Impact of natural farming practices on growth, yield and quality of Banana **(*Musa paradisiaca* L.)** cv. Grand Naine

ABSTRACT

The present investigation entitled **“**Impact of natural farming practices on growth, yield and quality of banana (*Musa paradisiaca* L.) cv. Grand Naine**”** was conducted during the year 2023-24 and 2024-25 at Horticulture farm, College of Horticulture, Anand Agricultural University, Anand. The experiment was laid out in a Randomized Block Design with seven treatments and three replications. The treatment consists of single, double and triple green manuring of dhaincha and sunhemp with Ghanjeevamrut applied as a basal dose per pit as per treatment 160, 240 and 320 g/plant, Jeevamrut 160, 240 and 320 ml/plant were applied to the plant in every 21 days, among this natural farming practices the higher value of pseudostem girth (70.32 cm), bunch weight (29.40 kg), finger girth (14.04 cm) and total soluble solid (23.90 0Brix) were recorded significantly with triple green manuring by dhaincha + ghanjeevamrut 160 g/plant + soil application of jeevamrut 160 ml/plant at sowing & every 21 days interval, while minimum days taken to fruit harvest was found non-significant result among different natural farming practices. It is therefore concluded that application of triple green manuring by Dhaincha + ghanjeevamrut 160 g/plant + soil application of jeevamrut 160 ml/plant at sowing & every 21 days interval increased Pseudostem girth, bunch weight, finger girth and total soluble solid of banana cv. Grand Naine.

Key words: Dhaincha, sunhemp, green manuring, jeevamrut, ghan-jeevamrut

**INTRODUCTION**

 Banana (*Musa paradisiaca L*.) is one of the oldest and most important fruit crops globally, and India ranks as its largest producer. In Gujarat, Grand Naine is the dominant cultivar due to its export potential and desirable agronomic traits. However, banana is a heavy feeder crop that depends largely on chemical fertilizers, leading to high input costs and environmental degradation.

Natural farming practices, which include green manuring (using crops like sunhemp and dhaincha) and organic formulations like Jeevamrut, Ghanjeevamrut, and Beejamrut, offer sustainable alternatives by improving soil fertility, microbial activity, and plant metabolism while reducing reliance on synthetic inputs (Palekar, 2006).

Sunhemp (*Crotalaria juncea*) is a member of the pea family (Fabaceae) used as a green manure. It's the most common green manure crop, and it's grown all around the country except in locations where waterlogging is a problem. Even in poor soils, it grows quickly to a height of 1-2 meters. The plant has a lot of herbage and decomposes quickly. Apart from that, it is recognized for its weed-controlling (Rupper 1987), anthelminthic (Rotar and Joy 1983), and soil erosion-resistant qualities. Dhaincha (*Sesbania aculeata*) is a West African native produces nitrogen fixing nodules in both roots and stem. It's a tall, branching annual herb that grows in wet area and heavy soils. It is a quick growing green manure crop which can be incorporated to 45 to 60 days after sowing. (Hargrove 1986; Sharma and Mittra 1988). The organic matter and nitrogen produced by *sesbania* improve the soil health. It is decreases mineral nitrogen leaching losses through its strong root system, in addition to actively fixing nitrogen in its root nodules (Ganapathi & Dharmatti, 2018)

Beejamrut is prepared by mixing up cow dung with cow urine, lime and handful of live soil and leave it for 24 hrs. It is applied before planting. Ghanjeevamrut is a dried solid variant, can be stored for up to six months, offering flexibility in nutrient management. Jeevamrut is a miracle fermented microbial culture which supply nutrients. Soil application of jeevamrut create favourable conditions for the availability of nutrients by increasing pH in acidic soil and decreasing pH in alkaline soil (Reddy and Menon., 2021), It is prepared by mixing up cow dung with cow urine, jaggery, legume flour and handful of live soil. Preparation of Jeevamrut apply after 5–7 days of aerobic fermentation and it contains enormous amount of microbial load which multiply and act as soil tonic.

In line with the Government of India’s initiative on promoting natural farming under the National Mission on Natural Farming (NMNF), the present study was undertaken to assess the potential of these natural farming sources in improving banana growth, yield and quality under field conditions.

**MATERIALS AND METHODS**

The Experiment was conducted at Horticulture Farm, College of Horticulture, Anand Agricultural University, Anand during the year 2023-24 and 2024-25. The experiment was laid out in a Randomized Block Design with seven treatments and repeated thrice. The experimental plot was prepared by deep ploughing and harrowing. Pits of 30 cm3 were dug out by tractor drawn digger at a spacing of 1.8 m × 1.8 m and well decomposed FYM @ 10 kg pit -1 was applied prior to planting in all the treatments. The seeds of dhaincha and sunhemp green manuring were broadcasted insitu between the banana plants as per the experimental treatments Single, Double and Triple after 45 to 50 days of sowing, the fully green biomass of the dhaincha and sunhemp produce were incorporated in to the soil by ring method as sown in table 1 and 2. Banana tissue culture plant was dipped in beejamrut solution for 15 minutes before planting, Ghanjeevamrut applied as a basal dose per pit as per treatment 160, 240 and 320 g/plant, Jeevamrut was incubate for 7 days, then after as per treatment 160, 240 and 320 ml/plant were applied to the plant in every 21 days. The various treatments followed for the experiment were as under **T1**: Triple green manuring by Sunhemp + ghanjeevamrut 160 g/plant + soil application of jeevamrut 160 ml/plant at sowing & every 21 days interval, **T2**: Triple green manuring by Dhaincha + ghanjeevamrut 160 g/plant + soil application of jeevamrut 160 ml/plant at sowing & every 21 days interval, **T3** : Double green manuring by Sunhemp + ghanjeevamrut 240 g/plant + soil application of jeevamrut 240 ml/plant at sowing & every 21 days interval, **T4**: Double green manuring by Dhaincha + ghanjeevamrut 240 g/plant + soil application of jeevamrut 240 ml/plant at sowing & every 21 days interval, **T5**: Single green manuring by Sunhemp + ghanjeevamrut 320 g/plant + soil application of jeevamrut 320 ml/plant at sowing & every 21 days interval, **T6**: Single green manuring by Dhaincha+ ghanjeevamrut 320 g/plant + soil application of jeevamrut 320 ml/plant at sowing & every 21 days interval, **T7**: RDF (FYM: 10 kg/plant, NPK: 300:100:200 g/plant/year).

**Table 1: Time of sowing and dates of incorporation of Sunhemp and Dhaincha of 1st season (2023-24)**

|  |  |  |
| --- | --- | --- |
| **Agricultural practices** | **Sunhemp** | **Dhaincha** |
| **SGM** | **DGM** | **TGM** | **SGM** | **DGM** | **TGM** |
| Date of sowingDate of incorporation | 20February 2023 | 20 February 2023 | 20 February 2023 | 20 February 2023 | 20 February 2023 | 20 February 2023 |
| 06 April2023 | 06 April2023 | 06 April2023 | 07 April2023 | 07 April2023 | 07 April2023 |
| Date of sowing | - | 25April 2023 | 25April 2023 | - | 25April 2023 | 25April 2023 |
| Date of incorporation | - | 07June 2023 | 07June 2023 | - | 09June 2023 | 09June 2023 |
| Date of sowingDate of incorporation | - | - | 20June 2023 | - | - | 20June 2023 |
| - | - | 10 August2023 | - | - | 09August 2023 |

**Table 2: Time of sowing and dates of incorporation of Sunhemp and Dhaincha of 2nd season (2024-25)**

|  |  |  |
| --- | --- | --- |
| **Agricultural practices** | **Sunhemp** | **Dhaincha** |
| **SGM** | **DGM** | **TGM** | **SGM** | **DGM** | **TGM** |
| Date of sowingDate of incorporation | 05 March 2024 | 05 March 2024 | 05 March 2024 | 05 March 2024 | 05 March 2024 | 05 March 2024 |
| 22April2024 | 22April2024 | 22April2024 | 24April2024 | 24April2024 | 24April2024 |
| Date of sowingDate of incorporation | - | 06May 2024 | 06May 2024 | - | 06May 2024 | 06 May 2024 |
| - | 21June 2024 | 21June 2024 | - | 21June 2024 | 21June 2024 |
| Date of sowingDate of incorporation | - | - | 02July 2024 | - | - | 02July 2024 |
| - | - | 27 August2024 | - | - | 27 August 2024 |

SGM- Single Green Manuring, DGM- Double Green Manuring

TGM- Triple Green Manuring

**RESULTS AND DISCUSSION**

**Pseudostem girth (cm) at shooting stage**

It is clear from the result in Table 3 that triple green manuring by dhaincha + ghanjeevamrut 160 g/plant + soil application of jeevamrut 160 ml/plant at sowing & every 21 days interval noted significantly maximum pseudostem girth (70.32 cm), while minimum pseudostem girth (53.33 cm) was recorded significantly with Single green manuring by Sunhemp + ghanjeevamrut 320g/plant + soil application of jeevamrut 320 ml/plant at sowing & every 21 days interval. A similar observation was also recorded by Bhoomika *et al.* (2024), Ganapathi and Dharmatti (2018) in banana. It might be due to triple green manuring of dhaincha improves soil porosity, aeration, and structure enhanced root growth and better anchorage lead to greater stem stability, which correlates with more robust girth and microbial metabolites from jeevamrut and ghan-jeevamrut (like IAA, GA3, cytokinins) enhance vascular differentiation, stimulate secondary growth this leads to more xylem and phloem tissue, translating into increased stem girth.

**Minimum days taken to fruit harvest**

It is clear from the result in Table 3 that different treatments of natural farming sources showed non-significant result. The minimum number of days taken to harvest (366.61) was observed with RDF (FYM: 10 kg/plant, NPK: 300:100:200 g/plant/year), while maximum days taken to harvest (385.57) was noticed with Single green manuring by Sunhemp + ghanjeevamrut 320g/plant + soil application of jeevamrut 320 ml/plant at sowing & every 21 days. A similar observation was also recorded Carvalho‑Neta *et al.* (2024) in banana intercropping with lemon grass, due to banana has a long vegetative phase, and slight differences in nutrient regime do not drastically alter the timing of reproductive events. The genetic control and growth physiology dominate over nutritional influence for flowering time which ultimately delay to fruit harvesting.

**Bunch weight (kg)**

It is clear from the result in Table 3 and Figure 1 that triple green manuring by dhaincha + ghanjeevamrut 160 g/plant + soil application of jeevamrut 160 ml/plant at sowing & every 21 days interval obtained significantly maximum bunch weight (29.40 kg), while significantly minimum bunch weight (19.32 kg) was recorded with Single green manuring by Sunhemp + ghanjeevamrut 320g/plant + soil application of jeevamrut 320 ml/plant at sowing & every 21 days interval. Similar results were found by Phukan *et al.,* 2016, Bhoomika *et al.,* (2024) due to repeated improves soil porosity, moisture-holding capacity, maintain **continuous soil fertility and** every incorporation of green manure **recharge soil microbes** and organic matter. Green manuring also contributed to a more balanced C/N ratio and greater presence of essential plant nutrients for physiological processes.

**Finger girth (cm)**

It is clear from the result in Table 3 that triple green manuring by dhaincha + ghanjeevamrut 160 g/plant + soil application of jeevamrut 160 ml/plant at sowing & every 21 days interval obtained significantly maximum finger girth (14.04 cm), while significantly minimum finger girth (19.32 kg) was recorded with Single green manuring by Sunhemp + ghanjeevamrut 320 g/plant + soil application of jeevamrut 320 ml/plant at sowing & every 21 days interval. Similar results were found by Ganapathi and Dharmatti (2018) in banana cv. Grand Nain, Manju and Pushpalatha (2022) in banana cv. Nendran and Bhoomika *et al.* (2024) in banana cv. Grand Naine. due to balanced and continuous nutrient supply, especially potassium and calcium, which support cell expansion and fruit bulking, enhanced microbial activity from jeevamrut improves nutrient uptake and stimulates hormone production (auxins, cytokinins), which promote fruit thickness.

**Total soluble solids (0Brix)**

It is clear from the result in Table 3 and Figure 1 that triple green manuring by dhaincha + ghanjeevamrut 160 g/plant + soil application of jeevamrut 160 ml/plant at sowing & every 21 days interval] obtained significantly maximum total soluble solids (23.90 0Brix) while minimum total soluble solids (21.73 0Brix) were recorded with RDF (FYM: 10kg/plant, NPK: 300:100:200 g/plant/year)]). Similar results were found by Athani and Hulamani (2000) in banana, Marathe *et al*. (2017) in pomegranate, Kumar *et al.* (2017) in mango cv. Dashehari and Patel *et al.* (2020) in mango cv. Amrapali. Due to application of triple green manuring of dhaincha increases TSS in banana by organic inputs release K slowly and steadily, which plays a key role in sugar translocation from leaves to fruit and better sugar accumulation in fruit pulp supported by improved soil health and microbial activit

**Table 3: Effect of natural farming practices on banana cv. Grand Naine**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Treatment Details** | **Pseudostem girth (cm)** | **Minimum days taken to fruit harvest** | **Bunch weight (kg)**  | **Finger girth (cm)** | **Total soluble solids (0Brix)** |
| **T1** | Triple green manuring by Sunhemp + ghanjeevamrut 160 g/plant + soil application of jeevamrut 160 ml/plant at sowing & every 21 days interval | 56.55 | 382.01 | 20.62 | 12.32 | 23.37 |
| **T2** | Triple green manuring by Dhaincha + ghanjeevamrut 160 g/plant + soil application of jeevamrut 160 ml/plant at sowing & every 21 days interval | 70.32 | 368.59 | 29.40 | 14.04 | 23.90 |
| **T3** | Double green manuring by Sunhemp + ghanjeevamrut 240 g/plant + soil application of jeevamrut 240 ml/plant at sowing & every 21 days interval | 68.19 | 371.40 | 27.35 | 13.60 | 23.88 |
| **T4** | Double green manuring by Dhaincha + ghanjeevamrut 240 g/plant + soil application of jeevamrut 240 ml/plant at sowing & every 21 days interval | 63.97 | 375.85 | 21.45 | 12.35 | 23.54 |
| **T5** | Single green manuring by Sunhemp + ghanjeevamrut 320g/plant + soil application of jeevamrut 320 ml/plant at sowing & every 21 days interval | 53.33 | 385.57 | 19.32 | 11.96 | 22.05 |
| **T6** | Single green manuring by Dhaincha+ ghanjeevamrut 320g/plant + soil application of jeevamrut 320 ml/plant at sowing & every 21 days interval | 66.67 | 372.61 | 27.06 | 13.18 | 23.68 |
| **T7** | RDF (FYM: 10kg/plant, NPK: 300:100:200 g/plant/year) | 65.79 | 366.61 | 26.71 | 13.02 | 21.73 |
| **T** | **S. Em. ±**  | 2.28 | 8.60 | 0.87 | 0.21 | 0.27 |
| **C. D. (P=0.05)** | 6.60 | NS | 2.53 | 0.63 | 0.80 |
|  | **C.V. %** | 11.73 | 6.25 | 9.69 | 4.61 | 3.25 |

**(Pooled data of 2023-34 and 2024-25)**

**Fig. 1: Impact of natural farming practices on bunch weight (kg) and total soluble solid (0Brix) of banana cv. Grand Naine**

 **CONCLUSION**

* From the two years of experiment, it can be concluded that application of triple green manuring by Dhaincha + ghanjeevamrut 160 g/plant + soil application of jeevamrut 160 ml/plant at sowing & every 21 days interval increased Pseudostem girth, bunch weight, finger girth and total soluble solid of banana cv. Grand Naine.
* **LIMITATIONS**

Increases labor costs or time requirement, which is a limitation for large-scale farming

Require more manual operations like weeding, mulching and preparing bio-inputs

Many farmers are unaware or lack proper training in the correct methods of natural farming.

Natural farming produce is often not distinguished clearly in markets.

* **FUTURE SCOPE**

Natural farming practices showed promising results in improving yield and quality. Future studies can focus on long-term soil health effects, standardization of organic input doses, impact on fruit nutrition, economic feasibility at large scale, and integration with eco-friendly pest and disease management practices.

**Author contributions**

First author designed the analysis; Collected the data; Performed the analysis; Wrote the paper.
Second author Supervised the research; Contributed to experimental design and critical revision of the manuscript.

Third author Provided technical guidance and editorial suggestions.
Fourth author Assisted in data collection and analysis; Reviewed and refined the manuscript

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**Conflict of interest**

The authors declare that they have no known financial, personal, or other conflicts of interest that could have appeared to influence the work reported in this paper.

**Disclaimer:** No generative AI technologies used such as large language modules

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