

Effect of different sources of organic manure on growth and yield of sweet pepper

Abstract

Indiscriminate use of chemical fertilizers is a common practice which is hazardous both for soil health and environment. It has been more than three decades that the global agriculture has been depicted towards organic agriculture owing to sustainability and reduced environmental effects. A pot experiment was conducted at IAAS, Lamjung Campus to study the effect of various sources of organic manure on the growth and yield of sweet pepper. The experiment was conducted in Complete Randomized Design using 7 treatments replicated thrice. Each treatment consisted of single pot with single plant. The treatments used were: Control, Chemical fertilizer, Vermi-compost, Poultry manure, Farm yard manure, Goat manure and Commercial organic fertilizer. Effect of different treatments on growth and yield of sweet pepper was affected significantly. The results revealed better growth and yield performance by vermi-compost followed by poultry manure over control and FYM. Chemical fertilizers, however, had similar yield as the previously mentioned treatments, but was slow in its flowering and fruiting behavior.

Keywords: sweet pepper, organic manures, vermi-compost, goat manure, poultry manure, chemical fertilizer, farm yard manure, soil health, capsicum annum, cash crop, green pepper, capsaicin, vitamin c, polyphenols, chlorophylls, carotenoids, sugars

Volume 3 Issue 5 - 2016

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Introduction

Capsicum (*Capsicum annum*) commonly known as Bell pepper or Sweet pepper or Green pepper belongs to family Solanaceae and is native to Mexico with secondary center of origin at Guatemala and Bulgaria.¹ Sweet peppers differ from common hot peppers in size and shape of the fruits, capsaicin content and usage. The fruits are non-pungent and have been widely used in immature or green stage as vegetable for stuffing or for salads. Considered as high cash crop, it has occupied an important rank in world agriculture due to its high profit and nutritional values for human health. Sweet pepper fruits are a rich source of vitamin C, polyphenols, chlorophylls, carotenoids, sugars,² magnesium, calcium, potassium, phosphorus and iron.³ The environmental conditions in the mid hills of Nepal are very conducive for producing excellent quality fruits of bell pepper.⁴

Application of chemical fertilizers alone can supply only one or two nutrient elements to the crop. On the other hand, supplying only organic inputs can improve soil physical and biological environment but suffers from drawback of low content of plant nutrients. However, in the modern days, when agriculture is motivated not only for production, but also accounts for the sustainability of all the resources including soil for the generations to come. The use of chemical fertilizers has been many-a-times reported for degrading soil and water resources. Moreover, organic farming is both a philosophy and a system of agriculture,⁵ which avoids or largely excludes the use of synthetically produced fertilizers, pesticides and to the maximum extent possible relies upon crop rotations, crop residues, animal manures, legumes, green manures, off farm organic wastes, mineral bearing rocks and bio-fertilizers to maintain soil productivity and to

supply plant nutrients and biological means to control insects, weeds and other pests. Thus, this experiment was carried out in order to study the effect of various sources of plant nutrients on growth, development and yield of sweet pepper and to compare the nutrient value of various sources of organic manure used in production of sweet pepper.

Materials and methods

The research was carried out in pots at Lamjung Campus, IAAS during 2015 at an altitude of 625masl. The pot media was made by mixing soil collected from upland orchard mixed with the amount of various sources of organic manure as per the treatment. The experiment was carried out in Complete Randomized Design (CRD) with 7 treatments replicated thrice. The treatments consisted of different sources of organic manure compared to that of untreated control and chemical fertilizer. The different sources of organic manure used were Poultry manure, Goat manure, Vermi-compost, farm yard manure and Commercially available Organic fertilizer. Weeding, crop management and harvesting was done manually. Various growth and yield attributes were examined at various times of crop cycle.

Results and discussion

The analysis of data obtained from the experiment showed varied response of the plant nutrient materials applied to the crop (Table 1).

Days to first flowering

Days to first flowering was significantly accelerated by poultry manure and vermicompost, which was significantly rapid than the other treatments. This is a profound phenomenon exhibited for a

longer indeterminate reproductive growth which ultimately aids to the overall fresh pepper yield. Moreover, FYM produced the flowers significantly earlier than that by commercial organic fertilizer and control, both of which were better than chemical fertilizer. Chemical fertilizers tend to provide the plant nutrients readily and encourage vegetative growth, thereby, delaying the flowering phenomenon in sweet pepper.

Days to first harvest

The result of the experiment for the days to first harvest did not follow the exact trends of the days to first flowering. Use of poultry manure and vermicompost resulted in similar days to first harvest, which were significantly earlier than rest of the treatments, except that resulting from use of FYM. FYM, however, was found to be similar to control and goat manure in its influence in the days to first harvest, but was significantly early than chemical fertilizer and commercial organic fertilizer.

Plant height

Application of various manures and fertilizers showed varied influence on the final attainable plant height. Plant height obtained from application of poultry manure and vermicompost were similar, both of which were significantly taller than the ones produced by other treatment. All the other treatment produced plant height similar to each other.

Stem diameter

Poultry manure produced the largest stem diameter, which was significantly larger than rest of the treatment except that of vermicompost. Vermicompost, however, was at par with both poultry manure and FYM, but significantly robust than the other treatments. The overall stem diameter and other vegetative features gained by the use of organic sources of plant nutrients thereby can be correlated to higher dry matter accumulation as compared to tall succulent plants resulting due to use of chemical sources.

Number of branches

Vermicompost produced the significantly higher number of branches than the other treatments except poultry manure. Further, poultry manure was superior to all other treatments but was at par with goat manure, which was found to be superior than control in producing branches. Control was found to be at par with chemical fertilizer, FYM and commercial organic fertilizer.

Average fruit weight

Vermicompost produced the significantly heavier fruits than the other treatments except poultry manure. Further, poultry manure was superior to all other treatments but was at par with FYM. FYM proved to be superior in terms of fruit weight than chemical fertilizer and commercial organic fertilizer, but similar to goat manure. Moreover, goat manure, chemical and organic fertilizers were similar among each other, but superior to control (Table 2).

Table 1 Effect of various treatments used on phenological and morphological parameters of sweet pepper

Treatment	Days to 1st flower	Days to 1st harvest	Plant height at harvest (cm)	Stem diameter (cm)
C	50c	72bcd	28.3b	6.1c
CF	60d	80d	28.8b	7.7c
VC	26a	54a	38.5a	11.0ab
GM	50c	69bc	28.0b	7.5c
FYM	36b	63ab	32.1b	8.5bc
PM	30a	55a	38.7a	11.9a
COF	52c	76cd	32.1b	6.6c
Lsd	5	10	5.97	2.9
CV%	6.5	8.5	10.4	19.6
Grand mean	44	67	32.4	8.5

Treatments: C, control; CF, chemical fertilizer; VC, vermi-compost; GM, goat manure; FYM, farm-yard manure; PM, poultry manure; COF, commercial organic fertilizer (MAXO). The means were separated by using Least Significant Difference (LSD) at 5% level of significance. The treatments with same letter(s) are non-significant to each other.

SPAD

SPAD reading is considered to be highly correlated to the chlorophyll content of the leaves. SPAD reading was most prominent in chemical fertilizer, which was superior to all the treatments except vermicompost.

Yield per plant

Use of vermicompost and poultry manure showed superior yielding caliber in sweet pepper producing yield superior than control and commercial organic fertilizer. The other treatments however were similar to each other in their yielding capacity.

Chemical fertilizers tend to provide the plant nutrients readily

and encourage vegetative growth, thereby, delaying the flowering phenomenon in sweet pepper. Moreover, use of bulky organic manures accelerated the flowering than commercial organic fertilizer, chemical fertilizer and control was also reported by Abu-Zahara⁶ suggesting the phenomenon to be developed by the increased temperature in the rhizosphere due to decomposition of those substrates.

Positive response of vermi-compost in different growth parameters of sweet pepper is due to fact that it increases the microbial population and also provides the source of energy to sustain them and remain active.⁷ It increases the plant growth and yield by providing nutrients in the available form as compared to other organic manures and conventional inorganic fertilizers. Vermicompost retains nutrients for long time while the conventional compost fails to deliver the required

amount of macro and micronutrient including the vital NPK to plants in shorter time. Euras⁸ reported that the vermin-compost is proving to be highly nutritive organic fertilizer and more powerful growth promoter over the conventional composts. The Vermicomposting accelerates the rate of decomposition of the organic matter, alters the physical and chemical properties of the material, and lowers the C: N ratio, leading to a rapid humification process in which the unstable organic matter is fully oxidized.⁹ Application of vermin-compost to soils increased their microbial biomass and dehydrogenase activity.¹⁰ This increase in microbial mass and dehydrogenase activity helps in nitrogen fixation and increase the availability to the crop and boost up the growth and development. Rosen & Bierman¹¹ reported it improves soil structure or tilt and increases its water holding capacity.

Table 2 Effect of various treatments on yield attributes and yield of sweet pepper

Treatment	Number of branches	Average fruit weight (g)	SPAD	Yield per plant (g)
C	7d	21.4e	29.8cd	62.3c
CF	9cd	27.0d	51.1a	91.7abc
VC	15a	36.6a	49.9ab	126.7a
GM	11bc	28.1cd	39.5bc	99.3abc
FYM	10cd	32.0bc	26.0d	105.3ab
PM	14ab	35.9ab	39.5bc	120.3a
COF	9cd	26.3d	40.6b	81.7bc
Lsd	3.3	4.5	10.4	38.4
CV%	17.1	8.8	14.8	13.8
Grand mean	11	29.6	39.5	98.2

Treatments: C, control; CF, chemical fertilizer; VC, vermi-compost; GM, goat manure; FYM, farm-yard manure; PM, poultry manure; COF, commercial organic fertilizer (MAXO). The means were separated by using Least Significant Difference (Lsd) at 5% level of significance. The treatments with same letter(s) are non-significant to each other.

Conclusion

The experiment showed that the use of vermicompost was better for sweet pepper growth and development as compared to other organic manures and chemical fertilizers used in the experiment. The use of commercially available organic fertilizer was seen to be a poor choice. The use of other organic manures and chemical fertilizer were similar concerning the growth and yield of sweet pepper. The use of high cost-chemical fertilizer can be readily substituted by farm-produced organic sources of plant nutrients and thus aid in sustainable and efficient resource use. However, it is important to note the better results of vermi-compost as the source of organic manure in sweet pepper.

Acknowledgements

None.

Conflict of interest

The author declares no conflict of interest.

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