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Performance of different table varieties of mango (*Mangifera indica* L.) for growth and yield under ultra-high density planting in Telangana state

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Abstract

Mango (*Mangifera indica* L.) is one of the most important fruit crop of India. The study on “Performance of different table varieties of mango (*Mangifera indica* L.) for growth and yield under Ultra high density planting in Telangana state” was conducted in Randomized Block Design with six table varieties. Each variety was considered as a treatment with four replications. The present study revealed that the tree height (1.64 m), tree spread (2.04 m and 2.05 m) (N-S and E-W direction) and stem girth (17.15 cm) were minimum in Alphonso. Alphonso (27.40 cm) and Suvarnarekha (26.84 cm) had maximum leaf length whereas Baneshan (5.18 cm) and Kesar (4.92 cm) recorded maximum leaf breadth. Panicle initiation (195.50 days) was early in Mahamooda Vikarabad, whereas Alphonso recorded lesser number of days for 50% (13.54 days) and complete flowering (29.08 days). Early fruit maturity (83.62 days) was attained by Baneshan. Mahamooda Vikarabad produced maximum number of fruits/tree (38.25) whereas individual fruits of Himayat had highest fruit weight (408.87 g). Suvarnarekha recorded maximum yield/tree (8.11 kg/tree).

Keywords: Mango, ultra high density planting, vegetative growth, flowering, yield

1. Introduction

Mango (*Mangifera indica* L.) is one of the most important fruit crop suitable for table and processing purpose. India occupies 40.28% of the world’s production of mango. The area occupied by mango in India is 22.58 lakh hectare, where the annual production and productivity is 218.22 lakh MT and 9.7 MT/ ha respectively as against a higher productivity of 30 MT/ ha in Israel. The area, production and productivity of mango in Telangana is 1.15 lakh ha, 10.80 lakh MT and 9.31 MT/ ha respectively. Though India leads in the production of mango, the main reason for low productivity in India can be attributed due to many reasons. The old, senile wider spacing and unproductive orchard having unmanageable canopy experiences poor sunlight interception which harbor more pests and disease, ultimately leading to poor yield.

Therefore, to meet the challenge of high productivity to feed the growing population, gradual decline in the cultivable area, optimization of growth parameters and minimization of the unproductive components of trees without sacrificing the overall health and quality of the product are required. Accommodation of the maximum possible number of the plants per unit area to get the maximum possible profit per unit of the tree volume in a short period without impairing the soil fertility status is called the ultra high density planting. Adoption of drip irrigation system and fertigation techniques (Kumar, 2019) ^[10] and selection of dwarf varieties are the important pre-requisite for establishing UHDP. Each varieties and hybrids perform well at a specific climatic regime. Therefore, it is important to evaluate the varieties suitable for UHDP system in Telangana condition.

Keeping the above points in view, evaluation has been made in 6 different commercial table varieties of mango like Kesar, Baneshan, Alphonso, Suvarnarekha, Himayath, and Mahamooda Vikarabad under UHDP systems in Telangana state with the following objectives.

2. Objectives

1. To study the various vegetative characteristics of different table varieties of mango under Ultra High Density Planting system.
2. To study the various flowering and fruiting characteristics of different table varieties of mango under Ultra High Density Planting system.

3. Materials and Method

The present investigation was carried out at the mango block of Centre of Excellence, Mulugu, Siddipet district during the time period from January to June 2020, on six table mango varieties, namely Kesar, Baneshan, Alphonso, Suvarnarekha, Himayat and Mahamooda Vikarabad. The three years old trees were having uniform growth and vigour planted at a spacing of 3 m × 2 m. The experiment was laid out as Randomized Block Design with 4 replications and three trees per replication were selected. Data were collected on vegetative and yield parameters. The experimental data were subjected to ANOVA and Tukey's HSD test was carried out to test any significant differences among the means using R software with version R 3.4.2 (Marathe *et al.* 2019) [12]. Differences at the 5% level ($p < 0.05$) were considered statistically significant.

4. Results and Discussion

4.1. Vegetative Parameters

The data regarding all the vegetative parameters of mango varieties have been presented in the table 1.

4.1.1. Tree height (m)

The maximum tree height (2.23 m) was observed in T₂- Baneshan and it was found to be on par with T₄- Suvarnarekha (2.18 m), T₁- Kesar (2.09 m), T₆- Mahamooda Vikarabad (2.06 m) and T₅- Himayat (2.04 m). Minimum tree height (1.64 m) was recorded in T₃- Alphonso. The trees of mango cultivars studied showed different heights and the differences in the tree height could be due to pruning, varietal nature and environmental influence which were upheld by Kanpure *et al.* (2009) [9].

4.1.2. Tree spread (m) (N-S and E-W directions)

Maximum spread of the canopy in north-south direction (2.87 m) was observed in T₂- Baneshan and it was found to be on par with T₄- Suvarnarekha (2.72 m), T₅- Himayat (2.61 m), T₆- Mahamooda Vikarabad (2.58 m) and T₁- Kesar (2.41 m). The least spread was observed in T₃- Alphonso (2.04 m). The maximum tree spread in east- west direction was found to be

observed in T₂- Baneshan (3.04 m) which was on par with T₄- Suvarnarekha (2.74 m) and the minimum spread was found to be observed in T₃- Alphonso (2.05 m) which was on par with T₆- Mahamooda Vikarabad (2.38 m). The differences in the tree spread in different varieties of fruits were probably due to pruning, genetic makeup of the varieties as well as due to the influence of climatic factors which was supported by Mandal and Thokchom (2018) [11] and Adak *et al.* (2019) [1] in mango cultivars.

4.1.3. Stem girth (cm)

The maximum stem girth (23.55 cm) was found in T₁ Kesar which was on par with T₂- Baneshan (21.40 m) followed by T₆- Mahamooda Vikarabad (19.02 m) while the minimum stem girth (17.15 m) was recorded in T₃- Alphonso. These variations could be attributed due to pruning, genetic makeup of the varieties and climatic factors. The variations due to varietal nature were confirmed in the study made by Bakshi *et al.* (2012) [5] in mango and Pal *et al.* (2016) [13] in guava.

4.1.4. Leaf length (cm)

The varieties differed significantly with regard to leaf length. Maximum leaf length (27.40 cm) was observed in T₃- Alphonso which was found to be on par with T₄- Suvarnarekha (26.84 cm), T₂- Baneshan (26.64 cm) and T₁- Kesar (25.79 cm). The minimum leaf length (17.54 cm) was observed in T₆- Mahamooda Vikarabad. Halder *et al.* (2020) [8] found that the variations might be due to genetic makeup, cultural practices, climatic conditions and growth stages.

4.1.5. Leaf breadth (cm)

Maximum leaf breadth (5.18 cm) was found in T₂- Baneshan which was found to be on par with T₁- Kesar (4.92 cm), T₄- Suvarnarekha (4.66 cm), T₃- Alphonso (4.63 cm) and T₅- Himayat (4.34 cm). The leaf breadth (3.88 cm) was found least in T₆- Mahamooda Vikarabad. The varied breadths of the leaves were due to varietal nature, genetic makeup, cultural practices, climatic conditions and growth stages which was upheld by Halder *et al.* (2020) [8] in mango.

Table 1: Tree height (m) and Tree spread (m) (N-S and E-W direction), Leaf length (cm) and Leaf breadth (cm)

Treatments	Tree height (m)	Tree spread N-S (m)	Tree spread E-W (m)	Stem girth (cm)	Leaf length (cm)	Leaf breadth (cm)
T ₁ - Kesar	2.09 ^a	2.41 ^{ab}	2.50 ^b	23.55 ^a	25.79 ^{ab}	4.92 ^a
T ₂ - Baneshan	2.23 ^a	2.87 ^a	3.04 ^a	21.40 ^{ab}	26.64 ^a	5.18 ^a
T ₃ - Alphonso	1.64 ^b	2.04 ^b	2.05 ^c	17.15 ^c	27.40 ^a	4.63 ^{ab}
T ₄ - Suvarnarekha	2.18 ^a	2.72 ^a	2.74 ^{ab}	18.98 ^b	26.84 ^a	4.66 ^{ab}
T ₅ - Himayat	2.04 ^{ab}	2.61 ^a	2.58 ^b	18.20 ^{bc}	22.99 ^b	4.34 ^{ab}
T ₆ - Mahamooda Vikarabad	2.06 ^a	2.58 ^{ab}	2.38 ^{bc}	19.02 ^{bc}	17.54 ^c	3.88 ^b
Overall mean	2.04	2.54	2.55	19.72	24.53	4.60
SE (m) ±	0.12	0.17	0.13	1.01	0.92	0.26
HSD (0.05)	0.41	0.55	0.43	3.26	3.00	0.86

4.2. Yield Parameters

The data regarding all the yield parameters of mango varieties have been presented in the table 2 and table 3. Although the weight and size of the fruits are varieties' inherent character, we have taken up those characters also in our study.

4.2.1. Days taken for panicle initiation

The minimum number of days taken for panicle initiation from pruning (195.50 days) was observed in cultivar T₆- Mahamooda Vikarabad which was on par with T₅- Himayat (199.58 days). The maximum number of days taken for

panicle initiation from pruning (225.33 days) was observed in T₃- Alphonso. The differences in the time of panicle emergence of different varieties might be due to cultural practices, inherent character of the varieties and climatic factors which were found to be in accordance with findings of Gill *et al.* (2011) [15], Ahmed *et al.* (2016) [2] and Azam *et al.* (2018) [4] in mango.

4.2.2. Days taken for 50% flowering

The minimum number of days taken for 50% flowering from panicle initiation (13.54 days) was observed in T₃- Alphonso

which was on par with T₆- Mahamooda Vikarabad (14.08 days) and T₄- Suvarnarekha (16.15 days) whereas the maximum number of days taken for 50% flowering from panicle initiation (22.50 days) was observed in T₁- Kesar. This difference was due to cultivar behavior under different environment conditions in mango which was also reported by Singh and Pathak (2018) [16] in mango.

4.2.3. Days taken for complete flowering

The minimum number of days taken for complete flowering from panicle initiation (29.08 days) was observed in T₃-

Alphonso which was on par with T₅- Himayat (30.17 days) and T₆- Mahamooda Vikarabad (32.75 days) while the maximum number of days taken for complete flowering from panicle initiation (42.24 days) was observed in T₂- Baneshan which was on par with T₄- Suvarnarekha (36.88 days). These variations might be due to pruning, inherent character of the varieties and the duration of flowering in mango is governed by prevailing local climatic conditions which were upheld by Halder *et al.* (2020) [8], Balamohan and Vidhya (2020) [6] and Rani *et al.* (2020) [14].

Table 2: Days taken for panicle initiation, Days taken for 50% flowering and Days taken for complete flowering

Treatments	Days taken for panicle initiation	Days taken for 50% flowering	Days taken for complete flowering
T ₁ - Kesar	206.58 ^{bc}	22.50 ^a	34.49 ^{bc}
T ₂ - Baneshan	209.58 ^{bc}	17.58 ^{bc}	42.24 ^a
T ₃ - Alphonso	225.33 ^a	13.54 ^d	29.08 ^c
T ₄ - Suvarnarekha	209.67 ^b	16.15 ^{bcd}	36.88 ^{ab}
T ₅ - Himayat	199.58 ^{cd}	18.00 ^b	30.17 ^{bc}
T ₆ - Mahamooda Vikarabad	195.50 ^d	14.08 ^{cd}	32.75 ^{bc}
Overall mean	207.71	16.98	34.27
SE (m) ±	2.97	1.15	2.23
HSD (0.05)	9.64	3.73	7.23

4.2.4. Period of maturity of fruits (days)

The minimum number of days taken for fruit maturity from fruit set (83.62 days) was observed in T₂- Baneshan which was on par with T₃- Alphonso (84.89 days). The maximum number of days taken for fruit maturity from fruit set (110.94 days) was observed in T₅- Himayat. The reason for varied days for maturity of fruits might be due to combined effects of varietal behaviour and the local environmental conditions. The results were similar with the findings of Gill *et al.* (2011) [15] in mango.

4.2.5. Number of fruits/tree

The maximum number of fruits/tree (38.25) was observed in T₆- Mahamooda Vikarabad followed by T₄- Suvarnarekha (32 fruits/tree) whereas the minimum number of fruits/tree (7.50) was observed in T₃- Alphonso which was on par with T₂- Baneshan (14.25), T₁- Kesar (10.75) and T₅- Himayat (13.75). The variations in number of fruits/tree might be attributed due to genotypic character of the varieties which was supported in the study made by Bakshi *et al.* (2012) [5] and Kanpure *et al.* (2009) [9] in mango.

4.2.6. Fruit weight (g)

The maximum fruit weight (408.87 g) was observed in T₅- Himayat followed by T₂- Baneshan (335.25 g) while the minimum fruit weight was observed in T₆- Mahamooda Vikarabad (175.38 g). The fruit weight depends on cultural practices, varietal nature and climatic conditions of the growing region which was supported by Anila and Radha (2006) [3] and Gopu *et al.* (2014) [7] in mango.

4.2.7. Fruit yield/tree (kg/tree)

The maximum fruit yield/tree (8.11 kg/tree) was found in T₄- Suvarnarekha which was on par with T₆- Mahamooda Vikarabad (6.96 kg/tree). Minimum yield/tree (1.79 kg/tree) was observed in T₃- Alphonso. The number of fruits/tree and fruit weight influences the fruit yield/tree. The differences in yield also might be due to differences in the climatic conditions, cultural practices and inherent character of the varieties which resulted in the variable size/weight of the fruits. This was found to be in similar trends with Singh *et al.* (2010) [17], Singh and Pathak (2018) [16] and Kumar (2019) [10] in mango.

Table 3: Period of maturity of fruits (days), Number of fruits/tree, Fruit weight (g) and Fruit yield/tree (kg/tree)

Treatments	Period of maturity of fruits (days)	Number of fruits/tree	Fruit weight (g)	Fruit yield/tree (kg/tree)
T ₁ - Kesar	97.32 ^c	10.75 ^b	293.39 ^c	3.17 ^c
T ₂ - Baneshan	83.62 ^e	14.25 ^b	335.25 ^b	4.74 ^b
T ₃ - Alphonso	84.89 ^e	7.50 ^b	239.34 ^d	1.79 ^d
T ₄ - Suvarnarekha	89.13 ^d	32.00 ^a	264.04 ^d	8.11 ^a
T ₅ - Himayat	110.94 ^a	13.75 ^b	408.87 ^a	5.29 ^b
T ₆ -Mahamood Vikarabad	106.18 ^b	38.25 ^a	175.38 ^e	6.96 ^a
Overall mean	95.35	19.42	286.04	5.01
SE (m) ±	0.76	2.43	9.00	0.40
HSD (0.05)	2.47	7.89	29.22	1.30

Conclusion

Based on the study conducted, six mango varieties showed variations in terms of vegetative and yield parameters. The genetic makeup of the trees, cultural practices and the environmental conditions have effect on the vegetative and yield parameters. Minimum tree height, stem girth and tree spread were found in Alphonso. Maximum leaf length was

found in Alphonso and Suvarnarekha and maximum leaf breadth was found in Baneshan and Kesar. Mahamooda Vikarabad recorded lesser number of days taken for panicle initiation from pruning whereas Alphonso recorded lesser number of days for 50% and complete flowering. Baneshan reached maturity earlier. More number of fruits/tree was found in Mahamooda Vikarabad whereas weight of the

individual fruit was high in Himayat. Yield/tree was high in Suvarnarekha.

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