Research Article

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Feasibility of banana (*Musa paradisiaca* L.) cultivation under Banswara district conditions of Rajasthan

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ABSTRACT

An experiment was conducted at seven locations denoted as AF_1, AnF_1, AnF_2, LF_1, MF_1, SF_1 and IF_1 respectively to study the feasibility of banana cultivation under Banswara district conditions of Rajasthan which are very much milder than that in the desert regions in further north and north-west Rajasthan and also commensurate with the required environmental conditions for banana. For this, phenology of banana cv. Grand Naine was studied by observing the growth pattern. At harvest the vegetative parameters such as range of leaf area varied from 1.21 m^2 (IF_1) to 5.52 m^2 (AnF_1) per plant, number of functional leaves varied from 5.03 (IF_1) to 10.03 (AnF_1), pseudostem height from 131.18 cm (IF_1) to 203.37 cm (AnF_1), pseudostem girth from 39.65 cm (IF_1) to 59.38 cm (AnF_1). Likewise, yield and yield attributing characters were also observed such as peduncle length from 33.96 cm (IF_1) to 45.01 cm (AnF_1), bunch weight from 8.42 kg (IF_1) to 17.06 kg (AnF_1), number of hands per bunch from 6.56 (IF_1) to 8.76 (AnF_1), number of fruits per hand from 10.63 (IF_1) to 14.04 (AF_1), fruit length from 12.68 cm (IF_1) to 16.11 cm (AF_1), fruit diameter from 2.37 cm (IF_1) to 3.35 cm (AnF_1), fruit weight from 90.75 g (IF_1) to 118.30 g (AF_1) and estimated yield per hectare from 25.98 t (IF_1) to 52.65 t (AnF_1). The study of crop duration had shown values which varied from 292.74 (AnF_1) to 307.03 days (IF_1) for shooting, fruits attained the physiological maturity after flower emergence from 105.84 days (AnF_2) to 114.34 days (IF_1) and plants completed their life cycle in 398.63 days (AnF_2) to 421.37 days (IF_1). The parameters pertaining to quality of fruits were also studied such as TSS (°Brix), titrable acidity (%) and organoleptic rating which ranged from 11.57 (IF_1) to 14.48 (AnF_2), 0.126 (AnF_1) to 0.196 (SF_1) and 6.95 (IF_1) to 7.64 (AnF_2), respectively. The results of the experiment proved that Banswara conditions are ideally suited for banana cultivation and the yield and quality of the fruits was at par with those of other locations in the country where banana cultivation is commercially practiced.

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Introduction

Banana (*Musa spp*.) is the second most important fruit crop in India after mango. This crop year round availability, affordability, varietal range, tastes and nutritive makes it the favorite fruit among all classes of people. Banana are grown in about 120 countries. Total annual worldwide production of banana is estimated at 135 million tonnes. As of 2022, bananas production in India was 34.5 million tonnes that accounts for 25.51% of the world's bananas production. Other leading producers are Brazil, Eucador, China, Phillipines, Indonesia, Costa Rica, Mexico, Thailand and Colombia.

In India, banana ranks first in production and third in area among fruit crops. It accounts for 13% of the total area and 33% of the production of fruits. The major banana producing states are Andhra Pradesh, Maharashtra, Karnataka, Gujarat and Assam. Overall, while banana cultivation in India is robust, there is room for non-traditional area cultivation feasibility to meet both domestic and international demands (Priyanka *et al.,* 2018).

Diversification of horticultural crops is the need of hour to suffice the demand of consumers for their nutritional or feeding requirements and to get along with the time new places for cultivation of such crops have to be explored. The agroclimatic conditions of Banswara district are in compliance with that of banana for cultivation and so far no feasibility studies have been carried out at Banswara. Thus, keeping the above points in mind, the present investigation was planned to study the feasibility of banana cultivation under Banswara district conditions of Rajasthan.

Materials and Methods

A field experiment was conducted during the year 2011-12 under Banswara district conditions of Rajasthan. In the experiment 105 plants (15 plants from each site randomly) of cultivar Grand Naine banana, planted at seven different sites at farmers' field *viz*. Arjun, Anil, Anirudh, Laxmikant, Manohar Lal, Shamim and Ishwar denoted as AF_1, AnF_1, AnF_2, LF_1, MF_1, SF_1 and IF_1 respectively, under conditions having subtle difference in climatic and soil conditions, were selected. Several variations were observed in the plants even when a single cultivar was planted on large scale which is mainly due to soil properties leading to differences in root characteristics followed by altered rate of nutrient uptake and prevalence of different environmental conditions. These studies were done in order to study the extent of feasibility of banana cultivation under agro climatic conditions of Banswara district of Rajasthan.

In this study we measured vegetative parameters, yield and yield attributing characters, data related to crop duration and quality parameters. Vegetative parameters included leaf area (m^2), number of functional leaves, psuedostem height (cm) and psuedostem girth (cm). The yield and yield attributing characters included peduncle length, bunch weight (kg), number of hands per bunch, number of fruits per hand, fruit length (cm), fruit diameter (cm), fruit weight (g). Crop duration included days to shooting and time taken for shooting to harvesting. The quality parameters included TSS (°Brix), titrable acidity (%) and organoleptic rating. The experiment was subjected to one way analysis of variance.

Results and Discussion

Vegetative parameters

Average leaf area of banana at the time of harvest varied from 1.21 m^2 (IF_1) to 5.52 m^2 (AnF_1). Locations AnF_1 and AnF_2 were at par with each other and were highly significant over the site IF_1 (1.21 m^2). Locations, which were non-significant in growth pattern of leaf area (AnF_1, 5.52m^2 and AnF_2, 5.32 m^2) had shown a significant difference with other locations. There was no significant difference between number of functional leaves at location AnF_1 (10.03) and AnF_2 (9.48). However both gave significant results in comparison to all other sites. The minimum numbers of functional leaves born by the plants of site IF_1 (5.03), which were 99.40 % less in comparison to number of leaves born by the plants of site AnF_1. Pseudostem height increased with the time and attained a maximum value of 203.37 cm (AnF_1) at harvest, which was significantly higher in comparison to the plants of site IF_1 (131.18 cm) thus at the time of harvesting the plants at site AnF_1 attained 55.13 per cent more height in comparison to the plants at site IF_1. pseudostem girth increased gradually as the crop matures and attained maximum value of 59.38 cm at the location AnF_1 at the time of harvest, which was at par with the treatment AF_1 (59.01 cm) and AnF_2 (58.95 cm), and which recorded significantly higher growth in comparison to other locations. Among all the locations, the site SF_1 had shown the minimum mean pseudostem girth (38.87 cm). The results were in confirmation with the work of Chahil *et al.* (2010), Hidoto (2009) and Rajamanickam and Rajmohan (2010).

Yield and yield attributing characters

The maximum peduncle length (45.01 cm) was observed at the site AnF_1, whereas, minimum value (33.96 cm) was found at the location IF_1. The site AnF_1 had shown at par results with the site AF_1 and AnF_2. Bunch weight of banana varied from 8.42 kg (minimum) to 17.06 kg (maximum), which were from the sites IF_1 and AnF_1, respectively. The values of bunch weight (kg) at sites AF_1 (16.67), AnF_1 (17.06) and AnF_2 (16.89) had non significant difference among each other but found to have significant difference with the plants of location LF_1 (14.74), MF_1 (11.94), SF_1 (9.89) and IF_1 (8.42). The maximum number (8.76) of hands per bunch, were found at site AnF_1while the least (6.56) number of hands per bunch were observed at IF_1. The location AF_1 (8.08), AnF_1 (8.76), AnF_2 (8.70) and LF_1 (8.44) were at par with each other and were significantly higher in comparison to rest of the location viz. MF_1 (7.34), SF_1 (6.74) and IF_1 (6.56). The plants at the site AF_1 had shown the significantly higher values (14.04 fruits per hand) among all other locations and found to possess 32.07 % more fruits per hand in comparison to the plants of location IF_1. However the treatment AnF_1 (13.85) and AnF_2 (13.89) were at par with each other and had shown significant results in comparison to site MF_1 (12.31), SF_1 (11.64) and IF_1 (10.63). Fruit length ranged from 12.68 cm (minimum at IF_1) to 16.11 cm (maximum at AF_1). Thus, among all these values the fruits of the site AF_1 were longest in comparison to fruits of other sites and were at par with AnF_1 (15.89) and AnF_2 (15.85) location. These locations differed significantly in comparison to site MF_1 (14.86), SF_1 (14.46) and IF_1 (12.68). The location AnF_1 (3.35 cm) and AnF_2 (3.21 cm) were at par, further the site AnF_2 (3.21 cm) was at par with AF_1. The least value was shown by IF_1 (2.37 cm), which was significantly lower (41.35 % less) in comparison to AnF_1 location. A range of 91.75 g (minimum at IF_1) to 114.30 g (maximum at AF_1) in terms of fruit weight was observed. The fruits of location AF_1 (114.30 g), AnF_1 (112.58 g) and AnF_2 (111.38 g) were at par, while others possessed significantly lower fruit weight viz. IF_1 (91.75 g) and that was about 22.70 % less in comparison to AF_1 location. These results are in concurrence with the findings of Chahil *et al.* (2010), Patil *et al.* (2010) and Rajmanickam *et al.* (2008).

Crop duration

The location IF_1 took maximum (307) days from planting to shooting and the plants at site AnF_1 flowered in the least time period of 292 days after planting. Fruits were ready for harvesting after a period of about 105.84 days to 114 days. The minimum days were taken by the plants of the AnF_2 location which was at par with the plants of site AnF_1 and rest of the locations had shown significantly different time period for maturity. The plants completed their life cycle in minimum 398 days to a maximum value of 421 days shown by the plants at location AnF_2 and IF_1 respectively. The plants from the site IF_1 took about 5.7 per cent more time in comparison to the site AnF_2. These results are in confirmation with the findings of Krishnamoorthy and Kumar (2005), Nainwad *et al.* (2005), Rajamanickam and Rajmohan (2010).

Quality *parameters*

The significantly higher value of 14.48°Brix was observed at AnF_2. While AF_1 (12.87°Brix), AnF_1 (12.8°Brix), AnF_2 (14.48°Brix) and LF_1 (12.52°Brix) were at par with each other. On the other side MF_1 (11.78°Brix), SF_1 (11.86°Brix) and IF_1 (11.57°Brix) were at par with each other. The values of titrable acidity from AnF_1 (0.126 per cent) and AnF_2 (0.129 per cent) location were at par with each other. Likewise, LF_1 (0.175 per cent) and MF_1 (0.169 per cent)

Table 1. Vegetative and fruit characteristics of banana under Baswara conditions

Locations	Leaf area (m^2)	No. of functional leaves	Pseudostem height (cm)	Pseudostem girth (cm)	Peduncle length (cm)	Bunch weight (kg)	No. of hands per bunch	No of fruits per hand	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)
AF_1	5.00	9.27	198.32	59.01	43.68	16.67	8.08	14.04	16.11	3.04	114.30
AnF_1	5.52	10.03	203.37	59.38	45.01	17.06	8.76	13.85	15.89	3.35	112.58
AnF_2	5.32	9.48	197.76	58.95	44.96	16.89	8.70	13.89	15.85	3.21	111.38
LF_1	5.11	9.38	195.45	53.05	42.25	14.74	8.44	12.61	15.18	2.80	108.93
MF_1	3.03	7.85	164.86	49.57	39.68	11.94	7.34	12.31	14.86	2.53	102.94
SF_1	1.96	6.47	134.37	38.87	37.83	9.89	6.74	11.64	14.46	2.42	100.78
IF_1	1.21	5.03	131.18	39.65	33.96	8.42	6.56	10.63	12.68	2.37	90.75
SEm±	0.09	0.20	2.49	0.79	0.58	0.21	0.18	0.21	0.21	0.06	1.65
CD (P=0.05)	0.25	0.58	6.98	2.23	1.63	0.59	0.52	0.59	0.59	0.17	4.64

Table 2. Crop duration and quality of banana under Baswara conditions

Locations	Days to shooting (days)	Shooting to harvesting (days)	Crop cycle (days)	TSS (°Brix)	Acidity (%)	Organoleptic rating (out of 10)
AF_1	294.40	107.27	401.67	12.87	0.134	7.32
AnF_1	292.74	106.05	398.79	12.89	0.126	7.59
AnF_2	292.79	105.84	398.63	14.48	0.129	7.64
LF_1	297.87	109.28	407.15	12.52	0.175	7.44
MF_1	298.95	108.98	407.93	11.78	0.169	7.41
SF_1	302.37	112.23	414.60	11.86	0.196	7.21
IF_1	307.03	114.34	421.37	11.57	0.184	6.95
SEm±	4.22	0.48	5.77	0.21	0.002	0.102
CD (P=0.05)	11.85	1.36	16.20	0.59	0.006	0.29

were also at par at each other. The titrable acidity was found in the range of 0.126 (AnF_1) per cent to 0.196 (SF_1) per cent. Organoleptic rating was found statistically significant. Results from the location AnF_2 (7.64) was maximum and was at par with AF_1 (7.32), AnF_2 (7.59), LF_1 (7.44) and MF_1 (7.41) and had significant difference with the locations SF_1 (7.21) and IF_1 (6.95). The results are in conformity with the findings of Abd El-Naby (2010) and Narayana and Mustaffa (2007).

Conclusion

The results of the experiment proved that Banswara conditions were ideally suited for banana cultivation and the yield and quality of the fruits was at par with those of other locations in the country where banana cultivation is commercially practiced. Among the locations Arjun (AF_1) and Anil (AnF_2) were most feasible for banana cultivation.

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References

Abd El-Naby, S.K.M. 2010. Effects of postharvest treatments on quality aspect of Maghrabi banana fruit. *American-Eurasian J. Agric. & Environ. Sci*., 8 (5): 582-587.

Chahil, B. S. Gill, T. K. and Singh, C. 2010. Performance of tissue cultured banana cv. Grand Naine (*Musa paradisiaca* L.) under sub-tropical climatic conditions. *Indian Journal of Ecology,* 37(2): 217-220.

Hidoto, L. 2009. Effect of sucker management on banana yield. *African Crop Science Conference Proceedings,* 9: 275-277.

Krishnamoorthy, V. and Kumar, N. 2005. Preliminary evaluation of diploid banana hybrids for yield potential, male fertility and reaction to *Radophalous similis*. *Plant Genet. Res. Newslr.,* 141: 39-43.

Narayana, C.K., Mustaffa, M.M. 2007. Influence of maturity on shelf-life and quality changes in banana during storage under ambient conditions. *Indian Journal of Horticulture,* 64 (1).

Nainwad, R., Kullkarni, N. and Kalalbundi, B. 2005. Extent of variation in growth and yield attributes of some tissue culture vs conventional sucker planted banana varieties. *Karnataka J. Agric. Sci.,* 18(1): 221-222. Patil, S., Solia, B. and Patil, B. 2010. Prediction of fruit yield of banana using stem girth and yield attributes. *Green Farming*, 1(2): 219.

Priyanka Kumari, K.M. Singh and Santosh Kumar Atre. 2018. Problems and Constraints in Banana Cultivation: A Case Study in Bhagalpur District of Bihar. *Int. J. Curr. Microbiol. App. Sci*. 7(07):1752-1759.

Rajamanickan, C., Rajmohan, K., Parthiban, S. and Venkatesan, K. 2008. Performance of triploid banana (*Musa spp*.) cultivars of Kerala. *South Indian Hort.,* 55(1-6): 119-132.

Rajamanickam, C. and Rajmohan, K. 2010. Variability studies in Palayankodan ecotypes AAB genomic group of banana (*Musa spp.*). *J. Hort. Sci.,* 5(2): 109-113.