ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 3, Issue 10 , October 2016

Influence of high density planting and fertigation on physiological parameters, flowering and yield of banana (*Musa acuminata* L.) cv. Grand Naine of Main and ratoon crop

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ABSTRACT: An experiment was conducted during 2013-15 to study the influence of high density planting (HDP) and fertigation on physiological growth, flowering and yield of banana. Physiological growth parameters like absolute growth rate (AGR) for pseudostem height was highest (1.24) in F_1 at 3-5 months after planting (MAP) and non significant due to plant densities. Whereas, reverse trend was observed at 5-7 MAP. The highest (0.39) absolute growth rate was recorded in S_1 (1.8 x 1.8 m) for pseodostem girth and was non- significant at 3-5 MAP and similar trend was noticed at 5-7 MAP. The leaf area index (LAI) was recorded highest (3.91) in S_1 (wider spacing) compared to S_2 (2 x 1.25 x 1.25 m). The lowest (319.56 & 326.30 days) crop duration was registered in S_1 and F_1 and highest (343.87 & 333.70 days) was noticed in S_2 and F_2 (75 % RDF). The longest crop duration was observed in high density planting and 75 per cent RDF and least in S_1 (wider spacing) and F_1 (100 % RDF). The yield differed significantly due to planting densities and fertigation levels, recording highest (92.79 and 89.87 t/ha) in S_2 (HDP) and F_1 (100 % RDF). In interaction between spacing and fertigation, the highest (103.81 t/ha) yield was noticed in S_2xF_1 compared to other interactions.

KEY WORDS : Banana, Grand Naine, Planting density, Fertigation, physiological growth parameters, yield.

I.INTRODUCTION

Banana is a tropical and commercial fruit crop of the country with higher productivity among the fruit crops. Increase in productivity of this crop to meet per capita demands for human nutrition is the major objective of todays researchers. Banana is botonicolly a herb, where training and pruning response is not applicable. Hence, alternative technologies to improve the productivity of banana are main concerns of present researchers. High density planting, which offers to plant more number of plants per unit area and fertigation with advantage of applying fertilizers with drip irrigation are very important stratagies to boost productivity of banana. The productivity depends on the management of optimum leaf area index (LAI) recorded the significant effect of leaf number and LAI on penetration of photosynthetically active radiation (PAR) on crop growth and yield parameters and to have direct effect on growth and yeild parameters like leaf number, LAI, obsorption of solor light and productivity (Nalina *et al* 2000).

II. MATERIAL AND METHODS

The present study was conducted during 2013-15 at Horticultural Research Station, Aswaraopet, Khammam Dist. The main objective of the study was to identify the optimum physiological parameters to obtain maximum yields under high density planting and fertigation in banana cv. Grand Naine. The investigation was carried out by planting tissue culture banana plant at three spacing levels *viz.*, S_1-under 1.8x1.8 m (3086 pl/ha), S_2 - 2.0x1.25x1.25 m (4414 pl/ha), S_3- 2.5x1.25X1.25 m (3657 pl/ha) and three fertigation levels *viz.*, F_1-100 per cent, 75

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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per cent and 50 per cent (Recommended Dose Fertilizer).

Fertigation levels

F_1- 100 % N and K – 300 g N and 300 g K_2O plant^{-1} (652 g urea and 500 g MOP per plant).
F_2 – 75 % N and K – 225 g N and 225 g K_2O plant^{-1} (489 g urea and 375 g MOP per plant).
F_3 – 50 % N and K – 150 g N and 150 g K_2O plant^{-1} (326 g urea and 250 g MOP per plant).

Details of split application for main crop

F_1 – The total quantity of 652 g urea and 500 g MOP per plant were applied in 30 equal splits @ 22.0 g urea and 17.0 g MOP (each split) at weekly intervals.

F_2 – The total quantity of 489.0 g urea and 375.0 g MOP per plant were applied in 30 equal splits @ 16.0 g urea and 13.0 g MOP (each split) at weekly intervals.

F_3 – The total quantity of 326.0 g urea and 250.0 g MOP per plant were applied in 30 equal splits @ 11.0 g urea and 8.0 g MOP (each split) at weekly intervals

Details of split application for ratoon crop

F_1 – The total quantity of 652.0 g urea and 500 g MOP per plant were applied in 20 equal splits @ 32.6 g urea and 25.0 g MOP (each split) at weekly intervals.

F_2 – The total quantity of 489.0 g urea and 375.0 g MOP per plant were applied in 20 equal splits @ 25.0 g urea and 19.0 g MOP (each split) at weekly intervals.

F_3 – The total quantity of 326.0 g urea and 250.0 g MOP per plant were applied in 20 equal splits @ 16.0 g urea and 12.5 g MOP (each split) at weekly intervals.

In the experiment, five plants in the each plot were selected to record physiological growth parameters at various phenological stages of the main crop and ratoon crop.

Physiological Parameters:

Total number of leaves : Progressive leaf number, number of green leaves and dried leaves were recorded by tagging at shooting stage.

Absolute growth rate (AGR) (cm day^{-1})

Absolute growth rate was estimated for pseudostem height and pseudostem girth by using the following formula.

AGR for pseudostem height

$$\text{Absolute growth rate of pseudostem height (cm day}^{-1}\text{)}: \frac{H_2 - H_1}{t_2 - t_1}$$

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 3, Issue 10 , October 2016

Where, H_1 and H_2 are pseudostem heights at times t_1 and t_2 respectively.

AGR of pseudostem girth

$$\text{Absolute growth rate of pseudostem girth (cm day}^{-1}\text{)} : \frac{G_2 - G_1}{t_2 - t_1}$$

Where, G_1 and G_2 are pseudostem girths at times t_1 and t_2 respectively.

Leaf Area Index (LAI): The leaf area was calculated by multiplying the product of length and breadth of lamina by the factor 0.83 and expressed in square meters. The length of leaf lamina was measured from the base to apex along with the midrib and width at the broadest portion of the lamina. Leaf area was measured using the following model developed by Robinson and Nel (1988), LA = {0.83(L × B)} × number of leaves, where, LA = leaf area per leaf (m^2), L = leaf length (m), B = leaf breadth (mLeaf area index was determined using the formula suggested by Watson (1952).

$$\text{LAI} = \frac{\text{Leaf area per plant}}{\text{Land area occupied per plant}}$$

III. FLOWERING CHARACTERS

Number of days taken for shooting : Days taken for emergence of flower stalk after planting of tissue cultured plants in the main crop were counted and recorded.
Number of days taken from shooting to harvest : Days taken from flower stalk emergence to fruit maturity (disappearance of angle and fullness of the fingers of the middle hand in the bunch) were counted and recorded.
YIELD(t/ha): Average bunch weight of selected plants in each treatment multiplied by 80 per cent of population was considered as the yield.

IV.RESULTS AND DISCUSSION

The effect of plant density and fertigation on total number of leaves , leaf area, leaf area index was presented in table-1.

Total number of leaves at shooting stage:

Main crop: There were significant differences in total number of leaves per plant. The highest number of leaves per plant (32.59) was recorded in F_1, which was on par with F_2 (31.30) and significantly least number of leaves was noticed in F_3 (29.49). The plants responded significantly to spacing levels, the highest number of leaves (34.36) was recorded in wider spacing *i.e.*, S_1 and was significant over S_3 (30.44) and S_2 (28.59). The interaction of S_1 with fertigation levels was not significant, however, S_2 and S_3 were significant. The highest number of leaves was recorded in S_2xF_1 (30.76) and S_3xF_1 (32.20) which were on par with S_2xF_2 (28.86) and S_3xF_2 (30.73) respectively and superior over S_2xF_3 and S_3xF_3.

Ratoon crop: The highest number of leaves per plant (31.62) was recorded in F_1 followed by F_2 (31.11) and F_3 (28.33). In plant densities, the highest (31.21) leaves per plant was recorded in S_1 which was significantly superior over S_3 (30.28) and S_2 (29.57). The interaction of S_1, S_2, S_3 densities with F_1 recorded highest number of leaves per plant and with F_3 resulted lowest leaves. The total number of leaves per plant was highest in higher fertigation dose (100 per cent RDF) and wider spacing (S_1). Whereas, in interaction effects, even though higher fertigation dose recorded more number of leaves but it was not statistically significant with other fertigation levels. Significant difference was not recorded in interaction effects between spacing levels and F_1 and F_2 fertigation levels.

The more number of leaves at higher fertigation and wider spacing may be due to adequate availability of nutrients to induce more leaves, provided with ample space for more light interception and air movement under tropical conditions. Whereas, lesser leaves were noticed in HDP. Similar results were reported by Nankinga *et al* (2005), Athani *et al* (2009) and Sarrwy *et al* (2012). Sufficient number of leaves will harness the light energy and synthesise adequate photosynthates for biomass production. More number of functional leaves produced from banana is an indication of the vigour, reflecting on yield and quality of fruits as they act as the source for the developing bunches (Husameldin *et al.* 2013).

Leaf area (sq. m. plant^{-1}) at shooting stage :

Main crop : The highest leaf area was observed in F_1 (12.11) and S_1 (12.68) followed by other treatments. The interaction of S_1 and S_2 with fertigation levels at shooting stage was found non significant. However, in S_3 level with fertigation S_3xF_1 (12.12) was significant over S_3xF_3 (11.54) and was on par with S_3xF_2 (11.92). Among all the interaction effects S_1xF_1 (12.73) recorded highest leaf area compared to all other interactions. The leaf area was highest in wider spacing and at higher levels of fertigation, and as the density increased and fertigation levels decreased the leaf area was reduced. In the present study, higher leaf area was noticed in the conventional planting density (S_1). It is well known that the leaf area has the greater influence on photosynthetic efficiency through higher light interception, as well as higher light assimilation.

Ratoon crop : During shooting stage, the highest leaf area (8.80) was recorded in F_1, which was significantly superior over F_2 (8.41) and F_3 (8.20). In plant densities S_1 registered highest (9.42) leaf area, which was significantly followed by S_3 (8.16) and with lowest value in S_2 (7.84). The interactions of plant densities and fertigation were significant. In S_1, S_2 and S_3 interactions with fertigation levels, the highest values were recorded with F_1 level and lowest in F_3. The leaf area gradually increased during crop growth. At shooting stage highest leaf area was noticed.

Leaf Area Index (LAI)

The variation observed in Leaf Area Index (LAI) due to plant densities and fertigation in main and ratoon crop is presented in table-1.

Main crop: At shooting stage, the leaf area index was not significant due to fertigation levels and interactions between plant densities and fertigation. However, the plant densities influenced the leaf area index, with highest (3.91) leaf area index in S_1, followed by S_3 (3.61) and S_2 (3.03). Wider plant density recorded highest leaf area index and it decreased with increase in plant density in this experiment. The reason for increased leaf area index might be due to higher fertigation levels, enhanced vegetative growth in respect of number of leaves and leaf area which simultaneously enhanced leaf area index, as reported by Hazarika and Ansari 2010) in banana.

Ratoon crop: At shooting stage, the LAI was found significant. The highest (2.60) LAI was registered in F_1 which was significantly followed by F_2 (2.48) and F_3 (2.42). In plant densities the highest LAI (2.91) was recorded in S_1, which was superior over S_3 (2.51) and S_2 (2.09). In all interaction effects higher fertigation dose F_1 with two densities S_1, S_3 resulted highest LAI and lowest with F_3. However, the interaction effect due to plant densities and fertigation levels was not significant. The LAI has increased gradually during crop growth with highest at shooting stage. Higher dose of fertigation (F_1) and wider spacing (S_1) resulted in more LAI. Whereas, it was lowest in high density planting (S_2) and lower dose of fertigation.

Absolute Growth Rate (AGR) for pseudostem height (cm day^{-1})

The absolute growth rate as influenced by plant densities and fertigation of main and ratoon crop is presented in table-2.

Main crop: The Absolute Growth Rate (AGR) at 3rd-5th MAP did not differ significantly due to fertigation and spacing levels. At 5th-7th MAP, the fertigation did not show significant influence on absolute growth rate for plant height. However, the plant densities differed significantly, with highest (0.84) at S_2, which was on par with S_3 (0.83) and significantly superior over S_1 (0.68). The interactions were found non significant.

ISSN: 2350-0328

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Ratoon crop: The absolute growth rate for pseudostem height of cv. Grand Naine of ratoon crop was significant due to plant densities at 3rd-5th MAR. The highest (1.03) was recorded in S_2, which was on par with S_3 (0.87) and significant over S_1 (0.77) . However, The AGR was non-significant due to fertigation and interaction of densities and fertigation at 3rd-5th MAP.

Similar trend was noticed in absolute growth rate for pseudostem height for 5th MAR to shooting stage. It was found non significant due to fertigation levels and interaction between plant densities and fertigation levels.

Absolute Growth rate (AGR) for pseudostem girth (cm day^{-1})

Main crop : The absolute growth rate for psecudostem girth at 3rd-5th MAP due to fertigation levels was non significant (table-1). However, the plant densities significantly influenced the absolute growth rate for pseudostem girth, with highest (0.39) in S_1, followed by S_3 (0.29) and S_2 (0.24) .The interaction effect of plant densities and fertigation at this stage was non significant.

At 5th-7th MAP the absolute growth rate for pseudostem girth was not influenced by fertigation levels and interaction effects of plant densities and fertigation. Whereas, absolute growth rate differed significantly, due to different plant densities. The highest absolute growth rate (0.30) was recorded in S_1, which was on par with S_3 (0.28), which inturn was non significant with S_2 (0.23). The highest absolute growth rate in wider spacing may be due to enhanced growth parameters. Any crop management practice should aim in keeping the physiological processes of the plants in an active condition so that these plants can produce more biomass with least destructive process. Higher photosynthetic activity is a good indication of physiological efficient plants in banana.(Kuttimani *et al*. 2013).

Ratoon crop : The absolute growth rate for psudostem girth at 3rd-5th MAR due to plant densities and fertigation was non significant. However, it was significant for 5th months after ratooning to shooting stage due to plant densities and fertigation levels, but not significant between their interactions. The highest (0.297) absolute growth rate for pseudostem girth was noticed in F_1, which was on par with F_2 (0.253) and significant over F_3 (0.183). In plant densities, the highest (0.367) AGR for psudostem girth was recorded in S_1, which was superior over S_2 (0.173) and S_3 (0.193).

Number of days taken for shooting, shooting to harvest and crop duration

The data pertaining to influence of plant density and fertigation on number of days to shooting stage, shooting to harvest, crop duration and yield for main and ratoon crop was presented in table – 3.

Main crop : The number of days taken for shooting was not significant. There were significant differences for days taken from shooting to harvesting. The least number of days (96.13) taken from shooting to harvesting was recorded in F_1, which was superior over F_2 (103.16) and F_3 (104.23). The plant density levels significantly influenced number of days taken from shooting to harvesting. The least number of days (96.25) was recorded in S_1,followed by S_3 (100.34) and S_2 (106.93). In Interaction levels, the lowest number of days taken from shooting to harvest was registered in S_3 x F_1 (93.61) and it was on par with all S_1 interaction with three fertigation levels. The highest number of days taken in S_2 x F_2 (115.59) and wider spacing resulted in least number of days from shooting to harvesting and highest number of days was taken in high density planting (S_2).

The least crop duration (326.30) was recorded in F_1 which was significantly superior over F_2 (333.7) and F_3 (332.85). In respect of effect of plant densities, the lowest duration (319.56) was observed in S_1 which was followed by S_3 (329.41) and S_2 (343.87). The high density planting system (S_2) influenced the crop duration with longest period compared to other densities. The lowest crop duration was recorded in S_1 x F_1 (316.79) which was on par with S_1 x F_2 and S_1 x F_3 and highest crop duration was registered in S_2 x F_2 (351.61).

The extension of crop duration from planting to shooting and to harvest under high density (S_2 - 2.0×1.25×1.25m) could be attributed to lower leaf production and poor photosynthetic activity. Such extended vegetative or reproductive cycle with increase in plant density were in line with the results of Badgujar and Gowade (2007), Sarrwy *et al*. (2012). Robinson and Nel (1988) suggested that reduced temperature inside the canopy under high density planting could be the reason for enhanced crop duration especially under subtropical conditions.

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The early shooting in wider spacing may be attributed to higher number of leaves and more leaf area recorded during vegetative period leading to better photosynthetic activity. The above results are in conformity with the results of Apshara and Sathiamoorthy (1997), Kumar and Nalina (2001) and Pandey *et al*. (2001). The positive effect of nitrogen and potash in production of more number of leaves with better photosynthetic activity resulted in higher C:N ratio for early shooting and faster bunch development (Turner and Barkus 1982). Belatcazar *et al.* (1994) opined that extended duration under HDP could be compensated by higher yield per unit area. So the farmers could afford to wait for extra three to four months which may be compensated by higher returns.

Ratoon crop :

The plant density did not differ significantly with respect of number of days taken for shooting. However, the fertigation differed significantly, the lowest number of days taken for shooting (181.79) was recorded in F_1, which was significantly followed by F_2 (197.37) and F_3 (194.70). In interaction of S_1 and S_3 with three fertigation levels was not significant. Whereas, S_2xF_1 registered lowest (182.89) days to shooting, and S_2xF_2 recorded higher number of days for shooting.

The extension of crop duration from planting to shooting and to harvest under narrow spacing (S_2) could be attributed to lower leaf production and poor photosynthetic activity. Such extended vegetative or reproductive cycle with increase in plant density were in line with the results of Badgujar and Gowade (2007), Sarrwy *et al*. (2012). Robinson and Nel (1988) suggested that reduced temperature inside the canopy under high density planting could be the reason for increased duration especially under subtropical conditions.

The plant densities and fertigation levels significantly influenced the days taken from shooting to harvesting. The least number of days (102.84) was registered in F_1, which was significantly superior over F_2 (108.83) and F_3 (114.94). In plant densities, S_1 recorded lowest number of days (101.73), which was superior over S_3 (110.47) and S_2 (114.41). The interaction of plant densities and fertigation was significant. In all the interaction effects S_1, S_2 and S_3 with F_1 recorded lowest number of days taken from shooting to harvesting. In the present study, days to shooting and harvesting were significantly influenced by plant density. The duration has increased with higher plant density (S_2). Reduced duration recorded in higher dose of fertigation (F_1) and wider spacing (S_1) may be attributed to higher number of leaves and more leaf area recorded during vegetative period leading to better photosynthetic activity. The other reason may be more leaf surfaces exposed to light in wider spacing (S_1), which increased the metabolism of the plant causing early physiological maturity and flowering. The positive effect of nitrogen and potash in production of more number of leaves with better photosynthetic activity resulted in higher C:N ratio for early shooting and faster bunch development has been indicated by Turner and Barkus (1982).

The crop duration was lowest (284.63) in F_1,followed by F_2 (306.22) and F_3 (309.64). Plant densities significantly influenced crop duration, with least duration (291.56) in S_1 followed by S_3 (300.99) and S_2 (307.94). The interaction effect of densities and fertigation was significant S_1,S_2 and S_3 interaction with F_1 recorded lowest was crop duration and rest of interactions were on par to each other with highest duration.

Yield (t/ha):

Main crop : The yield differed significantly recording highest (89.87) in F_1 and followed by F_2 (83.46) and F_3 (69.70). The influence of plant densities on yield showed significant differences. The highest yield (92.79) was recorded in S_2 which is significantly superior over S_3 (80.55) and S_1 (69.69).

The interaction effect of plant densities and fertigation was also significant. The interaction of S_2xF_1 recorded highest yield (103.81) followed by S_2xF_2 (96.18) and S_3xF_1 (86.58) and lowest were recorded in S_1F_3 (59.52).

Ratoon crop : The higher yields in higher dose of fertigation may be attributed to constant and continuous supply of nutrients at optimum levels at root zone. The scheduling of potash in different splits at optimum levels increased bunch weight in the present study.

The fruit yield was significantly influenced by plant densities and fertigation levels. The highest yield was recorded in F_1 (81.64), which was significantly superior over F_2 (77.51) and F_3 (72.23). In plant densities the highest yield was registered in S_2 (89.74), which was significantly superior over S_3 (76.25) and S_1 (65.39).

The interaction effects of plant densities and fertigation levels was significant. Similar trend was noticed in all interaction effects with highest yield in F_1 interaction with S_1, S_2, S_3 followed by F_2 and F_3. However, S_2xF_1 recorded highest yield (96.14) and significantly followed by S_2xF_2 (90.53) and S_2xF_3 (82.55).

ISSN: 2350-0328
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It can be concluded from the data that highest yield was noticed with higher dose of fertilizers along with high density planting system compared to lower density planting. However, the per hectare yield was reduced under normal spacing (S_1) due to lesser plant density as compared to closer spacing (S_2). The increase in yield per unit area under HDP can be attributed to increase in plant population per unit area (Ahmed and Mannan, 1970).

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Table:1: Effect of Spacing and fertigation on Total number of leaves, leaf area and leaf area index at shooting stage of Banana cv.Grand Naine (Main and Ratoon Crop)

Tretments	Total no of leaves/plant^{-1}		Leaf area(sq.m. plant^{-1})		Leaf Area Index	
	Main	Ratoon	Main	Ratoon	Main	Ratoon
Factor A Spacing						
S_1	34.36	31.21	12.68	9.42	3.91	2.91
S_2	28.59	29.57	11.28	7.84	3.03	2.09
S_3	30.44	30.28	11.86	8.16	3.61	2.51
Factor B Fertigation						
F_1	32.59	31.62	12.11	8.80	3.57	2.60
F_2	31.3	31.11	11.94	8.41	3.52	2.48
F_3	29.49	28.33	11.78	8.20	3.47	2.42
Factor AxB Spacing and Fertigation intaractions						

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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S_1xF_1	34.8	32.18	12.73	9.94	3.93	3.07
S_1xF_2	34.32	31.84	12.69	9.27	3.91	2.86
S_1xF_3	33.95	29.62	12.63	9.06	3.9	2.79
S_2xF_1	30.76	30.86	11.48	8.13	3.1	2.13
S_2xF_2	28.86	30.62	11.21	7.83	3.05	2.08
S_2xF_3	26.15	27.24	11.16	7.55	2.95	2.05
S_3xF_1	32.2	31.83	12.12	8.34	3.67	2.60
S_3xF_2	30.73	30.88	11.92	8.13	3.59	2.51
S_3xF_3	28.38	28.14	11.54	8.00	3.57	2.42
Factor A (SE m ±)	0.51	0.06	0.1	0.05	0.035	0.020
Factor A (CD 5%)	1.54	0.20	0.32	0.15	0.11	0.05
Factor B (SE m ±)	0.51	0.06	0.1	0.05	0.035	0.020
Factor B (CD 5%)	1.54	0.20	0.32	0.15	NS	0.05
Factor Ax B(SE m ±)	0.89	0.11	0.18	0.09	0.57	0.024
Factor AxB (CD 5%)	2.66	0.35	0.56	0.26	NS	0.08

Table:2: Effect of Spacing and fertigation on Absolute growth rate for pseudostem height and girth of Banana at different stages cv.Grand Naine (Main and Ratoon Crop)

Tretments	Absolute growth rate(cm day^{-1}) pseudostem height 3-5 MAP / MAR		Absolute growth rate(cm day^{-1}) pseudostem height 5-7 MAP / 5MAR - shooting stage		Absolute growth rate(cm day^{-1}) pseudostem girth 3-5 MAP / MAR		Absolute growth rate(cm day^{-1}) pseudostem girth 5-7 MAP / 5 MAR - shooting stage.	
	Main	Ratoon	Main	Ratoon	Main	Ratoon	Main	Ratoon
Factor A Spacing								
S_1	1.2	0.77	0.68	0.68	0.39	0.23	0.3	0.37
S_2	1.23	1.03	0.84	1.72	0.24	0.22	0.23	0.17
S_3	1.23	0.87	0.83	0.71	0.29	0.21	0.28	0.19
Factor B Fertigation								
F_1	1.24	0.93	0.8	1.04	0.31	0.23	0.28	0.30
F_2	1.2	0.89	0.8	1.01	0.3	0.23	0.26	0.25
F_3	1.22	0.84	0.76	1.06	0.3	0.21	0.27	0.18
Factor AxB Spacing and Fertigation intaractions								
S_1xF_1	0.68	0.82	0.68	0.65	0.4	0.25	0.29	0.41

ISSN: 2350-0328

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S_1xF_2	0.66	0.79	0.66	0.68	0.4	0.24	0.27	0.35
S_1xF_3	0.71	0.69	0.71	0.72	0.37	0.22	0.33	0.34
S_2xF_1	0.81	1.04	0.81	1.76	0.24	0.22	0.23	0.22
S_2xF_2	0.88	1.04	0.88	1.64	0.24	0.24	0.24	0.17
S_2xF_3	0.84	1.00	0.84	1.76	0.23	0.20	0.22	0.13
S_3xF_1	0.91	0.92	0.91	0.70	0.3	0.22	0.31	0.26
S_3xF_2	0.87	0.85	0.87	0.72	0.27	0.22	0.27	0.24
S_3xF_3	0.72	0.84	0.72	0.71	0.29	0.21	0.26	0.08
Factor A (SE m ±)	0.01	0.03	0.016	0.040	0.013	0.024	0.018	0.030
Factor A (CD 5%)	NS	0.12	0.05	0.14	0.04	NS	0.06	0.10
Factor B (SE m ±)	0.01	0.03	0.016	0.040	0.013	0.024	0.018	0.030
Factor B (CD 5%)	NS	NS	NS	NS	NS	NS	NS	0.10
Factor Ax B(SE m ±)	0.032	0.06	0.032	0.07	0.026	0.04	0.031	0.06
Factor AxB (CD 5%)	NS	NS	NS	NS	NS	NS	NS	NS

Table:3: Effect of Spacing and fertigation on number of days taken for shooting, shooting to harvesting, crop duration and yield of Banana cv.Grand Naine (Main and Ratoon Crop)

Tretments	No. of .days taken for shooting		No. of. days taken from shooting to harvesting		Crop Duration(days)		Yield (t/ha)	
	Main	Ratoon	Main	Ratoon	Main	Ratoon	Main	Ratoon
Factor A Spacing								
S_1	223.31	189.81	96.25	101.73	319.56	291.56	69.69	65.39
S_2	236.91	193.53	106.93	114.41	343.87	307.94	92.79	89.74
S_3	229.06	190.52	100.34	110.47	329.41	300.99	80.55	76.25
Factor B Fertigation								
F_1	230.14	181.79	96.13	102.84	326.3	284.63	89.87	81.64
F_2	230.54	197.37	103.16	108.83	333.7	306.22	83.46	77.51
F_3	228.59	194.70	104.23	114.94	332.85	309.64	69.7	72.23
Factor AxB Spacing and Fertigation interactions								
S_1xF_1	218.15	180.84	98.64	95.96	316.79	276.80	79.24	69.44
S_1xF_2	226.74	194.76	93.85	102.84	320.57	297.67	70.33	64.93

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
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S_1xF_3	225.03	193.82	96.26	106.38	321.32	300.20	59.52	61.82
S_2xF_1	240.25	182.89	96.15	109.84	336.46	292.73	103.81	96.14
S_2xF_2	236	200.96	115.59	112.72	351.61	313.68	96.18	90.53
S_2xF_3	234.47	196.74	109.06	120.68	343.54	317.42	78.38	82.55
S_3xF_1	232.01	181.64	93.61	102.72	325.64	284.36	86.58	79.35
S_3xF_2	228.89	196.38	100.03	110.94	328.92	307.32	83.88	77.09
S_3xF_3	226.27	193.54	107.38	117.76	333.68	311.30	71.21	72.33
Factor A (SE m ±)	1.24	1.93	1.2	1.70	1.87	1.42	0.82	0.11
Factor A (CD 5%)	NS	NS	3.62	5.13	5.64	4.27	2.46	0.35
Factor B (SE m ±)	1.24	1.93	1.2	1.70	1.87	1042.00	0.82	0.11
Factor B (CD 5%)	NS	5.80	3.62	5.13	5.64	4.27	2.46	0.35
Factor Ax B(SE m ±)	2.16	3.34	2.09	2.95	3.25	2.46	1.42	0.20
Factor AxB (CD 5%)	NS	10.05	6.27	8.88	9.78	7.40	4.27	0.61