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Varietal evaluation in banana (*Musa* spp.) for growth and yield attributes

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Abstract

Banana is one of the most important fruit crop in Karnataka. However, most of the cultivars grown under Ghataprabha command area (North Karnataka-Zone 3) are poor yielders even though the region is having congenial condition for commercial cultivation of banana. To find the suitable genotype for Ghataprabha command area, thirty cultivars of banana were evaluated for their growth and yield characters at All India Coordinated Research Project (AICRP) on Tropical fruits orchard, KRCCH, Arabhavi during 2011-2015. Among the thirty cultivars of banana evaluated, Hoovu bale recorded maximum plant height at 6 MAP (2.30 m) and at shooting stage (3.30 m) respectively. The variety Udayam (ABB) recorded plant height of 2.95 m which is on par with Hoovubale at shooting stage. The variety Hanuman showed maximum bunch yield per plant (32.10 kg), bunch yield per plot (160.21 kg) and bunch yield per hectare (80.0 t). The varieties such as Udayam, Robusta, Poovan and Yangambi also recorded better performance for yield characters.

Keywords: Banana, varieties, evaluation, growth and yield

Introduction

India has been considered as one of the important centre of biodiversity for banana, having about eight species and 120 distinct clones. Banana is well adapted to diverse regions varying from humid tropics to humid sub tropics and semi arid sub tropics upto an elevation of 2000 m above mean sea level. The wide range of adoption of banana is due to its appreciable genetic diversity and suitability to varying agro climatic conditions. The diverse agro climatic conditions have encouraged the development and sustenance of a large number of varieties catering to local needs (Rajamanickam *et al.*, 2006) [4].

A large number of local varieties are under cultivation in Karnataka along with commercial cultivars. However, information on the performance of these cultivars for growth, yield and quality characters in agro climatic condition of north Karnataka (Zone 3) is lacking. Field evaluation of germplasm for growth and yield characters, disease and pest resistance and their suitability for fresh fruit or processing is a key factor for selection and further multiplication of promising cultivar and their by improve the crop productivity. Kulapati *et al.* (2000) [3] evaluated seven banana cultivars (Dwarf Cavendish, Karibale, Poovan, Elakkibale, Rasbale, Robusta and Vaatbale) in Karnataka for morphological and bunch characters and reported that Robusta was found to be the best cultivar as far as its yield performance is concerned ensuring the highest return to the farming community and was recommended for cultivation in the region-IV of Karnataka.

Materials and Methods

The experiment was laid out in Randomized Block Design with 30 treatments (Accessions/Genotypes) and 2 replications which include plants with a spacing of 2mx2m. To find the suitable genotype for Ghataprabha command area, thirty cultivars of banana were evaluated for their growth and yield characters at All India Coordinated Research Project (AICRP) on Tropical fruits orchard, KRCCH, Arabhavi during 2011-2015.

The details of treatments is mentioned below.

Treatment	Cultivar	Genomic composition	Treatment	Cultivar	Genomic composition
T ₁	Dwarf Cavendish	AAA	T ₁₆	Hoovu bale	AAB
T ₂	Hanuman	AAA	T ₁₇	Udayam	ABB
T ₃	Robusta	AAA	T ₁₈	Krishna Vazhai	AAB
T ₄	Sakkarebale	AAB	T ₁₉	Red banana green	AAA
T ₅	Ney Poovan	AB	T ₂₀	Cultivar Rose	AA
T ₆	Rajapuri	AAB	T ₂₁	Karpur bale	AAB
T ₇	Karibale	AAA	T ₂₂	Yangambi Selection	AAA
T ₈	Mitli	AB	T ₂₃	Bargi bale	AAB
T ₉	Palaykondan	AB	T ₂₄	Kothia	ABB
T ₁₀	Poovan	AAB	T ₂₅	H-1	AAB
T ₁₁	Saba	ABB	T ₂₆	Monthan	ABB
T ₁₂	Kadali	AA	T ₂₇	Gold finger	AAAB
T ₁₃	Mysore mitli	AA	T ₂₈	Bluggoe	ABB
T ₁₄	Sonakel	AAB	T ₂₉	Pisang lilin	AAB
T ₁₅	Pisang Awak	ABB	T ₃₀	Grand Naine	AAA

Observations were recorded on growth characters like Plant height, Pseudostem girth, Number of functional leaves, Leaf area, Number of days for shooting, Number of days for maturity & Total crop duration. Bunch characters like Bunch length, Bunch width, Number of hands per bunch, Number of fingers in third hand and Total number of fingers per bunch. Yield parameters like Bunch weight (Kg/plot), Bunch weight (Kg/plot) and Bunch weight (t/ha).

Results and Discussion:

In the present study, Hoovu bale recorded maximum plant height at 6 MAP (2.30 m) and at shooting stage (3.30 m) respectively. The variety Udayam (ABB) recorded plant height of 2.95 m which is on par with Hoovubale at shooting stage. The high yielding varieties like Hanuman and Pisang Awak recorded moderate plant height of 2.70 m and 2.83 m respectively. However minimum plant height was observed in the variety Dwarf Cavendish (1.40 m) at shooting stage. With respect to girth, the maximum pseudostem girth was observed in Hoovu bale (78.50 cm) at shooting stage which is on par with Hanuman, Robusta, Ney Poovan, Sonakel, Bargi bale and Monthan. The variety Udayam recorded stem girth of 60.0 cm at shooting stage. However, lowest stem girth was found in H-1 (38.0 cm) during shooting stage. This variation in growth parameters like plant height and stem girth among different varieties of banana may be attributed to the genetic character of the respective variety and its expression in a given environment. In the present investigation also variations in growth characters was distinctly observed. The present results corroborates with the studies conducted at NRC on banana where NRCB Sel. 001 (Udayam) was identified and selected for good plant height and maximum pseudostem girth (Uma *et al.* 2005) ^[6]. The present results are also in line with the findings of Deshmukh *et al.* (2004) ^[1, 2] who observed maximum girth of pseudostem in cv. Padalse (Hanuman).

In the present investigation, the variety Hanuman recorded maximum bunch length (90.0 cm), number of hands per bunch (16.0) and total fingers per bunch (178.0) besides recording moderate values for bunch width and number of fingers in third hand. While the maximum number of fingers in third hand (22.0) was recorded in the variety Udayam,

which also had moderate values for the characters like bunch length, bunch width, number of hands per bunch and total number of fingers per bunch. The varieties Pisang Awak and Hoovubale recorded moderate values for bunch characters. The bunch width was found maximum in the variety Karibale. The maximum values for bunch characters recorded by the varieties Hanuman, Robusta, Pisang Awak, Hoovubale and Udayam may be attributed to vigorous growth of these varieties as noted by their maximum values for stem girth, number of leaves and leaf area. These vegetative characters might have helped in enhanced photosynthesis and accumulation of food in sink and their by improved values for bunch characters. This finding is supported by views of Sagar *et al.* (2014) ^[5]. Similar observations were reported by Deshmukh *et al.* (2004) ^[1, 2] who recorded maximum number of hands and number of fingers per bunch in variety Padalse (Hanuman). Where as Uma *et al.* (2005) ^[6] observed NRCB Sel. 001 (Udayam) had maximum values for bunch characters which matched with present results.

The higher values for bunch yield recorded by the varieties Hanuman (AAA), Udayam (ABB) and Yangambi Selection (AAA) may be attributed to varietal character and vigorous growth of these varieties as noted by maximum values for stem girth, number of leaves and highest leaf area. These vegetative characters helped in enhanced photosynthesis and accumulation of food and their by improved bunch yield. The enhanced yield attributes like maximum number of hands per bunch, maximum total fingers per bunch, finger length, finger girth and fruit weight of these cultivars also contributed to maximizing the bunch yield. The results of present investigation corroborates with the findings of Sagar *et al.* (2014) ^[5] who observed maximum yield in Hanuman (43.07 t/ha). Kulapati *et al.* (2000) ^[3] recorded maximum yield in Robusta (AAA) followed by Dwarf Cavendish. Deshmukh *et al.* (2004) ^[1, 2] observed maximum bunch weight in Padalse (Hanuman) followed by Shrimanti (AAA). Barua *et al.* (2007) found heaviest bunches (15.88 Kg) in Barjahaji (AAA) and also observed highest yield in Barjahaji (49.0 t/ha). Uma *et al.* (2005) ^[6] recorded maximum bunch weight in NRCB Sel. 001 (Udayam). The present results are in conformity with these findings.

Table 1: Evaluation of performance of banana germplasm for growth parameters like plant height and stem girth

Germplasm	Plant height (m)			Stem girth (cm)		
	3 MAP	6 MAP	Shooting stage	3 MAP	6 MAP	Shooting stage
T ₁ : Dwarf Cavendish	0.76	1.15	1.40	33.00	49.00	58.00
T ₂ : Hanuman	0.63	1.17	2.70	28.00	46.00	75.00
T ₃ : Robusta	0.59	1.76	2.10	23.00	53.50	76.20
T ₄ : Sakkarebale	0.64	2.12	2.16	24.00	56.50	57.50
T ₅ : Ney Poovan	0.92	1.36	2.76	26.00	45.00	75.00
T ₆ : Rajapuri	0.70	1.30	1.96	27.00	48.00	62.00
T ₇ : Karibale	0.86	1.86	2.65	26.00	45.00	60.00
T ₈ : Mitli	0.64	1.51	2.26	17.00	39.50	55.00
T ₉ : Palaykondan	0.87	2.05	2.70	27.00	48.00	52.00
T ₁₀ : Poovan	0.76	1.79	2.40	21.00	41.00	58.00
T ₁₁ : Saba	0.57	1.30	1.80	20.00	33.00	40.00
T ₁₂ : Kadali	0.78	1.33	2.15	24.00	38.50	55.00
T ₁₃ : Mysore mitli	0.74	1.72	2.83	20.00	40.00	60.50
T ₁₄ : Sonakel	0.47	1.45	2.93	10.00	35.00	75.00
T ₁₅ : Pisang Awak	0.73	2.21	2.83	20.00	53.50	67.00
T ₁₆ : Hoovu bale	1.23	2.30	3.30	31.50	54.00	78.50
T ₁₇ : Udayam	1.30	1.99	2.95	34.00	50.50	60.00
T ₁₈ : Krishna Vazhai	0.80	2.20	2.93	28.00	55.00	70.00
T ₁₉ : Red banana green	1.12	1.72	2.15	33.00	49.00	52.25
T ₂₀ : Cultivar Rose	0.25	1.46	2.49	10.00	34.00	61.66
T ₂₁ : Karpur bale	0.85	1.39	2.30	24.00	40.00	56.00
T ₂₂ : Yangambi	0.69	2.02	2.24	21.00	30.00	53.00
T ₂₃ : Bargi bale	0.78	2.02	2.93	30.00	29.00	77.50
T ₂₄ : Kothia	0.65	1.76	2.90	28.00	26.00	75.00
T ₂₅ : H-1	0.42	1.32	2.00	25.50	22.00	38.00
T ₂₆ : Monthan	0.92	1.77	2.91	32.00	53.00	76.50
T ₂₇ : Gold finger	0.82	1.95	2.50	32.00	36.00	70.00
T ₂₈ : Bluggoe	0.40	2.00	2.40	25.00	30.00	65.00
T ₂₉ : Pisang lilin	0.78	1.34	1.75	25.00	37.50	49.00
T ₃₀ : Grand Naine	0.54	1.09	1.98	32.00	47.00	58.00
S.Em±	0.11	0.10	0.12	0.73	1.10	1.50
CD (P = 0.05)	0.33	0.31	0.38	2.20	3.30	4.51
CV(%)	10.07	12.22	10.12	14.04	12.32	13.80

Table 2: Evaluation of performance of banana germplasm for growth parameters like number of leaves per plant and leaf area

Germplasm	Number of leaves/plant			Leaf area (m ²)		
	3 MAP	6 MAP	Shooting stage	3 MAP	6 MAP	Shooting stage
T ₁ : Dwarf Cavendish	14.25	13.50	12.50	2.86	6.52	5.90
T ₂ : Hanuman	14.25	14.50	12.50	2.40	8.33	10.00
T ₃ : Robusta	9.15	13.02	12.40	1.29	6.83	8.50
T ₄ : Sakkarebale	12.43	14.15	12.25	2.03	8.70	6.68
T ₅ : Ney Poovan	13.02	14.00	10.00	3.18	7.05	9.07
T ₆ : Rajapuri	9.20	12.50	11.21	1.58	8.81	7.17
T ₇ : Karibale	11.50	11.21	8.00	2.54	6.16	7.66
T ₈ : Mitli	8.40	11.50	8.50	1.41	4.72	9.43
T ₉ : Palaykondan	12.21	10.52	12.00	2.51	7.16	7.80
T ₁₀ : Poovan	7.60	12.50	12.50	1.45	6.56	7.07
T ₁₁ : Saba	5.40	13.20	12.00	1.25	6.98	6.20
T ₁₂ : Kadali	11.20	10.00	7.50	1.87	4.02	5.37
T ₁₃ : Mysore mitli	9.10	12.00	11.00	1.22	6.50	8.30
T ₁₄ : Sonakel	5.20	11.33	11.00	1.11	4.91	9.20
T ₁₅ : Pisang Awak	6.60	14.00	9.00	1.49	10.00	8.80
T ₁₆ : Hoovu bale	10.00	12.66	11.00	3.23	9.00	9.00
T ₁₇ : Udayam	11.00	12.50	12.75	5.41	10.50	10.25
T ₁₈ : Krishna Vazhai	9.00	14.00	9.50	1.64	9.00	8.50
T ₁₉ : Red banana green	11.00	13.20	8.00	3.26	10.40	8.14
T ₂₀ : Cultivar Rose	4.00	9.00	7.60	1.05	3.98	4.32
T ₂₁ : Karpur bale	11.00	9.25	8.00	2.36	4.98	6.59
T ₂₂ : Yangambi	9.21	12.20	11.30	1.37	4.32	8.95
T ₂₃ : Bargi bale	9.00	14.00	9.00	1.60	4.54	8.00
T ₂₄ : Kothia	8.02	9.25	10.50	1.22	5.02	8.30
T ₂₅ : H-1	6.52	8.25	10.00	1.35	2.56	5.00
T ₂₆ : Monthan	8.00	11.50	9.11	1.03	5.08	8.28
T ₂₇ : Gold finger	9.00	10.10	11.50	2.00	3.80	6.50
T ₂₈ : Bluggoe	7.12	10.00	12.00	1.50	3.40	5.40
T ₂₉ : Pisang lilin	9.16	9.00	8.50	1.64	3.55	4.82
T ₃₀ : Grand Naine	13.56	14.20	12.25	2.78	6.50	7.80
S.Em±	0.41	0.37	0.38	0.43	0.47	0.38
CD (P = 0.05)	1.25	1.12	1.14	1.24	1.42	1.15
CV(%)	12.32	11.80	10.33	15.21	13.83	10.32

Table 3: Evaluation of performance of banana germplasm for crop duration

Germplasm	Days taken for shooting	Days taken for maturity	Total Crop duration
T ₁ : Dwarf Cavendish	280.53	123.12	403.65
T ₂ : Hanuman	295.02	122.24	417.26
T ₃ : Robusta	310.12	125.52	435.64
T ₄ : Sakkarebale	290.50	125.20	415.70
T ₅ : Ney Poovan	261.02	123.14	384.16
T ₆ : Rajapuri	297.20	122.50	419.70
T ₇ : Karibale	285.02	125.50	410.52
T ₈ : Mitli	315.12	130.81	445.93
T ₉ : Palaykondan	283.31	130.21	413.52
T ₁₀ : Poovan	316.42	125.52	441.94
T ₁₁ : Saba	335.12	128.52	463.64
T ₁₂ : Kadali	283.32	128.51	411.83
T ₁₃ : Mysore mitli	317.21	125.00	442.21
T ₁₄ : Sonakel	327.81	129.21	457.02
T ₁₅ : Pisang Awak	280.52	121.12	401.64
T ₁₆ : Hoovu bale	268.20	105.10	373.30
T ₁₇ : Udayam	282.52	120.50	403.02
T ₁₈ : Krishna Vazhai	316.52	122.32	438.84
T ₁₉ : Red banana green	314.82	132.81	447.63
T ₂₀ : Cultivar Rose	262.61	110.50	373.12
T ₂₁ : Karpur bale	330.10	133.32	463.42
T ₂₂ : Yangambi	335.51	130.21	465.72
T ₂₃ : Bargi bale	343.22	130.22	473.44
T ₂₄ : Kothia	325.51	129.82	455.33
T ₂₅ : H-1	325.02	128.80	453.82
T ₂₆ : Monthan	330.21	129.12	459.33
T ₂₇ : Gold finger	320.31	128.21	448.52
T ₂₈ : Bluggoe	335.22	132.01	467.23
T ₂₉ : Pisang lilin	286.52	120.50	407.02
T ₃₀ : Grand Naine	268.05	118.25	386.20
S.Em±	2.99	2.05	3.96
CD (P = 0.05)	8.98	6.15	11.88
CV(%)	14.21	17.20	15.32

Table 4: Evaluation of performance of banana germplasm for bunch characters

Germplasm	Bunch length (cm)	Bunch width (cm)	No. of hands per bunch	Fingers in 3 rd hand	Total fingers per bunch
T ₁ : Dwarf Cavendish	50.66	34.33	8.66	14.66	126.15
T ₂ : Hanuman	90.00	46.00	16.00	21.50	178.00
T ₃ : Robusta	60.00	35.00	15.25	18.00	154.50
T ₄ : Sakkarebale	33.23	31.26	7.25	18.35	110.00
T ₅ : Ney Poovan	47.82	33.80	7.60	15.00	130.40
T ₆ : Rajapuri	45.52	32.00	9.00	16.50	102.00
T ₇ : Karibale	53.21	47.50	6.30	12.50	86.50
T ₈ : Mitli	40.21	36.20	6.20	12.00	80.00
T ₉ : Palaykondan	63.33	36.60	10.10	16.20	132.41
T ₁₀ : Poovan	45.00	28.00	10.50	15.50	125.50
T ₁₁ : Saba	33.50	28.75	6.00	12.50	80.00
T ₁₂ : Kadali	50.02	35.00	11.10	12.00	120.40
T ₁₃ : Mysore mitli	54.12	32.66	10.66	14.66	126.15
T ₁₄ : Sonakel	63.50	30.50	13.00	17.11	127.50
T ₁₅ : Pisang Awak	64.04	33.00	14.15	20.20	146.40
T ₁₆ : Hoovu bale	67.80	33.80	13.40	18.30	141.50
T ₁₇ : Udayam	65.50	30.66	15.20	22.00	148.00
T ₁₈ : Krishna Vazhai	37.50	29.00	6.50	12.00	71.00
T ₁₉ : Red banana green	47.50	36.26	7.50	14.40	109.15
T ₂₀ : Cultivar Rose	45.00	20.25	9.10	15.00	100.10
T ₂₁ : Karpur bale	35.50	28.00	6.51	11.50	85.20
T ₂₂ : Yangambi	63.60	33.00	7.60	13.00	96.33
T ₂₃ : Bargi bale	49.33	28.60	9.66	11.33	95.30
T ₂₄ : Kothia	58.00	28.00	10.40	10.40	95.25
T ₂₅ : H-1	42.00	30.00	9.20	16.80	98.40
T ₂₆ : Monthan	44.56	30.00	9.00	12.10	110.30
T ₂₇ : Gold finger	43.24	37.10	6.00	12.00	72.50
T ₂₈ : Bluggoe	40.75	28.75	5.75	12.45	61.50
T ₂₉ : Pisang lilin	29.66	24.50	4.00	11.33	52.66
T ₃₀ : Grand Naine	61.32	37.40	7.60	15.88	120.30
S.Em±	2.22	2.02	0.85	1.33	6.33
CD (P = 0.05)	6.41	5.85	2.46	3.85	18.32
CV(%)	16.16	14.88	12.94	12.69	17.96

Table 5: Evaluation of performance of banana germplasm for bunch yield characters

Germplasm	Bunch Yield (Kg/plant)	Bunch Yield (Kg/plot)	Bunch Yield (tons/ha.)
T ₁ : Dwarf Cavendish	16.15	80.10	40.10
T ₂ : Hanuman	32.10	160.21	80.00
T ₃ : Robusta	22.30	110.10	55.00
T ₄ : Sakkarebale	7.50	35.50	17.52
T ₅ : Ney Poovan	11.40	57.31	28.51
T ₆ : Rajapuri	11.00	55.00	27.53
T ₇ : Karibale	12.45	60.20	30.05
T ₈ : Mitli	10.45	50.80	25.56
T ₉ : Palaykondan	13.40	65.30	32.50
T ₁₀ : Poovan	24.30	120.21	60.05
T ₁₁ : Saba	6.00	30.31	15.05
T ₁₂ : Kadali	8.40	40.00	20.00
T ₁₃ : Mysore mitli	10.33	51.65	25.82
T ₁₄ : Sonakel	13.50	67.50	33.75
T ₁₅ : Pisang Awak	18.00	90.20	45.10
T ₁₆ : Hoovu bale	15.80	79.10	39.50
T ₁₇ : Udayam	30.60	150.10	75.05
T ₁₈ : Krishna Vazhai	4.50	22.50	11.25
T ₁₉ : Red banana green	8.00	40.20	20.10
T ₂₀ : Cultivar Rose	6.27	30.10	15.00
T ₂₁ : Karpur bale	6.25	31.25	15.62
T ₂₂ : Yangambi	28.33	141.65	70.15
T ₂₃ : Bargi bale	9.35	45.40	22.55
T ₂₄ : Kothia	9.00	45.40	22.55
T ₂₅ : H-1	8.30	40.00	20.05
T ₂₆ : Monthan	8.30	40.00	20.05
T ₂₇ : Gold finger	6.50	32.50	16.25
T ₂₈ : Bluggoe	5.62	28.10	14.05
T ₂₉ : Pisang lilin	2.16	10.80	5.40
T ₃₀ : Grand Naine	19.03	95.15	47.57
S.Em±	2.03	4.54	3.71
CD (P = 0.05)	5.88	13.14	10.72
CV(%)	22.37	10.11	16.52

Conclusion

The plants of Udayam, Hoovu bale, Hanuman, Pisang Awak and Robusta were found most vigorous in growth among thirty cultivars studied as noted by their plant height, stem girth, number of leaves per plant and leaf area at different stages of growth. With respect to yield characters, the variety Hanuman showed maximum bunch yield per plant (32.10 kg), bunch yield per plot (160.21 kg) and bunch yield per hectare (80.0 t) which was supported by better values for bunch length (90 cm), number of hands per bunch (16.0) and total fingers per bunch (178.0) respectively. The varieties such as Udayam, Robusta, Poovan and Yangambi also recorded better performance for yield characters.

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