



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(10): 1819-1826
© 2021 TPI
www.thepharmajournal.com
Received: 21-07-2021
Accepted: 24-08-2021

MS Navgare
P.G. Student,
College of Horticulture,
Dr. B.S. Konkan Krishi
Vidyapeeth, Dapoli. Dist.
Ratnagiri, Maharashtra, India

SL Ghavale
Research Officer,
Regional Coconut Research
Station, Bhatye, Ratnagiri,
Maharashtra, India

BR Salvi
Head of the Department,
College of Horticulture,
Dr. B. S. Konkan Krishi
Vidyapeeth, Dapoli. Dist.
Ratnagiri, Maharashtra, India

CD Pawar
Professor,
College of Horticulture,
Dr. B. S. Konkan Krishi
Vidyapeeth, Dapoli. Dist.
Ratnagiri, Maharashtra, India

VG Salvi
Professor,
Department of Soil Science and
Ari. Chemistry, College of
Agriculture, Dr. B.S. Konkan
Krishi Vidyapeeth, Dapoli. Dist.
Ratnagiri, Maharashtra, India

RG Khandekar
Professor,
College of Horticulture,
Dr. B. S. Konkan Krishi
Vidyapeeth, Dapoli. Dist.
Ratnagiri, Maharashtra, India

Corresponding Author:
MS Navgare
P.G. Student,
College of Horticulture,
Dr. B.S. Konkan Krishi
Vidyapeeth, Dapoli. Dist.
Ratnagiri, Maharashtra, India

Effect of different levels of fertilizers on growth and yield of Banana cultivars in coastal plain of Western India

MS Navgare, SL Ghavale, BR Salvi, CD Pawar, VG Salvi and RG Khandekar

Abstract

Field experiment was carried out at College of Horticulture, Dr. BSKKV., Dapoli, Dist. Ratnagiri in the year of 2019-2021 cropping season to find out the optimum dose of NPK and suitable variety for maximizing yield of banana in Konkan region. The experiment was carried out in split plot statistical design with three main plot treatments viz., different banana cultivars – Konkan Safed Velchi (V₁), Red Banana (V₂), Grand Naine (V₃) and five sub-plot treatments viz., different fertilizer levels – F₁ (RDF 200:100:200 g NPK/plant), F₂ (300:100:100 g NPK/plant), F₃ (300:100:200 g NPK/plant, F₄ (300:100:300 g NPK/plant) and F₅ (300:100:400 g NPK/plant) and having fifteen treatment combinations which were replicated three times. The growth characters and yield of banana were significantly increased with the increase of fertilizer levels. Maximum bunch length (89.4 cm), maximum bunch weight (23.1 kg), maximum number of hands (14.4 nos.), highest hand weight (1.54 kg), maximum number of fingers (16.42 nos.), highest stalk weight (1.06 kg), highest stalk length (103.01cm), highest fruit length (17.43 cm), maximum finger weight (0.104 kg), maximum yield/plant (23.89 kg), maximum yield t/ha (71.08 t/ha) were recorded in V₃F₄ due to interaction effect of cultivars and fertilizer levels. The present study clearly indicated that for obtaining better growth of banana crop, the cultivar Red Banana performed well and for yield is concerned the cultivar Grand Naine performed the best. For obtaining maximum yield of banana, the fertilizer dose of 10 kg FYM + 300:100:300 g NPK/plant/year has been found beneficial for maximum yield in banana variety Grand Naine which was also proved to be the superior combination for vigorous growth and highest yield.

Keywords: Lentil, fusarium, fungicides, evaluation, neem

1. Introduction

Banana (*Musa spp.*) is monocotyledonous perennial herb within the order zingiberales and belonging to family musaceae. It is considered 4th staple food after rice, corn and wheat and grown in more than 150 countries, producing 110 million tonnes of banana fruit per annum (Falcomer *et al.*, 2019) [5]. It is being cultivated throughout the warm tropical regions of the world between 30° N and 30° S of the equator. It grows well in slightly alkaline soils, but saline soils with salinity exceeding 0.05 per cent are unsuitable. Alluvial and volcanic soils are the best for banana cultivation. In India, banana is being grown in an area of 8.83 lakh ha with a production of about 308.07 lakh tonnes and average productivity of banana in India is 34.9 t/ha. Andhra Pradesh rank first in production (50.03 lakh tonnes) followed by Gujarat (44.72 lakh tonnes) and Maharashtra (42.09 lakh tonnes), whereas Madhya Pradesh leads in productivity (69.5 t/ha). The nutritional point of view, banana has a calorific value ranging from 116 calories per 100 g and is closely comparable with potatoes but digested more easily (Gopalan *et al.* 2004) [6]. Banana cultivars are highly responsive to chemical fertilizers particularly at early stages of crop. Among the cultivars, Grand Naine the commercially popular variety is being cultivated on large scale. However, the local types like Konkan Safed Velchi and Red Banana which are being commercially cultivated in Konkan region. Banana uptakes more nutrients from soil as compared to other crop due to their rapid and vigorous growth and higher yield (Rahate *et al.*, 2020) [13]. Among the nutrients, nitrogen is the most essential element and has a positive influence on plant growth, flowering and productivity in banana cultivars (Mustaffa and Kumar, 2012) [8]. Though the requirement of phosphorous is low, it helps to produce healthy rhizome, strong root system. It also plays a vital role in overall development of the plant and flower set. Another element of high importance for growth of banana is potassium. It is commonly known as quality mineral nutrient and its requirement is

very high during the flowering period. Supply of potassic fertilizers in adequate quantity not only increases growth and yield in banana but also the physiology of plant and offers resistance against biotic and abiotic stresses (Mustaffa and Kumar, 2012) [8]. The choice and dosage of nutrients, time, mode and frequency of application vary depending upon the cultivars, soil fertility status, production system and agro-climatic conditions. In view of the above context the experiment on effect of different levels of fertilizers on growth and yield of banana cultivars in coastal plain of western India was carried out to find out the optimum dose of NPK and suitable variety for maximizing yield of banana in Konkan region.

Materials And Methods

Field experiment was carried out at College of Horticulture, Dr. BSKKV., Dapoli, Dist. Ratnagiri in the year of 2019-2021 cropping season to find out the optimum dose of NPK and suitable variety for maximizing yield of banana in Konkan region. Experimental site situated on 17° 45' North latitude and 73° 12' East longitude and altitude of 88.55 m above sea level. The region is characterized by a warm and humid tropical climate. The soils of this region are lateritic, deep, porous and acidic in reaction having pH range of 5.6-6.5. The average minimum and maximum temperature are 18.5°C and 30°C respectively. Average annual rainfall is 3500-4000 mm distributed mainly during South West monsoon from June to October. The experiment was carried out in split plot statistical design with three main plot treatments viz., different banana cultivars – Konkan Safed Velchi (V₁), Red Banana (V₂), Grand Naine (V₃) and five sub-plot treatments viz., different fertilizer levels – F₁ (RDF 200:100:200 g NPK/plant), F₂ (300:100:100 g NPK/plant), F₃ (300:100:200 g NPK/plant), F₄ (300:100:300 g NPK/plant) and F₅ (300:100:400 g NPK/plant) and having fifteen treatment combinations which were replicated three times. The recommended spacing of 1.8 m x 1.8 m was adopted for planting. Suckers of uniform size of banana obtained from disease free field were planted in all the treatments. Four plants per treatment were used and having 180 numbers of total plant population were maintained. NPK fertilizers were applied in 4 splits doses (30 DAP, 60 DAP, 90 DAP and 120 DAP) starting from 30 days after planting by ring placement method. Recommended cultural practices were carried out regularly. The vegetative growth and yield attributing characters of banana viz. plant height, plant girth, number of leaves, number of suckers, leaf area and leaf area index was measured at 90,180 and 270 days after planting. Days from flower initiation to bunch harvest were counted. The yield attributing characteristics viz. bunch length, bunch weight, number of hands/bunch, hand weight, number of fingers/hand, stalk weight, stalk length, fruit length, finger weight were measured. The data obtained in the present study was statistically analyzed as per the methods suggested by Panse and Sukatme (1995) [13] using split plot design and valid conclusions were drawn only on significance differences between treatment mean at 0.05 % level of significance.

Results And Discussion

Plant height (cm)

Data on plant height at 270 DAP were revealed that the significantly highest plant height (313.0 cm) recorded in Red Banana (V₂) and lowest (218.2 cm) were in Grand Naine (V₃) (Table 1). Considering the different fertilizer levels the

significantly highest plant height (282.3 cm) recorded in treatment F₄ (300:100:300 g NPK/plant) and it was at par with F₃ (280.5 cm) and F₅ (281.5 cm), while lowest (271.1 cm) was recorded in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the significantly highest plant height (315.7 cm) recorded in V₂F₄ (300:100:300 g NPK/plant) in Red Banana which was at par with V₂F₃ (315.2 cm) and V₂F₅ (314.9 cm), while lowest (205.7 cm) was in V₃F₁ (200:100:200 g NPK/plant) in Grand Naine. Differences in height among varieties might be due to genetic factor and availability of proper nutrients. Findings analogous to this observation have also been reported by Suresh *et al.* (2008) [14] in Nendran and Rahate *et al.* (2020) [13] in Red Banana.

Plant girth (cm)

Data on plant girth at 270 DAP were revealed that the significantly maximum plant girth (68.34 cm) recorded in Red Banana (V₂) and minimum (57.30 cm) was in Konkan Safed Velchi (V₁) (Table 1). Considering the different fertilizer levels the significantly maximum plant girth (65.78 cm) recorded in F₄ (300:100:300 g NPK/plant) which was at par with F₃ (63.41 cm) and F₅ (64.28 cm) while minimum (61.71 cm) was in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the significantly maximum plant girth (70.68 cm) was in V₂F₄ (300:100:300 g NPK/plant) in Red Banana which was at par with V₂F₅ (70.36 cm), whereas the minimum (54.44cm) was in V₁F₁ (200:100:200 g NPK/plant) in Cv. Konkan Safed Velchi. Differences in girth among varieties also might be due to genetic varietal character and available sunlight, space, optimum fertilizers utilization. Similar findings in relation to girth were observed by Dinesh *et al.* (2012) [3] in Monthan and Rahate *et al.* (2020) [13] in Cv. Red banana.

Number of leaves/plant (nos.)

Data on number of leaves/plant at 270 DAP were revealed that the significantly maximum leaves/plant (12.98 nos.) recorded in Konkan Safed Velchi (V₁) and minimum (11.80 nos.) were recorded in Red Banana (V₂) (Fig.1). Considering the different fertilizer levels the significantly maximum leaves/plant (13.08 nos.) recorded in F₃ (300:100:200 g NPK/plant) which was at par with F₂ (12.75 nos.) and F₄ (12.69 nos.), while the minimum (11.50 nos.) were recorded in F₅ (300:100:400 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the significantly maximum leaves/plant (13.92 nos.) recorded in the V₁F₃ (300:100:200 g NPK/plant) in Konkan Safed Velchi which was at par with V₁F₂ (13.83 nos.) while minimum (11.0 nos.) were in V₂F₁ (200:100:200 g NPK/plant) in Red Banana whereas, in interaction effect, V₁F₃ was highest as compared to others which might be due to the availability of proper amount of nutrients with water and sunlight. The present findings are in conformity with findings of Suresh *et al.* (2008) [14] in Nendran and Rahate *et al.* (2020) [13] in Konkan Safed Velchi.

Number of suckers/plant (nos.)

Data on number of suckers/plant at 270 DAP were revealed that the significantly maximum suckers/plant (3.33 nos.) were recorded in Grand Naine (V₃) and minimum (2.10 nos.) were in Red Banana (V₂) (Fig.2). Considering the different fertilizer levels the significantly maximum suckers/plant (3.47 nos.) were recorded in F₄ (300:100:300 g NPK/plant) and it was at par with F₂ (2.94 nos.), whereas the minimum suckers/plant (2.11 nos.) were in F₅ (300:100:400 g

NPK/plant). Due to interaction effect of varieties and fertilizer levels the significantly maximum suckers/plant (4.33 nos.) were recorded in V₃F₄ (300:100:300 g NPK/plant) in Grand Naine whereas the minimum suckers/plant (1.58 nos.) was in V₂F₅ (300:100:400 g NPK/plant) in Red Banana. Genetic characters of variety along with proper nutrients management, water and sunlight promotes proper vegetative growth and similar findings were reported by Suresh *et al.* (2008) [14] in Cv. Nendran and Rahate *et al.* (2020) [13] in Cv. Grand Naine.

Leaf area (m²)

Data on leaf area (m²) at 270 DAP were revealed that the significantly highest leaf area (10.60 m²) was in Red Banana (V₂) and lowest (6.83 m²) was in Grand Naine (V₃) (Table 2). Considering the different fertilizer levels the significantly highest leaf area (9.18 m²) was in F₃ (300:100:200 g NPK/plant) which was at par with F₂ and F₄ (8.80 m²) whereas the lowest leaf area (7.85 m²) was in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the significantly highest leaf area (11.21 m²) was in V₂F₄ (300:100:300 g NPK/plant) in Red Banana whereas the lowest leaf area (6.21 m²) was in V₃F₁ (200:100:200 g NPK/plant) in Grand Naine. Similar findings were reported by Suresh *et al.* (2008) [14] in Nendran, Indhumati and Durga (2016) [7] in Grand Naine and Rahate *et al.* (2020) [13] in Red Banana.

Leaf area index (LAI)

Data on leaf area index (LAI) at 270 DAP were revealed that the significantly highest LAI (3.30) was in Red Banana (V₂) while lowest (1.94) was in Grand Naine (V₃) (Table 2). Considering the different fertilizer levels the significantly highest LAI (2.82) was in F₄ (300:100:300 g NPK/plant) and it was at par with F₃ (2.81) whereas lowest LAI (2.65) was in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the significantly highest LAI (3.43) was in V₂F₄ (300:100:300 g NPK/plant) in Red Banana and it was at par with V₂F₃ (3.31) and V₂F₅ (3.28) whereas lowest LAI (1.92) was in V₃F₁ (200:100:200 g NPK/plant) in Grand Naine. The highest LAI which might be due to genetic potential of variety, nutrients and favorable climatic conditions. Similar findings were also reported by Indhumati and Durga (2016) [7] in Grand Naine and Rahate *et al.* (2020) [13] in Red Banana.

Days required for boot leaf stage

Data on days for boot leaf stage were revealed that the significantly minimum days (219.57 days) required for boot leaf stage were recorded in Grand Naine (V₃) and maximum (303.5 days) were in Red Banana (V₂) (Table 3). Considering the different fertilizer levels the significantly minimum days (250.69 days) required for boot leaf stage recorded in F₃ (300:100:200 g NPK/plant) which was at par with F₂ F₄ (252 days) whereas the maximum (267.72 days) was in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the significantly minimum days (211 days) for boot leaf stage were in V₃F₄ (300:100:300 g NPK/plant) in Grand Naine which was at par with V₃F₃ (213.67 days) whereas maximum (312.0 days) were in V₂F₁ (200:100:200 g NPK/plant) in Red Banana. Proper nutrient and genetic characters of varieties resulted in early shooting. Similar results were reported by Badgujar *et al.* (2004) [1] in Grand Naine and Rahate *et al.* (2020) [13] in Grand Naine.

Days required for flowering

According to data the significantly minimum days (223.72 days) required for flowering was recorded in Grand Naine (V₃) and maximum days (306.02 days) were in Red Banana (V₂) (Table 3). Considering the different fertilizer levels the significantly minimum days (253.19 days) required for flowering was in F₃(300:100:200 g NPK/plant) which was at par with F₃ (254.44 days) whereas maximum days (273 days) was in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the minimum days (213.33 days) required for flowering were in V₃F₄ (300:100:300 g NPK/plant) in Grand Naine which was at par with V₃F₃ (216 days) whereas the maximum days (314.83 days) was in V₂F₁ (200:100:200 g NPK/plant) in Red Banana. Similar results were reported by Tirkey *et al.* (2003) [15] in Dwarf Cavendish and Rahate *et al.* (2020) [13] in Grand Naine.

Days required for fruiting

The significantly minimum days (241.4 days) required for fruiting were recorded in Grand Naine (V₃) and maximum (325.97 days) were in Red Banana (V₂) (Table 3). Considering the different fertilizer levels the significantly minimum (271.53 days) required for fruiting were recorded in F₃ (300:100:200 g NPK/plant) which was at par with F₄ (271.94 days) whereas the maximum (291.56 days) were in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the minimum (229.0 days) required for fruiting were in the V₃F₄ (300:100:300 g NPK/plant) in Grand Naine whereas the maximum (336.67 days) in V₂F₁ (200:100:200 g NPK/plant) in Red Banana. The results in early fruiting which might be due to optimum utilization of nutrients, water and sunlight and similar findings were reported by Tirkey *et al.* (2003) [15] in Dwarf Cavendish and Rahate *et al.* (2020) [13] in Grand Naine.

Days required from flowering to harvest

The significantly minimum 113.15 days required for maturity were recorded in Grand Naine (V₃) and maximum 114.48 days were in Red Banana (V₂) (Table 3). Considering the different fertilizer levels the significantly minimum 108.75 days required for maturity were recorded in F₄(300:100:300 g NPK/plant) whereas maximum 118.75 days were in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the minimum 107.5 days required for maturity were recorded in V₃F₄ (300:100:300 g NPK/plant) in Grand Naine whereas maximum days 121.08 days were recorded in V₁F₁ (200:100:200 g NPK/plant) in Konkan Safed Velchi. Fertilizer reduced phyllochron and increased the leaf area in a short span of time thereby helping the plant to attain early physiological maturity. Similar results were recorded by Pandey *et al.* (2005) [11] in Cv. Robusta, Balasubrahmanyam *et al.* (2003) [2] in Grand Naine and Rahate *et al.* (2020) [13] in Grand Naine.

Bunch length (cm)

Data revealed that the significantly highest bunch length (85.51 cm) was recorded in Grand Naine (V₃) whereas the lowest 43.51 cm was in Red Banana (V₂) (Table 3 and Plate 1,2,3). Considering the different fertilizer levels the significantly highest bunch length (60.38 cm) was recorded in F₄ (300:100:300 g NPK/plant) and was at par with F₃ (59.44 cm) while lowest 54.34 cm in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the significantly highest bunch length (89.38 cm) were in V₃F₄

(300:100:300 g NPK/plant) in Grand Naine whereas lowest 40.48 cm was in V₂F₁ (200:100:200 g NPK/plant) in Red Banana. Similar findings were reported by Rahate *et al.* (2020)^[13] in Red Banana.

Bunch weight (kg/plant)

The significantly maximum bunch weight (22.02 kg) was recorded in Grand Naine (V₃) and minimum 10.27 kg was in Konkan Safed Velchi (V₁) (Table 4). Considering the different fertilizer levels the significantly maximum bunch weight (15.22 kg) was recorded in F₄ (300:100:300 g NPK/plant) whereas minimum 13.62 kg was in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels maximum bunch weight (23.12 kg) was in V₃F₄ (300:100:300 g NPK/plant) in Grand Naine whereas minimum 9.59 kg was in V₁F₁ (200:100:200 g NPK/plant) in Konkan Safed Velchi. Increased availability and uptake of nutrients led to the better expression of growth and yield attributes which ultimately resulted in higher yield. Similar findings were reported by Ebeed *et al.* (2008)^[4] in Grand Naine and Rahate *et al.* (2020)^[13] in Grand Naine.

Number of hands/bunch (nos.)

The significantly maximum 13.84 hands/bunch were recorded in Grand Naine (V₃) and minimum 9.0 hands/bunch were in Konkan Safed Velchi (V₁) (Table 4). Considering the different fertilizer levels the significantly maximum 11.0 hands/bunch were recorded in F₃ (300:100:200 g NPK/plant) whereas the minimum 10.3 hands/bunch were recorded in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the maximum 14.4 hands/bunch were in V₃F₃ (300:100:200 g NPK/plant) in Grand Naine and it was at par with V₃F₄ (14.3 nos.) whereas minimum 8.8 hands/bunch were in V₁F₁ (200:100:200 g NPK/plant) in Konkan Safed Velchi. Maximum numbers of hands might be due to genetic character of variety and proper nutrient management led to yield attributes which ultimately resulted in higher yield. Similar findings were reported by Nalina *et al.* (2009) in Robusta and Rahate *et al.* (2020)^[13] in Grand Naine.

Hand weight (kg)

The significantly maximum hand weight (1.52 kg) was recorded in Grand Naine (V₃) and minimum (1.06 kg) hand weight was in Konkan Safed Velchi (V₁) (Table 4). Considering the different fertilizer levels the significantly maximum hand weight (1.26 kg) was recorded in F₄ (300:100:300 g NPK/plant) and it was at par with F₃ (1.24 kg) and F₅ (1.25 kg) whereas minimum hand weight (1.20 kg) was in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the maximum hand weight (1.54 kg) was recorded in V₃F₄ (300:100:300 g NPK/plant) in Grand Naine and it was at par with V₃F₅ (1.53 kg) while minimum hand weight (1.0 kg) in V₁F₁ (200:100:200 g NPK/plant) in Konkan Safed Velchi. Similar results were reported by Rahate *et al.* (2020)^[13] in Grand Naine.

Number of fingers/hand (nos.)

The significantly maximum fingers (15.43 nos.) were recorded in Grand Naine (V₃) and it was at par with Red Banana (V₂) (15.3 nos.) whereas minimum (14.4 nos.) fingers were in Konkan Safed Velchi (V₁) (Table 4). Considering the different fertilizer levels the significantly maximum (15.64 nos.) fingers were in F₄ (300:100:300 g NPK/plant) whereas

minimum (14.08 nos.) fingers were in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the maximum (16.42 nos.) fingers were in V₃F₃ (300:100:200 g NPK/plant) in Grand Naine which was at par with V₂F₄ (16.17 nos.) whereas the minimum (13.58 nos.) fingers in V₁F₁ (200:100:200 g NPK/plant) in Konkan Safed Velchi. Similar findings were reported by Nalina *et al.* (2009)^[9] in Robusta and Rahate *et al.* (2020)^[13] in Grand Naine.

Stalk weight (kg)

The lowest stalk weight (0.81 kg) was recorded in Konkan Safed Velchi (V₁) and highest stalk weight (1.04 kg) was in Grand Naine (V₃) (Table 4). Considering the different fertilizer levels the significantly lowest stalk weight (0.92 kg) was in F₁ (200:100:200 g NPK/plant) whereas highest (0.98 kg) in F₃ (300:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the lowest stalk weight (0.76 kg) was in V₁F₁ (200:100:200 g NPK/plant) in Konkan Safed Velchi whereas the highest (1.06 kg) was in the V₃F₄ (300:100:300 g NPK/plant) in Grand Naine. Similar results were reported by Rahate *et al.* (2020)^[13] in Konkan Safed Velchi.

Stalk length (cm)

The significantly highest stalk length (99.91 cm) was recorded in Grand Naine (V₃) and lowest 56.16 cm was in Red Banana (V₂) (Table 5). Considering the different fertilizer levels the significantly highest stalk length (74.63 cm) was recorded in F₄ (300:100:300 g NPK/plant) which was at par with F₂ (72.69 cm) whereas the lowest 68.36 cm was in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the highest stalk length (103.01 cm) was recorded in the V₃F₄ (300:100:300 g NPK/plant) in Grand Naine and lowest 53.48 cm in V₂F₁ (200:100:200 g NPK/plant) in Red Banana. Similar findings were reported by Rahate *et al.* (2020)^[13] in Konkan Safed Velchi.

Fruit length (cm)

The significantly highest fruit length (16.61 cm) was recorded in Grand Naine (V₃) and lowest fruit length (10 cm) was in Konkan Safed Velchi (V₁) (Table 5). Considering the different fertilizer levels the highest fruit length (13.88 cm) was recorded in F₄ (300:100:300 g NPK/plant) and it was at par with F₅ (13.22 cm) whereas lowest 12.30 cm in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels highest fruit length (17.43 cm) was in V₃F₄ (300:100:300 g NPK/plant) in Grand Naine whereas lowest 9.18 cm in V₁F₁ (200:100:200 g NPK/plant) in Konkan Safed Velchi. Highest fruit length might be due to the availability of proper nutrients; water and sunlight to plant and similar findings were reported by Tirkey *et al.* (2003)^[15] in Dwarf Cavendish and Rahate *et al.* (2020)^[13] in Grand Naine.

Finger weight (kg)

The significantly highest finger weight (0.098 kg) was recorded in Grand Naine (V₃) and lowest finger weight (0.073 kg) was in Konkan Safed Velchi (V₁) (Table 5). Considering the different fertilizer levels the significantly highest finger weight (0.085 kg) was recorded in F₁ (200:100:200 g NPK/plant) and lowest 0.081 kg was in F₄ (300:100:300 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the maximum finger weight (0.104 kg) was in V₃F₁ (200:100:200 g NPK/plant) in Grand Naine whereas

minimum 0.0716 kg was in V₂F₄ (300:100:300 g NPK/plant) in Red Banana. Similar findings were reported Pandey *et al.* (2002)^[10] in Robusta and Rahate *et al.* (2020)^[13] in Grand Naine.

Banana yield (kg/plant)

The significantly highest yield (19.48 kg/plant) was recorded in Grand Naine (V₃) and lowest yield (8.98 kg/plant) was in Konkan Safed Velchi (V₁) (Table 5). Considering the different fertilizer levels the significantly highest yield (15.12 kg/plant) was recorded in F₄ (300:100:300 g NPK/plant) whereas the lowest yield (10.39 kg/plant) was in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the highest banana yield (23.89 kg/plant) was in V₃F₄ (300:100:300 g NPK/plant) in Grand Naine whereas lowest yield (7.28 kg/plant) was in V₁F₁ (200:100:200 g NPK/plant) in Konkan Safed Velchi. Increased availability and uptake of nutrients led to the better expression of growth and yield attributes which ultimately resulted in higher yield. Similar results were reported by Rahate *et al.* (2020)^[13] in Grand Naine.

Banana yield (t/ha)

The significantly highest yield (63.42 t/ha) was recorded in Grand Naine (V₃) whereas the lowest yield (28.68 t/ha) was in Konkan Safed Velchi (V₁) (Table 5). Considering the different fertilizer levels the significantly highest banana fruit yield (46.4 t/ha) was recorded in F₄ (300:100:300 g NPK/plant) and lowest yield (37.57 t/ha) was in F₁ (200:100:200 g NPK/plant). Due to interaction effect of varieties and fertilizer levels the significantly highest banana yield (71.08 t/ha) was in V₃F₄ (300:100:300 g NPK/plant) in Grand Naine whereas the lowest banana yield (25.22 t/ha) in V₁F₁ (200:100:200 g NPK/plant) in Konkan Safed Velchi. Similar results reported by Rahate *et al.* (2020)^[13] in Grand Naine.

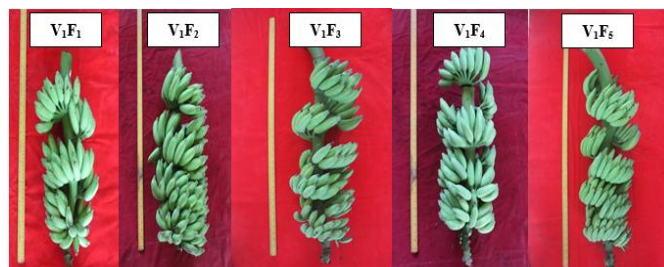


Plate 1: Effect of variety, fertilizer levels and their interactions on bunch length of banana Cv. Konkan Safed Velchi



Plate 2: Effect of variety, fertilizer levels and their interactions on bunch length of banana Cv. Red Banana

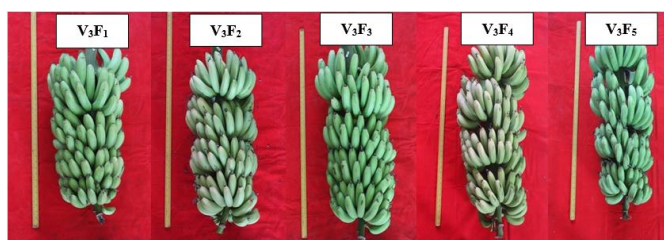


Plate 3: Effect of variety, fertilizer levels and their interactions on bunch length of banana Cv. Grand Naine

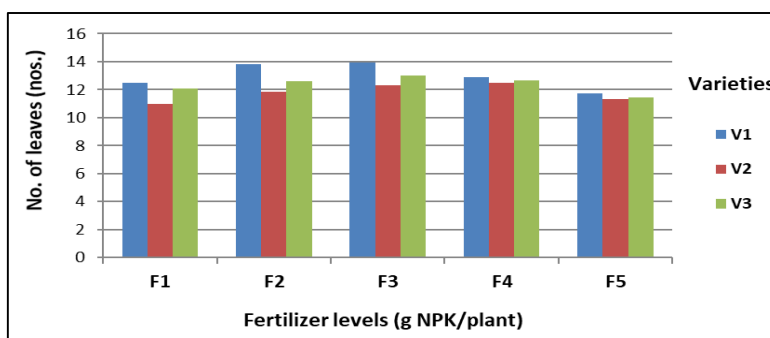


Fig 1: Effect of varieties, fertilizer levels and their interactions on number of leaves in banana at 270 DAP

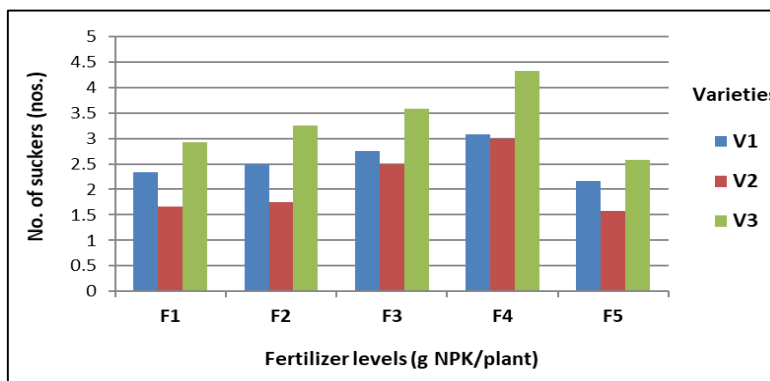


Fig 2: Effect of varieties, fertilizer levels and their interactions on number of suckers in banana at 270 DAP

Table 1: Effect of varieties, fertilizer levels and their interactions on plant height and girth of banana

Treatments	Plant height (cm)												Plant girth (cm)														
	90 DAP				180 DAP				270 DAP				90 DAP				180 DAP				270 DAP						
	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃
F ₁	104.7	72.3	99.8	92.3	215.3	195.2	174.5	195.0	296.0	311.5	205.7	271.1	13.83	13.65	24.49	17.32	44.11	43.70	44.46	44.09	54.44	67.41	63.29	61.71			
F ₂	107.9	73.3	101.7	94.3	222.6	194.5	172.2	196.4	304.0	307.6	210.3	273.9	14.01	13.84	24.49	17.45	43.50	44.53	45.59	44.54	57.81	65.88	63.86	62.52			
F ₃	111.8	74.3	104.4	96.8	223.9	199.3	175.3	199.5	302.6	315.2	223.5	280.5	14.98	14.82	24.47	18.09	45.02	46.67	46.52	46.07	57.26	67.37	65.60	63.41			
F ₄	110.1	72.4	105.8	96.1	219.9	195.5	177.4	197.6	305.5	315.7	225.8	282.3	15.54	15.62	25.54	18.90	47.19	48.07	48.44	47.90	60.72	70.68	65.93	65.78			
F ₅	111.8	73.3	103.4	96.2	227.9	195.0	177.2	200.1	303.9	314.9	225.6	281.5	14.88	15.64	24.70	18.41	43.69	47.72	47.39	46.27	56.29	70.36	66.20	64.28			
Mean	109.3	73.1	103.0	95.1	221.9	195.9	175.3	197.7	302.4	313.0	218.2	277.9	14.65	14.72	24.74	18.03	44.70	46.14	46.48	45.77	57.30	68.34	64.97	63.54			
	Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F				
S.Em±	0.09	1.04	0.35		0.28	3.92	1.31		0.23	2.27	0.76		0.04	0.70	0.23		0.19	1.72	0.57		0.13	1.53	0.51				
C.D.(P=0.05)	0.36	3.02	1.01		1.09	11.43	3.81		0.90	6.62	2.21		0.14	2.05	0.68		0.75	5.02	1.67		0.52	4.47	1.49				

Table 2: Effect of varieties, fertilizer levels and their interactions on leaf area and leaf area index of banana

Treatments	Leaf area (m ²)												Leaf area index (LAI)														
	90 DAP				180 DAP				270 DAP				90 DAP				180 DAP				270 DAP						
	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃
F ₁	0.48	0.85	0.88	0.74	5.34	6.59	4.39	5.44	7.16	10.19	6.21	7.85	0.25	0.27	0.61	0.38	1.84	2.13	1.80	1.92	2.82	3.22	1.92	2.65			
F ₂	0.89	0.85	0.92	0.89	6.26	6.79	4.62	5.89	8.91	10.77	6.73	8.80	0.28	0.28	0.63	0.40	2.06	2.15	1.81	2.00	3.06	3.26	1.93	2.75			
F ₃	0.92	0.86	0.93	0.90	6.29	7.08	4.96	6.11	9.74	10.62	7.17	9.18	0.33	0.29	0.65	0.42	2.18	2.17	1.82	2.06	3.19	3.31	1.95	2.81			
F ₄	0.79	0.93	0.95	0.89	5.71	7.37	4.81	5.96	8.01	11.21	7.18	8.80	0.30	0.30	0.67	0.42	1.73	2.10	1.85	1.89	3.05	3.43	1.97	2.82			
F ₅	0.71	0.88	0.90	0.83	5.58	7.07	5.08	5.91	6.83	10.21	6.85	7.96	0.26	0.27	0.63	0.39	1.84	2.11	1.80	1.92	3.06	3.28	1.94	2.76			
Mean	0.76	0.87	0.92	0.85	5.84	6.98	4.77	5.86	8.13	10.60	6.83	8.52	0.28	0.28	0.64	0.40	1.93	2.13	1.81	1.96	3.04	3.30	1.94	2.76			
	Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F				
S.Em±	0.01	0.09	0.03		0.01	0.45	0.15		0.02	0.41	0.14		0.003	0.035	0.012		0.01	0.12	0.04		0.01	0.20	0.07				
C.D.(P=0.05)	0.02	0.26	0.09		0.03	1.31	0.44		0.08	1.20	0.40		0.010	0.103	0.034		0.05	0.36	0.12		0.03	0.59	0.20				

Table 3: Effect of varieties, fertilizer levels and their interactions on boot leaf stage, days required for flowering, fruiting, flowering to harvest and bunch length of banana

Treatments	Boot leaf stage (days)				Days for flowering (days)				Days for fruiting (days)				Days from flowering to harvest (days)				Bunch length (cm)			
	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean
F ₁	260.83	312.00	230.33	267.72	263.08	314.83	241.08	273.00	279.83	336.67	258.17	291.56	121.08	118.00	117.17	118.75	40.73	40.48	81.83	54.34
F ₂	249.50	304.17	222.17	258.61	251.75	306.33	224.67	260.92	272.83	328.25	240.42	280.50	114.00	116.33	115.50	115.28	45.05	43.23	84.30	57.53
F ₃	240.75	297.67	213.67	250.69	243.08	300.50	216.00	253.19	259.25	315.25	240.08	271.53	112.92	115.42	113.50	113.94	48.04	43.66	86.62	59.44
F ₄	245.92	299.08	211.00	252.00	248.08	301.92	213.33	254.44	264.58	322.25	229.00	271.94	109.42	109.58	107.50	108.83	46.17	45.58	89.38	60.38
F ₅	253.08	304.58	220.67	259.44	255.25	306.50	223.50	261.75	271.33	327.42	239.33	279.36	114.75	113.08	112.08	113.31	44.73	44.61	85.43	58.25
Mean	250.02	303.50	219.57	257.69	252.25	306.02	223.72	260.66	269.57	325.97	241.40	278.98	114.43	114.48	113.15	114.02	44.94	43.51	85.51	57.99
	Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F	
S.Em±	0.58	3.32	1.11		0.81	4.92	1.64		1.05	5.89	1.96		0.17	1.16	0.39		0.07	1.07	0.36	
C.D. (P=0.05)	2.29	9.69	3.23		3.20	14.37	4.79		4.14	17.20	5.73		0.68	3.40	1.13		0.26	3.13	1.04	

Table 4: Effect of varieties, fertilizer levels and their interactions on bunch weight, hands/bunch, hand weight, fingers/hand and stalk weight of banana

Treatments	Bunch weight (kg)				Number of hands/bunch (nos.)				Hand weight (kg)				Number of fingers/hand (nos.)				Stalk weight (kg)			
	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean
F ₁	9.59	10.90	20.39	13.62	8.8	9.0	13.0	10.3	1.00	1.10	1.49	1.20	13.58	14.25	14.42	14.08	0.76	0.99	1.00	0.92
F ₂	10.14	11.60	21.82	14.52	9.0	9.5	13.9	10.8	1.04	1.11	1.50	1.22	14.00	15.17	15.50	14.89	0.81	1.00	1.04	0.95
F ₃	10.77	11.89	22.81	15.16	9.2	9.6	14.4	11.0	1.08	1.14	1.52	1.24	14.92	15.50	16.42	15.61	0.86	1.01	1.05	0.98
F ₄	10.44	12.11	23.13	15.22	8.8	9.6	14.3	10.9	1.09	1.16	1.54	1.26	15.08	16.17	15.67	15.64	0.83	1.03	1.06	0.97
F ₅	10.43	11.72	21.97	14.71	9.1	9.3	13.7	10.7	1.06	1.15	1.53	1.25	14.42	15.42	15.17	15.00	0.81	1.03	1.04	0.96
Mean	10.27	11.64	22.02	14.65	9.0	9.4	13.8	10.7	1.06	1.13	1.52	1.23	14.40	15.30	15.43	15.04	0.81	1.01	1.04	0.95
	Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F	
S.Em±	0.07	0.37	0.12		0.06	0.30	0.10		0.001	0.013	0.004		0.06	0.44	0.15		0.001	0.029	0.010	
C.D. (P=0.05)	0.27	1.08	0.36		0.23	0.87	0.29		0.003	0.038	0.013		0.22	1.27	0.42		0.005	0.083	0.028	

Table 5: Effect of varieties, fertilizer levels and their interactions on stalk length, fruit length, weight of finger and yield of banana

Treatments	Stalk length (cm)				Fruit length (cm)				Weight of finger (kg)				Banana yield (kg/plant)				Banana yield (t/ha)			
	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean	V ₁	V ₂	V ₃	Mean
F ₁	55.57	53.48	96.03	68.36	9.18	11.77	15.97	12.30	0.074	0.078	0.104	0.085	7.28	7.88	16.02	10.39	25.22	29.21	58.29	37.57
F ₂	60.06	55.64	98.74	71.48	9.65	12.50	16.38	12.84	0.074	0.073	0.097	0.082	8.66	8.81	17.12	11.53	26.50	30.16	60.15	38.94
F ₃	61.97	55.81	100.28	72.69	10.13	12.62	16.46	13.07	0.073	0.073	0.092	0.079	8.93	9.50	19.21	12.55	28.09	30.56	62.54	40.40
F ₄	61.37	59.53	103.01	74.63	10.94	13.28	17.43	13.88	0.072	0.072	0.098	0.081	10.76	10.72	23.89	15.12	33.22	34.90	71.08	46.40
F ₅	59.03	56.33	101.48	72.28	10.08	12.74	16.83	13.22	0.074	0.074	0.101	0.083	9.28	10.36	21.13	13.59	30.38	31.05	65.02	42.15
Mean	59.60	56.16	99.91	71.89	10.00	12.58	16.61	13.06	0.073	0.074	0.098	0.082	8.98	9.45	19.48	12.64	28.68	31.18	63.42	41.09
	Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F		Varieties (V)	Fertilizer levels (F)	V x F	
S.Em±	0.14	1.16	0.39		0.03	0.29	0.10		0.0002	0.002	0.001		0.03	0.30	0.10		0.02	0.67	0.22	
C.D. (P=0.05)	0.56	3.38	1.13		0.14	0.83	0.28		0.001	0.007	0.002		0.13	0.89	0.30		0.07	1.96	0.65	

Conclusion

The results of this study revealed that for obtaining better growth of banana crop, the cultivar Red Banana performed well and as yield is concerned the cultivar Grand Naine performed the best. For obtaining maximum yield of banana the fertilizer dose of 10 kg FYM + 300:100:300 g NPK/plant/year in Grand Naine performed best which was proved to be the superior combination for vigorous growth and highest yield.

Acknowledgements

This work is a part of M.Sc research work, at College of Horticulture, DBSKKV, Dapoli, (M.S.), India. The authors are thankful to the Head and Associate Dean, College of Horticulture, DBSKKV, Dapoli and Research Guide for providing the facilities. Authors extend their sincere thanks to the colleagues of M.Sc. student, Department of Horticulture, Dapoli for their support in field data collection.

References

1. Badgujar C, Dusane SM, Desmukh S. Influence of plant spacing on growth, maturity and yield of Grand Naine banana, South Indian Horticulture 2004;52(1-6):13-17.
2. Balasubrahmanyam V, Dhake A, Patil K, Moitra P, Daryapurkar S. Precision farming of banana in Maharashtra, Precision farming in horticulture 2003, 114-123.
3. Dinesh K, Pandey V, Nath Vishal. Growth, yield and quality of vegetable banana Monthan in relation to NPK fertigation. Indian Journal of Horticulture 2012;69(4):467-471.
4. Ebeed S, Mortafa E, Salem M. Effect of gibberelic acid and male bud removal on yield and fruit quality of banana. Research Journal of Agricultural and Biological Science 2008;44:289-292.
5. Falcomer AL, Riquette RFR, De Lima BR, Ginani VC, Zandonadi RP. Health benefits of green banana Consumption: A Systematic Review. Nutrients 2019;11:1222.
6. Gopalan C, Sastri BVR, Balasubramanian SC. Nutritive value of Indian foods. National Institute of Nutrition, Indian Council of Medical Research, Hyderabad 500007, India 2004, 2-58.
7. Indhumathi P, Durga D. Effect on different doses on nutrient for growth and physiological characters in banana Cv. Grand Naine. Advances in Life Sciences, 2016;5(11):2278-4705.
8. Mustaffa MM, Kumar V. Banana production and productivity enhancement through spatial, water & nutrient management. Journal of Horticultural Science 2012;7(1):1-28.
9. Nalina L, Kumar N, Soorianathasundram K, Jayakumar P. Effect of different nutrient levels on growth and development of tissue cultured banana Cv. Robusta. Indian Journal of Horticulture 2009;66(2):169-174.
10. Pandey SD, Jeyabaskaran KJ, Mustaffa MM, Dhanasekar D. Effect of N and K fertilization at different frequencies on growth & yield of banana Robusta. Global Conference on banana and plantain, 2002, 132.
11. Pandey V, Kumar D, George S. Response of micro propagated Robusta banana to varying combinations of NPK nutrition in lateritic soils of coastal Orissa, Indian Journal of Horticulture 2005;62(2):122-126.
12. Panse VG, Sukatme PV. Statistical methods for Agriculture workers, ICAR, New Delhi 1995.
13. Rahate SC, Shinde VV, Ghavale SL, Salvi BR, Dhovavkar RV. Effect of nutrient management on growth and yield performance of banana (*Musa spp.*) varieties under coastal ecosystem of Maharashtra. Journal of Pharmacognosy and Phytochemistry 2020;9(5):317-326.
14. Suresh CP, Mahato SK, Gurung S, Chheteri B. Effect of N and K on growth morphology of plantain Cv. Nendran under Terai region of West Bengal. International Journal of Agriculture Sciences 2008;7:707-713, 0975-3710.
15. Tirkey T, Pandey SD, Agrawal S. Studies on the response of nitrogen levels and split application of N, P and K on growth, yield & quality of tissue culture raised banana cv. Dwarf Cavendish. Orissa Journal of Horticulture, 2003;31(1):65-70.