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ORIGINAL ARTICLE

Vermicompost on Nutrient Content of The Green Leafy Vegetables (Fenugreek, Spinach, Amaranth and Gogu) and Quality of The Products

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ABSTRACT
'Agriculture' is the history of evolution of mankind. In India and other developing countries, the usage of agro chemicals such as chemical fertilizers and pesticides is increased in order to increase the food production to meet the increasing demands of growing population. The excessive and imbalanced use of chemical fertilizers has adversely affected the soil causing decrease in organic carbon, reduction on microbial flora of soil, increasing acidity and alkalinity and hardening of soil. Excessive use of Nitrogen containing fertilizers causes contamination of water bodies thus affecting fish fauna and causing health hazards for human beings as well as animals. It also leads to serious health problems in human beings by entering the food chain. Further, increased production of chemical fertilizers great yields to environmental pollution. This has resulted in the reassessment of agricultural practices with a shift towards organic farming which can produce quality food without adversely affecting the soil and environment. The findings of the study revealed that application of vermi-compost to the soil resulted in an increased growth and yield of the plants due to the availability of nitrogen from mineralization of organic fertilizers and increase the availability of nutrients and better physical condition of the soil. Vermi-compost treated soil grown crops had a better growth, yield, height and nutrients when compared with the chemical and control treated soil. Concludes that vermi-compost served as a potential organic fertilizer and it is strongly believed that during the succeeding seasons crops would be better due to application of vermi-compost. Thus, application of vermi compost decreases the usage of chemical fertilizers and pesticides which have created serious health problems polluting the air, water, land and entering the food chain. Only when the quality and fertility of the soil are maintained or increased farming can be truly called organic. As a result, bygone golden age can be replaced by diversification of agriculture for human nutrition.
Keywords: Vermi compost, agro chemicals, chemical fertilizers, organic fertilizers, Agriculture.

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INTRODUCTION

History of 'agriculture' is the history of evolution of mankind. In India and other developing countries, the usage of agro chemicals such as chemical fertilizers and pesticides is increased in order to increase the food production to meet the increasing demands of growing population. However, the indiscriminate use of these toxic chemicals in agro system has created several serious environmental problems related to air, water and land. The excessive and imbalanced use of chemical fertilizers has adversely affected the soil causing decrease in organic carbon, reduction on microbial flora of soil, increasing acidity and alkalinity and hardening of soil. Excessive use of Nitrogen containing fertilizers causes contamination of water bodies thus affecting fish fauna and causing health hazards for human beings as well as animals. It also leads to serious health problems in human beings by entering the food chain. Further, increased production of chemical fertilizers greatly adds to environmental pollution. This has resulted in the reassessment of agricultural practices with a shift towards organic farming which can produce quality food without adversely affecting the soil and environment [1, 2, 3].

Organic farming is one of the old ways of farming using the easily available manures including horse dung, cow dung, pig, chickand sheep products and is based on the key assumption of sustainability. Usage of Vermi compost is one of the organic ways of farming which is 100 percent safe, non-toxic and odour

free. Vermi compost also helps plants grow faster, stronger and increases the size of the fruits and flowers. In Vermi-technology, the earthworms crush the soil and organic matter (e.g. agricultural waste, urban soil waste, agro industry waste). After its consumption by the earthworms, the matter undergoes a complex biochemical process in its digestive system. This compost is an odourless clean, organic material containing adequate quantities of nitrogen, phosphorus and potassium (NPK) and several micro nutrients essential for plant growth. Usage of vermi compost results in bumper yield, better taste, size and quality of fruits and vegetables. Vermi compost also reduces soil erosion, water evaporation and increases immunity to diseases and also increases the nutritive values in vegetables and fruits [4, 5, 6].

Green leafy vegetables are an important component of a balanced diet and are regularly included in the foods of people, especially from tropical and temperate climates. They are inexpensive, and are rich sources of minerals and vitamins [7]. Several reports are available on the beneficial role of vermi compost on the nutrient content of food grains and vegetables. The nutritional quality assessment of organic foods in green leafy vegetables was studied and reviewed by many researchers[8,9,10] Application of vermi compost to soil resulted in better physicochemical and microbial characteristic of soil, better quality of final produce, and better retention of plant nutrients. Availability of nitrogen from organic fertilizers and increased availability of nutrients was seen. This is the same reason for better retention of plant nutrients in vermi treated soil grown green leafy vegetables. According to one of the study yield amaranth obtained with 5 tonnes farm yard manure + 75 percent NPK/ha and 10 tonnes farm yard manure per ha + 75 percent NPK was on par with 5 tonnes FYM/ha + 100 percent NPK The results indicated that combined application of NPK and FYM enhanced uptake of NPK[11].The effect of vermi compost produced form domestic waste in comparison with commercial available fertilizers in tomato plants was studied by one of the research study and it was seen that there were no symptom of nutrient deficiency on plants cultivated in vermi compost medium while plants grown in commercial fertilizers were affected[12]. Thus, these findings clearly indicate the beneficial effects of vermin composting on the growth and nutritive value of foods like leafy vegetables. Vermi compost industry has already been developed in countries like U.S.A., Canada, U.K., Japan, Italy, Philippines and Taiwan. In China, farmers are attracted towards organic farming; but it has not yet taken up roots in majority of developing countries including India. In this background, the present study was taken up to evaluate the effect of bio-fertilizers on the nutrient content of the green leafy vegetables with the following objectives:

1. To study the effect of bio-organic manure on the growth and yield of green leafy vegetables in comparison with chemical fertilizers.
2. To estimate and compare the vitamin content (Vitamin A, Vitamin C, Riboflavin) of green leafy vegetables grown with bio and chemical fertilizers.
3. To analyse and compare the acceptability between the green leafy vegetables grown with bio and chemical fertilizers.

MATERIAL AND METHODS

A good quality compost free from weeds, pathogens and rich in nutrients is a pre-requisite for adopting organic farming practice. Depending upon the nature and quantity of raw material available with farmer,different methods have been developed for the preparation of quality compost from farm wastes which include INDORE method, NADEP method, NADEP PHOSPHO compost, VERMI compost, BHABHUT AMRIT RANI, AMRIT SANJEEVANI, PITCHER KHAD, BIO GAS SLURRY, GREEN manures, and BIO fertilizers. For the present study,Vermi compost method was selected as per the following procedure.

The field experiment to evaluate the fertilizer value of vermi compost was carried out in an open area during the months of January to March 2005 for a period of one and half month at the Department of Home Science, Sri Padmavati Mahila Visvavidyalayam, Tirupati. The total area was divided into square feet (12x12”). The collected soil was sieved to avoid foreign particles, stores etc. Vermi compost / Soil admixture are taken as different percentages (25%, 50%, 75% and 100%). Soil treated with chemical fertilizers was also included and pure soil without vermin compost was taken as control for comparison.

Four types of green leafy vegetables viz. Fenugreek leaves, Spinach, Amaranth and Gogu were selected as the test crops. Vermi compost was added to the soil at 2 to 3” depth. One square feet for control and another set was taken for chemical fertilizer (N_6 P_{24} K_{24}). Seeds were sown in all parts at a depth of two cm from the top layer. All the seeds were sown in the month of January. A continuous record of growth and yield parameters like plant height, rate of germination for different plants was done. The growth was noted for different types of experiments to determine the optimal vermi compost (soil admixture for growth of green leafy vegetables). The samples were taken from different soils (experiments for nutrient analysis).

Vitamin A, vitamin C and riboflavin content of the vermi-treated, chemically treated and controlled treated green leafy vegetables grown viz., Fenugreek, Spinach, Amaranth and Gogu were estimated using the CARR PRICE method, DCPIP method, and AACC method respectively.

RESULTS AND DISCUSSION

The record of growth and yield attribute of the vegetables grown in control, chemically and vermi-treated soils were maintained. The growth and yield of the vegetables were known by the difference in plant height, rate of germination and plant yield. Application of vermi compost to the soil increased the germination rate, height, yield and vitamins than chemically and control treated plants. Estimation of composition of vitamin A, vitamin C, and riboflavin in the vermi-treated soil indicated an increase in the vitamin composition of the plants grown in the same soil. Hence, nutrient uptake of the produce was seen, thus providing that vermicomposting grown crops are superior to the chemically treated and control soil crops.

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Table 1. Main yield of the plants

Main treatment	Fenugreek (gm)	Noof leaflets	Spinach (gm)	Noof leaflets	Amaranth (gm)	Noof Leaflets	Gogu (gm)	No of Leaflets
25 % (VC +Soil)	60	5	80	4	60	5	95	3
50 % (VC +Soil)	75	6	100	5	87	6	100	5
75 %(VC + Soil)	90	8	120	6	95	8	105	4
100 % (VC +Soil)	85	7	105	6	80	6	120	5
Average	77.5	6.5	97.5	5.25	80.5	6.25	105	4.25
Chemical fertilizer	50	5	90	3	75	3	80	3
Control	50	3	75	2	75	2	75	2

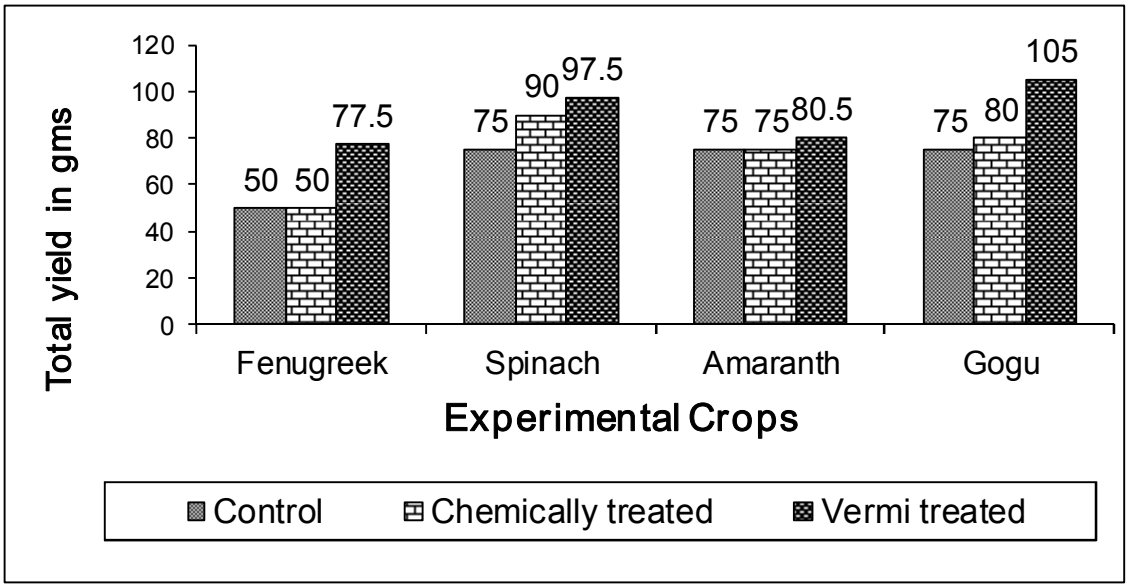
VC = Vermicompost

F1 ANOVA value 18.8** (between main treatments)

**Significant at 0.01 level

From table 1, it is clear that there was significant difference with regard to total yield of plants grown in vermi, chemically and control treated plants. The yield of vermi-treated green leafy vegetable plants is higher than chemical and control treated plants. The yield increased for all the green leafy vegetables at 75% of VC+Soil. The yield in gram per square foot decreased for chemically treated plants and control treated plants. In Fenugreek the yield increased to 90 gms at 75% VC+Soil in chemically (50 gms) when compared with control (50 gms) treated plants respectively. The number of leaflets in control, chemically treated and vermi-treated (average) were 3, 5 and 6.5 respectively. For Amaranth the yield for square feet in 75 gms in both chemically and control treated plants. There is a similar increase (75 gms) in chemically when compared with control (75 gms). The number of leaflets in control, chemically treated and vermi-treated (average) were 2, 3 and 6.25 respectively. In Spinach the yield increased to 120 gms at 75% (VC+Soil) and for chemically (90 gms) when compared with control treated plants (75 gms). The number of leaflets in control, chemically treated and vermi-treated (average) were 2, 3 and 5.25 respectively. For Gogu the yield per square feet in (120 gms) at 100%. In both Chemically and control treated plants. There is a slight increase in (80 gms) for chemically when compared with control (75 gms). The number of leaflets in control, chemically treated and vermi-treated (average) were 2, 3 and 4.25 respectively.

Figure 1. Yield (gms) of Control, Chemical fertilizer and Vermi compost soils Grown Green Leafy Vegetables.



NUTRIENT ANALYSIS (Vitamins)

VITAMIN A COMPOSITION

ANOVA value of vitamin A in four different Green leafy vegetable plants.

TABLE No.2 Vitamin a content of green leafy vegetables grown in experimental and control soils.

Main treatments	Fenugreek µg	Spinach µg	Amaranth µg	Gogu µg
25 % (VC+Soil)	2,329	5,501	248	2,790
50 % (VC+Soil)	2,332	5,560	252	2,880
75 %(VC +Soil)	2,341	5,579	254	2,896
100 %(VC +Soil)	2,338	5,582	250	2,898
Average	2,335	5,555	251	2,866
Chemical fertilizers	2,229	5,499	242	2,679
Control	2,219	5,320	240	2,662
ICMR Values	2,340	5,580	255	2,898

VC = Vermi Compost

Factor value - 6.122**

**Significant at 0.01 level.

The data regarding Vitamin A content of the different vermi, chemically and control treated green leafy vegetables are represented in the above table.

Vitamin A content of Fenugreek is 2,341 µg at 75% VC+Soil which is better in vermi compost than chemical (2,229 µg) and control (2,219 µg) treated plants. For Spinach it is 5,582 µg at 100% VC+Soil and is better in vermi compost than chemical (5,499 µg) and control (5,320 µg) treated plants. Vitamin A content of Amaranth in 254 µg at 75% VC+Soilis better in vermi compost than chemical (242 µg) and control (240 µg) treated plants. Vitamin A content of Gogu is 2,898 µg at 100% VC+Soil better in vermi compost than chemical (2,679 µg) and control (2,662) µg treated plants respectively.

The comparison between the averages of Vitamin A content of Amaranth, Fenugreek, Spinach and Gogu treated with vermi are higher than chemically and control treated plants i.e. 251 µg, 2,335 µg, 5,555 µg and 2,866 µg respectively. The results are on par with the ICMR values higher than the chemical and control treated plants.

From the data it is evident that in all samples there is a significant difference in the vitamin A content of vermi treated, when compared with chemically treated and control treated green leafy vegetables. There was an increase in nutrient uptake due to application of vermi compost. Difference between the treatments for four types of Green leafy vegetables are seen in fig 2. These similar results were also reported by the earlier popular research related to bio- farming techniques [13,14,15].

VITAMIN C COMPOSITION

TABLE No. 3 Vitamin C Content Of Green Leafy Vegetables Grown In Experimental And Control Soils.

Main treatments	Fenugreek Mg	Spinach Mg	Amaranth Mg	Gogu Mg
25 % (VC+Soil)	49	20	8.5	17
50 % (VC+Soil)	51.5	24	9	20
75 %(VC +Soil)	52	26	11	21
100 %(VC+Soil)	51	28	10.8	22.5
Average	50.875	24.5	9.825	20.125
Chemical fertilizers	47	15	8	14
Control	40	13	6	11.5
ICMR Values	52	28	10	20

VC = Vermi Compost
Factor value = 15. 878**.
**Significant at 0.01 level.

Vitamin C content of Green leafy vegetables grown in vermi, chemically and control treated soils are represented in table No. 3.
Vitamin C content of Fenugreek was higher (52 mg) at 75 % VC+Soil treated than chemically (47 mg) and control (40 mg). For Spinach Vitamin C content was higher (28 mg) at 100% VC+Soil treated than chemically (15 mg) and control (13 mg). Vitamin C content of Amaranth was also higher (11 mg) at 75% VC+Soil treated than chemically (8 mg) and control (6 mg). Gogu was higher (22.5 mg) at 100% VC+Soil treated than chemically (14 mg) and control (11.5 mg).
The average vitamin C content for vermi treated plants such as Amaranth is 9.825 mg, Gogu is 20.125 mg, Fenugreek is 50.875 mg and Spinach is 24.5 mg. respectively. Vermi treated plants are better than chemically and control treated plants. The results are on par with the ICMR values higher than the chemical and control treated plants.
From the data it is evident that in all samples there is a significant difference in the vitamin C content for vermin-treated, chemically treated and control treated soils grown green leafy vegetables. There was an increase in nutrient uptake due to application of vermi compost. These results were found to be in agreement with the findings of several reports [16, 17, 18].

RIBOFLAVIN COMPOSITION

Table No.4: Riboflavin Content Of Green Leafy Vegetables Grown In Experimental And Control Soils.

Main treatments	Fenugreek mg	Spinach Mg	Amaranth mg	Gogu mg
25 %(VC+Soil)	0.25	0.21	0.12	0.28
50 %(VC+Soil)	0.28	0.24	0.17	0.30
75 %(VC+Soil)	0.30	0.25	0.18	0.38
100 %(VC+Soil)	0.27	0.26	0.16	0.36
Average	0.28	0.24	0.16	0.33
Chemical fertilizers	0.21	0.18	0.11	0.22
Control	0.17	0.15	0.09	0.19
ICMR Values	0.31	0.13	0.18	0.39

VC = Vermi Compost
Factor value = 0.48^{NS} (Not Significant).

Riboflavin content of Green leafy vegetables grown in different vermi treated, chemically treated and control are depicted in table No. 4.
It is observed that riboflavin content for was higher for Fenugreek, Amaranth and Gogu 0.30 mg, 0.18 mg and 0.38 mg respectively than chemically and control treated plants at 75% VC+Soil and 0.26 mg at 100 % VC+Soil for Spinach.
From comparative data between vermi, chemically and control treated soils. The average of vermi treated plants of Amaranth is 0.16 mg, Gogu is 0.33 mg, Fenugreek is 0.28 mg and Spinach is 0.24 mg. respectively. The Vermi treated plants are better than chemically and control treated plants. The results are on par with the ICMR values higher than the chemical and control treated plants.
From the data it is evident that in all samples there is a not significant difference in the riboflavin content of Green leafy vegetables grown in vermi treated, chemically treated and control treated soils. Several

scientists studied nutrient management in vegetables and revealed that available nutrient status in the soil increased with the application of vermin compost.

CONCLUSION

The findings of the study revealed that application of vermi compost to the soil resulted in an increased growth and yield of the plants due to the availability of nitrogen from mineralization of organic fertilizers and increase the availability of nutrients and better physical condition of the soil. Vermi-compost treated soil grown crops had a better growth, yield, height and nutrients when compared with the chemical and control treated soil.

It can be concluded that vermi-compost served as a potential organic fertilizer and it is strongly believed that during the succeeding seasons crops would be better due to application of vermi compost. Thus, application of vermi-compost decreases the usage of chemical fertilizers and pesticides which have created serious health problems polluting the air, water, and land and entering the food chain. Only when the quality and fertility of the soil are maintained or increased farming can be truly called organic. As a result, bygone golden age can be replaced by diversification of agriculture for human nutrition.

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