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Studies on effect of Ghana jeevamrutha and liquid jeevamrutha on yield and yield attributes of banana cv. Ney poovan (AB)

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Abstract
A field experiment was conducted to study the effect of Ghana jeevamrutha and liquid jeevamrutha at different levels at Hanagal Taluk of Haveri district Karnataka. The experiment contains tens treatments with three replications laid in a randomized complete block design and the cv. Ney poovan is the commercial variety used for the study. T_{10} - POP recorded the maximum values for bunch length (69.87 cm), bunch width (35.08 cm), finger length (12.72 cm), finger girth (3.65 cm), finger weight (88.42 g), finger volume (81.77 cc), yield per plant (13.17 kg) and yield per acre (7.31 t). Among the different levels of ghana jeevamrutha and liquid jeevamrutha application the maximum bunch length (58.33 cm), bunch width (30.47 cm), finger length (11.10 cm), finger girth (3.33 cm), finger weight (76.67 g), finger volume (71.08 cc), yield per plant (9.35 kg) and yield per acre (5.19 t) were recorded in T_9 - ghana jeevamrutha @ 600 kg/acre + liquid jeevamrutha @ 300 l/acre. Minimum values for all these parameters were recorded in T_1.

Keywords: Ghana jeevamrutha, liquid jeevamrutha, besides, parameters

Introduction
Banana is one of the most important herbaceous fruit crop in the world which belongs to family musaceae. It is an exhaustive crop which requires large amount of fertilizers, especially potassium and nitrogen. Farmers are facing problems due to the high cost of chemical fertilizers. Besides, these chemical fertilizers are considered as air, soil and water polluting agents during their production and utilization. Consequently, it has drowned the attention of the researchers and banana growers to use alternate source of fertilizers such as Ghana jeevamrutha and jeevamrutha which are safe for human, animal and environment. Thus, it is preferred to use natural fertilizers to avoid pollutions, reduce the fertilizers cost and for sustainable banana production. Application of Ghana jeevamrutha and liquid jeevamrutha promotes and enhances biodiversity, biological cycles and soil biological activities.
This practice helps in reducing the use of off-farm and chemical inputs and management practices which helps in restoring, maintaining and enhancing the ecological harmony. Among different varieties of banana, the cultivar Ney poovan which is also known as Elakkibale, Mitli and Puttabale is the most popular diploid cultivar (AB) and under commercial mono cultivation on a large scale particularly in Karnataka and Tamil Nadu. It is slender, medium tall, plant takes about 12 to 13 months for its crop cycle and occupies large areas in Karnataka. Average bunch weight is 12 to 16 kg with small fruits packed closely having a windblown appearance. This cultivar has a great export potential mainly due to its edible quality, keeping quality and exceptional flavor which attain good yellow colour after ripening. The current study focuses on enhancing the yield of banana cv. Ney poovan by using organic nutrients to help maintain soil fertility and to boost crop growth in a sustainable manner.

Material and Methods
The present investigation on the effect of ghana jeevamrutha and liquid jeevamrutha on yield and yield attributes of banana cv. Ney poovan (AB) was carried out at Hanagal of Haveri district situated at 14.767 ºN 75.126 ºE latitude and at 555 m elevation which comes under zone 09 of Karnataka during 2019-2020 and 2020-2021. The experiment was laid out in Randomized Complete Block Design with three replications.

Tissue cultured plants were treated with beejamrutha and planted at the spacing of 2.7 × 2.7 m. The required intercultural operations were taken regularly.

Table 1: Details of the treatments imposed during the experimentation

Treatment No.	Treatment
T_1	Ghana jeevamrutha @ 200 kg/acre + liquid jeevamrutha @ 100 l/acre
T_2	Ghana jeevamrutha @ 400 kg/acre + liquid jeevamrutha @ 100 l/acre
T_3	Ghana jeevamrutha @ 600 kg/acre + liquid jeevamrutha @ 100 l/acre
T_4	Ghana jeevamrutha @ 200 kg/acre + liquid jeevamrutha @ 200 l/acre
T_5	Ghana jeevamrutha @ 400 kg/acre + liquid jeevamrutha @ 200 l/acre
T_6	Ghana jeevamrutha @ 600 kg/acre + liquid jeevamrutha @ 200 l/acre
T_7	Ghana jeevamrutha @ 200 kg/acre + liquid jeevamrutha @ 300 l/acre
T_8	Ghana jeevamrutha @ 400 kg/acre + liquid jeevamrutha @ 300 l/acre
T_9	Ghana jeevamrutha @ 600 kg/acre + liquid jeevamrutha @ 300 l/acre
T_{10}	Package of practice (200:100:300 g NPK/plant/year)

*Ghana jeevamrutha was applied 30 days before planting and at starting of ratoon crop.
* Liquid jeevamrutha was applied at 15 days interval.
* NPK was applied at monthly intervals after planting to till two months before shooting.

The bunch length was measured by using meter scale from the first hand at the top upto last and bunch width was measured at widest portion of the bunch and the mean was recorded and expressed in centimeters. The finger length was measured from the base of the fruit to the tip where it is attached to the stalk and the finger girth was measured at the widest portion by using vernier callipers and both were expressed in centimetres. Immediately after the harvest, five matured fruits from each treatment were weighed and the average weight of the fruit was recorded and expressed in gram. The finger volume was determined by the conventional water displacement method and the mean was computed and expressed in cubic centimetres. The yield per plant was obtained by harvesting the matured bunches by leaving the peduncle length of 22.50 cm above the first hand and 5 cm below the last hand and the weight of the bunch was recorded by using the electronic weigh balance and was expressed in kilograms. The total yield was calculated by multiplying the yield per plant with the total number of plants per acre and expressed in tonnes per acre. Experimental data collected was subjected to statistical analysis by adopting Fisher's method of Analysis of Variance (ANOVA) as outlined in Gomez and Gomez (1984) [8]. Critical Difference (CD) values were calculated whenever the "F" test was significant at 5 per cent level.

Results and Discussion

Yield attributes

The data pertaining to bunch parameters are presented in the Table 2. The maximum bunch length (69.87 cm) was recorded in treatment T_{10} which was on par with T_9 (58.33 cm) and minimum was recorded in T_1 (43.83 cm). The maximum bunch width was in recorded in T_{10} which was on par with T_9 (30.47 cm), T_8 (30.17 cm) and T_7 (29.28 cm) whereas, the minimum was recorded in T_1 (22.67 cm).

The data pertaining to finger parameters are presented in the Table 3. The maximum value for finger length (12.72 cm) was noticed in T_{10} which was on par with T_9 (11.10 cm), T_8 (11.00 cm) and T_7 (10.95 cm) while minimum was recorded in T_1 (7.87 cm). The highest values for finger girth (3.65 cm), finger weight (88.42 g) and finger volume (81.77 cc) was recorded in T_{10} which was followed by T_9 (3.33 cm, 76.67 g and 71.08 cc, respectively) where as the minimum was recorded in T_1 (2.75 cm, 49.67 g and 46.31 cc, respectively).

Table 2: Effect of Ghana jeevamrutha and liquid jeevamrutha on bunch parameters of banana cv. Ney poovan

Treatments	Bunch length (cm)			Bunch width (cm)		
	Plant crop	Ratoon crop	Pooled	Plant crop	Ratoon crop	Pooled
T_1	43.00	44.67	43.83	22.00	23.33	22.67
T_2	48.33	50.00	49.17	23.13	25.67	24.40
T_3	49.33	51.00	50.17	24.67	27.33	26.00
T_4	50.00	52.33	51.17	26.17	28.00	27.08
T_5	51.67	54.00	52.83	26.67	28.67	27.67
T_6	53.00	55.67	54.33	27.67	28.33	28.00
T_7	54.33	57.67	56.00	28.90	29.67	29.28
T_8	55.33	58.83	57.08	29.67	30.67	30.17
T_9	56.33	60.33	58.33	30.10	30.83	30.47
T_{10}	68.17	71.57	69.87	34.00	36.17	35.08
SEm±	3.91	4.31	4.05	2.13	2.18	2.03
CD @ 5%	11.62	12.81	12.03	6.32	6.48	6.03

Table 3: Effect of Ghana jeevamrutha and liquid jeevamrutha on finger parameters of banana cv. Ney poovan

Treatments	Length (cm)			Width (cm)			Weight (g)			Volume (cc)		
	Plant crop	Ratoon crop	Pooled	Plant crop	Ratoon crop	Pooled	Plant crop	Ratoon crop	Pooled	Plant crop	Ratoon crop	Pooled
T_1	7.77	7.97	7.87	2.72	2.78	2.75	49.33	50.00	49.67	45.41	47.21	46.31
T_2	8.67	8.83	8.75	2.80	2.83	2.82	52.00	53.90	52.95	48.71	51.17	49.94
T_3	8.80	8.87	8.83	2.82	2.93	2.88	58.00	59.50	58.75	53.75	55.16	54.46
T_4	9.53	9.67	9.60	2.93	3.00	2.97	61.33	63.43	62.38	58.43	58.77	58.60
T_5	10.00	10.23	10.12	3.07	3.03	3.05	68.00	70.23	69.12	63.03	65.07	64.05
T_6	10.37	10.70	10.53	3.10	3.13	3.12	70.33	72.27	71.30	65.17	66.93	66.05
T_7	10.90	11.00	10.95	3.17	3.27	3.22	73.67	75.93	74.80	68.27	70.19	69.23
T_8	10.83	11.17	11.00	3.23	3.30	3.27	75.00	77.33	76.17	69.63	71.99	70.81
T_9	11.00	11.20	11.10	3.30	3.37	3.33	75.33	78.00	76.67	70.17	72.00	71.08
T_{10}	12.67	12.77	12.72	3.63	3.67	3.65	87.83	89.00	88.42	81.04	82.50	81.77
SEm±	0.68	0.60	0.64	0.13	0.10	0.10	3.01	3.18	3.07	2.78	2.84	2.77
CD @ 5%	2.03	1.80	1.89	0.38	0.30	0.31	8.96	9.44	9.12	8.27	8.43	8.24

Increased yield attributes in the treatment T_{10} - POP could be due to the increase in morphological traits and also higher nutrient uptake by the plants. This is in conformation with the findings of Agarwal *et al.* (1997) [1], Shakila (2000) [18], Babu (2006) [20]. Krishnan and Shanmugavelu (1979) [13] found that plants with thicker pseudostem are desirable as they reflect on bunch size and other related characters. It is also probable that the number of fingers per bunch and finger size is influenced more by the quantity of fertilizers up to a certain level than the time of application (Beena *et al.*, 1993) [21]. Application of potassium exerted a significant influence on bunch weight (Geetha *et al.*, 1990) [7]. The study on standardizing nutrient requirement in banana in the cultivar Njalipoovan (Syn. Ney Poovan) conducted by Indira and Nair (2008) [10] opined that, increasing the rate of application of nitrogen, phosphorous and potassium improved the yield and yield attributes of banana. Kumar *et al.* (2008) [14] observed that application of different doses of nitrogen and potassium influenced the yield attributes of banana.

Among the different levels of Ghana jeevamrutha and liquid jeevamrutha, plants treated with ghana jeevamrutha @ 600 kg/acre + liquid jeevamrutha 300 l/acre (T_9) recorded the maximum values for fruit physical parameters. This might me due to slow and consistent release of nutrients throughout the period ultimately resulting in higher yield attributing factors. Liquid jeevamrutha contains kinetin which helps to increase the cell activity in the fruit and fruit weight is positively correlated with the pulp weight of the fruit. The results are similar with the findings of Jhade *et al.* (2020) [11] where in, that the maximum fruit weight was recorded in papaya due to application of RDF + jeevamrutha compare to without application of jeevamrutha.

Yield parameters

The data pertaining to yield parameters are presented in the Table 4. The pooled data revealed that T_{10} recorded the maximum yield per plant (13.17 kg) and yield per acre (7.31 t) which was followed by T_9 (9.35 kg and 5.19 t, respectively). The minimum value of yield per plant (6.93 kg) and yield per hectare (3.85 t) were recorded in T_1.

Table 4: Effect of Ghana jeevamrutha and liquid jeevamrutha on yield parameters of banana cv. Ney poovan

Treatments	Yield per plant (kg)			Yield per acre (t)		
	Plant crop	Ratoon crop	Pooled	Plant crop	Ratoon crop	Pooled
T_1	6.83	7.03	6.93	3.79	3.90	3.85
T_2	7.00	7.33	7.17	3.89	4.07	3.98
T_3	7.17	7.47	7.32	3.98	4.14	4.06
T_4	7.63	7.90	7.77	4.24	4.38	4.31
T_5	7.90	8.27	8.08	4.38	4.59	4.49
T_6	8.07	8.30	8.18	4.48	4.61	4.54
T_7	8.47	8.67	8.57	4.70	4.81	4.75
T_8	8.83	9.10	8.97	4.90	5.05	4.98
T_9	9.13	9.57	9.35	5.07	5.31	5.19
T_{10}	13.00	13.33	13.17	7.22	7.40	7.31
SEm±	0.49	0.30	0.28	0.27	0.17	0.15
CD @ 5%	1.46	0.90	0.82	0.81	0.50	0.46

The increased yield parameters in T_{10} - POP is due to application of nutrients through chemical fertilizers that might be attributed to the quick release and availability of nutrients in required quantity with the application of fertilizers. By this it increases the growth traits such as plant height, girth, leaf area and also higher nutrient uptake by plants which results in increased photosynthetic activity leading to higher accumulation of carbohydrates which is utilized for development of bunch Chezhyan *et al.* (1999) [5]. The results are supported with the findings of Gorabal (2020) [9] where in, it is reported that application of inorganic fertilizers resulted in higher yield and its components were recorded in groundnut compared to jeevamrutha and ghana jeevamrutha and their interactions and Anusha *et al.* (2018) [2] reported that application of 100 per cent RDF improved the yield compared to organic sources of nutrients. The results are in agreement with the findings of Nileema and Sreenivasa, 2011 [16]; Mahapatra *et al.*, 2017 [15].

Among the different levels of Ghana jeevamrutha and liquid jeevamrutha plants treated with higher level (ghana jeevamrutha 600 kg/acre + liquid jeevamrutha 300 l/acre) recorded the maximum yield parameters when compared to other levels of ghana jeevamrutha and liquid jeevamrutha. Higher doses of Ghana Jeevamarutha and liquid jeevamrutha resulted in profused growth and yield parameters which is in accordance with the findings of Kasbe *et al.* (2009) [12] and Dekhane *et al.* (2011) [6]. Also application of liquid manures at regular interval act as a stimulus in the plant system and in turn increase the production of growth regulators in the cell system and growth hormones which in turn might have enhanced the soil biomass, there by sustaining the availability and uptake of applied as well as native soil nutrients which ultimately have resulted in better growth and yield of crops. These findings are in conformity with the results of Sharma and Thomas, (2010) [19] and Reshma *et al.* (2018) [17].

Plants treated with Ghana jeevamrutha @ 200 kg/acre + liquid jeevamrutha @ 100 l/acre (T_1) recorded the minimum yield parameters and this may be due to the low application rate that might have resulted in insufficient supply of plant nutrients. Another reason may be due to lack of translocation of the nutrients from vegetative parts to yield contributors. Further, it has been reported that the beneficial effect of organic farming starts after certain time lapse. Similar results were also reported by Athani *et al.* (1999) [3].

Conclusion

The present study reveals that application of inorganic fertilizers has enhanced the yield and yield attributes. Among the organic treatments combination, application of ghana jeevamrutha @ 600 kg/acre + liquid jeevamrutha @ 300 l/acre gave maximum yield, yield attributes and also sustains banana production. These fermented organic nutrients can be a better alternative for the use of inorganic inputs to maintain soil health for sustainable development.

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