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Studies on physico-chemical evaluation of tamarind (*Tamarindus indica* L.) genotypes prevailing in bastar region of Chhattisgarh on macro nutrient status of tamarind pulp

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Abstract

The present investigation entitled “Studies on physico-chemical evaluation of tamarind (*Tamarindus indica* L.) genotypes prevailing in Bastar region of Chhattisgarh” was carried out in the laboratory, Department of Horticulture, College of Agriculture, IGAV, Raipur (C.G.) during the year 2004-05 and 2005-06. The study was carried out with 16 treatments (genotypes) consist of ripe fruits collected from selected trees of tamarind exist in Tokapal and Jagdalpur block of Bastar district (C.G.) under Randomized Block Design with three replications. Higher Mg content of pulp was observed in IGTAM-15 (30.63 mg/100g) and lower Mg content of pulp was observed in IGTAM-6 (18.03 mg/100g). Maximum Ca content of pulp was observed in IGTAM-15 (423.67 mg/100g) and minimum Ca content of pulp was observed in IGTAM-13 (94.14 mg/100g) Higher P content of pulp was noticed in IGTAM-15 (155.78 mg/100g) and lower P content of pulp was noticed in IGTAM-5 (87.60 mg/100g). Maximum K content of pulp was observed in IGTAM-15 (491.73 mg/100g) and minimum K content of pulp was observed in IGTAM-13 (70.30 mg/100g).

Keywords: Tamarind, phosphorous, potassium, calcium and magnesium

Introduction

Tamarind (*Tamarindus indica* L.) is a hardy evergreen monotypic tree which belongs to the family ‘Leguminosae’ and sub-family Caesalpinaceae and has the chromosome number $2n=24$. The name tamarind was derived from the Arabic word ‘Tamar-E-Hind’ meaning ‘Date of India’. It is cultivated throughout the tropics and sub-tropics of the world and has become naturalized at many places.

Tamarind is an economically important tree of India as well as Chhattisgarh. In India, it is abundantly grown in Madhya Pradesh, Bihar, Andhra Pradesh, Tamil Nadu and Karnataka.

In India, tamarind is one of the most important common fruit trees and it is under cultivation for several centuries. Almost every part of it finds some use, but the most important is the fruit pulp which is the richest source of tartaric acid. It is being used in the manufacture of several products such as tamarind juice concentrate, pulp powder, pectin, pickle, chutneys, sauces, soups, jam, syrups, candy, tartaric acid, alcohol, refreshing tamarind drinks and tamarind kernel powder.

In India, few improved varieties of tamarind are in existence, like PKM-1 of Periyakulam, Pratisthan of Maharashtra and Urigam of Tamil Nadu (Geetha, 1995) ^[4]. Looking to the large area of tamarind either in forest or in homestead of tribal people.

Materials and Method

Phosphorus

The total phosphorus was determined by using spectrophotometer (Olsen *et al.*, 1954) and Vanado molybdate yellow reagent procedure. In this procedure 0.5 g sample was digested in 10 ml diacid (HNO_3 and HClO_4 9:4) and then using yellow reagent (Ammonium molybdate + Ammonium meta vanadate + nitric acid) in aliquots.

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Calcium

Calcium was determined by oxalatory method as described by Chapman (1928).

Magnesium

Magnesium was determined by thiazole yellow method as described by Young and Gill (1951).

Potassium

Potassium (K) was determined by flame photometer method as described by Chapman and Pratt (1961)

Results and Discussions**Phosphorus (pulp)**

Data gathered on phosphorus (p) content of pulp are presented in Table 1

It is apparent from the data that phosphorus content of pulp in different genotypes included in this study ranged between 87.60 mg/100g (IGTAM-5) to 155.78 mg/100g (IGTAM-15) during 1st year (2004-05), 87.64 mg/100g (IGTAM-5) to 155.56 mg/100g (IGTAM-15) during 2nd year (2005-06) and 87.62 mg/100g (IGTAM-5) to 155.67 mg/100g (IGTAM-15) in case of pooled data (mean of both the years). Significant difference was observed among the genotypes in respect of phosphorus content of pulp during 1st year and 2nd year of study as well as in pooled data.

During 1st year (2004-05), the highest phosphorus content of pulp was noticed in IGTAM-15 (155.78 mg/100g), which was found significantly superior than all the genotypes studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-9 (145.80 mg/100g), IGTAM-16 (140.43 mg/100g) and IGTAM-10 (135.45 mg/100g). The lowest phosphorus content of pulp was observed in IGTAM-5 (87.60 mg/100g).

During 2nd year (2005-06), the maximum phosphorus content of pulp was noticed in IGTAM-15 (155.56 mg/100g), which was found better than all the genotypes studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-9 (145.36 mg/100g), IGTAM-16 (140.30 mg/100g) and IGTAM-10 (135.14 mg/100g). The minimum phosphorus content of pulp was recorded in IGTAM-5 (87.64 mg/100g). followed by IGTAM-16 (140.30 mg/100g), IGTAM-8 (140.30 mg/100g) and IGTAM-9 (140.30 mg/100g). The lowest calcium content of pulp was noticed in IGTAM-13 (95.14 mg/100g).

In case of pooled data, the maximum calcium content of pulp was observed in IGTAM-15 (423.60 mg/100g), which was found remarkably better than all the genotypes studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-16 (341.52 mg/100g), IGTAM-8 (340.46 mg/100g) and IGTAM-9 (306.84 mg/100g). The minimum calcium content of pulp was recorded in IGTAM-13 (95.25 mg/100g). Thus, the data recorded on calcium content of pulp clearly show that highest calcium content of pulp was noticed in IGTAM-15 and least calcium content of pulp was observed in IGTAM-13 in case of both the years as well as in pooled data.

Potassium (pulp)

The data recorded on potassium (K) content of pulp are presented in Table 2.

A perusal of data indicate that potassium content of pulp in different genotypes included in this study varied from 70.3 mg/100g (IGTAM-13) to 490.46 mg/100g (IGTAM-15) during 1st year (2004-05), 70.90 mg/100g (IGTAM-13) to 491.73 mg/100g (IGTAM-15) during 2nd year (2005-06) and 491.73 mg/100g (IGTAM-15) during 2nd year (2005-06) and

70.60 mg/100g (IGTAM-13) to 491.09 mg/100g (IGTAM-15) in case of pooled data (mean of both the years). Significant difference was observed among the genotypes in respect of potassium content of pulp during 1st year and 2nd year of study as well as in pooled basis.

Table 1: Variation in mineral composition of different tamarind genotypes (P content of pulp)

Treatments	Phosphorus (mg/100 g)		
	2004-05	2005-06	Pooled
IGTAM-1	110.73	110.69	110.71
IGTAM-2	105.45	105.35	105.40
IGTAM-3	120.48	120.33	120.41
IGTAM-4	95.73	95.48	95.61
IGTAM-5	87.60	87.64	87.62
IGTAM-6	93.97	94.05	94.01
IGTAM-7	112.43	112.28	112.36
IGTAM-8	123.13	123.46	123.30
IGTAM-9	145.80	145.36	145.58
IGTAM-10	135.45	135.14	135.30
IGTAM-11	117.36	117.43	117.40
IGTAM-12	92.61	92.34	92.48
IGTAM-13	90.53	90.09	90.31
IGTAM-14	103.44	103.26	103.35
IGTAM-15	155.78	155.56	155.67
IGTAM-16	140.43	140.30	140.37
SE(m)±	0.3121	0.0802	0.1749
CD(5%)	0.90	0.23	0.51

Potassium (pulp)

The data recorded on potassium (K) content of pulp are presented in Table 2.

A perusal of data indicate that potassium content of pulp in different genotypes included in this study varied from 70.3 mg/100g (IGTAM-13) to 490.46 mg/100g (IGTAM-15) during 1st year (2004-05), 70.90 mg/100g (IGTAM-13) to 491.73 mg/100g (IGTAM-15) during 2nd year (2005-06) and 70.60 mg/100g (IGTAM-13) to 491.09 mg/100g (IGTAM-15) in case of pooled data (mean of both the years). Significant difference was observed among the genotypes in respect of potassium content of pulp during 1st year and 2nd year of study as well as in pooled basis.

During 1st year (2004-05), the maximum potassium content of pulp was recorded in IGTAM-15 (490.45 mg/100g), which was found remarkably better than all the genotypes studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-16 (410.68 mg/100g), IGTAM-8 (380.16 mg/100g) and IGTAM-9 (301.45 mg/100g). The minimum potassium content of pulp was recorded in IGTAM-13 (70.3 mg/100g).

During 2nd year (2005-06), the highest potassium content of pulp was noticed in IGTAM-15 (491.73 mg/100g), which was found remarkably better than all the genotypes studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-16 (411.04 mg/100g), IGTAM-8 (380.75 mg/100g) and IGTAM-9 (301.72 mg/100g). The lowest potassium content of pulp was observed in IGTAM-13 (70.9 mg/100g).

In case of pooled data, the maximum potassium content of pulp was recorded in IGTAM-15 (491.09 mg/100g), which was found remarkably better than all the genotype studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-16 (410.86 mg/100g), IGTAM-8 (380.45 mg/100g) and IGTAM-9 (301.59 mg/100g). The minimum potassium content of pulp was noticed in IGTAM-13 (70.6 mg/100g).

Thus, the data recorded on potassium content of pulp clearly indicate that highest potassium content of pulp was observed in IGTAM-15 and lowest potassium content of pulp was recorded in IGTAM-13 in case of 1st year and 2nd year of study as well as in pooled data

In the present investigation, variations were also observed in phosphorus (P) content of pulp among the different tamarind genotypes studied (Table 2).

Table 2: Variation in mineral composition of different tamarind genotypes (K content of pulp)

Treatments	Potassium (mg/100 g)		
	2004-05	2005-06	Pooled
IGTAM-1	270.31	270.84	270.38
IGTAM-2	150.12	151.22	150.67
IGTAM-3	110.61	110.83	110.72
IGTAM-4	80.42	80.77	80.59
IGTAM-5	290.57	290.81	290.69
IGTAM-6	260.42	260.69	260.56
IGTAM-7	100.27	100.28	100.28
IGTAM-8	380.16	380.75	380.45
IGTAM-9	301.45	301.72	301.59
IGTAM-10	91.06	91.22	91.14
IGTAM-11	201.30	201.61	201.46
IGTAM-12	165.25	165.97	165.61
IGTAM-13	70.30	70.90	70.60
IGTAM-14	280.61	280.45	280.53
IGTAM-15	490.45	491.73	491.09
IGTAM-16	410.68	411.04	410.86
SE(m)±	0.0897	0.2812	0.1609
CD(5%)	0.26	0.81	0.46

The phosphorus content of pulp ranged between 87.60 mg/100g (IGTAM-5) to 155.78 mg/100g (IGTAM-15).

The difference in mineral (Ca and P) content of tamarind pulp was possibly due to genetic difference among the genotypes studied in this investigation. These results are in close conformity with the findings of Ishola *et al.* (1990)^[5] and Bhattacharya *et al.* (1994)^[2], who reported that tamarind pulp contain 86.00 to 190.0 mg/100 g phosphorus.

Calcium (pulp)

Data recorded on calcium (Ca) content of pulp are presented in Table 3

A perusal of data indicate that calcium content of pulp in different genotypes included in this study varied between 95.36 mg/100g (IGTAM-13) to 423.67 mg/100g (IGTAM-15) during 1st year (2004-05), 95.14 mg/100g (IGTAM-13) to 423.54 mg/100g (IGTAM-15) during 2nd year (2005-06) and 95.25 mg/100g (IGTAM-13) to 423.60 mg/100g (IGTAM-15) in case of pooled data (mean of both the years). Significant difference was observed among the genotypes in respect of calcium content of pulp during 1st year and 2nd year of the study as well as in pooled data basis.

During 1st year (2004-05), the maximum calcium content of pulp was noticed in IGTAM-15 (423.67 mg/100g), which was found remarkably better than all the genotypes studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-16 (341.70 mg/100g), IGTAM-8 (340.82 mg/100g) and IGTAM-9 (306.95 mg/100g). The minimum calcium content of pulp was observed in IGTAM-13 (95.36 mg/100g). During 2nd year (2005-06), the highest calcium content of pulp was recorded in IGTAM-15 (423.54 mg/100g), which was found excellent than all the genotypes studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-16 (341.34 mg/100g), IGTAM-8 (340.10 mg/100g)

and IGTAM-9 (306.72 mg/100g). The lowest calcium content of pulp was noticed in IGTAM-13 (95.14 mg/100g).

In case of pooled data, the maximum calcium content of pulp was observed in IGTAM-15 (423.60 mg/100g), which was found remarkably better than all the genotypes studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-16 (341.52 mg/100g), IGTAM-8 (340.46 mg/100g) and IGTAM-9 (306.84 mg/100g). The minimum calcium content of pulp was recorded in IGTAM-13 (95.25 mg/100g).

Table 3: Variation in mineral composition of different tamarind genotypes (Ca content of pulp)

Treatments	Calcium (mg/100 g)		
	2004-05	2005-06	Pooled
IGTAM-1	240.60	240.64	240.62
IGTAM-2	201.82	202.14	201.99
IGTAM-3	180.43	180.53	180.48
IGTAM-4	150.10	149.82	149.96
IGTAM-5	155.03	155.62	155.33
IGTAM-6	120.47	121.17	120.82
IGTAM-7	99.96	100.41	100.18
IGTAM-8	340.82	340.10	340.46
IGTAM-9	306.95	306.72	306.84
IGTAM-10	136.13	135.78	135.96
IGTAM-11	110.88	110.85	110.86
IGTAM-12	106.75	106.74	106.75
IGTAM-13	95.36	95.14	95.25
IGTAM-14	289.91	290.44	290.34
IGTAM-15	423.67	423.54	423.60
IGTAM-16	341.70	341.34	341.52
SE(m)±	0.3466	0.2464	0.1954
CD(5%)	1.00	0.71	0.56

Thus, the data recorded on calcium content of pulp clearly show that highest calcium content of pulp was noticed in IGTAM-15 and least calcium content of pulp was observed in IGTAM-13 in case of both the years as well as in pooled data. In the present investigation, variations were also observed in calcium (Ca) content of pulp among the different tamarind genotypes studied (Table 3).

The maximum calcium content of pulp was recorded in IGTAM-15 (423.67 mg/100g) and minimum in IGTAM-13 (95.14 mg/100g).

The difference in mineral (Ca) content of tamarind pulp was possibly due to genetic difference among the genotypes studied in this investigation. These results are in close conformity with the findings of Ishola *et al.* (1990)^[5] and Bhattacharya *et al.* (1994)^[2], who reported that tamarind pulp contain 81.00 to 466.00 mg/100 g calcium.

Magnesium (pulp)

Data recorded on magnesium (Mg) content of pulp are presented in Table 4.

It is evident from the data that magnesium content of pulp in different genotypes included in this study varied from 18.03 mg/100g (IGTAM-6) to 29.94 mg/100g (IGTAM-15) during 1st year (2004-05), 18.52 mg/100g (IGTAM-6) to 30.63 mg/100g (IGTAM-15) during 2nd year (2005-06) and 18.28 mg/100g (IGTAM-6) to 30.32 mg/100g (IGTAM-15) in case of pooled data (mean of both the years). Significant difference was observed among the genotypes in respect of magnesium content of pulp during 1st year and 2nd year of the study as well as in pooled basis.

During 1st year (2004-05), the maximum magnesium content of pulp was recorded in IGTAM-15 (29.94 mg/100g) which was found significantly superior than all the genotypes

studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-16 (27.98 mg/100g), IGTAM-9 (27.23 mg/100g) and IGTAM-14 (25.44 mg/100g). The minimum magnesium content of pulp was noticed in IGTAM-6 (18.03 mg/100g).

During 2nd year (2005-06), the highest magnesium content of pulp was recorded in IGTAM-15 (30.63 mg/100g) which was found significantly excellent

than all the other genotypes studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-16 (28.41 mg/100g), IGTAM-9 (27.03 mg/100g) and IGTAM-14 (25.12 mg/100g). The lowest magnesium content of pulp was observed in IGTAM-6 (18.52 mg/100g).

Table 4: Variation in mineral composition of different Tamarind genotypes (Mg, content of pulp)

Treatments	Magnesium (mg/100 g)		
	2004-05	2005-06	Pooled
IGTAM-1	22.45	22.37	22.41
IGTAM-2	21.70	21.60	21.65
IGTAM-3	20.09	20.33	20.21
IGTAM-4	20.31	20.58	20.45
IGTAM-5	19.99	20.44	20.22
IGTAM-6	18.03	18.52	18.28
IGTAM-7	19.01	19.36	19.18
IGTAM-8	23.37	23.35	23.36
IGTAM-9	27.23	27.03	27.13
IGTAM-10	24.77	24.17	24.47
IGTAM-11	19.03	19.27	19.15
IGTAM-12	23.30	23.25	23.28
IGTAM-13	19.92	20.59	20.26
IGTAM-14	25.44	25.12	25.28
IGTAM-15	29.94	30.63	30.32
IGTAM-16	27.98	28.41	28.20
SE(m)±	0.3117	0.1317	0.164
CD(5%)	0.90	0.38	0.47

In case of pooled data, maximum magnesium content of pulp was recorded in IGTAM-15 (30.32 mg/100g) which was found significantly better than all the genotypes studied in this investigation. This genotype (IGTAM-15) was followed by IGTAM-16 (28.20 mg/100g), IGTAM-9 (27.13 mg/100g) and IGTAM-14 (25.28 mg/100g). The minimum magnesium content of pulp was recorded in IGTAM-6 (18.28 mg/100g).

Thus, the data presented on magnesium clearly show that highest magnesium content of pulp was observed in IGTAM-15 and least magnesium content of pulp was recorded in IGTAM-6 in case of both the years as well as in pooled data.

In the present investigation, variations were also observed in magnesium (Mg), content of pulp among the different tamarind genotypes studied (Table 4)

The maximum magnesium content in the pulp was recorded in IGTAM-15 (30.63 mg/100g) while minimum magnesium content in IGTAM-6 (18.03 mg/100g). The difference in minerals (Mg,) content of pulp may be due to genetic nature of the genotypes. The results are also in close agreement with the findings of Ishola *et al.* (1990) [5], who reported that tamarind pulp contain magnesium (72.00 mg/100g), Similar results on Mg, content of tamarind pulp have been reported by Bhattacharya *et al.* (1994) [2] and Parvez *et al.* (2003) [8].

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