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Comparative study of quality attributes of spinach grown on vermicompost and artificial fertilizer

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ABSTRACT : In the present study, a leafy vegetable was grown using vermicompost and artificial fertilizer, in the Department of Home Science garden and was studied for its sensory characteristics. Recipe was formulated and evaluated. Three trials(T_1,T_2 and T_3) were conducted for testing of various sensory characteristics such as appearance, colour, texture, taste, flavour and acceptability. For this purpose, six human panelists were coded as J_1, J_2, J_3, J_4, J_5 and J_6. Recipes were served fresh. Based on the mean values, results were tabulated and analyzed statistically by applying 't' test. It was observed that vermicompost variety significantly scored maximum than artificial fertilizer. It showed highly significant difference in both the varieties when compared on organoleptic characteristics. Thus, it was concluded that vermicompost variety was highly appreciated and more superior in all the sensory characters over artificial fertilizer which was statistically proved. Thus, by using organic manure for farming, we can save our ecosystem and health by consuming these vegetables.

KEY WORDS : J1–J6 (Judges), Vermincompost, Artificial fertilizers, Sensory characteristics, Ecosystem

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India is an Agro-based country and about 80 per cent of its population depends directly or indirectly on agriculture as their occupation. In early days, agriculture practice was done without any manures or fertilizers since the early man did not have knowledge about it. When cow dung and other wastes were used in addition to water more and better yield was obtained. Thus, agricultural practice got a new way of technology. This type of farming is known as organic or substantial farming. The growth in the agriculture production has to be enhanced to feed the growing population. This is possible only when the soil is in good health. One of the primary factors that influences the soil is the status of organic matter in the soil. In our country, since centuries, organic manures were the primary sources of plant nutrients for crop growth and development. Recycling of organic waste and application of bulky organic manures were the most popular agronomic measures adopted to sustain soil health (Sehgal and Chauhan, 2000) .

To satisfy the ever increasing demand of food production to feed the increasing population, Indian Agriculture Research, since 1960, focused its attention on increased productivity, high yielding varieties, fertilizers and pesticides along with irrigation. The chemical fertilizers played significant role in providing large quantities of nutrients needed for intensive crop production which brought about manifold increase in agricultural production in the initial days. But its repeated use has led to degradation of soil health, pollution of ground water, salinity, and soil biodiversity went down (Jackson, 1967).

Due to the above reasons, organic farming is being practiced now-a-days, which involves the use of humus, cow dung, compost, vermicompost, that improves and maintains soil fertility.

Compost is a dark brown crumbly material that is produced when a collection of plant and animal material is decomposed into fine organic matter and humus. For the formation of compost, dead and decaying organic material is

subjected to composting. During composting, the biological degradation of organic material takes place. It is due to enzymes produced by living micro-organisms and other decomposing organisms. Vermicomposting is the method of making compost with the use of earthworms. Earthworm species such as *Eisenia foetida, Perionyx excavates* and *Eudrilus eugenia* are easily adaptable to agricultural wastes like after harvesting stribbles, sugarcane thrash, coir waste, paper pulp, faecal matter of cow, sheep, horse, activated sludge and biogas sludge of poultry droppings. The breakdown of these materials or the degraded organic matter by worm activity is called 'Vermicompost'. Vermicompost is a nutrient rich natural fertilizer and soil conditioner which can be used as the top soil or the organic manure in the fields to prevent organic carbon deficiency and soil erosion. The process of producing vermicopmost is called 'Vermicomposting'.

Vermicompost application to the soil drastically improves the soil fertility, increase the yield, improves soil pH, releases more available nutrients, increases pest resistance, enhances water infilteration and water holding capacity of the soil, reduces irrigation requirement, improves soil microbial activities, yield produces with the better taste, luster, keeping quality and low pesticide residues enhancing its exportability (Bhawalkar and Bhawalkar, 1991).

According to the study conducted by Bhatiya (2005) on the effect of organic manures and bio-fertilizers on growth of Indian bean concluded that the treatment of organic manure was most favourable for providing best vegetative growth, higher as well as earlier flowering and yield of Indian beans.

Jugele (1999) conducted a study on effect of organic manuring on cotton and showed that the yield contributing characters and yield of seed cotton were highest with the application of farm yard manure @5t/ha+1/2 recommended dose of fertilizer.

Poinkar (2004) conducted a study on the effect of organic manure and bio-fertilizers on growth yield and quality of turmeric and showed that application of farm yard manure along with use of bio-fertilizer was beneficial in respect of growth, yield and earliness in maturity period.

Shinde (2007) conducted a survey on kitchen waste recycling and the observations were that most of the respondents used kitchen waste *i.e.* vegetable peeling, leftover food, papers, etc; for preparing compost manure in their home. Majority of the respondents were aware of the kitchen waste recycling.

Jogdane (1997) conducted a study on the effect of different layouts and nitrogen levels on growth and yield of soybean and the results indicated that from different levels of nitrogen studied, it was found all the yield contributing characters and yield (grain and straw) were found to be significantly increased from 0kg N/ha to 45 kg N/ha.

Mendhe, (2005), undertaken a study on effect of inorganic fertilizers and organic manure fertilization on the growth and yield of paddy variety PKV-Makarand. The growth and yield contributing characters of paddy increased significantly with the application of urea-DAP briquette at transplanting +25 per cent N at tilering +25 per cent N at panicle initiation. The grain and straw yields increased significantly.

The objective of the study was :

–To study the preparation of vermicompost and time required for its preparation.

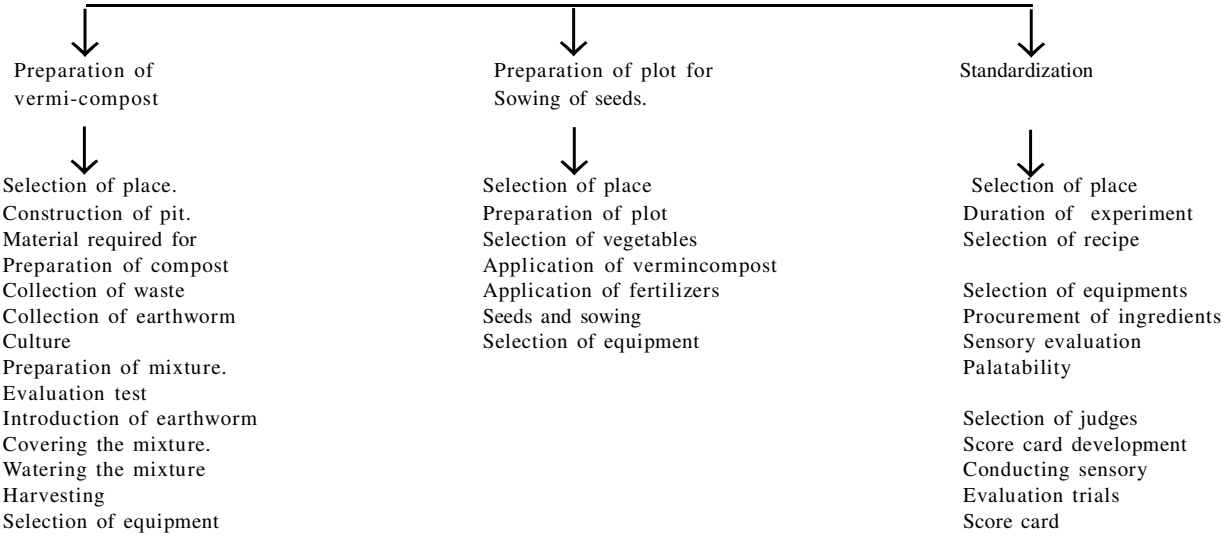
–To assess the expenditure incurred in growing spinach.

–To assess the sensory characteristics of cooked vegetable.

■ RESEARCH METHODS

The experimental procedure of the present study was carried out as under :

Experimental plan



Preparation of vermi-compost :

(Method of preparation was followed from Sathe, 2004)

Kitchen garden of house was selected for preparation of vermicompost, a cemented tank/pit was prepared on the land, the size of which was 76 cm. long, 72 cm. wide and 35 cm. in depth/height. There was a hole/exit at base to remove excess water in the tank. Kitchen waste, cow dung and earthworms were used for preparation of vermicompost. Gunny bags were used for covering the mixture. Gunny bags were altered twice in a week. To maintain the optimum moisture level in the bed, water was added. Vermicompost was ready for use within 45-60 days. Garden of Post Graduate Teaching Department of Home Science was selected as plot for sowing of seeds. The garden land was firstly harrowed and pre-sowing irrigation was done so as to create a favourable soil moisture level. When the soil reached the field condition, then the prepared vermicompost was applied uniformly and mixed with soil by harrowing. Seeds were sown in the month of July and vegetable (spinach) was harvested in August. Same procedure was followed for artificial fertilizer. Full dose of fertilizer was added to the soil *i.e.* nitrogen, phosphorus and potassium.

Sensory evaluation :

It was done on the basis of organoleptic characteristics of the spinach soup that was prepared using fresh spinach, ploughed from the experimental plot, grown on vermicompost. After collection of 100g of spinach, it was cleaned, washed, chopped and 250 ml water was added to it. It was cooked till tender and grounded. Salt was added, boiled for a minute and the hot soup was served to the judges. Same procedure was followed for spinach grown on artificial fertilizer. The cooking time for vermicompost grown spinach soup was 6 min and that for artificial fertilizer grown spinach was 7 min. Score card was developed for the recipe on the basis of – appearance, colour, texture, taste, flavour, consistency and acceptability.

Statistical appriasal of the data was done using :

– Arithmatic mean/average

– 't' test

– Graphical representation

Null Hypotheses :

'HO'- "There is no real difference between the sensory characters of two varieties of leafy vegetables grown on vermicompost and artificial fertilizer and if it is, it is just by chance."

The purpose of the present study was comparative study of spinach grown on vermicompost and artificial fertilizer. Spinach soup recipe was prepared and standardized and results were tabulated, analyzed and discussed under the following heads :

Preparation of vermicompost by using household waste.

Time required for preparation of vermicompost.

Expenditure incurred in growing the leafy vegetable.

Sensory characteristics of cooked vegetable.

Preparation of vermicompost by using household waste :

The material required for vermin-compost are shown in Table A.

Table A : Material required for vermi-compost

Sr.No.	Material required	Quantity
1.	Kitchen waste	2 kg.
2.	Cowdung	2 kg.
3.	Earthworm	50 Nos.

Time required for preparation of vermincompost:

Time is one resource, which we are all sharing. We usually indicate the need for synchronizing our activity with that of others whether it may be for food, work, rest, etc., Vermicompost is the excreta of earthworm, which is rich in humus. Earthworms eat cow dung or household waste along with other kitchen waste and pass it through their body and in the process convert it into vermincompost. Vermicompost takes 45-60 days in preparation.

■ RESEARCH FINDINGS AND DISCUSSION

The findings of the present study well as relevant discussions have been presented under following heads:

Expenditure incurred in growing the leafy vegetables:

Expenditure incurred in growing the leafy vegetables by the methods (*i.e.* vermicompost and artificial fertilizer) is given in Table 1.

Table 1: Expenditure incurred for vermi-compost

Sr. No.	Material required	Quantity	Cost in Rs.
1.	Kitchen waste	2kg.	--
2.	Cowdung	2kg.	05/-
3.	Earthworm	50 Nos.	05/-
4.	Compost tank	1No.	50/-
5.	Seeds of spinach	5g.	05/-
	Total		65/-

From Table 1, it can be said that the amount spent on preparation of vermincompost for growing leafy vegetable was Rs. 65/- Cost of tank is a one time investment and as the researchers in doing all the work, labour cost is deducted.

From Table 2, it can be said that the amount spent on

Table 2 : Expenditure incurred for fertilizer

Sr.No.	Material required	Quantity	Cost in Rs.
1.	Mixed fertilizer	2 kg.	70/-
2.	Seeds of spinach	5 g.	5/-
	Total		75/-

fertilizer for growing spinach was Rs. 75/-.

Sensory characteristics of cooked vegetables :

Spinach soup was prepared and evaluated for sensory characteristics and discussed with results as under.

Spinach soup :

Spinach soup was prepared and tested for its appearance, colour, consistency, flavour, taste and acceptability. Each sensory characteristic with statistical treatment is discussed below .

Appearance :

Appearance is the first appraisal of the food. Eye appeal is gained through contrasting and interesting combination of foods differing in types of colour and form (Table 3).

Table 3 : Palatability evaluation scores for spinach soup

Judges	Appearance of spinach soup							
	Vermi-compost				Artificial fertilizer			
	T_1	T_2	T_3	Mean score	T_1	T_2	T_3	Mean score
J_1	8	8	10	8.66	10	8	10	9.33
J_2	10	10	10	10	8	8	10	8.66
J_3	10	10	10	10	8	8	8	8
J_4	8	10	10	9.33	6	10	10	8.66
J_5	10	10	10	10	10	10	10	10
J_6	10	10	10	10	8	8	10	8.66
Mean				9.66				8.88

't' value = 7.8*

Table 3 shows that the appearance of spinach soup of vermincompost variety had scored 9.66 and artificial fertilizer variety scored 8.88 which showed highly significant difference. It was statistically proved significant when compared on the organoleptic characteristics. Hence, it can be concluded that vermicompost variety was more superior over artificial fertilizer variety.

Colour :

Colour is an important factor that regulates overall appearance of the product. The colours of the green leafy vegetable vary according to the chlorophyll content of these vegetables.

From Table 4, it is clear that the colour of spinach soup of vermincompost variety had scored 9.88 because it is bright green and artificial fertilizer variety scored 8.55 because it is dull green. This showed highly significant difference in both the varieties when compared on the organoleptic characteristics. Hence, can be concluded that vermicompost variety was appreciated more than artificial fertilizer variety.

Table 4 : Palatability evaluation scores for spinach soup

Judges	Colour of spinach soup							
	Vermi-compost				Artificial fertilizer			
	T_1	T_2	T_3	Mean score	T_1	T_2	T_3	Mean score
J_1	8	10	10	9.33	10	8	8	8.66
J_2	10	10	10	10	8	8	8	8
J_3	10	10	10	10	8	8	8	8
J_4	10	10	10	10	8	10	8	8.66
J_5	10	10	10	10	10	10	10	10
J_6	10	10	10	10	8	8	8	8
Mean				9.88				8.55

't' value = 13.3*

Consistency :

Consistency may be considered a textural quality attribute, in many instances we can see consistency and so it is another factor in food appearance.

From Table 5 it is seen that the consistency of spinach soup of vermincompost variety had scored 9.66 and artificial fertilizer variety scored 8.44. It was statistically proved significant when compared on the organoleptic characteristics.

Table 5 : Palatability evaluation scores for spinach soup

Judges	Consistency of spinach soup							
	Vermi-compost				Artificial fertilizer			
	T_1	T_2	T_3	Mean score	T_1	T_2	T_3	Mean score
J_1	8	8	8	8	8	8	8	8
J_2	10	10	10	10	10	10	10	10
J_3	10	10	10	10	8	8	8	8
J_4	10	10	10	10	8	8	8	8
J_5	10	10	10	10	8	10	8	8.66
J_6	10	10	10	10	10	6	8	8
Mean				9.66				8.44

't' value = 6.1*

Flavour :

Flavour depends on taste, odour or aroma, temperature sensation of hot and cold and texture. Flavour is the result of a number of components, some of which may be present in a high proportion but most are present in low proportion.

From Table 6, it can be said that the flavour of spinach soup of vermincompost variety had a mean score of 9.33 and artificial fertilizer variety scored 7.33, which showed highly significant difference in both the varieties when compared on the organoleptic characteristics.

Taste :

Taste plays a very dominating role in food acceptability.

From Table 7, it was observed that the taste of spinach

Table 6 : Palatability evaluation scores for spinach soup

Judges	Flavour of spinach soup							
	Vermi-compost				Artificial fertilizer			
	T_1	T_2	T_3	Mean score	T_1	T_2	T_3	Mean score
J_1	6	8	10	8	4	6	6	5.33
J_2	10	10	10	10	8	8	8	8
J_3	10	10	10	10	8	8	8	8
J_4	8	8	8	8	8	6	6	6.66
J_5	10	10	10	10	8	8	8	8
J_6	10	10	10	10	8	6	10	8
Mean				9.33				7.33

't' value = 6.6*

Table 7 : Palatability evaluation scores for spinach soup

Judges	Taste of spinach soup							
	Vermi-compost				Artificial fertilizer			
	T_1	T_2	T_3	Mean score	T_1	T_2	T_3	Mean score
J_1	8	8	10	8.66	4	6	6	5.33
J_2	10	10	10	10	8	8	8	8
J_3	10	10	10	10	6	6	6	6
J_4	10	10	10	10	6	6	6	6
J_5	10	10	10	10	8	8	8	8
J_6	10	10	10	10	8	6	10	8
Mean				9.77				6.88

't' value = 9.6*

soup of vermincompost variety had scored 9.77 because its taste was very good and artificial fertilizer variety scored 6.88, which suggested that taste of spinach soup prepared from vermincompost variety was better than artificial fertilizer. Hence, can be concluded that vermicompost variety was appreciated more than artificial fertilizer variety.

Acceptability :

The term acceptability or unacceptability is used to describe whether the product is liked or disliked by the consumer. Exterior part plays an important role for acceptability.

From Table 8, it is clear that the acceptability of spinach soup of vermincompost variety had scored 9.66 and artificial fertilizer variety scored 6.99. Hence, it does not support the hypothesis, which was statistically proved highly significant when compared on the organoleptic characteristics.

Thus, it can be concluded that when compared on the organoleptic characteristics vermicompost variety had been appreciated more than the artificial variety. Thus, it showed that vermicompost was more superior over artificial fertilizer variety which was statistically proved.

Vermicompost can be prepared from household and kitchen waste by housewives at household level, which is

Table 8 : Palatability evaluation scores for spinach soup

Judges	Acceptability of spinach soup							
	Vermi-compost				Artificial fertilizer			
	T_1	T_2	T_3	Mean score	T_1	T_2	T_3	Mean score
J_1	6	8	8	8	6	6	6	6
J_2	10	10	10	10	8	8	8	8
J_3	10	10	10	10	6	6	6	6
J_4	10	10	10	10	6	4	6	5.33
J_5	10	10	10	10	8	8	8	8
J_6	10	10	10	10	8	8	10	8.66
Mean				9.66				6.99

't' value = 9.6*

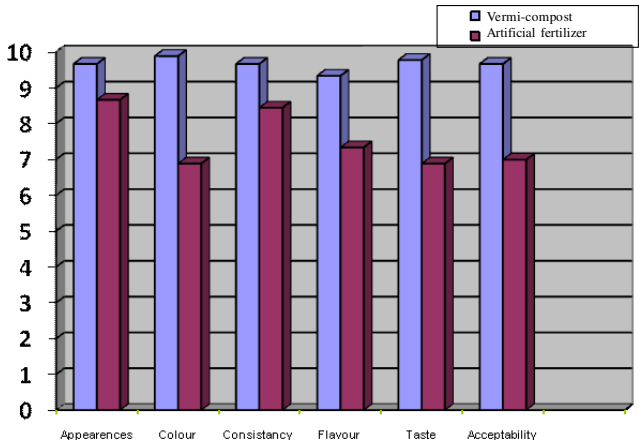


Fig. 1 : A comparative study in organoleptic characteristic of vermicompost and artificial fertilizer

also called as organic manure. Use of this manure for farming is known as organic farming. Organic farming is eco-friendly and also enhances the quality of soil. It helps in increasing the productivity, it keeps the environment clean and balanced. Fruits and vegetables grown on this compost are healthy, highly nutritious and no harmful residues are left in the soil, water and in crop. At the same time original colour, texture, flavour and taste are retained. Artificially cultivated vegetables require lots of chemical fertilizers and pesticides. These chemicals get accumulated in vegetables, fruits, soil and water. If these fruits and vegetables are not washed properly they remain in the food and cause ill effects on human body. Thus, by using organic manure for farming, we can save our ecosystem and health by consuming these vegetables.

The technology of utilizing household waste and kitchen waste for preparation of compost need to be popularized among the community at the household level. By doing so, we can save our environment from pollution, money, energy and time. For this purpose, extensive training is required to be provided to the farming community of the entire state. This technique can also be popularized among common masses by organizing exhibitions, demonstrations and other such activities.

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