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Effect of different levels of Fertigation on quality attributes of banana (*Musa paradisiaca* L.) *cv*. grand Naine

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Abstract
An investigation on "Effect of different levels of fertigation on quality attributes of banana (*Musa paradisiaca* L.) *Cv*. Grand Naine" was conducted at Banana Research Station, Nanded, Taluka and District Nanded, Maharashtra, during year 2018-2019. The field experiment was laid out in Randomized Block Design with seven treatments and three replications. The experiment consists of seven treatment combinations *viz*., T_1 - 50% RDF through fertigation, T_2 - 60% RDF through fertigation, T_3 - 70% RDF through fertigation, T_4 - 80% RDF through fertigation, T_5 - 90% RDF through fertigation, T_6 - 100% RDF through fertigation, T_7 (control) - 100% RDF through Soil application. An investigation showed that the quality attributes *viz*., maximum weight of pulp (108.50 g), weight of peel (46.10 g), pulp to peel ratio (2.35), acidity (0.163%), reducing sugar (12.70%), non-reducing sugar (7.20%), total sugar (19.90%), and total soluble solids (23.02^{0}Brix) were recorded by treatment T_6 *i.e.,* 100% RDF through fertigation. However, minimum weight of pulp, weight of peel, pulp to peel ratio, acidity, reducing sugar, non-reducing, total sugar, and total soluble solids, recorded by treatment T_7 *i.e.,* 100% RDF through soil application (Control).

Keywords: Fertigation, quality, banana

Introduction
Banana (Musa spp.) is one of the oldest fruits known to mankind and it's the distant past traced back from its point out in Ramayana (2029 BC, Kautilyas Arthashatra 300-400 BC). Banana belongs to the family Musaceae of the order Scitaminae. Today it is a leading tropical fruit in world market with a high scale of export potentiality. Banana is cultivated in the world in the vicinity of 4.83 million ha with worldwide production 99.99 million Metric tonnes, having 20.8 Metric tonnes production. In which India donate 29% and ranked first in area and production of banana in the globe. Next to India, China ranked second, whereas, Philippines ranked third country in the production, contributing 10% and 9%, respectively (Anon. 2017) [1]. Banana is an intense feeder of nutrients and requires large quantities of mineral nutrients for appropriate growth and development (Hazarika and Ansari 2010) [4]. Consequently, it is of supreme importance to sustain a high amount of soil productiveness to guarantee high yield of better-quality fruits. It is estimated that expenses on manures and fertilizers alone amounts to nearly 20-30 per cent of the cost of production for banana (Robusta) (Kulasekaran, 1993) [6]. Hence, striking an equilibrium between water and fertilizer scheduling requires extraordinary attention to uphold high productivity. It is estimated that losses of water and applied nutrients in the conventional method of usage of water and fertilizers are additional than 30 - 40 percent. Fertigation is a new inventive intellectual method, by which not only fertilizers, soil amendments or other water-soluble products are applied through an irrigation system to get higher fertilizer use efficiency but also increases the crop yield. It increases the fertilizer use efficiency through small and controlled quantity of fertilizers that are applied throughout the crop growing season in as compaired to large quantity of fertilizers located on the soil at the commencement of the season, as in straight practice (Dangler and Locascio, 1990) [3]. In Marathwada area there is very less precipitation and also water resources are limited, so that the utilization of fertigation system in banana plays vital function in growth and development of crop. Hence, present investigation was carried out during 2018- 2019.

Materials and Methods
A field experiment was carried out during 2018-2019 at Banana Research Station, Nanded,

Maharashtra. The experiment was laid out in randomized block design. The randomization was in seven treatments with three replications. The treatments were undertaken during five different stages of crop growth. The time of application fertilizer (fertigation) to banana is, 1) 30 – 45 DAP, 2) 46 – 70 DAP, 3) 71 – 146 DAP, 4)147 – DAP, 5)273 – 300 DAP. The recommended dose of fertilizer to banana is 200:160:200 g NPK per plant. In control treatment fertilizers were applied through urea, single super phosphate and muriate of potash, respectively. In water soluble fertilizer treatments, different grades of fertilizer *viz*., urea (46:0:0), monoammonium phosphate (12:61:00), potassium sulphate (0:0:50) were used for fertigation. All the observations regarding to biochemical characters were recorded from composite sample of 10 fruits. Total soluble solids (TSS) was measured by Hand Refractometer (0–32^{0}Brix). Total titrable acidity was determined by titrating fruit juice against 0.1 N NaOH in the presence of phenolphthalein indicator by (Ranganna, 1977) [15] method while sugars were estimated by Benedict's method (Benedict's S.R. 1908) [2]. The statistical analysis of the figures in respect of quality component plant was done with standard procedure given for Randomized Block Design by following the Fisher's analysis of variance (ANOVA) technique as given by Panse and Sukhatme (1967) [11].

Results and Discussion

Effect of Different Levels of Fertigation on Quality attributes of Banana

1. Weight of pulp (g)

The maximum weight of pulp (108.50 g) was recorded by treatment T_6 *i.e.*, 100% RDF through fertigation. Minimum weight of pulp (89.77 g) was recorded by treatment T_7 *i.e.*, 100% RDF through soil application (Control). (Table. 1). Pulp weight of the fruit exhibited significant differences among the different treatments, the treatment T_6 *i.e.*, 100% RDF through fertigation recoded the maximum pulp weight. The increased pulp weight might be due to appropriate supply and translocation of nutrients throughout the fruit developmental stage which might have contributed for better pulp weight. Similar results were also obtained by Kumar *et al.*, (2012) [7], Pawar and Dingre (2013) [12], and Pramanik and Patra (2015) [13].

2. Weight of peel (g)

The maximum weight of peel (46.10 g) was recorded by treatment T_6 *i.e.*, 100% RDF through fertigation. Minimum weight of peel (39.48 g) was recorded by treatment T_7 *i.e.*, 100% RDF through soil application (Control). (Table. 1). The highest peel weight with higher dose of fertigation might be due to increase in vegetative growth, accumulation of metabolites, better nutritional environment in the root zone and more availability of nutrients as compared to other treatments and higher frequency of irrigation increased the peel weight (Natesh, 1993) [9]. Similar result was also obtained by Kumar *et al.*, (2012) [7].

3. Pulp to peel ratio

The treatment T_6 i.e., 100% RDF through fertigation (2.35), which have significantly maximum pulp to peel ratio. The minimum pulp to peel ratio (2.27) was recorded by treatment T_7 *i.e.*, 100% RDF through soil application (Control). (Table. 1). The remarkable difference was not recorded among the different treatments for this attribute. Hence, the treatments were statistically non-significant at this stage.

4. Acidity

The maximum acidity (0.163 percent) was recorded by T_6 *i.e.*, 100% RDF through fertigation. Minimum acidity (0.155 percent) was recorded by treatment T_7 *i.e.*, 100% RDF through soil application (Control). (Table. 1). Highest acidity was achieved by applying higher dose of N and K per plant (Pandit *et al.*, 1992) [10]. The results are in line with the findings of Raskar (2003) in banana reported that increased availability of N and K through fertigation might be due to the involvement of K in carbohydrate synthesis, breakdown and translocation of starch, synthesis of protein and neutralization of physiologically important organic acids (Twyford, 1967) [20].

Table 1: Effect of different levels of fertigation on quality attributes of banana Cv. Grand Naine

Tr. No.	Treatment details	Weight of pulp (g)	Weight of peel (g)	Pulp to peel ratio	Acidity (%)
T_1	50% RDF through fertigation	101.58	44.23	2.29	0.156
T_2	60% RDF through fertigation	102.24	44.35	2.30	0.158
T_3	70% RDF through fertigation	103.89	44.97	2.31	0.160
T_4	80% RDF through fertigation	105.57	45.35	2.32	0.161
T_5	90% RDF through fertigation	106.68	45.58	2.34	0.162
T_6	100% RDF through fertigation	108.50	46.10	2.35	0.163
T_7	100% RDF through soil application (control)	89.77	39.48	2.27	0.155
	S.E. m±	3.02	1.13	0.11	0.0016
	CD at 5%	9.32	3.50	NS	0.0050

5. Total soluble solids (°Brix)

The maximum total soluble solids (23.02^{0}Brix) was recorded by treatment T_6 *i.e.*, 100% RDF through fertigation. The minimum total soluble solids (20.86°Brix) was recorded by treatment T_7 *i.e.*, 100% RDF through soil application (Control). (Table. 2). The increase in total soluble solid may be due to respirational demand and adequate supply of nutrients, synthesis of invertase and starch splitting enzymes (Ram and Prasad, 1988) [14]. This might be due to the increased level of potassium and less competition for nutrients leads to increased translocation of carbohydrates from leaves to fruit favoured the conversion of sugars to starch when photosynthates reach the fruit. The similar results had been reported by Reddy *et al.*, (2002) [16], Pawar and Dingre (2013) [12] and Senthilkumar *et al.*, (2016) [17].

6. Reducing sugar and Non-reducing sugar (%)

The treatment T_6 *i.e.*, 100% RDF through fertigation recorded maximum reducing sugar (12.70 percent) and non-reducing sugar (7.20 percent). The minimum reducing sugar (9.32 percent) and non-reducing sugar (3.79 percent) were recorded by treatment T_7 *i.e.*, 100% RDF through soil application

(Control). (Table. 2). Among the different treatments, the treatment T_6 *i.e.*, 100% RDF through fertigation recorded the maximum reducing and non-reducing sugar. This might be due to the accumulation of sugar and other soluble components from hydrolysis of protein and oxidation of ascorbic acid due to higher accumulation of photosynthates because of higher N and K through fertigation (Mahalakshmi, 2000) [8]. Kavino (2001) [5] reported that increase in sugar contents when nutrients applied through fertigation in banana. Similar result was also obtained by Pramanik Patra (2015) [13].

7. Total sugar (%)

The treatment T_6 i.e., 100% RDF through fertigation significantly recorded maximum total sugars (19.90 percent). It was found that, the minimum total sugar (12.27 percent) was recorded by treatment T_7 *i.e.*, 100% RDF through soil application (Control). (Table. 2). Highest total sugar was achieved by applying higher dose of N and K per plant (Pandit *et al.*, 1992) [10]. The increasing sugar content of fruits might have been due to the process of photosynthesis, which ultimately led to the accumulation of large amount of carbohydrates and increased the sugar content of fruits (Singh *et al.*, 1990, Singh *et al.*, 2004) [19, 18]. Similar result was also obtained by Pramanik and Patra (2015) [13].

Table 2: Effect of different levels of fertigation on quality attributes of banana Cv. Grand Naine

Tr. No.	Treatment details	TSS (°Brix)	Reducing sugar (%)	Non-reducing sugar (%)	Total sugar (%)
T_1	50% RDF through fertigation	21.58	10.28	5.26	15.54
T_2	60% RDF through fertigation	21.77	10.72	5.32	16.04
T_3	70% RDF through fertigation	21.83	11.34	5.82	17.16
T_4	80% RDF through fertigation	22.44	11.68	6.12	17.80
T_5	90% RDF through fertigation	22.70	12.10	6.70	18.80
T_6	100% RDF through fertigation	23.02	12.70	7.20	19.90
T_7	100% RDF through soil application (control)	20.86	9.32	5.00	14.32
	S.E. m±	0.37	0.31	0.17	0.39
	CD at 5%	1.16	0.98	0.53	1.21

Conclusion

The present findings have clearly indicated that the application of 100% RDF through fertigation significantly improved the quality attributes of banana cv. Grand Naine.

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