Influence of *jeevamrit* and *kunapajala* on growth and herbage yield of sweet basil (*Ocimum basilicum* L.) under Mollisol region of Uttarakhand

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ABSTRACT

A field experiment was carried out during the Kharif season of 2019 at the Medicinal Plants Research and Development Centre (MRDC), G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, to investigate the impact of jeevamrit and kunapajala on the herbage yield and quality of sweet basil (Ocimum basilicum L.). The experiment was laid out in Randomized Block Design with eight treatments replicated thrice. Treatments i.e. T_1: Recommended dose of fertilizer (RDF) (120:60:40) kg/ha, T_2: 15 t/ha farmyard manure (FYM), T_3: 500 l/ha kunapajala, T_4: 1000 l/ha kunapajala, T_5: 500 l/ha kunapajala + 7.5 t/ha FYM, T_6: 500 l/ha jeevamrit, T_7: 1000 l/ha jeevamrit, T_8: 500 l/ha jeevamrit+ 7.5 t/ha FYM. The results revealed that the treatment T_1 obtained highest plant height (109.67 cm), number of branches (20.50), leaf: stem ratio (0.85), fresh weight (615.74 g/plant), dry matter accumulation (116.71 g/plant), crop growth rate (10.29 g/m^2/day) as well as herbage yield (271.86 q/ha) but was statistically at par with treatment T_8. Keeping in view the harmful effects of chemical fertilizers, the use of these eco-friendly fermented organic liquid manures provides alternate production technologies.

Keywords: Dry matter, *jeevamrit*, kunapajala, *Ocimum basilicum*, organic, yield

INTRODUCTION

Sweet Basil (*Ocimum basilicum* L.) of Lamiaceae family is one of the most important medicinal and aromatic plants grown in India. It is a warm, tropical industrial crop with a short growing period of 75-90 days. The leaves and seeds of sweet basil are economically important parts of the whole plant. The different plant parts of the sweet basil contain heterogeneous group of aromatic compounds of immense value of flavour and fragrance (Corrado *et al*., 2020). The essential oil of basil contains mono-terpenes, phenol, sesqui-terpenes, eugenol, methyl-eugenol, thymol, methyl-cinnamate, linalool, methyl chavicol, Citral 'A' and 'B', alcohol, camphor, etc., which are liable for the unique pleasant odour and flavors (Hallmann *et al*., 2024). The oil of sweet basil finds different uses in the cosmetic and perfumery industries and also in indigenous system of medicine. Its oil is utilized for flavouring food stuff in confectionary, thermogenic, cardiotonic, condiments, depurative, dental cream and mouth freshener and other countless indigenous and ayurvedic health care system (El-Mahrouk *et al*., 2024). Its extract can be utilized as bio-insecticide, fungicide, antifeedants and preparation of food products. A little work has been accomplished so far on mineral nutrition of different medicinal and aromatic crops including sweet basil (*Ocimum basilicum* L.). The organic fertilization is not just a cost effective and ecofriendly, but improves soil environment, yield and oil quality of medicinal and aromatic plants. Not all nutrients in the soil are immediately available to plants. They must first be converted into an accessible form through the action of microorganisms naturally present in the soil. However immoderate use of chemical products has disturbed the flora as well as fauna along with the population of micro-organisms and population of earthworms is almost negligible. Therefore, it is essential to activate and sustain populations of various soil microorganisms and enhance earthworm biomass through innovative natural or traditional methods, such as the use of desi cow dung, cow urine, and organic matter. Ancient Indian texts describe more scientifically and clinically formulated liquid biofertilizers under the general name "*kunapajala*," as noted by Surapala (1996) in the *Vrikshayurveda*. These biofertilizers stimulate biological activity in the soil and make nutrients available to crops (Kanali, 2016). Organic liquid manure, such as *jeevamrit*, is a rich bio-formulation containing beneficial microbial consortia (Pathak and Ram, 2013). *Jeevamrit* also enhances soil nitrogen content by promoting non-symbiotic nitrogen fixation. In light of these findings, the present study, titled "Effect of *jeevamrit* and *kunapajala* on growth and herbage yield of sweet basil under the Foothills of Shivalik Himalayan, India," was conducted.

MATERIAL AND METHODS

Experimental Site: The field experiment on Sweet basil variety CIM-Saumya was carried out at the Medicinal Plants Research and Development Centre, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar (Uttarakhand) during the Kharif season of 2019. Pantnagar is situated in the Tarai belt, approximately 30 km south of the foothills of the Shivalik range of the Himalayas, at a longitude of 79° 29′ E and an altitude of 243.83 meters above mean sea level, within a subtropical humid climate. The soils of the Tarai region belong to the Mollisol order and have a sandy clay loam texture. The soil used in the experiment was sandy clay loam, neutral in pH, with medium organic carbon content (0.68%), low available nitrogen (186.60 kg/ha), and medium levels of phosphorus (18.90 kg/ha) and potassium (201.23 kg/ha).

Experimental details: The experiment was designed in Randomized Block Design with 8 treatments replicated thrice. A total of 24 plots each with gross plot size of 5.0 x 3.2 m and a net plot size of 3.5 x 2.4 m were made.

Treatment details: T_1: RDF ((N_{120}:P_{60}:K_{40}) kg/ha); T_2: FYM @ 15 t/ha, T_3: *Kunapajala* @ 500 l/ha, T_4: *Kunapajala* @ 1000 l/ha, T_5: *Kunapajala* @ 500 l/ha + FYM @ 7.5 t/ha, T_6: *Jeevamrit* @ 500 l/ha, T_7: *Jeevamrit* @ 1000 l/ha, T_8: *Jeevamrit* @ 500 l/ha + FYM @ 7.5 t/ha

Cultural operations: The experimental field was ploughed by disc plough followed by two harrowing and leveled by using wooden plank. Plots were made, each separated by bunds of 60 cm width and 20 cm height. Well decomposed FYM was incorporated in the field 10 days before the planting was done. The recommended dose of fertilizer (120:60:40) kg/ha in the form of urea, Diammonium phosphate (DAP) and Muriate of potash (MOP) were applied in the field. Uniform amount of *jeevamrit* (200 l) and *kunapajala* (200 l) were applied in the plots before planting of the seedlings. After that, both the formulations were applied at regular intervals of 15, 30, 45, and 60 days after transplanting up to the final harvest of the crop. A total of 2 irrigations were given during the entire growth period. Manual weeding and mulching were done to check the weed flora. The crop was harvested at 80 days after planting manually with the help of sickle by cutting plant at ground level in the plots leaving a border of 50 cm.

Preparation and application of organic sources of nutrients

Jeevamrit was prepared using the method developed by Padmashri Shri Subhash Palekar (Palekar, 2006), while *kunapajala* was prepared following the method outlined by Nene (2012).

Jeevamrit

Jeevamrit is a rich microbial formulation prepared by providing the un-restricted growth of microbes through the fermentation process. The components used were cow dung, pulse flour, cow urine, jaggery and virgin forest soil (for inoculation). It can be used at a regular interval of 15-30 days with irrigation water. This bio- formulation can be used within 6-7 days of preparation. A quantity of 200 litres is sufficient for an acre area. 3-4 sprays are sufficient for one crop cycle. *Jeevamrit* can be used for drenching the mulch material before its application. It is also effective in quickly decomposition of residues in the field if given with irrigation water applied for field preparation. 3-4 times more area can be covered, if micro irrigation is adopted with the same amount of *jeevamrit*.

Materials required for preparation of 200 litres *jeevamrit* (for an acre of land)

S. No.	Ingredients	Quantity	S. No.	Ingredients	Quantity
1.	*Desi* cow dung	10 kg	4.	Virgin forest soil	100 g
2.	Pulse flour	2 kg	5.	Jaggery	2 kg
3.	*Desi* cow urine	5 litres	6.	Water	200 litres

Procedure

All the ingredients *i.e., desi* cow dung, pulse flour, cow urine, virgin forest soil and jiggery were mixed in the required amounts as mentioned above in 200 litres of water and rotated clockwise twice a day and stored for 6-7 days for fermentation, than *jeevamrit* was applied with irrigation water.

Kunapajala

According to Y.L. Nene, the organic source '*kunapajala*' has the potentiality to play the role of providing immunity and promoting growth in the plant system. The *kunapajala* bioformulation proposed by Y. L. Nene and S. L. Choudhary consists of nine products: *Desi* cow dung, *desi* cow urine, cane jaggery, germinated blackgram pulse, mustard oil cake, finely chopped local weeds (broadleafy only), Virgin forest soil and plain water. It can be used at an interval of 15-30 days with irrigation water. Soil drenching and foliar application of *kunapajala* from the beginning up to 40 days of its preparation will be helpful for plant and soil so that we can utilize its total potential.

Materials required for preparation of 200 litres *kunapajala* (for an acre of land)

S. No.	Ingredients	Quantity	S. No.	Ingredients	Quantity
1.	*Desi* cow dung	20 kg	5.	Mustard oil cake	2 kg
2.	*Desi* cow urine	10 litres	6.	Finely chopped local weeds (broad leafy only)	20 kg
3.	Jaggery	2 kg	7.	Water	100 litres
4.	Germinated pulse (urd bean)	2 kg	8.	Virgin forest soil	100 gm

A quantity of 200 litres is sufficient for an acre area. 2-3 sprays are sufficient for one crop cycle. *Kunapajala* can be used for drenching the mulch before its application. It is effective in quickly decomposition of residues in the field if drenched with irrigation water given for field preparation. If micro irrigation is adopted, 3-4 times more field area can be covered with the same amount of *kunapajala*.

Procedure

All the ingredients *i.e.*, *desi* cow dung, cane jaggery, *desi* cow urine, germinated blackgram pulse, mustard oil cake, finely chopped local weeds (broad leafy only), and Virgin forest soil were mixed in the required amounts in 100 litres of water and rotated clockwise twice a day and stored for 6-7 days for fermentation, than *kunapajala* was applied with irrigation water but recommendation for application is from 20 to 40 days after preparation. As much quantity as require, it can be made in advance and can be used for a long time. The older it is the batter it is for use.

Observations

Plant height per metre square per plant (cm) with wooden scale, number of branches per metre square per plant, Leaf-stem ratio (at harvest) of three plants, fresh weight in grams per metre square (gm) and dry weight after oven drying at 65 ± 5°C for 48-72 hours in grams per metre square (gm) of three plants were recorded manually at 30, 60 days after planting and at harvest and averaged.

Total fresh herbage yield

$$\text{Total herbage yield (q ha}^{-1}) = \frac{\text{Weight of plants harvested from net plot area (kg)}}{\text{net plot area } \times 100} \times 10000$$

Growth analysis

Mean crop growth rate

Crop growth rate was calculated by given formula:

$$\text{CGR} = \frac{W_2 - W_1}{t_2 - t_1} (\text{g m}^{-1}\text{day}^{-1})$$

Where, W_1 and W_2 are dry matter productions at times t_1 and t_2 respectively. It is expressed as gram of dry matter produced per square meter per day (g m^{-1} day^{-1}) (Redford, 1967).

Mean relative growth rate

Relative growth rate (RGR) was calculated by using the given formula:

$$\text{RGR} = \frac{\log_e W_2 - \log_e W_1}{t_2 - t_1} (\text{mg g}^{-1}\text{day}^{-1})$$

Where, W_1 and W_2 are the dry weights of plant at time t_1 and t_2 respectively. It is expressed as mg of dry matter which is produced by gram of existing dry matter in a day (mg/g/day) (Redford, 1967).

Statistical analysis

The experimental data were analyzed using the standardized procedure for a randomized block design (RBD) with the assistance of a computer program for R.B.D (STPR-3), developed by the Department of Mathematics and Statistics, College of Basic Sciences and Humanities, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar.

RESULT AND DISCUSSION

Plant height

The data (Table 1) found that all the treatments had a direct and significant influence on the plant height. At 30 DAP it was observed that treatment T_1 recorded the highest plant height (41.87 cm) which was significantly highest among all the treatments. A similar trend was observed at 60 DAP, treatment T_8 in which the plant height was lower than T_1 at 30 DAP it was *at par* with T_1 at 60 DAP, The lowest plant height during both at 30 and 60 days (32.67 cm and 67.16 cm respectively) was observed in treatment T_2. At harvest, a significant difference was observed in the plant height as affected by different treatments among which T_1 remained significantly highest (109.67 cm) and was *at par* with T_8 (104.56 cm) and also found *at par* with T_5 (99.53

cm) in which the plant height was lower than T_1 at 30 and 60 DAP while all the other treatments were lower. Among the different treatments of fermented liquid manure, the better performance was observed in treatment T_8 and T_5. Solid application of *jeevamrit* or *kunapajala* on soil showed fair results but non availability of organic matter (Farmyard manure) for microbes restricted the continuous availability of essential nutrients to plant resulted lower plant height in treatments T_3, T_4, T_6 and T_7. Supportive evidence was given by research conducted by Al-mansour *et al.* (2018) in sweet basil and Dey *et al.* (2019). Also, similar results were reported by Chauhan (2019) in bramhi where application of *jeevamrit* @5000 l/ha combined with FYM @2.5 ton/ha reported highest shoot length, no. of shoots and no. of leaf/m^2.

Number of branches/plant

Like plant height, numbers of branches were also considerably affected by different treatments and with the advancement of crop age (Table 1). The number of branches was significantly higher in treatment T_1 (17.53 branches/plant) over the rest of the treatments at 30 DAP and it was found statistically *at par* with T_8 treatment (16 branches/plant) followed by T_5 treatment (15.85 branches/plant) while all the other treatments (T_2, T_3, T_4, T_6 and T_7) showed lower no. of branches. Similar results were observed at 60 DAP. At harvesting stage the no. of branches were significantly higher in treatment T_1 (21.81 branches/plant) which is *at par* with treatment T_8 (20.50 branches/plant) and the rest of the results were similar to as on 30 and 60 DAP. Combined application of liquid manures with FYM resulted in more number of branches. It can be related to the fact that liquid manures (product of microbial consortia) when applied in the soil helps to enhance the microbial population that in turn helps in quick decomposition of FYM and helps to mineralize the organic stock of nitrogen in the soil. Similar results were reported by Chauhan (2019) in bramhi where application of *jeevamrit* @5000 l/ha combined with FYM @2.5 ton/ha reported highest number of shoots.

Leaf-stem ratio at harvest (on fresh weight basis)

The factor that decides the harvesting stage of basil is leaf-stem ratio (Table 1). At harvest, the maximum leaf-stem ratio was recorded in treatment T_1 (0.85) significantly higher than the other treatments which was *at par* with the treatments T_8 (0.80) and T_5 (0.76). The lowest leaf-stem ratio was recorded in treatment T_2 (0.62). In all the growth attributes discussed above, it is evident that treatment T_1 showed the highest results at all the growth stages of crop followed by T_8. It was also observed that T_8 and T_5 were *at par* during most of the crop stages for different growth attributes. The solid application of farmyard manure or single application of fermented liquid manures (*jeevamrit* and *kunapajala*) showed less crop growth in all the growth stages. The similar result has been corroborated by Patel *et al.* (2018). Ankad *et al.* (2018) also found similar results in *Withania somnifera* where *kunapajala* treatments were higher in leaf area index and total leaf area.

Fresh weight (g/plant)

There was an increasing trend of dry matter with increased dose of liquid manures but combined application of liquid formulations with FYM showing its significant effect on the same as compare to solid application (Table 2). Fresh weights taken at 30 DAP showed that T_1 treatment showed the highest fresh weight (114.72 g/ plant) which was significantly higher than rest of the treatments. At 60 DAP, the trend in fresh weight as affected by different treatments was the same like 30 DAP. The observations recorded at harvest showed significant yield advantage of treatment T_1 (615.7 g/plant) over various treatments. The lowest fresh biomass was observed in treatment T_2 (449.6 g/plant). Use of liquid organic products like *jeevamrit*, *beejamrit* and *kunapajala* results in higher growth, yield, and higher quality of crop and improve the soil biological as well as physico-chemical properties (Devakumar *et al*., 2008 and Tharmaraj *et al*., 2011).

Dry matter accumulation

Dry matter has a direct correlation with the fresh weight of the crop and is directly influenced by the treatment combinations at all the growth stages of crop (Table 2). At 30 DAP, the treatment T_1 (16.2 g/plant) was found statistically *at par* treatment T_8 (14.8 g/plant) and treatment T_5 (14.2 g/plant). The lowest dry matter accumulation was recorded in T_2 (12.07 g/plant). At 60 DAP, T_1 (65.3 g/plant) had a significant effect on the dry matter accumulation by plant and was *at par* with T_8 (61.4 g/plant) and T_5 (60.2 g/plant) Solely applied liquid manures had less dry matter accumulation as compared to integrated application of FYM+ *jeevamrit* or *kunapajala*. The lowest accumulation of dry matter was recorded in treatment T_2 (48.5 g/plant). At harvest, the treatments differed significantly from each other and it was recorded that treatment T_1 (116.7 g/plant) was also *at par* with T_8 (110.7 g/plant), T_5 (108.9 g/plant) and T_7 (105.6 g/plant). Treatment T_2 (92.2 g/plant) gave the lowest values of dry matter accumulation at harvest. Since the dry weight is directly related to the fresh herbage yield of the crop is also affected by the same parameters as the former. In an experiment conducted by Sharma *et al*. (2010) in carnation Siddappa (2015) in fieldbean and Kaur (2019) in wheat by applying bioenhancer also showed the same results.

Mean crop growth rate (CGR)

The CGR was significantly affected by the treatments (Table 3) and when recorded at the initial stage (30-60 DAP), the highest value was recorded in T_1 (8.19 g/m^2/day) which was significantly *at par* with T_8 (7.78 g/m^2/day), T_5 (7.68 g/m^2/day) and T_7 (7.46 g/m^2/day). It was observed that treatment T_3 (6.14 g/m^2/day) T_4 (6.76 g/m^2/day) and T_6 (6.31 g/m^2/day), showed the lower crop growth rate. A rapid increase in crop growth rate was observed at 60-85 days interval. Treatment T_1 (10.29 g/m^2/day) showed highest crop growth rate which was significantly higher than all the others treatment and it was found statistically *at par* with treatment T_8 (9.84 g/m^2/day) and T_5 (9.74 g/m^2/day). The solely applied *jeevamrit* and *kunapajala* treatments showed lower crop growth rate as compare to combined application with FYM. The lowest crop growth rate was observed in T_2 (8.73 g/m^2/day). Natural solutions (*jeevamrit* and *kunapajala*), which may not provide enough nutrients in applied area, but they help in the quick soil fertility build-up through increased activity of soil microflora and fauna (Yadav and Mowade, 2004).

Mean relative growth rate (RGR)

All the treatments positively affected the relative growth rate of the crop at all the growth stages (Table 3). At 30-60 days, it was observed that the relative crop growth rate was highest in treatment T_7 (48.31 mg/g/day) which was significantly higher than most of treatments. Treatment T_7 was *at par* with the all the remaining treatments *viz*., T_5 (48.26 mg/g/day), T_8 (47.57 mg/g/day), T_1 (46.78 mg/g/day) and T_2 (46.67 mg/g/day). At 60-85 days period, it was found that the growth rate was maximum in treatment T_3 (26.30 mg/g/day) which was significantly superior than other treatments. The lowest relative crop growth rate was observed in T_1 (23.25 mg/g/day). This can be attributed to the deficiency of nutrients in absence of organic manures, as *jeevamrit* may not directly provide enough nutrients, required by crop but it supports the crop growth initially. It needs organic source for microflora build up, in former and continual supply of microbial inoculums (*jeevamrit* and kuanapajala) to soil in later stages, which might have brought down the population of soil microbial flora and fauna, hence low rate of mineralization of native nutrients. Similar resuls were also obtained by Yadav and Vijayakumari (2004).

Fresh biomass yield

All the treatments had a positive and significant influence on the crop fresh biomass yield (Fig. 1). The application of NPK (120:60:40 kg/ha) *i.e.*, T_1 recorded significantly the highest fresh herbage yield (271.86 q/ha). It was closely followed by *jeevamrit* @ 500 L + FYM @ 7.5 t/ha (256.07 q/ha) *i.e.* T_8 followed by *kunapajala* @ 500 L + FYM @ 7.5 t/ha (244.03 q/ha) *i.e.* T_5 and these were found statistically *at par* to T_1 (271.86 q/ha). The lowest fresh herbage yield was recorded in T_2 applied with FYM (15 t/ha) alone (199.57 q/ha) and application of different doses of *jeevamrit* and *kunapajala* alone or their combination with FYM *i.e.* T_3, T_4, T_5, T_6, T_7, T_8 showed significantly higher fresh herbage yield as compare to FYM alone. The results obtained during the course of experiment indicated that there was a significant increase in fresh herbage yield which is due to more contribution of yield attributing parameters. Many successful attempts to show the beneficial effects of fermented liquid formulation on crop growth were done by Balakumbahan *et al.* (2010) in *Acorus calamus*. Similarly, Chauhan (2019) recorded higher fresh biomass yield in bramhi at different doses of *jeevamrit* combined with FYM.

CONCLUSION

Based on these findings and to ensure a balance between crop production and soil health, it can be concluded that applying *jeevamrit* at 500 l/ha combined with half of the recommended dose of farmyard manure (7.5 t/ha) is effective for providing nutrients to crops, enhancing fresh herbage yield, and maintaining soil health over the long term. This approach could serve as an alternative production technique for organic farmers and offer a new perspective for the scientific community to further refine and validate traditional farming practices in today's context, aiming to produce safe food, sustain soil health, and protect the environment.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES:

Al-mansour, B. Kalaivanan1, D., Suryanarayana, M. A., Umesha, K. and Nair, A. K. 2018. Influence of organic and inorganic fertilizers on yield and quality of sweet basil (*Ocimum basilicum* L.). *J. Spi. Aro. Crops*, **27**(1): 38-44.

Ankad, G. M., Hiremath, J., Patil, R. T., Pramod, H.J. and Hegde, H. V. 2018. Nutrient analysis of *Kunapajala* and *panchagavya* and their evaluation on germination of ashwagandha and kalamegha seeds: A comparative study. *J. Ayrd. & Inte. Medi.*, **9**: 13-19.

Balakumbahan, R., Rajamani, K. and Kumanan, K. 2010. *Acorus calamus*: An overview. *J. of Medi. Plants Res.*, **4**(25): 2740-2745.

Chauhan, A. 2019. Innovation in natural farming nutrient management practices for sustainable soil health and herbage yield of brahmi. M. Sc. thesis, G. B. Pant University of Agriculture and Technology, Pantnagar-263145 (Uttarakhand).

Corrado, G., Chiaiese, P., Lucini, L., Miras-Moreno, B., Colla, G. and Rouphael, Y. 2020. Successive harvests affect yield, quality and metabolic profile of sweet basil (*Ocimum basilicum* L.). *Agronomy*, **10**(6): 830.

Devakumar, N., Rao, G. G. E., Shubha, S., Imrankhan, N. and Gowda, S. B. 2008. Activities of organic farming research centre. Navile, Shimoga. *Uni. of Agri. Sci., Bangalore*.

Dey, A., Srivastava, P. C., Pachauri, S. P. and Shukla, A. K. 2019. Time-dependent release of some plant nutrients from different organic amendments in a laboratory study.

International Journal of Recycling of Organic Waste in Agriculture, **8**(1): 173-188.

El-Mahrouk, E. S. M., Atef, E. A. M., Gabr, M. K., Aly, M. A., Głowacka, A. and Ahmed, M. A. 2024. Application of ZnO NPs, SiO_2 NPs and date pollen extract as partial substitutes to nitrogen, phosphorus, and potassium fertilizers for sweet basil production. *Plants*, **13**(2): 1-24.

Hallmann, E., Rusaczonek, A., Muszyńska, E., Ziółkowski, D., Kuliński, S., Jasek, J. and Ponder, A. 2024. A Long-Term Study on Chemical Compounds and Their Location in Sweet Basil Leaves from Organic and Conventional Producers. *Foods*, **13**(3): 1-19.

Kanali, S. 2016. Functional degrowth: Matching degrowth dynamics a view point paper. *Res. Ins. for European and American Stu.,* 1-27.

Kaur, P. 2019. Standardization of the doses and time of application of *'jeevamrit'* in wheat under natural farming system. Ph D.. Thesis, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur.

Nene, Y. L. 2012. Potential of some methods described in *Vrikshayurvedas* in crop yield increase and disease management. *Asian Agri-History,* **16**(1): 45–54.

Palekar, S. 2006. Text book on Shoonya bandavalada naisargika krushi, published by Swamy Anand, Agri Prakashana, Bangalore, India.

Patel, U. K. and Tiwari, J. K. 2018. Effect of organic and inorganic fertilizer nutrients on yield of soybean crop. *Int. J. Curr. Microbial Sci.* Special Issue-7, pp. 392-396.

Pathak, R. K. and Ram, R. A. 2013. Bio-enhancers: A potential tool to improve soil fertility, plant health in organic production of horticultural crops. *Progressive Hort.*, **45**(2): 237-254

Redford, P. J. 1967. Growth analysis formula, their use and abuse. *Crop Sci.*, **7**(17): 1-175.

Sharma, B. P., Gautam, A., Gupta, Y. C., Dhiman, S. R. and Bhalla, R. 2010. Effect of foliar sprays of biostimulants on growth and flowering of carnation *cv.* Sunrise. *J. of Orn. Hort.* **13**(2): 101-106.

Siddappa. 2015. Use of *jeevamrita* and farmyard manure on growth and yield of fieldbean (*Lablab purpureus* var. *lignosus*). M. Sc. Thesis, University of Agricultural Sciences, Bengaluru, India.

Surapala, S. N. 1996. Surapala's Vrikshayurveda (The science of plant life by Surapala). Agri History Bulletin No 1. Secunderabad. *Asian Agri History Foundation*; pp. 104.

Tharmaraj, K., Ganesh, P., Kumar, R. S., Anandan, A. and Kolanjinathan, K. 2011. A critical review on *panchagavya*-a boon plant growth. *Int. J. Pharmaceutical & Biological Archives*, **2**(6): 1611-1614.

Yadav, A. K. and Mowade, S. M. 2004. Organic manures and compost. Organic farming-A ray of hope for Indian farmer, pp.164-167.

Yadav, R. H. and Vijayakumari, B. 2004. Impact of vermicompost on biochemical characters of chilli (*Capsicum annuum*). *J. Ecotoxicology & Env. Monitoring*, **14**(1): 51-56.

Table 1: Plant height (cm), Number of branches (per plant) and leaf: stem ratio as influenced by different treatments

Treatments details	Plant height (cm)			Number of branches (per plant)			Leaf: stem
	30 DAP	60 DAP	At harvest	30 DAP	60 DAP	At harvest	
T_1: RDF (N_{120}:P_{60}:K_{40}) kg/ha	41.87	77.17	109.67	17.53	20.50	21.81	0.85
T_2: FYM @ 15 t/ha	32.67	67.16	84.67	13.00	14.83	16.00	0.62
T_3: *Kunapajala* @ 500 l/ha	33.33	68.07	91.56	14.88	17.42	17.98	0.66
T_4: *Kunapajala* @ 1000 l/ha	34.20	68.99	93.06	15.50	17.73	18.67	0.71
T_5: *Kunapajala* @ 500 l/ha + FYM @ 7.5 t/ha	35.80	71.77	99.53	15.85	18.37	19.37	0.76
T_6: *Jeevamrit* @ 500 l/ha	33.73	70.05	92.22	15.30	17.55	18.08	0.68
T_7: *Jeevamrit* @ 1000 l/ha	35.07	71.13	98.10	15.75	18.23	18.83	0.74
T_8: *Jeevamrit* @ 500 l/ha + FYM @ 7.5 t/ha	37.07	74.89	104.56	16.00	18.57	20.50	0.80
S.Em±	1.70	1.76	3.95	0.66	0.76	0.84	0.04
CD at 5%	4.97	5.16	11.55	1.92	2.21	2.46	0.11

Table 2: Fresh weight of basil (g/plant) and dry matter accumulation of basil (g/plant) as influenced by different treatments

Treatments details	Fresh weight of basil (g/plant)			Dry matter accumulation (g/plant)		
	30 DAP	60 DAP	At harvest	30 DAP	60 DAP	At harvest
T_1: RDF (N_{120}:P_{60}:K_{40}) kg/ha	114.72	534.48	615.74	16.21	65.27	116.71
T_2: FYM @ 15 t/ha	84.88	385.61	449.66	12.07	48.50	92.17
T_3: *Kunapajala* @ 500 l/ha	90.42	412.59	476.57	12.83	49.67	95.87
T_4: *Kunapajala* @ 1000 l/ha	94.95	448.43	517.98	13.43	53.97	100.57
T_5: *Kunapajala* @ 500 l/ha + FYM @ 7.5 t/ha	100.85	477.18	551.18	14.17	60.23	108.9
T_6: *Jeevamrit* @ 500 l/ha	93.74	427.79	494.14	12.87	50.73	96.76
T_7: *Jeevamrit* @ 1000 l/ha	100.30	461.86	533.49	13.74	58.52	105.63
T_8: *Jeevamrit* @ 500 l/ha + FYM @ 7.5 t/ha	104.11	500.71	578.36	14.77	61.44	110.67
S.Em±	5.49	21.14	24.01	0.78	2.42	2.75
CD at 5%	16.08	61.85	70.24	2.28	7.08	8.04

Table 3: Crop growth rate ($g/m^2/day$) and relative growth rate (mg/g/day) as affected by different treatments

Treatments details	Crop growth rate ($g/m^2/day$)		Relative growth rate (mg/g/day)	
	30-60 DAP	60-85 DAP	30-60 DAP	60-85 DAP
T_1: RDF (N_{120}:P_{60}:K_{40}) kg/ha	8.18	10.29	46.78	23.34
T_2: FYM @ 15 t/ha	6.07	8.73	46.67	25.72
T_3: *Kunapajala* @ 500 l/ha	6.14	9.24	45.10	26.30
T_4: *Kunapajala* @ 1000 l/ha	6.76	9.32	46.38	24.90
T_5: *Kunapajala* @ 500 l/ha + FYM @ 7.5 t/ha	7.68	9.74	48.26	23.75
T_6: *Jeevamrit* @ 500 l/ha	6.31	9.20	45.71	25.84
T_7: *Jeevamrit* @ 1000 l/ha	7.46	9.42	48.31	23.63
T_8: *Jeevamrit* @ 500 l/ha + FYM @ 7.5 t/ha	7.78	9.84	47.57	23.72
S.Em±	0.33	0.23	0.57	0.61
CD at 5%	0.96	0.68	1.67	1.78

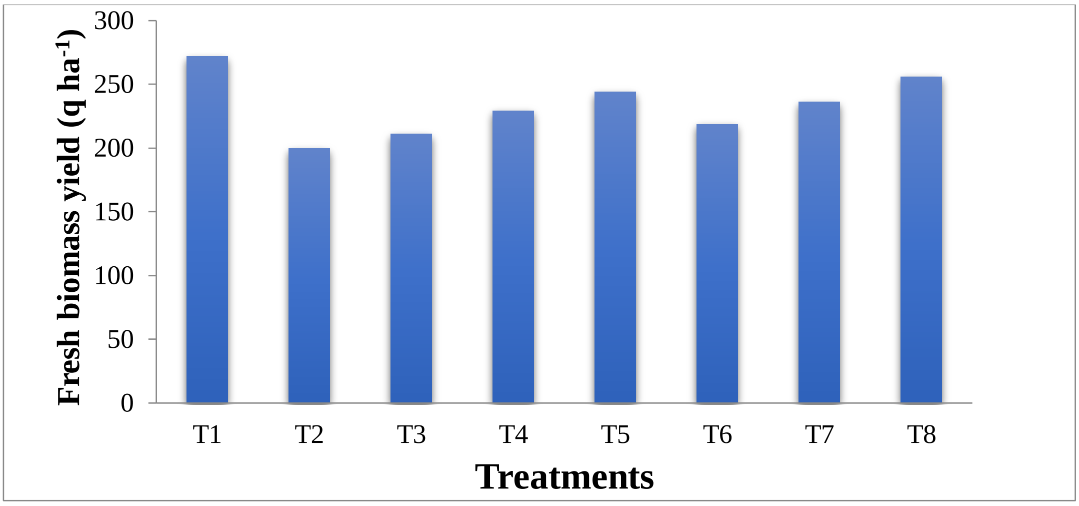

Fig. 1. Fresh biomass yield (q/ha) as affected by different treatment