

## Effect of dates of planting on growth and yield of banana (*Musa* AAA. Grand Nain)

J. S. BINDHU AND L. GIRIJADEVI

Department of Agronomy, Kerala Agricultural University  
College of Agriculture, Vellayani, Thiruvananthapuram-695522, Kerala, India

Received: 14-03-2016, Revised: 14-05-2016, Accepted: 25-05-2016

### ABSTRACT

A field experiment was conducted during 2014-15 at the Instructional Farm attached to the College of Agriculture, Vellayani, Kerala with the objective to find out the optimum planting time for Grand Nain banana and to study the phenology of the cultivar. The experiment was laid out in RBD with ten treatments and four replications. The treatments were ten dates of planting starting from the month of January onwards up to October. Planting was done on 28 day of every month from January onwards. The study revealed that the planting dates had significant influence on growth, yield and fruit quality of Grand Nain banana. From the study it can be inferred that ideal planting time for Grand Nain banana is February in the southern agro climatic condition of Kerala which resulted in shorter duration and higher productivity.

**Keywords:** Duration, february, grand nain, phenology, planting dates

India is the largest producer of banana in the world and it contributes to 32.60 per cent of the total fruit production (Anon, 2013). Among horticultural crops, contribution of banana to Agricultural Gross Domestic Product (AGDP) is the highest (Singh, 2007). In many banana growing states of India, there has been a steady increase in area, production and productivity of banana due to adoption of high yielding varieties like Grand Nain, Robusta and other Cavendish clones, use of virus free quality planting material and adoption of improved production technologies (Mustaffa and Kumar, 2012).

Grand Nain is one of the most remunerative among banana varieties. Detailed knowledge of phenological cycles of banana plant in a particular area enables the farmers to intensify the level of management, plan the planting date and harvest in accordance with the market demand (Robinson and Sauco, 2010). Unlike other fruits, the vegetative growth, flowering and fruit growth is not seasonal in banana and are largely influenced by time of planting, type and size of planting material and prevailing temperature. The present investigation was undertaken with the objective to find out the optimum planting time for Grand Nain banana and to study its phenology.

### MATERIALS AND METHODS

The experiment was conducted at the Instructional Farm attached to the College of Agriculture, Vellayani, Kerala situated at 8.5° N latitude and 76.9° E longitude and at an altitude of 29 m above mean sea level during 2014-2015. The experiment was laid out in RBD with ten treatments and four replications. The treatments were ten dates of planting from January to October. Planting

was done on 28 day of every month from January onwards. The soil of the experimental site is sandy clay loam, extremely acidic with low organic carbon, medium N and K and high P. The tissue cultured plants were planted at a spacing of 1.8 x 1.8 m. Farm yard manure @ 15 kg pit<sup>-1</sup> N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O fertilizers @ 200: 200: 400 g plant<sup>-1</sup> were applied (Anon, 2011). Farm yard manure and entire phosphorus were applied as basal and nitrogen and potash were given in equal splits at two and four months after planting (MAP). The crop was raised as rainfed and daily irrigation was given up to two weeks after planting for the establishment of the crop. In long intervals of dry spell, life saving irrigation was provided.

The growth parameters were recorded at 6 months after planting (MAP) and at harvest both growth parameters and yield attributes were recorded. Leaf area was calculated by the equation developed by Murray (1960). Observations on finger characteristics were recorded from D finger of the D hand. The second hand from the top of the bunch is regarded as D hand and the middle finger in the top row of the second hand is designated as the D finger. The quality attributes of D finger were analyzed. Total soluble solids (TSS) were determined using a hand refractometer and expressed in per cent and titrable acidity was measured using titration procedure (Ranganna, 1977). Data relating to each character is analyzed by applying the Analysis of Variance technique.

The weather data recorded at class B Agromet observatory attached to College of Agriculture, Vellayani during the crop growth period is given in table 4.

## RESULTS AND DISCUSSION

The data in table- 1 indicates that the growth characters viz., plant height, girth of pseudostem, number of functional leaves, functional leaf area and leaf area index were significantly different under different planting dates. The June ( $T_6$ ) planted crop recorded the highest plant height (246.75cm) at 6 MAP and January ( $T_1$ ) planted recorded the lowest (171.25cm). Yadav *et al.* (2011) reported that characteristics of the banana plant could be influenced by the season and he observed that suckers planted during June gave the maximum vegetative growth. The pseudo stem girth was the highest (69.75 cm) in July

( $T_7$ ) planted crop which was on par with all other treatments except August ( $T_8$ ) planted crop. The number of functional leaves was the highest (15.25) in February ( $T_2$ ) planted crop which was on par with April ( $T_4$ ) and October ( $T_{10}$ ) planted crops. The functional leaf area and LAI were the maximum (20.77 m<sup>2</sup>, 6.41) in April ( $T_4$ ) planted crop and was on par with February ( $T_2$ ), June ( $T_6$ ) and October ( $T_{10}$ ) planted crops at 6 MAP. At harvest, plant height was the highest in January ( $T_1$ ) planted crop which may be due to the longest duration of vegetative phase (Table 3) while girth was the highest in July ( $T_7$ ) planted crop. The number of functional leaves, functional leaf area and LAI were the highest in February ( $T_2$ ) planted crop.

**Table 1: Effect of planting dates on growth attributes of Grand Nain banana**

Treatments	At 6 MAP					At Harvest				
	Plant height (cm)	Girth of pseudostem (cm)	Number of functional leaves	Functional leaf area (m <sup>2</sup> )	Leaf area index	Plant height (cm)	Girth of pseudostem (cm)	Number of functional leaves	Functional leaf area (m <sup>2</sup> )	Leaf area index
$T_1$ (January)	171.25	64.75	14.00	10.01	3.09	300	70.75	6.00	11.67	3.61
$T_2$ (February)	196.75	68.25	15.25	18.92	5.84	229.5	72.75	10.00	16.43	5.07
$T_3$ (March)	204.50	65.25	10.25	8.81	2.72	223.75	64.75	6.00	7.94	2.45
$T_4$ (April)	213.25	65.75	14.75	20.77	6.41	226.25	67.50	7.50	11.01	3.40
$T_5$ (May)	202.75	64.00	15.00	16.77	5.18	230.25	68.50	6.50	8.94	2.76
$T_6$ (June)	246.75	67.75	14.25	19.16	5.91	264.00	81.00	7.00	10.48	3.24
$T_7$ (July)	218.25	69.75	14.50	21.13	6.53	262.25	78.25	8.00	13.10	4.04
$T_8$ (August)	176.25	52.50	13.75	11.85	3.66	223.50	68.00	6.00	7.78	2.40
$T_9$ (September)	206.25	63.75	10.50	12.95	4.00	264.00	71.50	7.00	11.40	3.52
$T_{10}$ (October)	211.75	66.00	14.75	18.43	5.69	241.25	69.75	5.75	8.46	2.61
<b>SEm (<math>\pm</math>)</b>	<b>6.43</b>	<b>2.53</b>	<b>0.35</b>	<b>1.24</b>	<b>0.38</b>	<b>6.42</b>	<b>2.52</b>	<b>0.45</b>	<b>0.92</b>	<b>0.28</b>
<b>LSD (0.05)</b>	<b>18.28</b>	<b>7.16</b>	<b>0.99</b>	<b>3.52</b>	<b>1.09</b>	<b>18.26</b>	<b>7.16</b>	<b>1.29</b>	<b>2.61</b>	<b>0.81</b>

**Table 2: Effect of planting seasons on the yield attributes, yield and quality parameters of Grand Nain banana**

Treatments	No. of Fingers in D hand	Peduncle length (cm)	Weight of D finger (g)	Total no. of fingers	No. of hands	Bunch weight (kg plant <sup>-1</sup> )	Length of D finger (cm)	TSS (%)	Titration acidity (%)
$T_1$ (January)	17.50	62.50	130.25	104.75	7.00	19.00	16.50	20.75	0.33
$T_2$ (February)	26.75	101.25	165.00	186.25	10.50	29.50	22.00	24.50	0.27
$T_3$ (March)	27.00	87.50	130.38	174.00	9.25	22.50	19.75	23.50	0.31
$T_4$ (April)	21.50	90.00	147.63	161.25	10.25	22.88	21.75	22.00	0.34
$T_5$ (May)	17.00	67.50	150.00	152.50	8.75	23.75	16.95	23.75	0.31
$T_6$ (June)	26.75	92.50	134.93	198.75	11.00	24.88	16.63	23.00	0.33
$T_7$ (July)	21.75	97.25	183.75	163.50	9.75	28.63	19.80	21.75	0.30
$T_8$ (August)	17.50	73.75	138.00	152.00	8.25	20.50	17.50	22.25	0.26
$T_9$ (September)	18.00	72.50	144.75	172.25	9.50	20.00	19.63	22.00	0.27
$T_{10}$ (October)	18.50	85.50	117.00	165.50	10.50	19.50	16.80	21.25	0.28
<b>SEm (<math>\pm</math>)</b>	<b>1.81</b>	<b>4.73</b>	<b>5.96</b>	<b>5.28</b>	<b>0.34</b>	<b>1.17</b>	<b>0.59</b>	<b>0.89</b>	<b>0.02</b>
<b>LSD (0.05)</b>	<b>5.14</b>	<b>13.45</b>	<b>16.93</b>	<b>15.00</b>	<b>0.96</b>	<b>3.33</b>	<b>1.69</b>	<b>2.53</b>	<b>0.05</b>

### Dates of planting on growth and yield of banana

In banana the bunch and finger characters like number of hands per bunch, weight of D hand, length and weight of D fingers etc are considered as yield determinants (Stover and Simmonds, 1987). The planting dates significantly influenced the yield attributes of Grand Nain banana. The number of fingers in D hand was significantly influenced by the treatments. Maximum number of fingers in D hand was recorded in February (T<sub>2</sub>) planting and it was on par with June (T<sub>6</sub>) and July (T<sub>7</sub>) planting and the lowest was recorded in May (T<sub>5</sub>) planting. The peduncle length of the bunch was significantly influenced by the treatments and it was found to be the highest in February (T<sub>2</sub>) planting and was on par with July (T<sub>7</sub>) planting. Similarly the weight of D finger is another yield contributor and in

this study the weight of D finger was found significantly higher in July (T<sub>7</sub>) and February (T<sub>2</sub>) planted crops and the lowest in October (T<sub>10</sub>) planted crop.

The total number of fingers, number of hands and length of D finger (Table 2) were found to be significantly influenced by dates of planting. The number of fingers was the highest (198.75) in June (T<sub>6</sub>) planted crop and was on par with February (T<sub>2</sub>) planting and the lowest (104.75) was recorded in January (T<sub>1</sub>) planting. Highest number of hands (11 hands) were recorded in June (T<sub>6</sub>) planted crop and was on par with February (T<sub>2</sub>), October (T<sub>10</sub>) and April (T<sub>4</sub>) planting. The length of D finger was maximum (22 cm) in February (T<sub>2</sub>) planting and the minimum (16.50 cm) in January (T<sub>1</sub>) planting.

**Table 3: Effect of planting dates on the duration of Grand Nain banana**

Treatments	Number of days for shooting	Number of days for shooting to harvest	Total duration ( days )
T <sub>1</sub> (January)	274.25	81.25	355.5
T <sub>2</sub> (February)	203.25	73.75	277
T <sub>3</sub> (March)	212.25	93.75	306
T <sub>4</sub> (April)	219.25	76.75	296
T <sub>5</sub> (May)	228.75	82.25	311
T <sub>6</sub> (June)	239	100.75	339.75
T <sub>7</sub> (July)	232	84.25	316.25
T <sub>8</sub> (August)	246.25	88.75	335
T <sub>9</sub> (September)	251.75	83.25	335
T <sub>10</sub> (October)	260.5	97.25	357.75
<b>SEm(±)</b>	<b>7.48</b>	<b>2.91</b>	<b>8.6</b>
<b>LSD (0.05)</b>	<b>21.271</b>	<b>8.282</b>	<b>24.442</b>

The total number of fingers, number of hands and length of D finger (Table 2) were found to be significantly influenced by dates of planting. The number of fingers was the highest (198.75) in June (T<sub>6</sub>) planted crop and was on par with February (T<sub>2</sub>) planting and the lowest (104.75) was recorded in January (T<sub>1</sub>) planting. Highest number of hands (11 hands) were recorded in June (T<sub>6</sub>) planted crop and was on par with February (T<sub>2</sub>), October (T<sub>10</sub>) and April (T<sub>4</sub>) planting. The length of D finger was maximum (22 cm) in February (T<sub>2</sub>) planting and the minimum (16.50 cm) in January (T<sub>1</sub>) planting.

The bunch weight per plant was found maximum in February (T<sub>2</sub>) planting (29.50 kg) which was on par with July (T<sub>7</sub>) planting and was significantly superior to all other dates of planting. Baiyeri (2008) reported that the number of standing leaves at harvest as the most reliable predictor of bunch weight. In this study also the maximum number of leaves was recorded in February (T<sub>2</sub>) planted crop followed by July (T<sub>7</sub>) planted crop.

This might be the reason for the highest bunch weights in February (T<sub>2</sub>) and July planted crops. The bunch weight per plant was the lowest in January (T<sub>1</sub>) planting (19.0 kg) and was found to be on par with August (T<sub>8</sub>), September (T<sub>9</sub>) and October (T<sub>10</sub>) plantings.

In banana, quality standards have become the most important factor influencing the economic yield. Bauri *et al.* (2014) reported that fruit size and quality is of great importance in banana though consumer acceptance varies from place to place. The fruit quality parameters like TSS and titrable acidity were also influenced by the treatments. TSS was found to be the highest in February (T<sub>2</sub>) planting, which was on par with May (T<sub>5</sub>), March (T<sub>3</sub>), June (T<sub>6</sub>), July (T<sub>7</sub>) and September (T<sub>9</sub>) planted crops and the lowest in January (T<sub>1</sub>) planted one. The titrable acidity was the lowest in February (T<sub>2</sub>) planting which was on par with all treatments except T<sub>1</sub> (January) and T<sub>8</sub> (August).

The data presented in table 3 reveals that February (T<sub>2</sub>) planting resulted in early harvest of crop due to

the shorter period for shooting, bunch emergence to harvest and physiological maturity. Flower emergence to harvest duration (E-H) is the main reproductive index of banana development. In this study the February (T<sub>2</sub>) planting took least number of days for flower emergence to harvest (73.75 days) and was significantly superior to all other dates of planting except April (T<sub>4</sub>) planting. The maximum duration from E-H was for June (T<sub>6</sub>) planted crop (100.75 days). Stover (1979) reported that the E-H for Grand Nain were 98 days for hot weather fruit development and 117 days for cool weather

development and February (T<sub>2</sub>) planting in this study was in accordance with this. The total duration of the crop was also significantly influenced by dates of planting and the results revealed that though April (T<sub>4</sub>) planted crop was on par with February (T<sub>2</sub>) planted crop in total duration, the bunch yield of April (T<sub>4</sub>) planted crop was significantly inferior to February (T<sub>2</sub>) planted ones. The total duration of the crop was reduced by planting it in February (277 days) where as the duration seems to be extended in October (T<sub>10</sub>) and January (T<sub>1</sub>) planted crops.

**Table 4 : Weather parameters during the crop growth period ( 2014-2015)**

Months	2014						2015					
	T <sub>max</sub> (°C)	T <sub>min</sub> (°C)	RH <sub>max</sub> (%)	RH <sub>min</sub> (%)	Rain (mm)	Evaporation (mm)	T <sub>max</sub> (°C)	T <sub>min</sub> (°C)	RH <sub>max</sub> (%)	RH <sub>min</sub> (%)	Rain (mm)	Evaporation (mm)
January	30.61	21.53	93.41	73.64	28.5	3.2	30.61	21.56	93.60	65.30	8	3.0
February	31.33	22.32	92.35	69.46	21	4.0	31.53	22.34	92.50	64.30	0	4.1
March	32.43	22.88	91.90	66.54	31.5	4.3	32.42	23.65	90.00	67.40	56.1	4.2
April	32.4	24.47	91.20	73.60	115	3.0	32.74	24.48	90.70	73.10	182.6	4.0
May	31.88	24.73	90.03	78.45	280.4	3.4	32.14	25.31	90.70	82.80	406	3.4
June	30.76	25.21	92.46	79.16	88	3.3	31.43	24.47	90.90	82.80	346.9	3.9
July	29.99	24.3	91.90	77.50	104.2	3.6	31.31	24.6	89.10	79.60	53.5	4.0
August	29.5	23.74	90.70	81.20	551.5	5.1	31.68	24.57	89.30	77.10	80.2	4.2
September	30.2	24.19	90.80	78.96	219.4	3.8	31.41	24.4	91.80	83.90	289.8	4.5
October	30.52	23.82	86.93	82.40	230.2	3.7	31.29	24.03	92.20	80.20	399.1	3.8
November	30.18	23.38	93.46	77.23	137.3	1.7						
December	31.2	23.25	94.30	78.30	133.5	2.5						

From this experimental results it can be concluded that for getting higher yield from Grand Nain banana under the southern agro climatic condition of Kerala the ideal time of planting is February which is characterized with shorter periods of phenological phases for all crop growth stages.

## REFERENCES

- Anonymous 2011. *Package of Practices Recommendation: Crops* (14<sup>th</sup>Ed.). Directorate of Extension, Kerala Agricultural University, Thrissur, pp.193-97.
- Anonymous 2013. *Indian Horticulture Database*, National Horticulture Board, Ministry of Agriculture, Government of India, Gurgaon. pp. 34-41.
- Baiyeri, K. P. 2008. Phenotypic relationships among growth, yield, and black leaf streak disease responses of *Musa* genotypes. *J. Crop Improvement*, **21**: 41-54.
- Bauri, F. K., De, A., Misra, D. K., Bandyopadhyay, B., Debnath, S., Sarkar, S. K. and Avani, P. 2014. Improving yield and quality of banana cv. Martaman (*Musa* AAB, Silk) through micronutrient and growth regulator application. *J. Crop Weed*, **10** : 316-19.
- Murray, D.B. 1960. Shade and fertilizer relations in the banana. *Trop. Agric. (Trinidad)*, **38**: 123-132.
- Mustaffa, M. M. and Kumar, V. 2012. Banana production and productivity enhancement through spatial, water and nutrient management. *J. Hort. Sci.*, **7**: 1-28.
- Ranganna, S.1977. *Manual of analysis of fruit and vegetable products*. Tata Mc graw hills publishing company Ltd., N. Delhi, pp.7-94.
- Robinson, J. C. and Saucó, V. G. 2010. *Banana and Plantains* (2<sup>nd</sup>Ed.). CAB International, UK, pp.90 - 91.
- Singh, H. P. 2007. Banana: Technological advancements. In: *National and International Scenario of Banana and Plantain* (Eds. Singh, H.P. and Uma, S.), AIPUB, pp.1-19.
- Stover, R. H. and Simmonds, N.W.1987. *Bananas* (3<sup>rd</sup> Ed). Longman, Harlow, pp.468.
- Stover, R. H. 1979. *Pseudostem growth, Leaf Production and Flower Initiation in the Grand Nain Banana*. SIATSA Bulletin No.8, La Lima, Honduras, pp. 3-37.
- Yadav, A., Ram, R.B., Kumar, R., Sonkar, P., Meena, M. L. and Latha, R. 2011. Response of planting dates on growth and yield characteristics of banana (*Musa* sp.) cultivars. *Ann. Hort.*, **4**:95-100.