Impact of Organic inputs (Jeevamruth and Bijamruth) on soil nutrients and uptake by Fenugreek

Abstract:

The present study on 'Biochemical evaluation of organic inputs (Jeevamruth and Beejamruth) and their efficacy on Greens' was carried out at the Department of sustainable organic agriculture, Tamil Nadu Agricultural University, Coimbatore and the laboratory experiments were carried out at the Department of Environmental Science. A field experiment was conducted in a randomized block design with three replications. Biometric observations were taken during 10^{th}, 20^{th} and 30^{th} days after sowing. Soil samples were collected during initial and at the stage of harvest and analysed for chemical and biological properties. Plant samples were analysed for protein and chlorophyll contents. The application of Jeevamruth in soil resulted in an increase in the nutrients (NPK) and organic carbon values. Liquid organic preparations contain higher number of bacteria, fungi,and actinomycets. From the studies it is evident that Beejamruth is to be used on the day of preparation while Jeevamruth should be used within 10 to 15 days from the date of preparation. The application of these liquid formulations would supplement the nutrients when biofertilizers were applied.

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

Introduction:

Green revolution had intensified agriculture to meet the ever increasing demand for food and fibre, which is a practice at great cost to the environment resulting in continuous loss of natural ecosystems, ground water, food stuff pollution and other environmental degradation. The greatest challenge to be faced by the nation in the coming years is, to provide safe food for the growing population in the country. In this regard, organic farming which is a holistic production management system for promoting and enhancing health of agro ecosystem, has gained wide

recognition as a valid alternative to conventional food production and ensures safe food for human consumption. This farming system avoids large use of synthetic fertilizers, growth regulators, livestock feed additives and relies on green manures, crop rotations, crop residues, animal manures, biofertilizers, different kinds of cow based liquid organic manures such as Panchagavya, Jeevamruth, Beejamruth, Amritpani etc. Among the liquid formulations, panchagavya is one of the most important liquid formulations to be considered for the study of shelf life as it not only proves to be most effective for crop growth but also widely used by the farmers (Sugumaran *et al*., 2018). Compounds Erioflorin and nagilactone A present in Beejamruth are plant growth regulators and hence Beejamruth is a valid and effective alternative fertilizer for the production of safe and good quality food produces which could cater the needs of the modern Indian requirements (Goveanthan *et al.,* 2019). Compounds Isoenanthic acid, Columbianetin and Lomatin,1, 6-Hexanediol, Mevastatin and Gitoxigenin, Dibutoxy anthracine, Erioflorin and nagilactone, Trimegestonea, Rofe Coxib, Clupanodonic acid are present in Jeevamruth which helps in the plant metabolism and also improves its growth (Goveanthan *et al*., 2021).

Organic agriculture is now finding a place in the mainstream of development and shows great promise commercially, socially and environmentally. While there is continuum of thought from earlier days to the present, the modern organic movement is radically different from its original form. Liquid formulations that are used in organic agriculture like Panchagavya, Beejamruth and Jeevamruth are the fermented products which are used as plant growth enhancing substances prepared with material available with farmers. They are the rich sources of beneficial micro flora which supports, stimulates the plant growth and helps in getting better vegetative growth and also good quality yield. Formulations prepared from agricultural by-products *viz.*, bran of grains, oil cakes, farmyard manure etc., which are found to support excellent growth carrier and storage media (Devakumar *et al.*, 2011). During the last few years, there has been an increasing interest in the use of Panchagavya, Beejamruth, Jeevamruth and other liquid organic formulations in organic agriculture.

Materials and methods:

Field experimental details

The experiment was conducted in a randomised block design with three replications. The experimental layout was kept undisturbed throughout the period of investigation and fenugreek seeds were soaked for 1 hr in the Beejamruth solution before sowing and were sown 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

Pre-experiment composite soil samples were collected and analysed for mechanical and chemical properties. Post-harvest soil samples were collected from each treatment plot after the harvest of Fenugreek and analysed for the pH, EC, organic carbon and major nutrients by following the standard procedures.

Preparation of the plant sample

The samples were collected for the estimation of dry matter production used for the estimation of nutrient uptake. The oven dried plant samples were ground using Wiley-Mill, sieved and analysed to calculate the total NPK up taken by multiplying the contents of N, P and K with the dry matter at the respective stages, the uptake was arrived and reported. The samples were pulverized and sieved through a 0.2 mm mesh sieve and the analysis were carried out by 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.

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).

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**

Table 2. Effect of organic nutrient source (Jeevamruth) on soil available nitrogen, available phosphorus, available potassium (kg ha-1)

Treatment	Nitrogen (Kg ha^{-1})	Phosphorus (Kg ha^{-1})	Potassium (kg ha^{-1})
T_1 - Control	248.0	7.0	122.0
T_2 - Jeevamruth @ 3% Spray(Green gram)	284	11	232
T_3 - Jeevamruth @ 5 % Spray(Green gram)	392	19	264
T_4 - Jeevamruth @ 3 % Spray(Black gram)	300	10	182
T_5 - Jeevamruth @ 5 % Spray(Black gram)	348	15	198
T_6 - Jeevamruth @ 3 % Spray(Green gram + Black gram)	308	12	188
T_7 - Jeevamruth @ 5 % Spray(Green gram + Black gram)	360	16	239
SEd	**0.5304**	**0.0438**	**0.5039**
CD(P = 0.05)	**1.1556**	**0.0954**	**1.0980**

Table 3. Effect of organic nutrient source (Jeevamruth) on Fenugreek Plant Total nitrogen, Total phosphorus, 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:

From the field experiment can be is inferred that,the plant height, root length and single plant weight are highest in the treatment T_3(Jeevamruth @ 5% spray). The application of Jeevamruth in soil resulted in an increase in the nutrients (NPK) and organic carbon values. Liquid organic preparations contain higher number of bacteria, fungi,and actinomycets. From the studies it is evident that Beejamruth is to be used on the day of preparation while Jeevamruth should be used within 10 to 15 days from the date of preparation. The application of these liquid formulations would supplement the nutrients when biofertilizers were applied.

Fig 1. Experimental field view

COMPETING INTERESTS DISCLAIMER:

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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