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Research Article

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Comparative yield analysis of Chilli (*Capsicum annuum* L.) by application of Vermicompost and Panchagavya

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ABSTRACT

The present study deals with application of Vermicomspost and Panchagavya on the yield parameters of chilli (Capsicum annuum) was studied. The soil was mixed with of 40 kg. Vermicompost, half kg of Azopirillum and half kg of Phosphobacteria per hectare. The crop was divided into two sections. One was treated with Panchagavya and the second was the control without treatment with Panchagavya. It was observed that the treatment with panchagavya enhanced the various growth parameters like length of plant, number of branches, number of fruits and size of fruits as compared to the plants which were grown on vermicompost alone.

Key words: Chilli, Panchagavya, Vermicompost, *Azospirillium, Phosphobacteria*

INTRODUCTION

The use of chemicals, such as fertilizers and pesticides for the enhancement of productivity of crops has become the order of the day. After the initiation of green revolution the crop productivity has increased manifold to meet the demand of ever growing population the world over. But the use of these chemicals have caused great damage to the environment in the form of pollution to air, water and soil and also led to various diseases to human beings, animals and plants. Over the last few decades there is change in the attitude of the farmers to revert back to the old system of farming using organic manures, panchagavya, vermicompost and other natural modes of fertilizers and pesticides, particularly in India. This is a welcome change for the sustainable development of agriculture and at the same time saving the nature from pollution. The present study is one such attempt to prove the efficacy of these age old methods of crop development without harming the nature. In this study chilli plant was chosen as an experimental plant which was treated with vermicompost and panchagavya as the only source of manure, fertilizer as well as pesticide, and the results were pretty encouraging.

Chilli *(Capsicum annuum* L.) is an important spice cum vegetable crop cultivated extensively in India. The total production of chilli in India in 2013-2014 was 1.15 million tons, whereas it is expected to be 1.30 million tons in 2014-2015. Thus our country is one of the major players in the world chilli market. Keeping the high export potential chilli production has to be increased by a combination of high yielding plant types, standard agronomic practices and balanced plant nutrition attained through Integrated Nutrient Management (INM). To maintain soil fertility and crop productivity all potential methods must be used.

Green revolution had lead to intensified agriculture to meet the ever increasing demand for food and fibre. The extensive use of chemical fertilizers in different combinations increased the crop yield many folds as compared to the earlier local farming practices. Although green revolution has met the needs of food, it has its own inherent side effects like ecological degradation, high rate of pollution of air water and soil ultimately leading to overall health problems to the population, organisms and plants. [1] The indiscriminate use of chemical pesticides in modern agriculture resulted in the development of several problems such as development of pesticide resistant insects, resurgence of target and non target pests, eutrophication of soil and water, destruction of beneficial organisms like

honey bees, pollinators, parasitoids, predators, soil fertility depletion, increase in soil acidity, run-off of fertile soil, soil erosion and other socioeconomic problems etc.

The use of pesticides has lead to the contamination of food, feed and fodder. This awareness has resulted in the development of Integrated Pest Management (IPM). Organic farming has developed very rapidly in recent years. [2, 3] Indian agriculture has better chance to convert itself towards organic mode of farming because in India the use of chemical fertilisers and pesticides is still lower compared to the global standards. Cattle, particularly the cow is considered to be an indispensible animal for any Indian agriculturist. The traditional Vedic formulation, Panchagavya, is being used by some farmers with certain modifications. These modifications particularly in south India have shown very effective crop yields, better quality and less pest infestation.[4] Pachagavya contain growth regulatory substances such as IAA, GA, Cytokinins and essential plant nutrients. Panchgavya is also known to contain some microorganisms like lactic acid bacterium, yeast and *Actinomycetes.* It also contains bio fertilizing microorganism like *Acetobactor, Azospirillum, Phosphobacterium* etc.

Chilli is an indispensable condiment of every home in India. It is used in the daily diet in one form or the other. It is a rich source of vitamin A and C with good medicinal properties. Chilli contains an alkaloid 'Capsaicinoid' due to which it has the pungent taste. Heavy use of chemical fertilizers in chilli is also causing environmental pollution. The increase in crop productivity is due to their combined and synergistic effects that help to improve chemical, physical and biological properties of soil and consequently, the soil organic matter and nutrient status. Long term manurial experiments conducted in India have amply demonstrated declining trend in productivity with usage of only inorganic fertilizers. The decline in productivity has been associated with the onset of deficiencies of nutrients like sulphur, zinc and deterioration in soil physical and chemical properties. Integrated use of organic manure and fertilizers has been found to be promising not only in maintaining higher productivity but also for providing stability in crop production. Good quality Farm Yard Manure (FYM) is perhaps the most valuable organic manure. It must be stressed that the value of FYM in soil improvement is also due its content of micro nutrients and its ability to improve the soil tilth and aeration, as well as water holding capacity of soil and to stimulate the activity of micro-organisms that make the plant food elements in the soil readily available to crops. In recent years, the potential of vermicompost to supply nutrients and support beneficial microbes is being recognized widely both in field and horticultural crops. Vermicompost has all the characteristics for use as most valuable organic manure. Panchagavya, an organic product has the potential to play the role of promoting growth and providing immunity in plant system. Panchagavya consists of five products viz., cow dung, cow urine, cow milk, curd and ghee and used widely for agriculture and horticultural crops. Panchagavya is a foliar nutrition prepared by organic growers of Tamil Nadu. Panchagavya is used as a traditional method to safe guard plants and micro organisms and to increase plant production. The use of bio-fertilizers has been observed to be effective in enhancing the yield and reducing the inorganic sources of nutrients. Several soil bacteria and fungi possess the ability to bring insoluble phosphates into soluble forms by secreting organic acids. Integrated Nutrient Supply System (INSS) primarily relates to combined application of different sources of plant nutrients (organic and inorganic) for sustainable crop production without degrading the natural resources of soil and that too, on long term basis. It, therefore, provides an ideal nutrition for a crop through a proper combination of various nutrient resources and their optimum utilization along with maintenance of soil productivity and ecology. The beneficial effects of combined application of chemical fertilizers with organic manures viz., farmyard manure, vermicompost, biofertilizers, panchagavya and many more of such materials are universally known. Application of organic manures in general improves the availability of micro nutrients like zinc, iron, manganese and copper. A balanced application of both organic and inorganic fertilizers and bio-fertilizers appear to be an ideal proposition to meet nutrient requirements of dry land crops rather than single application.

The present study was designed to find out the various growth parameters of chilli plants by two different fertilizers viz.

1. Vermicompost as the only source of fertilizer and,
2. Vermicompost and Pachchagavya combination as the source of fertilizer.

In both the cases no other chemicals and pesticides were used.

EXPERIMENTAL SECTION

Pachagavya is a formulation made of five products from the cow, namely, dung, urine, milk, ghee (processed butter) and curd. These five products are processed in specific ration and in specific time to obtain best results. Apart from the five cow products some additional materials were also being added to get even better results like, sugar cane juice, jaggery, tender coconut water etc. The process of preparation and application of Pachagavya is mentioned here under.

Ingredients

1. Fresh Cow dung	5kg
2. Cow Ghee (Processed Butter)	½ Kg
3. Cow Urine	3 lt.
4. Cow milk	2 lt.
5. Cow curd	2 lt.
6. Sugar cane Juice	3 lt. (Alternately, 500 gm of Jaggery in 3 lt. of water)
7. Fresh Toddy	2 lt. (Alternately 100 gm yeast powder+ 100 gm Jiggery in 2 lt. water)

Method

Day 1: First the fresh cow dung and ghee were mixed thoroughly and kept in a plastic container and it was covered with clean piece of cloth and kept in shade for three days. The mixture was stirred with a rod for 15 min both in the morning and evening.

Day 4: On the 4th day rest of the ingredients were added and mixed thoroughly. This mixture was also stirred twice daily (Morning/Evening) for at least for 15 minutes.

Day 19: On the 19th day Panchagavya was be ready for use. The mixture was filtered with a thick cloth and the clear solution was stored in an air tight vessel and was stirred every morning and evening till use. Cow urine was added in case the solution became thick. The products of only native breed of cows were used.

DOSAGE:

Folier spray:

3% solution i.e., 3 litres Panchagavya to 100 litres water per acre was used. The solution was power sprayed after filtering sediments. Hand operated spray gun with wider nozzle was used and the application was done during ascending period of moon.

Soil application:

20 litres of 3% panchagavya per acre through flooding was done to soil during descending period of moon.

Field preparation:

The field was tilled and a mixture of 40 kg. vermicompost + half kg. *Azopirillum* + half kg phosphobacteria per hectare was manually spread on the field and tilled thoroughly so that the soil was properly mixed with the compost mixture.

Seed Treatment:

200 gm of local variety of chilli seeds were soaked in 3% panchagavya for half an hour and were dried under shade. The seeds were sown on a nursery bed 4.5 ft x 3 ft.

The seedlings were transplanted after one week after tilling and hoeing of the plot.

A gap of 2 ft was left between two seedlings.
Second hoeing was done after two weeks.

The seedlings were divided into two portions while planting. Half of the rows were treated with panchagavya spray while the other half was not treated which served as control samples. The first spray of 3% panchagavya was done on the 73rd day after planting the seedlings. The spray was continued at every 20 days interval till the complete harvest was done. Hoeing was done 5 times at regular intervals. Watering of the plants was done by sprinklers as and when required depending on the environmental conditions. Flowering was observed by 8th day of plantation in both the experimental plot. The results were tabulated and analysis was made.

RESULTS AND DISCUSSION

During our experiment it was observed that the use of panchagavya has enhanced the parameters like growth rate of plant, number of branches per plant, number of flowers per plant and total yield per plant.

The treated plants gave much better results as compared to those of control plants, but however, the control plants also gave good results as compared to the results produced by inorganic farming. Table 1 represents the various parameters of study on chilli crop. Figure 1 and Figure 2 show the photographs of chilli plants grown on vermicompost alone. Figure 3 depicts the size of the plant (85 cm) which had vermicompost as the only source of

nutrition. Figure 4 represents the size of the plant (106 cm) which was treated with the foliar spray of panchgavya and also grown on vermicompost as manure. Figure 5 and 6 represent the chilli plants with the chilli yields.

Table 1. The growth parameters and yield patterns of chilli crop with and without the treatment of panchagavya

Sl. No.	Growth parameters	Treated with Panchagavya	Untreated	Comments
1.	Average Length of Plant	106 cm	85 cm	
2.	Average Number of Branches	25	15	
3.	Average Number of Flowers.	145	110	The fall of flowers were considerably reduced in treated plants.
4.	Average number of Green chillis Per picking	20	13	
5.	Number of Pickings	10	10	
6.	Total Number of Chillies	200	130	
7.	Average length of Chilli	11 cm	9.6cm	
8.	Average weight of chilli	0.95g	0.80g	

Figure 1

Figure 2

Figure 1 and 2. The chilli plants grown on vermicompost alone

Figure 3. Plant grown on vermicompost alone (85 cm)

Figure 4. The plant grown on vermicompost with panchagaya. (106 cm)

Figure 5.

Figure 6.

Figures 5 and 6 are representative photographs of Chilli plants.

It was reported by many workers that the use of different combinations of NPK and farmyard manure have given better results in chilli crops. Rao and Rao, 2014 have shown in their report how cultivation management has a role to play in chilli production. [5] Balraj, 1999 noticed plant height of 97.66cm by using NPK at ratio of 150:75:75. [6] Natesh *et al*, 2005 observed maximum plant height of 73.7 cm by using FYM, mycorrhiza and vermicompost. They have observed branches of more than 25 by using mycorrhiza, vermicompost and FYM. [7] In our study we have observed 25 branches per plant with our method and about 15 branches in the control plants.

In the present study the maximum height of 106 cm was observed when treated with vermicompost as manure and along with panchagavya spray where as the untreated plants were of 85 cm height.

Hatwar *et al*, 2003 sprayed a combination of zinc, boron and iron at 0.1% along with NPK at 150:50:50 to obtain maximum number of branches (more than 11). [8] Dange *et al*, 2002 used NPK in a ratio of 60:40:25 per hectare to obtain above 168 fruits per plant where as Hatwar *et al*, 2003 had 184 fruits per plant by treating with zinc, boron, iron and NPK. In the present study we have obtained around 200 chillies per plant and the yield of fruits were130 per plant with vermicompost alone. [9]

Hussain, 1989 reported fruit length of 6.8 cm by applying spay of Zn, B and Fe in combination with NPK. [10] Hangarge *et al*, 2002 observed a fruit length of 10.4 by applying coir pith compost and organic booster. [11] Natesh *et al*, 2005 reported a fruit length of 11.4 cm by applying zinc sulphate and vermicompost. We have obtained an average length of chilli of about 11 cm and 9.6 cm in treated and untreated plants respectively.

Narasappa *et al*, 1985 reported 145.68 g of green chilli per plant by using 150 kg of nitrogen per hectare. [12] Ananthi *et al*, 2004 found fruit weight of 0.73g when potassium was applied at 75 kg per hectare. [13] Malawadi *et al*, 2004 obtained 0.86g by using FYM and NPK. In the present study the average fruit weight was 0.95g. [14] The production per plant was about 190g and 80 g respectively in treated and untreated plants respectively, which was considerably higher than similar reports available.

From the above discussion it is very clear that the use of vermicompost and panchagavya have produced better results as compared to other forms of traditional manuring in chilli crop. Our strategy aims at using organic manure to get better results, stopping the use of chemicals as fertilizers and pesticides, thus giving a richer, healthier and economically feasible alternative traditional farming. It is concluded that with the use of vermicompost and panchagavya the yield of chilli fruit crop was considerably enhanced. The use of panchagavya has enhanced not only the quantity of the yield but it has produced chillies without any chemical either in the form of fertilizer or in the form of pesticides. It is suggested that by using these two natural products the Indian farmer will be benefitted financially and the people will be benefitted by getting organically produced vegetables without any harmful effects.

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