-25 having the respective shell weight of 1.41, 2.1, 3.94, 4.52, 5.68, 6.11 & 7.11 g was found significant differences among each other under the present investigation. Whereas, the maximum shell weight per pod (7.11 g) was registered under the genotype STAM-25.

As per the data obtained in Table 2, it can be concluded that various genotypes showed variation with respect to shell weight per pod of tamarind fruits. Among the various genotypes, the minimum shell weight per pod (1.41 g) was observed under the genotypes STAM-1, while the maximum shell weight per pod (7.11 g) was recorded by STAM-25 in pooled analysis under present investigation.

Variability in the shell weight per pod of tamarind genotypes depends on the inherent genetic potential and the influence of environmental condition during pod development. Such kinds of differences in shell weight reported by Divakara *et al.* (2012) [20] and Raut *et al.* (2022) [21] in tamarind genotypes.

Conti...

Table 2. Variability in mature pod weight (g), pulp weight per pod (g) and shell weight per pod (g) of tamarind genotypes

Genotypes	Mature pod weight (g)			Pulp weight/pod (g)			Shell weight/pod (g)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
STAM-1	11.74 ^{stuv}	10.42 ^{rstu}	11.08 ^{AB}	5.75 ^{klmn}	5.09 ^{no}	5.42 ^{qrst}	1.48 ^t	1.33 ^u	1.41 ^s
STAM-2	27.48 ^{de}	24.36 ^{ef}	25.92 ^{efgh}	13.02 ^d	11.54 ^c	12.28 ^e	6.48 ^b	5.74 ^{cd}	6.11 ^c
STAM-3	21.61 ^{kl}	19.95 ^{hij}	20.78 ^{nop}	8.92 ^h	8.24 ^{gh}	8.58 ^{hijk}	5.39 ^{defg}	4.97 ^{fghi}	5.18 ^{efgh}
STAM-4	14.7 ^{qr}	13.04 ^{opq}	13.87 ^{xy}	7.03 ^{ij}	5.99 ^{klm}	6.51 ^{mno}	3.04 ^{no}	2.7 ^{qr}	2.87 ^{op}
STAM-5	20.96 ^{klm}	18.58 ^{ijk}	19.77 ^{pqr}	10.72 ^{efg}	7.14 ^j	8.93 ^{ghij}	5.36 ^{defg}	4.76 ^{hijkl}	5.06 ^{efghi}
STAM-6	19.04 ^{mn}	16.88 ^{klm}	17.96 st	8.71 ^h	7.13 ^j	7.92 ^{kl}	4.18 ^k	3.7 ^{mn}	3.94 ^k
STAM-7	30.29 ^b	26.87 ^c	28.58 ^{cd}	15.76 ^{ab}	13.61 ^b	14.69 ^{bcd}	5.49 ^{cdefg}	4.87 ^{ghijk}	5.18 ^{efgh}
STAM-8	24.46 ^{ghi}	22.58 ^{fg}	23.52 ^{jkl}	11.1 ^{ef}	10.24 ^e	10.67 ^f	5.18 ^{efghi}	4.78 ^{hijk}	4.98 ^{fghi}
STAM-9	33.47 ^a	32.28 ^a	32.88 ^a	16.63 ^a	17.08 ^a	16.86 ^a	6.48 ^b	5.96 ^{bc}	6.22 ^{bc}
STAM-10	16.4 ^{pq}	15.76 ^m	16.08 ^{uv}	8.29 ^h	7.95 ^{hi}	8.12 ^{jk}	2.17 ^{pqr}	2.09 ^s	2.13 ^q
STAM-11	25.62 ^{efg}	23.64 ^f	24.63 ^{hij}	11.52 ^e	10.64 ^{de}	11.08 ^f	5.91 ^c	5.45 ^{de}	5.68 ^d
STAM-12	24.34 ^{ghi}	23.38 ^f	23.86 ^{ijk}	10.96 ^{efg}	10.54 ^{de}	10.75 ^f	5.58 ^{cdef}	5.36 ^{def}	5.47 ^{de}
STAM-13	23.05 ^{hijk}	21.27 ^{gh}	22.16 ^{lmn}	10.23 ^{fg}	9.45 ^f	9.84 ^g	5.71 ^{cd}	5.27 ^{efg}	5.49 ^{de}
STAM-14	30.23 ^b	29.05 ^b	29.64 ^{bc}	14.58 ^c	14 ^b	14.29 ^{cd}	5.56 ^{cdef}	5.34 ^{def}	5.45 ^{de}
STAM-15	15.68 ^q	15.06 ^{mn}	15.37 ^{vw}	7.32 ⁱ	7.04 ^j	7.18 ^{lm}	3.97 ^{kl}	3.81 ^m	3.89 ^{kl}
STAM-16	20.02 ^{lmn}	18.48 ^{ijkl}	19.25 ^{qrs}	8.6 ^h	7.94 ^{hi}	8.27 ^{jk}	5.15 ^{fghi}	4.75 ^{hijkl}	4.95 ^{fghi}
STAM-17	14.58 ^{qr}	13.46 ^{nop}	14.02 ^{wxy}	6.46 ^{ijk}	5.96 ^{klm}	6.21 ^{nopq}	3.41 ^{mn}	3.15 ^{op}	3.28 ^{mn}
STAM-18	18.71 ^{no}	17.97 ^{ijkl}	18.34 ^{rst}	5.83 ^{klmn}	5.61 ^{lmn}	5.72 ^{opqr}	4.93 ^{hij}	4.73 ^{hijkl}	4.83 ^{hij}
STAM-19	16.79 ^{opq}	14.89 ^{mno}	15.84 ^{uv}	8.31 ^h	7.37 ^{ij}	7.84 ^{kl}	2.26 ^p	2 st	2.13 ^q
STAM-20	10.03 ^{vw}	9.75 ^{stu}	9.89 ^{BCD}	3.69 ^o	3.68 ^{qrs}	3.69 ^u	2.27 ^p	2.09 ^s	2.18 ^q
STAM-21	29.71 ^{bc}	26.35 ^{cd}	28.03 ^{de}	15.86 ^{ab}	14.05 ^b	14.96 ^{bcd}	5.48 ^{defg}	4.86 ^{ghijk}	5.17 ^{efgh}
STAM-22	14.78 ^{qr}	13.64 ^{nop}	14.21 ^{wx}	7.27 ⁱ	6.19 ^{kl}	6.73 ^{mn}	3.68 ^{lm}	3.4 ^{no}	3.54 ^{lm}
STAM-23	22.41 ^{ijk}	19.87 ^{hij}	21.14 ^{nop}	10 ^g	8.88 ^{fg}	9.44 ^{gh}	5.59 ^{cdef}	4.95 ^{fghij}	5.27 ^{defg}
STAM-24	20.98 ^{klm}	19.38 ^{hij}	20.18 ^{opq}	8.75 ^h	8.07 ^{hi}	8.41 ^{ijk}	5.33 ^{defgh}	4.92 ^{ghij}	5.13 ^{efghi}
STAM-25	30.29 ^b	30.89 ^a	30.59 ^b	16.49 ^a	14.06 ^b	15.28 ^b	6.92 ^a	7.29 ^a	7.11 ^a
Genotypes	Mature pod weight (g)			Pulp weight/pod (g)			Shell weight/pod (g)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
STAM-26	8.99 ^w	8.31 ^u	8.65 ^D	3.56 ^o	3.27 ^s	3.42 ^u	1.49 ^t	1.66 ^{tu}	1.58 ^{rs}
STAM-27	17.93 ^{nop}	16.55 ^{lm}	17.24 ^{tu}	6.13 ^{ijkl}	6.63 ^{jk}	6.38 ^{mno}	3.56 ^m	3.28 ^{op}	3.42 ^{mn}
STAM-28	24.1 ^{ghij}	21.38 ^{gh}	22.74 ^{klm}	9.95 ^g	8.47 ^{gh}	9.21 ^{ghi}	5.23 ^{efghi}	4.63 ^{ijkl}	4.93 ^{ghi}
STAM-29	25.12 ^{fgh}	23.18 ^{fg}	24.15 ^{ijk}	11.36 ^e	10.48 ^e	10.92 ^f	5.6 ^{cde}	5.16 ^{efgh}	5.38 ^{def}
STAM-30	9.57 ^{vw}	10.79 ^{rst}	10.18 ^{BCD}	4.95 ^{mn}	4.39 ^{opq}	4.67 st	2 ^{pqrs}	1.78 ^{stu}	1.89 ^{qr}
STAM-31	22.72 ^{ijk}	20.14 ^{hi}	21.43 ^{mno}	10.24 ^{fg}	8.72 ^{fgh}	9.48 ^{gh}	5.06 ^{ghij}	4.48 ^{kl}	4.77 ^{hij}
STAM-32	11.15 ^{tuvw}	10.29 ^{rstu}	10.72 ^{ABC}	5.31 ^{lmn}	4.91 ^{nop}	5.11 ^{rst}	2.68 ^o	2.48 ^r	2.58 ^p

(continued on next page)

Genotypes	Mature pod weight (g)			Pulp weight/pod (g)			Shell weight/pod (g)		
	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled	2022-23	2023-24	Pooled
STAM-33	22.01 ^{ijkl}	20.31 ^{hi}	21.16 ^{nop}	10.04 ^g	9.26 ^f	9.65 ^g	4.7 ^j	4.34 ^l	4.52 ^j
STAM-34	13.4 ^{rs}	11.88 ^{pqr}	12.64 ^{yz}	4.83 ⁿ	4.29 ^{pqr}	4.56 ^t	3.31 ^{mn}	2.93 ^{pq}	3.12 ^{no}
STAM-35	12.91 ^{rst}	11.45 ^{qrs}	12.18 ^{zA}	4.91 ⁿ	4.35 ^{opqr}	4.63 ^t	3.34 ^{mn}	2.96 ^{pq}	3.15 ^{mno}
STAM-36	10.31 ^{uvw}	9.51 ^{stu}	9.91 ^{BCD}	5.97 ^{klm}	3.59 ^{rs}	4.78 st	1.78 ^{qrst}	1.64 ^{tu}	1.71 ^{rs}
STAM-37	27.9 ^{cd}	25.76 ^{cde}	26.83 ^{ef}	14.96 ^{bc}	13.8 ^b	14.38 ^{cd}	4.9 ^{ij}	4.52 ^{ijkl}	4.71 ^{ij}
STAM-38	9.37 ^w	9.27 ^{tu}	9.32 ^{CD}	5.58 ^{klmn}	5.16 ⁿ	5.37 ^{qrst}	2.18 ^{pq}	2.02 st	2.1 ^q
STAM-39	17.94 ^{nop}	15.9 ^m	16.92 ^{tu}	8.93 ^h	7.91 ^{hi}	8.42 ^{ijk}	2.29 ^p	2.03 st	2.16 ^q
STAM-40	26.69 ^{def}	23.67 ^f	25.18 ^{ghi}	12.69 ^d	11.25 ^{cd}	11.97 ^e	6.47 ^b	6.14 ^b	6.31 ^{ab}
STAM-41	12.43 ^{stu}	11.47 ^{qrs}	11.95 ^{zA}	5.8 ^{klmn}	5.36 ^{mn}	5.58 ^{pqrs}	3.29 ^{mn}	3.03 ^{opq}	3.16 ^{mno}
STAM-42	27.78 ^{cd}	24.64 ^{def}	26.21 ^{fg}	15.02 ^{bc}	13.32 ^b	14.17 ^d	5.25 ^{efghi}	4.65 ^{ijkl}	4.95 ^{fghi}
SE (m) ±	0.7	0.64	0.49	0.32	0.25	0.29	0.13	0.13	0.13
CD @ 5%	1.97	1.8	1.37	0.91	0.71	0.81	0.37	0.37	0.37
CV (%)	6.99	7.04	5.10	6.91	6.04	6.52	6.09	6.68	6.32

- (1) The superscript letters signifies that the treatment means with similar letters are at par at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

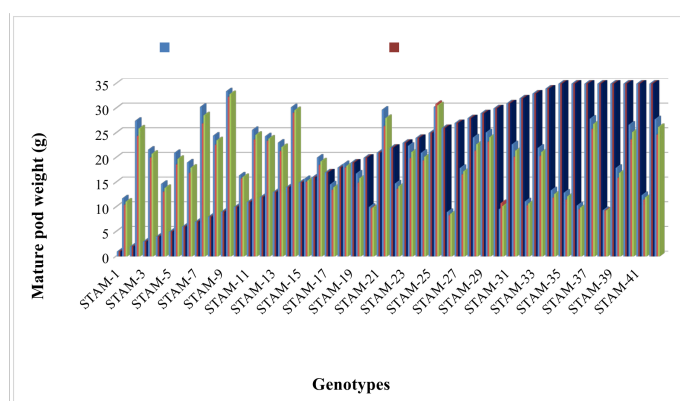


Figure 4. Variability in mature pod weight (g) of tamarind genotypes

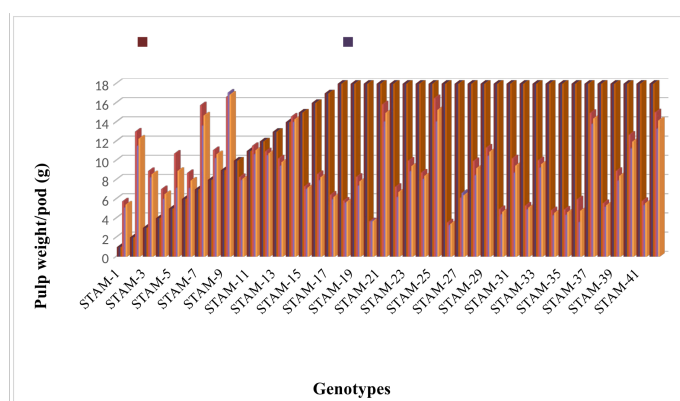


Figure 5. Variability in pulp weight per pod (g) of tamarind genotypes

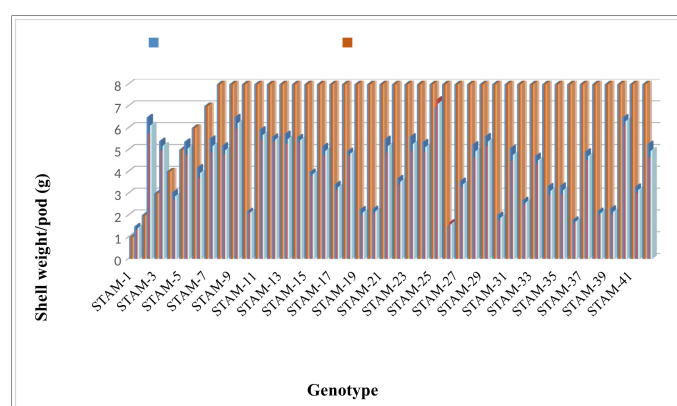


Figure 6. Variability in shell weight per pod (g) of tamarind genotypes

6. Fibre weight (g)

Significant variations were found between the tamarind genotypes studied in the current trial based on observations of fibre weight, which are compiled in Table 3 and visually depicted in Fig. 7.

In the first year of the study, it was observed that the fibre weight of tamarind genotypes ranged from 0.2 g (STAM-26) to 1.36 g (STAM-7). The genotypes STAM-26, STAM-36, STAM-38 & STAM-35 and STAM-1, STAM-32, STAM-30, STAM-34, STAM-15, STAM-20 & STAM-41 and STAM-17 & STAM-19 and STAM-27, STAM-31 & STAM-10 having the respective seed weight of 0.2, 0.21, 0.21 & 0.23 and 0.25, 0.26, 0.27, 0.28, 0.29, 0.30 & 0.30 and 0.43 & 0.45 and 0.74, 0.74 & 0.76 g were found statistically *at par* with each other under the present experiment.

The fibre weight of the tamarind genotypes differed from 0.15 g (STAM-26) to 1.26 g (STAM-7) during the second year of the study. According to the results of the present experiment, the genotypes STAM-7 had fibre weight of 1.26 g which was found statically statistically superior from all the other genotypes. As well, the genotypes STAM-26 & STAM-36 and STAM-38 and STAM-1, STAM-30, STAM-34, STAM-32, STAM-15, STAM-20 & STAM-41 and STAM-17 & STAM-19 and STAM-24, STAM-31 & STAM-27 with fibre weight of 0.15, 0.18 & 0.19 and 0.23, 0.23, 0.24, 0.24, 0.27, 0.28 & 0.28 and 0.39 & 0.39 and 0.65, 0.66 & 0.68 g was verified statistically *at par* with each other under the present trial.

In pooled analysis, significant variations were verified under the different tamarind genotypes tested under the present investigation. The maximum fibre weight (1.31 g) was recorded under the genotype STAM-7, which was found significantly superior from rest of the other genotypes. Moreover, the genotypes STAM-26, STAM-36, STAM-38 & STAM-35 and STAM-1, STAM-30, STAM-32, STAM-34, STAM-15, STAM-20 & STAM-41 and STAM-19 & STAM-22 and STAM-24 & STAM-27 having fibre weight of 0.18, 0.2, 0.2 &

0.22 and 0.24, 0.25, 0.25, 0.26, 0.28, 0.29 & 0.29 and 0.42 & 0.46 and 0.68 & 0.71 g showed non-significant differences to each other. However, the genotypes STAM-36, STAM-4, STAM-17, STAM-31, STAM-39 & STAM-7 having the respective fibre weight of 0.2, 0.35, 0.41, 0.58, 0.70 & 1.31 g were observed significant differences among each other under the present investigation. Whereas, the minimum fibre weight (0.18 g) was registered under the genotype STAM-26.

It is evident from the result obtained under the present investigation that the various genotypes showed variation with respect to fibre weight of tamarind. Among the various genotypes, the maximum fibre weight (1.31 g) was measured under the genotypes STAM-7, while the minimum weight of fibre (0.18 g) was recorded by STAM-26 in pooled analysis under the present investigation.

Dissimilarity in the fibre weight of tamarind genotypes might be due to genetic factor rather than due to edaphic or other environmental factors. Such kinds of differences in fibre weight also reported by Shukla (2006) [12], Algalal (2012) [17] and Mishra (2021) [14] in tamarind genotypes.

Variability in the fruit yield of tamarind genotypes might be due to genetic factor, which influences traits such as pod size, pulp content, flowering intensity, fruit retention capacity and resistance to biotic and abiotic stresses. Therefore, the variability in fruit yield is the combined effect of heritable traits and environmental influences. Such kinds of differences in fruit yield reported by Prabhushankar (2001) [16] and Mishra (2021) [14] in tamarind genotypes.

Conti...

Table 3. Variability in fibre weight (g) and fruit yield (kg) of tamarind genotypes

Genotypes	Fibre weight (g)		
	2022-23	2023-24	Pooled
STAM-1	0.25 ^{rst}	0.23 ^{rstu}	0.24 ^{stu}
STAM-2	1.06 ^{fg}	0.94 ^g	1 ^{fg}
STAM-3	0.78 ^{ikl}	0.72 ^{kl}	0.75 ^{lm}
STAM-4	0.37 ^q	0.33 ^q	0.35 ^r
STAM-5	0.89 ⁱ	0.79 ^j	0.84 ^k
STAM-6	1.02 ^g	0.9 ^{gh}	0.96 ^{gh}
STAM-7	1.36 ^a	1.26 ^a	1.31 ^a
STAM-8	0.92 ^{hi}	0.84 ⁱ	0.88 ^k
STAM-9	1.25 ^{bc}	1.19 ^b	1.22 ^b
STAM-10	0.76 ^{kl}	0.74 ^k	0.75 ^{lm}
STAM-11	1.19 ^{de}	1.09 ^{cd}	1.14 ^{cd}
STAM-12	0.88 ⁱ	0.84 ⁱ	0.86 ^k
STAM-13	0.92 ^{hi}	0.84 ⁱ	0.88 ^k
STAM-14	1.08 ^f	1.04 ^e	1.06 ^e
STAM-15	0.29 ^r	0.27 ^r	0.28 ^s
STAM-16	0.8 ^{jk}	0.74 ^k	0.77 ^l
STAM-17	0.43 ^p	0.39 ^p	0.41 ^q
STAM-18	0.95 ^h	0.91 ^g	0.93 ^{hi}
STAM-19	0.45 ^{op}	0.39 ^p	0.42 ^{pq}
STAM-20	0.3 ^r	0.28 ^r	0.29 ^s
STAM-21	1.24 ^{bc}	1.1 ^c	1.17 ^{bc}
STAM-22	0.48 ^o	0.44 ^o	0.46 ^p
STAM-23	0.96 ^h	0.86 ^{hi}	0.91 ^{ij}
STAM-24	0.71 ^m	0.65 ^m	0.68 ⁿ
STAM-25	1.21 ^{cd}	1.07 ^{cde}	1.14 ^{cd}
STAM-26	0.2 ^t	0.15 ^w	0.18 ^v
Genotypes	Fibre weight (g)		
	2022-23	2023-24	Pooled
STAM-27	0.74 ^{lm}	0.68 ^{lm}	0.71 ^{mn}

Genotypes	Fibre weight (g)		
	2022-23	2023-24	Pooled
STAM-28	1.19 ^{de}	1.05 ^{de}	1.12 ^d
STAM-29	1.07 ^f	0.99 ^f	1.03 ^{ef}
STAM-30	0.27 ^{rs}	0.23 ^{rstu}	0.25 st
STAM-31	0.74 ^{lm}	0.66 ^m	0.7 ⁿ
STAM-32	0.26 ^{rs}	0.24 ^{rst}	0.25 st
STAM-33	0.81 ^j	0.75 ^{jk}	0.78 ^l
STAM-34	0.28 ^r	0.24 ^{rs}	0.26 st
STAM-35	0.23 st	0.21 ^{stuv}	0.22 ^{uv}
STAM-36	0.21 ^t	0.18 ^{vw}	0.2 ^v
STAM-37	1.26 ^b	1.20 ^b	1.23 ^b
STAM-38	0.21 ^t	0.19 ^{stuvw}	0.2 ^{uv}
STAM-39	0.61 ⁿ	0.55 ⁿ	0.58 ^o
STAM-40	1.06 ^{fg}	0.94 ^g	1 ^{fg}
STAM-41	0.3 ^r	0.28 ^r	0.29 ^s
STAM-42	1.22 ^{bcd}	1.08 ^{cde}	1.15 ^{cd}
SE (m) ±	0.02	0.02	0.02
CD @ 5%	0.05	0.05	0.04
CV (%)	4.53	5.41	4.32

- (2) The superscript letters signifies that the treatment means with similar letters are at par at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

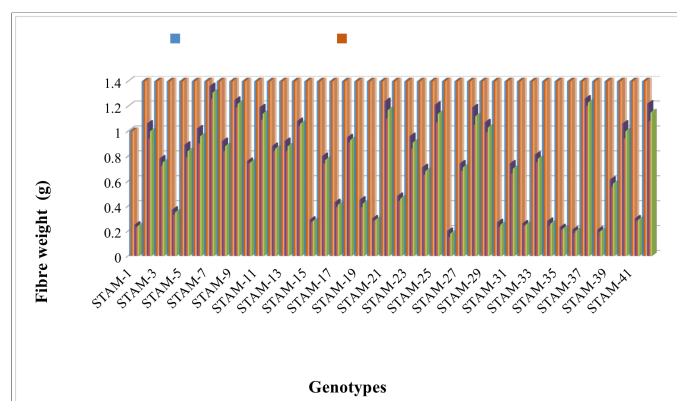


Figure 7. Variability in fibre weight (g) of tamarind genotypes

Conclusion

The present study reveals wide variation among pod characteristics of tamarind genotypes. Tamarind genotype STAM-9 recorded the highest mature pod weight (32.88 g), mature pod length (16.85 cm) and pulp weight per pod (16.86 g), highlighting its potential for improving overall pod yield. Similarly, STAM-40 exhibited the maximum pod width (2.84 cm), STAM-15 showed the highest pod thickness (1.8 cm), STAM-1 recorded the lowest shell weight per pod (1.41 g) and STAM-26 displayed the minimum fibre weight per pod (0.18 g). Since pod length, pod width and pulp weight were found to be closely associated with total yield, these traits hold considerable value as selection criteria in tamarind improvement programs. Genotypes exhibiting low shell and fibre content alongside high pulp weight are particularly desirable, as they directly contribute to greater processing efficiency and economic returns. Accordingly, STAM-9, STAM-40, STAM-15, STAM-1, and STAM-26 may be recommended for further exploitation, either through direct selection or as elite parents in hybridization programs targeted at developing high-yielding tamarind cultivars with superior pod quality.

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