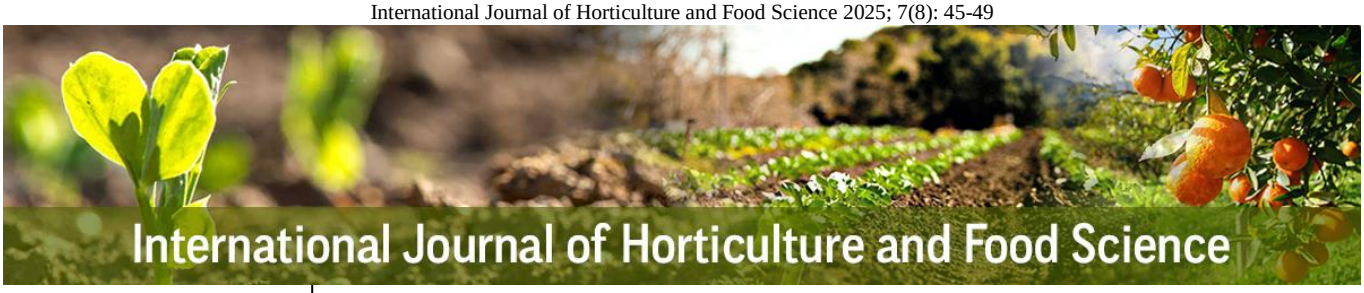

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Chetna M Patel
Assistant Professor, Horticulture Polytechnic, Aspee College of Horticulture (ACH), Navsari Agricultural University (NAU), Paria, Gujarat, India

SJ Patil
Professor and Head, Department of Horticulture, N.M. College of Agriculture (NMCA), Navsari Agricultural University (NAU), Navsari, Gujarat, India

SS Gaikwad
Professor, Horticulture Polytechnic, Aspee College of Horticulture (ACH), Navsari Agricultural University (NAU), Paria, Gujarat, India

SS Masaye
Assistant Professor, Horticulture Polytechnic, Aspee College of Horticulture (ACH), Navsari Agricultural University (NAU), Paria, Gujarat, India

SL Chawla
Professor, Department of Floriculture and Landscape Architecture (FLA), Aspee College of Horticulture (ACH), Navsari Agricultural University (NAU), Navsari, Gujarat, India

Corresponding Author:
Chetna M Patel
Assistant Professor, Horticulture Polytechnic, Aspee College of Horticulture (ACH), Navsari Agricultural University (NAU), Paria, Gujarat, India

Response of planting material and nutrients on growth of banana cv. Grand Naine

Chetna M Patel, SJ Patil, SS Gaikwad, SS Masaye and SL Chawla

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Abstract
A field experiment was conducted at Horticulture Polytechnic, ASPEE College of Horticulture, Navsari Agricultural University, Paria to study the response of planting material and nutrients on growth of banana cv. Grand Naine during the year 2022-23 and 2023-24. The experiment included fourteen treatment combinations with two factors in a randomized block design with factorial concept and repeated thrice *viz.*, Planting material (P): Tissue cultured plants and Macro propagation plantlets; Nutrients (N): Novel organic liquid nutrients (1 and 2%), Banana Shakti (1 and 2%), Grade IV micronutrient (1 and 2%) and Control. Nutrients were sprayed at 3rd, 5th and 7th month after planting. The individual effect of planting material and foliar application of nutrients at 3rd, 5th and 7th month after planting as well as their interactions on growth of banana cv. Grand Naine were recorded. The results of two years mean revealed that tissue cultured plants used as a planting material significantly increased the growth characters *viz.*, maximum pseudostem girth (71.74 cm), number of leaves (14.27), leaf area (12.73 m^2) and minimum days to shooting, harvesting as well as crop duration (214.14, 102.63 and 316.77 days, respectively). The foliar application of Grade IV micronutrient @ 2% at 3rd, 5th and 7th month after planting significantly gave the maximum pseudostem height and girth (2.14 m and 72.52 cm, respectively), number of leaves (14.41), leaf area (12.78 m^2) and minimum days to shooting, harvesting and crop duration (211.54, 101.40 and 312.94 days, respectively). While, interaction between planting material and nutrients found non-significant on growth characters.

Keywords: **T**issue culture, macro propagation, Grade IV micronutrient, Novel organic liquid nutrients and Banana Shakti

1. Introduction
Tissue culture plants is a key intervention in banana, which have the potential to benefit the banana farmers in multiple ways, as compared to the sucker propagation banana tissue culture yield better (Sebastian *et al.*, 2019) [8]. Macro-propagation technique is next best alternative with tremendous potential for production of quality planting material. The macro-propagation techniques involved decortations and decapitation, which is likely to produce nearly 15 to 20 plants/suckers depend on the cultivars. These shoots could be rooted and hardened like tissue culture plants. The farmers will be benefitted by this simple method because of easy multiplication of their own choice of variety and thus minimize the cost of planting material (Patel *et al.*, 2021) [4].

Nutritional deficiencies and imbalances are now-a-days emerging as major threats in the Indian banana production system. Lack of awareness about the importance of balanced fertilization has led to indiscriminate application of certain nutrients causing deficiency of micronutrients. In addition, non-availability of good quality organic manures is also one of the factors for poor soil health. Particularly, the micronutrients are very much neglected among the banana farming community in India and essentiality of micronutrients in banana production is gaining importance. Macronutrients as well as micronutrients is the key elements in plants found equally important for the growth and development. Micronutrients play a vital role in various enzymatic activities and synthesis of assimilates and hormones (Kumar, 2002) [10]. These micronutrients play an active role in the plant metabolism process starting from cell wall development to respiration, photosynthesis, chlorophyll formation, enzymatic activity, hormone synthesis, nitrogen fixation and reduction, *etc.* (Das, 2003) [2]. The foliar application of micronutrients (NOVEL, Grade IV micronutrient and Banana Shakti) in very minute quantity enhances the growth and yield of banana.

Materials and Methods

A field experiment was conducted at Horticulture Polytechnic, ASPEE College of Horticulture, Navsari Agricultural University, Paria to study the response of planting material and nutrients on growth of banana cv. Grand Naine during the year 2022-23 and 2023-24. The experiment included fourteen treatment combinations with two factors in a randomized block design with factorial concept and repeated thrice *viz*., Planting material (P): Tissue cultured plants and Macro propagation plantlets; Nutrients (N): Novel organic liquid nutrients (1 and 2%), Banana Shakti (1 and 2%), Grade IV micronutrient (1 and 2%) and Control. Nutrients were sprayed at 3rd, 5th and 7th month after planting. The individual effect of planting material and foliar application of nutrients at 3rd, 5th and 7th month after planting as well as their interactions on growth of banana cv. Grand Naine were recorded.

Results and Discussions

Effect of planting material

The data presented in Table 1 revealed that significantly the maximum pseudostem girth (71.74 cm), number of leaves (14.27), leaf area (12.73 m2) and minimum days to shooting, harvesting as well as crop duration (214.14, 102.63 and 316.77 days, respectively). While, pseudostem height found non-significant. The probable reason for higher pseudostem height and circumference of pseudostem in tissue culture plant might be due to tissue culture plants are well established as undisturbed along with good root system at the time of planting. Not only this but the whole plants have several leaves already present at the time of planting. Resulting in active photosynthesis and best utilization of applied moisture and nutrients under lower degree of inter and interplant competition (Patel, 2003) [5]. The days taken by tissue culture plants from planting to flowering and maturity were less than the days taken by macro propagated plants. The shorter cycle time advantage of tissue culture can be ascribed to the early establishment of whole plant. Thus, the tissue culture plants with a greater functional leaf area at planting and therefore this enables them to manufacture their own food. The fast vegetative growth of tissue cultured plants was reflected in early flowering and more number of leaves at flowering and reached harvest stage nearly a one and half month earlier than conventional once (Patel, 2003) [5].

Effect of nutrients

A perusal of data presented in Table 1 clearly indicated that there were significantly the maximum pseudostem height and girth (2.14 m and 72.52 cm, respectively), number of leaves (14.41), leaf area (12.78 m^2) and minimum days to shooting, harvesting and crop duration (211.54, 101.40 and 312.94 days, respectively) were observed in foliar application of Grade IV micronutrient @ 2% at 3rd, 5th and 7th month after planting.

In present investigation vegetative growth of banana plants in terms of pseudostem height and pseudostem girth were influenced by the Grade IV micronutrient treatments. It might be due to zinc which enhanced the synthesis of auxin in the plants. Copper also activates several enzymes in plant helps in chlorophyll synthesis and involves in carbohydrate and protein metabolism (Ram and Bose, 2000) [7]. In the present investigation, Grade IV micronutrient (N6) triggered early flowering, harvest and lesser crop duration. The probable reason might that micronutrient particularly zinc stimulates photosynthetic activity and its presence is more important for protein synthesis (Yadav *et al.*, 2010) [9].

There was a significant response on pseudostem height and girth with the foliar application of Novel organic liquid nutrients at 3rd, 5th and 7th month after planting as compared to control. This might be due to nitrogen which present in Novel organic liquid nutrients is responsible for the formation, growth and development of the cells and accelerating the synthesis of chlorophyll and amino acid which are associated with major photosynthesis process of plants, it causes an increased in the formation of meristematic tissues (Gurjar *et al.*, 2017 and Bhalerao *et al.*, 2014) [1, 3]. In the present investigation, it is also clearly seen that Novel organic liquid nutrients treatment (2%) triggered flowering characters as compared to control. This might be due to nitrogen and micronutrients which present in Novel organic liquid nutrients increased the rate of vegetative growth, which resulted in maximum leaves and leaf area and hence promoted early flowering and harvesting (Patil *et al.*, 2017) [6].

Table 1: Effect of different planting material and nutrients on growth of banana cv. Grand Naine (Mean of two years)

Treatments	Number of leaves	Leaf area (m^2)	Pseudostem height (m)	Pseudostem girth (cm)	Days to shooting after planting to flower bud initiation	Days to harvesting	Crop duration (days)
Planting material (P)							
P_1: Macro propagation plantlets	13.01	11.66	2.06	66.25	221.86	109.60	331.46
P_2: Tissue cultured plants	14.27	12.73	2.09	71.74	214.14	102.63	316.77
S.Em. ±	0.11	0.11	0.02	0.45	1.43	0.96	2.39
C.D. at 5%	0.32	0.30	NS	1.27	4.07	2.72	6.78
Nutrients (N)							
N_1: Novel organic liquid nutrients @1%	13.67	12.21	2.12	69.17	216.22	105.25	321.47
N_2: Novel organic liquid nutrients @2%	14.23	12.55	2.14	71.15	213.48	102.76	316.24
N_3: Banana Shakti @1%	13.08	11.91	2.11	66.51	222.29	110.36	332.64
N_4: Banana Shakti @2%	13.31	12.06	1.99	67.94	219.57	106.87	326.44
N_5: Grade IV micronutrient @1%	13.81	12.44	2.09	70.04	214.35	103.61	317.96
N_6: Grade IV micronutrient @2%	14.41	12.78	2.14	72.52	211.54	101.40	312.94
N_7: Control	12.97	11.39	1.93	65.68	228.57	112.55	341.12

S.Em. ±	0.21	0.20	0.04	0.84	2.68	1.79	4.47
C.D. at 5%	0.59	0.57	0.10	2.38	7.61	5.10	12.68
Interaction effect (P × N)							
S.Em. ±	0.14	0.30	0.03	0.50	0.69	1.61	1.76
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS
C.V.%	5.29	5.66	5.89	4.20	4.26	5.86	4.77

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