Evaluation of organic inputs viz., Jeevamruth and Bijamruth on soil nutrients and uptake by fenugreek absorption

Abstract:

The present study on the 'Biochemical evaluation of organic inputs (Jeevamruth and Beejamruth) and their efficacy on Greens' was conducted at the Department of Sustainable Organic Agriculture, Tamil Nadu Agricultural University, Coimbatore, with laboratory experiments carried out at the Department of Environmental Science. A field trial was set up in a randomized block design with three replications. Biometric observations were recorded on the 10th, 20th, and 30th days after sowing. Soil samples were collected initially and at harvest, and analyzed for chemical and biological properties. Plant samples were tested for protein and chlorophyll content. The application of Jeevamruth increased soil nutrients (NPK) and organic carbon levels. Liquid organic preparations were found to have higher populations of bacteria, fungi, and actinomycetes. The findings suggest that Beejamruth should be applied on the day of preparation, whereas Jeevamruth should be used within 10 to 15 days of preparation. The use of these liquid formulations helps supplement nutrients when biofertilizers are applied.

Key words: Jeevamruth, Beejamruth, Biochemical evaluation, Organic inputs, Organic farming, Green revolution

Introduction:

The Green Revolution intensified agriculture to meet the growing demand for food and fiber, but this practice has come at a significant environmental cost, leading to the ongoing loss of natural ecosystems, depletion of groundwater, food contamination, and other forms of environmental degradation. A major challenge for the nation in the coming years will be to provide safe food for the expanding population. In this context, organic farming, a holistic production management system designed to enhance the health of agroecosystems, has gained widespread recognition as a viable alternative to conventional food production and ensures safe food for human consumption. This farming approach minimizes the use of synthetic fertilizers, growth regulators, and livestock feed additives, and instead relies on green manures, crop rotations, crop residues, animal manures, biofertilizers, and various cow-based liquid organic manures such as Panchagavya, Jeevamruth, Beejamruth, Amritpani, etc. Among the liquid formulations, Panchagavya is one of the most significant to consider for shelf life studies, as it

is not only highly effective in promoting crop growth but also widely utilized by farmers. (Sugumaran *et al*., 2018). The compounds Erioflorin and Nagilactone A present in Beejamruth act as plant growth regulators, making Beejamruth a valid and effective alternative fertilizer for producing safe, high-quality food that meets the needs of modern Indian agriculture. (Goveanthan *et al.,* 2019). Compounds such as Isoenanthic acid, Columbianetin, Lomatin, 1,6-Hexanediol, Mevastatin, Gitoxigenin, Dibutoxy anthracine, Erioflorin, Nagilactone, Trimegestone, Rofe Coxib, and Clupanodonic acid present in Jeevamruth aid in plant metabolism and significantly enhance its growth. (Goveanthan *et al*., 2021).

Organic agriculture is increasingly gaining recognition as a key component of development, demonstrating considerable promise commercially, socially, and environmentally. While the concept has evolved over time, the modern organic movement is fundamentally different from its original form. Liquid formulations used in organic agriculture, such as Panchagavya, Beejamruth, and Jeevamruth, are fermented products made from locally available materials that act as plant growth enhancers. These formulations are rich in beneficial microorganisms that support and stimulate plant growth, leading to improved vegetative development and higher-quality yields. Formulations derived from agricultural by-products like grain bran, oil cakes, and farmyard manure serve as effective growth carriers and storage media (Devakumar et al., 2011). In recent years, there has been a growing interest in the use of Panchagavya, Beejamruth, Jeevamruth, and other liquid organic formulations in organic farming.

Materials and methods:

Field experimental details

The experiment was carried out using a randomized block design with three replications. The experimental layout remained undisturbed throughout the investigation period, and fenugreek seeds were soaked for 1 hour in the Beejamruth solution prior to sowing, after which they were planted in the field.

Design : RBD

Number of treatments : 7

Number of replications : 3

The treatment details are given below:

Treatments

T_1–Control

T_2-Jeevamruth @ 3% Spray (Green gram flour)
T_3-Jeevamruth @ 5 % Spray (Green gram flour)
T_4-Jeevamruth @ 3 % Spray (Black gram flour)
T_5-Jeevamruth @ 5 % Spray (Black gram flour)
T_6-Jeevamruth @ 3 % Spray (Green gram + Black gram flour)
T_7-Jeevamruth @ 5 % Spray (Green gram +Black gram flour)

Preparation of soil sample

Composite soil samples were collected before the experiment and analyzed for their mechanical and chemical properties. After harvest, soil samples were collected from each treatment plot and analyzed for pH, EC, organic carbon, and major nutrients following standard procedures.

Preparation of the plant sample

The samples were collected to estimate dry matter production, which was used for calculating nutrient uptake. Oven-dried plant samples were ground using a Wiley-Mill, sieved, and analyzed to determine the total NPK uptake by multiplying the N, P, and K contents with the dry matter at each respective stage. The uptake values were then calculated and reported. The samples were pulverized and sieved through a 0.2 mm mesh sieve, and the analyses were performed following standard procedures.

Results and Discussion:

The results from the experiment on "Biochemical evaluation of organic inputs (Jeevamruth and Beejamruth) and their efficacy on greens "conducted at the Department of Sustainable Organic Farming, Tamil Nadu Agricultural University, Coimbatore are summarized below.

Soil parameters

The soil pH was not significantly influenced by the different treatments.However, numerically higher soil pH was observed as given in the (Table 1). The Jeevamruth, as organic source of nutrient slightly increased the soil pH. But no significant difference in pH among various treatments was noticed. However, treatment which received Jeevamruth @ 5 % Spray (Green gram flour) recorded higher pH among the treatments. This was supported by Elias Azar (1980) who reported that soil pH had increased due to application of poultry manure as organic nutrient source. The soil EC was not significantly influenced by the different treatments. The high / low EC value was found in Jeevamruth @ 5 % Spray (Green gram flour) and Jeevamruth @ 5 % Spray (Black gram flour). At the time of inception of the study, the soil

organic content was 0.28 per cent. After harvest of the fenugreek crop, the organic carbon content of soil was higher in Jeevamruth @ 5% Spray (Green gram flour) (1.08%), followed by Jeevamruth @ 5 % Spray(Green gram +Black gram flour) (0.92%). The lowest organic carbon content was observed in control (0.33%). Addition of Jeevamruth @ 5 % Spray (Green gram flour) resulted in significant increase in the organic carbon content of soil . These results are in agreements with the findings of Mathan (2000) and Maskina *et al*. (1988).

The available soil nitrogen was not significantly influenced by the sources of nutrition. Numerically higher soil nitrogen was recorded in the treatments Jeevamruth @ 3% Spray (Green gram flour) and Jeevamruth @ 5 % Spray(Green gram +Black gram flour). The highest soil available phosphorus at 30 DAS, was recorded in the Jeevamruth @ 5% Spray (Green gram flour) and Jeevamruth @ 5 % Spray(Green gram +Black gram flour) treatments with values of 19.0 and 16.0 kg ha^{-1} respectively. The high soil potassium content was recorded in Jeevamruth @ 5% Spray (Green gram flour) (264.0 kg ha^{-1}) followed by Jeevamruth @ 5 % Spray(Green gram +Black gram flour) (239.0 kg ha^{-1}) treatments. Sole cropping with biofertilizers produced the highest seed yields for fennel (2233 kg ha−1) and fenugreek (1240 kg ha–1) (Ghaderimokri, 2022).

Plant Total NPK

The analysis for total NPK in fenugreek after harvest showed that the total nitrogen content was found to be high in Jeevamruth @ 5 % Spray(Green gram +Black gram flour) with 1.5 per cent, whereas the total phosphorus content was high in Jeevamruth @ 5 % Spray(Green gram) (0.33 per cent). The potassium content was high in the treatments Jeevamruth @ 5 % Spray(Green gram), Jeevamruth @ 5 % Spray (Black gram flour) and Jeevamruth @ 5 % Spray(Green gram +Black gram flour) with 0.22 per cent and they were on par with each other (Table 3). Nutrient uptake is a cordially event of nutrient concentration and dry matter accumulation. Organic manures promoted nutrient utilization and accounts for better NPK uptake. Increased uptake might be due to higher availability of nutrients from the soil reservoir and also from the added sources of organic manures (Priyadarsini and Prasad, 2003). The rate of uptake is dependent upon by crop N demand, phonological stage, soil N availability, transpiration, rooting depth and soil water status. Crop nitrogen demand is estimated depending on the rate of growth and the maximum concentration of nitrogen that different organic can accumulate depends upon their composition. Nitrogen uptake was maximum in Jeevamruth @ 5 % Spray(Green gram) and it was comparable with Jeevamruth @ 5 % Spray(Green gram +Black gram flour). Organic inputs known to have a favorable effect on soil structure, texture

and tilth thus facilitate quick and greater availability of plant nutrients and provides a better environment for root growth and proliferation, thereby creating more absorptive surface for uptake of nutrients. These results are in conformity with the findings of Chavan *et al*. (1997); Shashidhara (2000) and Kuttimani (2004) in chillies. The organic inputs might have increased the soil organic P content leading to increased P availability. Higher phosphorus uptake was recorded in T_3 which was on par with T_7. Increased P availability might be due to solubilisation of native P by the organic acids produced during organic inputs decomposition, thus leading to better utilization of available P, which in turn favored better P uptake. Similar results were also obtained by Beaulah (2001), Sreekhantan (1987) and Somasundaram (1991). The highest K uptake was registered with Jeevamruth @ 5 % spray (Use Green gram flour for preparation). The lower level of K uptake was observed in control (no manure/ no spray) at all the growth stages of the crop. The increased uptake of K observed in above said treatments might be the result of increased availability of K in soils due to the basal application of enriched farm yard manure. The enhanced K availability irrespective of the season coupled with higher K uptake due to organic manure incorporation could be attributed to higher DMP and K absorption, evidencing the priming effect of K contribution by organic manure. These results are in conformity with the findings of Santos *et al*.(1990) and Kuttimani (2004). The plant height, root length and single plant weight in fenugreek are high in the treatment as Jeevamruth 5% spray was observed as a viable organic approach to improve soil and eco-friendly fenugreek production (Goveanthan *et al.*, 2020). In another study, seeds treated with Panchagavya and Jeevamruth separately, the maximum shoot length and root length were recorded in Panchagavya treatment and minimum shoot length and root length of was recorded in Jeevamruth treated seeds and also the panchagavya treated seeds registered the maximum vigour index (Akila *et al.*, 2020). In another study, the soluble protein content (0.87 mg/g) and total sugar content (11.20 µg/g) were found to be improved in Panchagavya (Groundnut cake instead of ghee) @ 3% spray treatment and Recommended dose of NPK fertilizer applied plants (Sugumaran *et al.*, 2019). Another study showed that a 2:1 fenugreek-buckwheat intercropped system with the application of integrated fertilizer and broiler litter can successfully be implemented for improving productivity, N and P contents of fenugreek and buckwheat as well as the nutrient land equivalent ratio (compared with sole cropping with chemical fertilizer) under semi-arid growing conditions.(Salehi et al., 2018).

Table 1. Effect of organic nutrient source (Jeevamruth) on soil pH, EC (dS m^{-1}) and organic carbon (%)

Treatment	pH	EC (dSm^{-1})	Organic Carbon (%)
T_1 - Control	7.26	0.3	0.33
T_2 - Jeevamruth @ 3% Spray(Green gram)	7.28	0.8	1.08
T_3 - Jeevamruth @ 5 % Spray(Green gram)	7.29	1.5	0.90
T_4 - Jeevamruth @ 3 % Spray(Black gram)	7.40	0.4	0.46
T_5 - Jeevamruth @ 5 % Spray(Black gram)	7.62	1.5	0.72
T_6 - Jeevamruth @ 3 % Spray(Green gram + Black gram)	7.58	0.4	0.52
T_7 - Jeevamruth @ 5 % Spray(Green gram + Black gram)	7.74	0.8	0.92
SEd	**0.0021**	**0.0055**	**0.003**
CD (P = 0.05)	**0.0045**	**0.0119**	**0.06**

Fig. 1. Effect of organic nutrient source (Jeevamruth) on soil available nitrogen, available phosphorus and available potassium (kg ha^{-1})

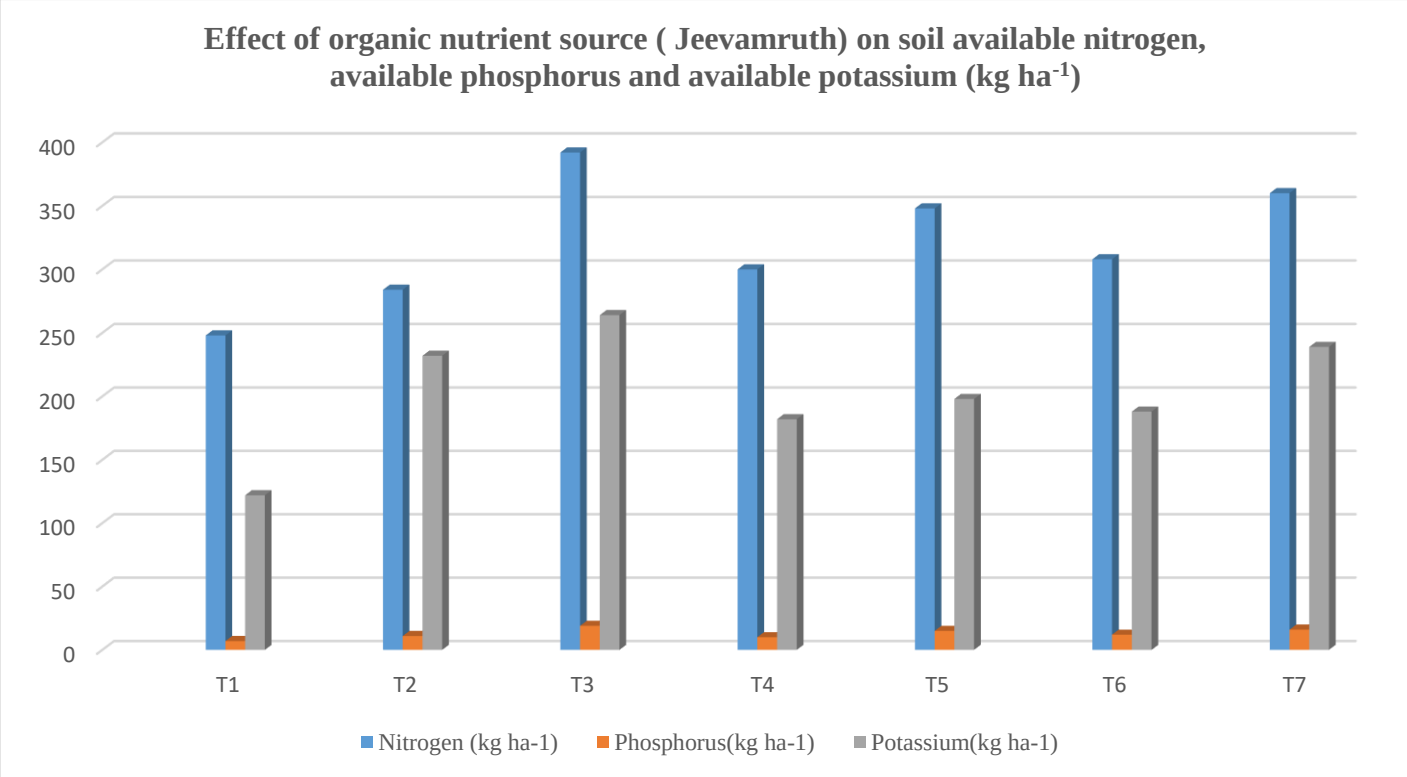

Table 2. Effect of organic nutrient source (Jeevamruth) on Fenugreek Plant Total nitrogen, Total phosphorus and Total potassium (%)

Treatment	Nitrogen (%)	Phosphorus (%)	Potassium (%)
T_1 - Control	0.16	0.05	0.17
T_2 - Jeevamruth @ 3% Spray(Green gram)	0.70	0.12	0.20
T_3 - Jeevamruth @ 5 % Spray(Green gram)	1.23	0.33	0.23
T_4 - Jeevamruth @ 3 % Spray(Black gram)	1.00	0.16	0.20
T_5 - Jeevamruth @ 5 % Spray(Black gram)	1.50	0.25	0.22
T_6 - Jeevamruth @ 3 % Spray(Green gram + Black gram)	1.06	0.18	0.21
T_7 - Jeevamruth @ 5 % Spray(Green gram + Black gram)	1.50	0.31	0.22
SEd	**0.0051**	**0.0011**	**0.0002**
CD(P = 0.05)	**0.0112**	**0.0024**	**0.0005**

Conclusions:

The field experiment indicates that plant height, root length, and single plant weight were highest in the T3 treatment (Jeevamruth @ 5% spray). Applying Jeevamruth to the soil enhanced nutrient (NPK) levels and organic carbon content. Liquid organic formulations are rich in bacteria, fungi, and actinomycetes. Studies suggest Beejamruth should be applied on the day of preparation, while Jeevamruth remains effective for 10 to 15 days after preparation. These liquid formulations can effectively supplement nutrients when combined with biofertilizers.

Fig 2. Experimental field view

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Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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