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Effect of *Ghanjeevamrut* and *Jeevamrut* on soybean (*glycine max* l.) Growth, yield and soil microbial activity under natural farming condition

Dakshkumar D. Patel[1,*], Mahendra S. Mevada[1], V.P. Ramani[2], Binal Gajera[3], and Bhumi Keshvala[1]

[1]M.Sc. (Agriculture) Organic Farming, Gujarat Natural Farming Science University, Halol, Gujarat, India
[2]Former principle & unit head, College of Agriculture & Polytechnique in Agriculture, Anand Agricultural University, Vaso, Gujarat, India
[3]Senior Research Fellow, Gujarat Natural Farming Science University, Halol, Gujarat, India
**Corresponding author email: pateldaksh8314@gmail.com*

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ABSTRACT

The field investigation titled *"Effect of Ghanjeevamrut and Jeevamrut on Soybean (Glycine max L.) Growth, Yield and soil microbial activity under Natural Farming Condition"* was conducted during *Kharif* 2024 at Gujarat Natural Farming Science University, Halol, Gujarat. The experiment was laid out in a Factorial Randomized Block Design with four levels of *Ghanjeevamrut* (0, 4, 6 and 10 t/ha) and three levels of *Jeevamrut* (0, 500 and 1000 L/ha), replicated four times. Among the treatments, *Ghanjeevamrut* @ 6 t/ha (G_2) significantly enhanced the dry weight of root nodules (31.33 mg/plant), indicating improved root–rhizobial interaction and greater organic carbon supply. Higher seed yield was observed with *Ghanjeevamrut* @ 10 t/ha (1298 kg/ha), which remained statistically at par with *Ghanjeevamrut* @ 6 t/ha (1222 kg/ha). Crude protein content (38.68%) and nitrogen content in seed were significantly influenced by *Ghanjeevamrut* @ 4 t/ha (G_1), with nitrogen showing a 6.19% improvement over control. *Ghanjeevamrut* also significantly reduced soil pH under the 6 t/ha treatment (G_2). The highest available phosphorus (13.09 kg/ha) was recorded with *Ghanjeevamrut* @ 10 t/ha (G_3), which was significantly superior to control and at par with G_2 (12.55 kg/ha). Microbial populations were significantly higher with *Ghanjeevamrut* @ 10 t/ha (139 × 10w *cfu*/g), at par with G_1. *Jeevamrut* @ 1000 L/ha (J_2) also recorded the highest microbial count (169 × 10w *cfu*/g). The combined applications further enhanced microbial activity, with the highest count in G_1J_2 (184 × 10w *cfu*/g), followed by G_3J_1 (179 × 10w *cfu*/g), both significantly superior to control.

***Keywords*: *Ghanjeevamrut*, *Jeevamrut*, Soybean, Natural farming, growth, yield**

INTRODUCTION

Natural farming philosophy is working with nature to produce healthy food, to keep ourselves healthy, and to keep the land healthy. Everything in Nature is useful and serves a purpose in the web of life. Also termed 'Do Nothing Farming', because the farmer is considered only to be a facilitator - the real work is done by Nature itself. No tillage and farming without the application of herbicides, inorganic fertilizers and pesticides is practiced. Natural farming differs from Organic farming by not using any organic manure like FYM and vermi-compost. In Japan, Fukuoka started Natural farming by experimenting with the Nature and following the natural ways of crop propagation. He achieved yields similar to those of chemical farming but without soil erosion. The essence of natural farming is minimizing the external inputs to the farm land, which degenerate the soil nature.to promote chemical-free farming, the Government launched the National Mission on Natural Farming (NMNF) in 2023-24 as an independent scheme by upscaling BPKP. Its success depends on behavioural change among farmers, requiring ongoing awareness, training, handholding, and capacity building in the early years (NMNFKP, 2023).

Soybean (*Glycine max* L.) is a significant heartbeat as well as oil seed crop. It is accepted to be started in China in around 2838 B.C. It is a member of Papilionaceae subfamily and Leguminosae family. Soybean was presented in sixties as a valuable oil seed harvest to beat the eatable oil deficiency in the country. It is a significant oilseed crop, used to get ready various results viz. soya milk, soya drops, soybean oil, soya rolls, soy refreshments, braced bread shop items and create rustic work for working on the economy of the cultivating local area, thus called "Golden bean".

Jeevamrut, a liquid prepared from cow dung, cow urine, pulse flour, jaggery and soil formed below the banyan tree, helps to enhance microbial population, soil fertility and productivity of soil. The *Jeevamrut* is cheaper eco-friendly liquid organic concoction which is an excellent source of organic carbon, nitrogen, phosphorous, potassium and lot of other micro nutrients required by crops (Palekar, 2006;). It was reported that it contains macro nutrients, micro nutrients, many vitamins, essential amino acids, growth promoting factors like IAA, GA and beneficial microorganisms. *Jeevamrut* contains small amount growth hormones which is helpful to enhancing the growth and yield of crops Due to availability of easy energy source particularly jaggary multiply the organisms enormously and during fermentative process produce beneficial metabolites such as organic acids and antibiotics which are effective against other pathogenic.

Ghanjeevamrut is the solid form of *Jeevamrut* that acts as natural fertilizer forthe crop. It is combined mixture of desi cow dung, cow urine, undisturbed soil, pulseflour and jaggery. It is a formulation made from cow dung, which is a source of micronutrients, phosphorus, potassium, and nitrogen. It is used to increase soil fertility by microbial consortia. Keeping these points in view, the present study on "Effect of different levels of Ghanjeevamrut and Jeevamrut on soybean (*Glycine max* L.) growth, yield and soil microbial activity under natural farming conditions" was carried out to evaluate the effect of different levels of *Ghanjeevamrut* and *Jeevamrut* on the growth and yield of soybean, as well as on the quality of soybean. The study also aimed to evaluate the interaction effects of Ghanjeevamrut and Jeevamrut under natural farming conditions.

MATERIALS AND METHODS

Experimental Site

The present investigation was carried out during *kharif,* 2024 at Gujarat Natural Farming Science University, Halol (Gujarat). Latitude of 22°42' N and a longitude of 73°54' E, Halol is positioned geographically at a sitting at an elevation of approximately 104 meters above mean sea level.

Experimental design and treatments

The experiment was laid out in a Randomized Block Design with Factorial concept comprising of four replications and twelve treatment combinations of two factors. The first factor was *Ghanjeevamrut* (G) with four levels i.e., G_0- Control, G_1- *Ghanjeevamrut*@ 4 t/ha, G_2- *Ghanjeevamrut* @ 6 t/ha, G_3- *Ghanjeevamrut* @10 t/ha and the second factor was *Jeevamrut* (J) *viz*., J_0- Control, J_1- *Jeevamrut* @ 500 L/ha and J_2- *Jeevamrut* @ 1000 L/ha. The experiment was comprised of twelve treatments by combinations of both factors. The experiment was carried out on soybean cv NRC-37, Kodo millet; CKMV 2, Green gram; GAM 8, Black gram; GAU 4, Maize; GM 6. Seeds were sown in July month. *Beejamrut* was utilized as a seed treatment at a dosage of 100 mL for each kilogram of seeds. *Ghanjeevamrut* was applied as a basal dose in the experimental plots as per treatments before two weeks of sowing. *Jeevamrut* was applied 50% at pre-sowing irrigation and 50% was applied equally as drenching at 30 and 45 DAS.

Soybean seed equivalent yield (kg/ha)

Soybean seed equivalent yield (kg/ha) was calculated for specified treatment by following the formula

$$\text{Soybean Seed equivalent yield (kg/ha)} = \text{Yield of Soybean Seed (kg/ha)} + \frac{\text{Yield of mix crops (kg/ha)} \times \text{Price of mix crops (Rs/kg)}}{\text{Price of Soybean Seed (Rs/kg)}}$$

RESULTS AND DISCUSSION

The data presented in Tables 1, 2 suggest that *Ghanjeevamrut* and *Jeevamrut* had significant effect

Table 1. Effect of *Ghanjeevamrut* and *Jeevamrut* on Weight of root nodule, Seed yield, Crude protein content and Nitrogen content in Seed

Treatments	Weight of root nodule (mg/plant)	Seed yield	Crude protein content (%)	Nitrogen content in Seed (%)
G_0: Control	28.32	1150	35.58	5.69
G_1: Ghanjeevamrut @ 4t/ha	31.14	1199	38.68	6.19
$G_{2:}$ Ghanjeevamrut @ 6t/ha	31.33	1222	37.15	5.94
$G_{3:}$ Ghanjeevamrut @ 10t/ha	31.19	1298	38.35	6.14
S.Em. ±	0.61	33	0.72	0.12
C.D.(P=0.05)	1.76	95	2.07	0.33
$J_{0:}$ Control	31.03	1171	37.11	5.94
$J_{1:}$ 500 litre/ha	30.07	1217	37.63	6.02
$J_{2:}$ 1000 litre/ha	30.39	1264	37.58	6.01
S.Em. ±	0.53	28	0.62	0.10
C.D.(P=0.05)	NS	NS	NS	NS
Interaction(G×J)	NS	NS	NS	NS
C. V. %	6.95	9.00	6.66	6.66

Table 2. Effect of Ghanjeevamrut and Jeevamrut on pH, Soil Phosphorus and Total soil microbial Count

Treatments	pH	Phosphorus (P_2O_5)	Total soil microbial count (cfu/g)
G_0: Control	7.33	11.79	9.00(100 × 10^7)
G_1: Ghanjeevamrut @ 4t/ha	7.30	11.80	9.12(133 × 10^7)
G_2: Ghanjeevamrut @ 6t/ha	7.20	12.55	9.09(122 × 10^7)
G_3: Ghanjeevamrut @ 10t/ha	7.22	13.09	9.14(139 × 10^7)
S.Em. ±	0.03	0.32	2.68
C.D.(P=0.05)	0.10	0.92	8
J_0: Control	7.26	12	8.62(42 × 10^7)
J_1: 500 litre/ha	7.27	12	9.20(159 × 10^7)
J_2: 1000 litre/ha	7.26	12	9.23(169 × 10^7)
S.Em. ±	0.03	0.28	2.32
C.D.(P=0.05)	NS	NS	7
Interaction(G×J)	NS	NS	13
C.V. %	1.61	8.99	7.48

on growth, yield and quality parameters of soybean studied in this experiment.

Effect of *ghanjeevamrut* and *jeevamrut* on growth parameters

The effect of different levels of *Ghanjeevamrut* and *Jeevamrut* on dry weight of root nodule in soybean at 40 DAS is presented in Table 1. The treatment effect showed that there was significant difference in *Ghanjeevamrut* while no significant difference observed in *Jeevamrut* and interaction effect too. The highest nodule dry weight (31.33 mg/plant) was observed with *Ghanjeevamrut* @ 6t/ha (G_2), followed by G_3 (31.19 mg/plant) and G_1 (31.14 mg/plant). The lowest value was recorded under the control (G_0) with 28.32 mg/plant. the significance of *Ghanjeevamrut* in enhancing nodule formation and growth.

The increased nodule dry weight under *Ghanjeevamrut* application can be attributed to improved microbial activity and organic carbon availability in the soil, which supports rhizobial multiplication and nodulation (Bhondave *et al.*, 2024). Organic amendments provide favourable conditions for nitrogen-fixing bacteria, leading to increased root nodule biomass and better nitrogen assimilation. The dry matter accumulation at 40 DAS was also influenced positively by, *Ghanjeevamrut* and *Jeevamrut* but the results were statistically non-significant. The interaction effect found non-significant.

Effect of *ghanjeevamrut* and *jeevamrut* on yield parameters

The seed yield of soybean as data presented in Table 1 revealed that application of *Ghanjeevamrut* found significant and higher seed yield was observed in *Ghanjeevamrut* @ 10 t/ha but it was at par with the *Ghanjeevamrut* @ 6 t/ha. Effect of *Jeevamrut* found non-significant. The interaction effect found non-significant. This slight improvement might be attributed to enhanced nutrient availability and microbial activity in the rhizosphere, which could have improved the plant's physiological efficiency and assimilate partitioning. Previous studies have shown that organic formulations like *Jeevamrut* and *Ghanjeevamrut* improve soil health and nutrient dynamics, leading to better crop growth and resource use efficiency. Similar findings were reported by Pushkarna *et al.,* 2025.

Effect of *ghanjeevamrut* and *jeevamrut* on quality parameters

The effect of different levels of *Ghanjeevamrut* and *Jeevamrut* on crude protein content is presented in Table 1. The treatment effect showed that there was significant difference is observed in *Ghanjeevamrut*, while no significant difference was observed in *Jeevamrut* and interaction effect. The application of *Ghanjeevamrut* significantly affected the crude protein content of soybean grains. The maximum crude protein content (38.68%) was recorded with *Ghanjeevamrut* @ 4 t/ha (G_1), followed by *Ghanjeevamrut* @ 10 t/ha (38.35%). The effect of different levels of *Ghanjeevamrut* and Jeevamrut on nitrogen content in seed presented in Table 1. The treatment effect showed that there was significant difference is observed in *Ghanjeevamrut* while no significant difference is observed in *Jeevamrut* and interaction effect. Nitrogen content in seed was significantly influenced by *Ghanjeevamrut* @ 4 t/ha was recorded Highest N content (6.19%), while the lower N content (5.69%) was observed in control. The increase in seed N content could be attributed to enhanced microbial activity and organic matter decomposition improving nitrogen mineralization and assimilation. Similar findings were reported by Rana *et al*. (2021), who observed that *Ghanjeevamrut* improved nitrogen availability in soybean grain.

Effect of *ghanjeevamrut* and *jeevamrut* on pH and soil phosphorus

The effect of *Ghanjeevamrut* and *Jeevamrut* on pH showed the significant difference by *Ghanjeevamrut* but no significant result found in *Jeevamrut* as data presented in Table 2. The interaction effect found non-significant. The initial soil pH was recorded 7.27. data presented in Table showed post-harvest, slight variations were observed across treatments. The pH ranged from 7.20 to 7.33, with the lower in G_2 (6 t/ha *Ghanjeevamrut*) and the higher in the control (G_0). Soil pH is a critical factor affecting nutrient availability. The use of organic inputs like *Ghanjeevamrut* and *Jeevamrut* enhances biological activity in the rhizosphere, potentially leading to acidification through microbial respiration and organic matter breakdown. The minor reduction in pH with higher *Ghanjeevamrut* application might be attributed to increased microbial activity and organic acid production during decomposition (Joshi *et al.*, 2019).

The effect of *Ghanjeevamrut* and *Jeevamrut* on available phosphorus showed the significant difference by *Ghanjeevamrut* but no significant result found in *Jeevamrut* as data are presented in Table 2. The interaction effect found non-significant. Among *Ghanjeevamrut* treatments, higher available phosphorus (13.09 kg/ha) was recorded with an application of *Ghanjeevamrut* @ 10 t/ha (G*f*), which was significantly superior over G• (Control: 11.79 kg/ha) and statistically at par with G, (12.55 kg/ha). The lower phosphorus content was observed in the control plot without *Ghanjeevamrut* application. This indicated the positive role of *Ghanjeevamrut* in enhancing the availability of phosphorus in the soil. An increase in phosphorus availability could be attributed to might help to organic acids produced during the decomposition of *Ghanjeevamrut*, which help solubilize the native phosphorus and reduce phosphorus fixation in the soil. Organic inputs like *Ghanjeevamrut* not only improve soil microbial activity but also enhance the solubilization of bound phosphorus compounds, making them more available to plants. The significant improvement in

Table 3. Interaction Effect on Soil Microbial Count

Treatments	Soil microbial count (cfu/g)			
	G_0 (Control)	G_1 (*Ghanjeevamrut* @ 2 t/ha)	G_2 (*Ghanjeevamrut* @ 3 t/ha)	G_3 (*Ghanjeevamrut* @ 4 t/ha)
$J_{0:}$ (Control)	7.40 (4 × 10^7)	8.71 (51 × 10^7)	8.76 (57 × 10^7)	8.76 (57 × 10^7)
: (Jeevamrut @ 500 L/ha)	9.15 (140 × 10^7)	9.22 (165 × 10^7)	9.19 (155 × 10^7)	9.25 (179 × 10^7)
J_2 :(Jeevamrut @ 1000 L/ha)	9.20 (159 × 10^7)	9.26 (184 × 10^7)	9.19 (155 × 10^7)	9.26 (182 × 10^7)
S. Em±		4.64		
C.D. at 5 %		12		
C.V. %		7.48		

Note: Data in parenthesis are original values

available phosphorus due to *Ghanjeevamrut* is in agreement with the findings of several researchers. the application of *Ghanjeevamrut* significantly improved available phosphorus in soil, likely due to enhanced microbial activity and solubilization of fixed phosphorus. Similarly, Joshi *et al.* (2015) reported that organic formulations like *Ghanjeevamrut* supply beneficial microbes that play a key role in phosphorus solubilization.

Effect of *ghanjeevamrut* and *jeevamrut* on soil microbial count

The effect of *Ghanjeevamrut* and *Jeevamrut* on soil microbial count as data presented in Table 2 & 3 showed significant difference by both factors as well as for interaction effect. The data are presented in Table 2 showed a marked increase in soil microbial count (*cfu/g*) with the application of *Ghanjeevamrut*, the higher microbial count was observed in *Ghanjeevamrut* @ 10 t/ha with values of 9.14 but at par with *Ghanjeevamrut* @ 4 t/ha (9.12). The data presented in Table 2 showed a marked increase in soil microbial count (*cfu/g*) with application of and *Jeevamrut*. higher microbial count was observed in J_2 (1000 L/ha), with values of 9.23. This is in line with the findings of Priya *et al.* (2023), who highlighted beneficial role of organic amendments like *Jeevamrut* and *Ghanjeevamrut* in enhancing microbial diversity and activity in soil ecosystems. Organic manures act as substrates for microbial growth, thereby supporting nutrient cycling and soil fertility. Statistically significant differences were found among treatments, indicating that organic formulations enhance microbial proliferation. In the Table 3 interaction effects revealed that combination of G_1J_2 (4 t/ha *Ghanjeevamrut* + 1000 L/ha *Jeevamrut*) recorded higher microbial count (184 *cfu/g*), followed closely by G_3J_2 (182 *cfu/g*) and G_3J_1 (179 *cfu/g*) treatment combinations. These interactions emphasize the synergistic effect. Such synergism between bio-organic inputs has been emphasized in the works of Priya *et al.* (2023) where they reported that moderate levels of integrated organic amendments enhance rhizospheric microbial dynamics without causing nutrient imbalance or toxicity.

CONCLUSION

Based on one season of experiment, the application of Ghanjeevamrut @ 4 t/ha significantly improved dry weight of root nodule (31.33 mg/plant) over control. The *Ghanjeevamrut* application @ 10 t/ha produced significantly higher seed yield (1298) kg/ha) over control, which was at par with the application of *Ghanjeevamrut* @ 6 t/ha (1222 kg/ha). The application of *Ghanjeevamrut* @ 4 t/ha recorded significantly higher crude protein content and nitrogen content in soybean seed over control. The individual application of both *Ghanjeevamrut* @ 4 t/ha (133 × 107 *cfu/g*) and *Jeevamrut* @ 500 L/ha (159 × 107 *cfu/g*) significantly promoted microbial proliferation. The combined applications of *Ghanjeevamrut* @ 4 t/ha and *Jeevamrut* @ 1000 L/ha recorded maximum microbial count (184 × 107 *cfu/g*) which was at par with the *Ghanjeevamrut* @ 10 t/ha and *Jeevamrut* @ 500 L/ha (179 × 107 *cfu/g*). The application of *Ghanjeevamrut* @ 6 t/ha significantly reduced the pH as compared to control. The application of *Ghanjeevamrut* @ 10 t/ha, significantly increased available phosphorus in soil over control.

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