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Effect of bio compost, cow dung compost and NPK fertilizers on growth, yield and yield components of chili

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Abstract

To investigate the effects of bio compost, cow dung compost and NPK fertilizers on growth, yield and yield components of chili the experiment was conducted randomized block design with three replications at Botanical Garden of Rajshahi University Campus, Bangladesh during August 2008 to February 2009. There were 15 treatments viz. T_1 = bio compost (3 kg/pot) + NPK, T_2 = bio compost (2 kg/pot) + NPK, T_3 = bio compost (1.5 kg/pot) + NPK, T_4 = bio compost (3 kg/pot), T_5 = bio compost (2 kg/pot), T_6 = bio compost (1.5 kg/pot), T_7 = cow dung compost 3 kg/pot + NPK, T_8 = cow dung compost (2 kg/pot) + NPK, T_9 = cow dung compost (1.5 kg/pot) + NPK, T_{10} = cow dung compost (3 kg/pot), T_{11} = cow dung compost (2 kg/pot), T_{12} = cow dung compost (1.5 kg/pot), T_{13}= NPK, T_{14}= bacterial suspension, T_{15}= control (only soil). Bio compost and NPK significantly (p=0.05) influenced the growth and yield of chili. The treatment bio compost (3kg/pot) +NPK (T_1) produced the highest germination (%), vigour index, growth and yield of chili and the lowest yield and yield contributing parameters were recorded in control (T_{15}). The correlation matrix showed that yield per plant of chili had significant and positive correlation with plant height (r = 0.929**), leaf number (r = 0.808**), number of primary branch (r = 0.918**), secondary branch (r = 0.985**), root number (r = 0.953**), root length (r = 0.947**), total number of flower at maximum flowering time(r = 0.981**), total number of fruit (r = 0.966**), fruit length (r = 0.917**), fresh fruit weight (r = 0.990**), dry fruit weight (r = 0.800**), number of seed/ fruit (r = 0.861**) and hundred seed weight (r = 0.954**) and yield was significant and negative correlation (r = -0.906**) with number of days required for first flower initiation. The results suggest that inorganic fertilizers (NPK) with bio compost (3kg/pot) is suitable for better production of chili that may increase soil fertility and this integrated approach could be contributed to improve crop production.

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Introduction

Solid waste management is becoming critically important in modern days. Many countries are trying to find alternatives for traditional land filling and incinerations. Everyday huge quantities of solid waste materials are generated in all City Corporation and Pourosova of Bangladesh. The amount of MSW generations are 5340, 520, 170 and 130 tons/day for Dhaka, Khulna, Rajshahi and Barisal city, respectively and the per capita waste generation rates are varied from 0.325 to 0.485 kg/day for four major cities of Bangladesh (Ahsan, 2010). The safe disposal of garbage is a major complex problem in Bangladesh that can affect the air, land, water and environment, as a result different diseases spread. Therefore, proper operation, maintenance and appropriate technology are to be developed to overcome the serious problems by adding proper management and utilization of garbage. Conversion of garbage into valuable organic compost seems to be an immediately solution of the problems (Walker and Willson, 1973). Microorganisms are important biological organisms helping nature to maintain nutrient flows from one system to another and also minimize environmental degradation. There are various types of microbes in the environment. Between theses microbe's bacteria, are the most important microbes for decomposition of waste.

Bacteria use wastes for the own metabolism and finally they produce some simple and useful compounds from them which are important for soil health, plant growth and over all to keep well balance of natural ecosystem. Compost is a mixture of decayed plants debris or organic matter, food etc. which is a rich source of plant nutrient. It can maintain a healthy soil environment for plant growth and development. This can reduce the use of chemical fertilizers in agriculture, which in directly helps a friendly environment. A good soil should have an organic matter content of more than 3 %. But in Bangladesh, most soils have less than 1.5 %; some soils have less than 1 % organic matter (BARC, 1997). Nowadays gradually deficiencies in soil organic matter and reduced yield of crop are alarming problem in Bangladesh (Alam *et al.*, 2007). The cost of inorganic fertilizers is very high but the organic manure is easily available and low cost. The use of readily available organic sources of nutrients should be used to maximize the economic return. The use of pesticides and inorganic fertilizers does not necessarily lead to better farming than the use of natural and organic methods in agriculture. Due to continuous application of only inorganic fertilizers and plant protection chemicals in agriculture, our soils have been badly degraded. It has destroyed stable traditional ecosystem of the soil (Palaniappan and Annadurai, 1999). There is need to encourage more productive, cost efficient and eco friendly farming system (Bhattacharya and Gehlot, 2003). The use of organic manure has been the need of by production input for improving the sustainable productivity of soil. Addition of compost improves soil structure, texture and tilth (Hesse and Mishra, 1982). Bio composts have gained importance since the fertilizers and pesticides cause a lot of environmental problems and health hazards and soil degradation (Ghugare *et al.,* 1988). Application of bio fertilizer encouraged plant growth and productivity of many crops was studied by some investigators (Abdalla *et al*., 2001 and Adam *et al*., 2002). Soil-application of compost provides an alternative to current methods of waste disposal, and at the same time may decrease the amount of water and fertilizer applied to crops (Ozores *et al.,* 1994). Municipal solid waste compost can also play a significant role in the development and maintenance of soil organic matter content (Parr and Hornick, 1992). Amending soil with mature and stable composted materials such as biosolids, MSW, and YT has been investigated extensively, and has been reported to increase vegetable crop yields on beans, black eye peas (*Pisum sativum* L.), okra (*Abelmoschus esculentus* L.) (Bryan and Lance, 1991) tomato (*Lycopersicon esculentum* Mill.), squash (*Cucurbita maxima* Duch. Ex Lam.), eggplant (*Solanum melongena*) and beans (Ozores-Hampton and Bryan, 1993a and b; Ozores-Hampton and Bryan, 1994; Ozores-Hampton *et al.,* 1994a and b), watermelon (*Citrullus vulgaris* Schrad.) and tomato (Obreza and Vavrina, 1994; Obreza and Reeder, 1994), corn (*Zea mays* L.) (Gallaher and McSorley, 1994a and b), and pepper (*Capsicum annuum* L.) (Roe *et al.,* 1993).

Use of bio compost for vegetable production in large scale can solve the problem for disposal of wastes and also solve the lack of organic matter. On the other hand, a judicious combination of organic and inorganic sources of nutrients might be helpful to obtain a good economic return with good soil health for the subsequent crops. Therefore, the main objectives of this present investigation were to evaluate the effect of different doses of bio compost and cow dung compost alone and their combination with inorganic fertilizer on growth, yield and yield contributing characters of chili.

Materials and methods

Experimental design

The experiment was carried out at the Botanical Garden, Rajshahi University, Bangladesh during August 2007 to February 2008 to assay the effect of bio compost, cow dung compost and NPK fertilizers on growth, yield and yield components of chili (*Capsicum annum* L). The experiment was arranged in randomized block design with three replicates and 10 chili plants were used in each replicates. There were 15 treatments viz. T_1 = bio compost (3 kg/pot) + NPK, T_2 = bio compost (2 kg/pot) + NPK, T_3 = bio compost (1.5 kg/pot) + NPK, T_4 = bio compost (3 kg/pot), T_5 = bio compost (2 kg/pot), T_6 = bio compost (1.5 kg/pot), T_7 = cow dung compost 3 kg/pot + NPK, T_8 = cow dung compost (2 kg/pot) + NPK, T_9 = cow dung compost (1.5 kg/pot) + NPK, T_{10} = cow dung compost (3 kg/pot), T_{11}= cow dung compost (2 kg/pot), T_{12} = cow dung compost (1.5 kg/pot), T_{13} = NPK, T_{14} = bacterial suspension, T_{15} = control (only soil). Each pot contain total amount of 6 kg with respective amount of bio compost, cow dung compost, NPK (0.54 gm urea, 0.08 gm TSP, and 0.48 gm MoP) and soil. The respective amount of bio compost, cow dung compost, urea, TSP and MoP were applied at the time of filling of soil into the pot. The rest of urea was applied at 20 days after sowing of seeds. For bacterial suspension treatment, combination of four bacterial strains suspension (*Bacillus* sp., *Micrococcus* sp. *Cellulomonus* spp. and *Pseudomonus* spp.) were applied at the rate of 50 ml/pot by pouring the liquid onto the pot soil at 7 days intervals up to harvesting of chili.

Production of bio compost

For production of bio compost, kitchen waste was collected from student hall dining, Rajshahi University Campus, Bangladesh and chopped into small pieces and pile method was followed (Rahman, 2009). Each pile contained 300 kg of chopped kitchen waste. The dimension of each pile was approximately 60 cm (width) × 132 cm (length) × 60 cm (height). For enhance composting process combination of four bacterial strains viz. *Bacillus* sp., *Micrococcus* sp., *Cellulomonus* spp., and *Pseudomonus* spp. were used as effective microorganism which were collected from the biotechnology and microbiology laboratory, Department of Botany, Rajshahi University, Bangladesh and these were previously isolated from soil, humus and garbage samples by Rahman (2008). Each bacterial strain were combined grew on BCD (Czapeck Dox) broth medium and mixed well with the chopped kitchen waste at the rate of 20 ml/kg and finally covered with polythene sheet. Every seven days, the moisture content of the treated kitchen waste was adjusted to 60 % through the addition of water before and during the composting process continued. When the temperature in compost piles reached the ambient temperature, addition of water was stopped although the composting process continued. Each compost pile was manually mixed with a shovel for about 10 minutes to turn the pile and provide aeration. This was done every 3-4 days until the compost piles reached maturity. At days 7, 14, 21, 28, 35, 42 and 49, after turning the compost piles, a 50 gm sub-samples was randomly collected from the compost pile and analyzed using some physical, biological and chemical parameters. Physical and biological parameters were determined in the Biotechnology and

Microbiology laboratory, Department of Botany, University of Rajshahi, Bangladesh and chemical characteristics of this bio compost were analyzed from the Soil Analysis Laboratory, Soil Resource Development Institute, Regional Office, Shampur, Rajshahi, Bangladesh. After 49 days of composting, when the compost was matured, the final physical and chemical characteristics of the bio compost were as; color: deep black, pH: 6.47±1.05, cfu's of the bacterial strains: $242\pm0.35\times10^6$/g, moisture content: 22.16±2.14 %, total Carbon 25.0±0.16%, C/N ratio: 11.70/1±1.58, organic matter: 42.87±1.87 %, total N: 1.75±2.32 %, total P: 1.28 ±3.48 %, total K: 1.48 ±2.97 %, total S: 0.46±1.48 %, Ca: 1.31±2.37 %, Mg: 0.65±1.57 %, Fe: 0.37±1.97 %, Mn: 119 ± 3.87 ppm, Cu: 107± 2.98 ppm, Zn: 56±0.98 ppm and B: 27±1.37 ppm.

Source of cow dung compost

Cow dung compost was collected from compost plant of the Botanical Garden of Rajshahi University campus, Bangladesh, where no effective microorganism was used for composting.

Soil preparation

Soil was collected from the research field of Rajshahi University campus, Bangladesh and sterilized with formaldehyde (formalin: water = 1:5 v/v) and covered with polythene. After 30 days of sterilization, soils were put in the earth pots (30 × 20 cm) (Hossain, 2000). To minimize the loss of excess water, a 2 cm hole was made from the bottom of earth pot.

Collection and sowing of seeds

The seed of chili variety Bogra Local was collected from Spice Research Centre, Bogra, Bangladesh. Seeds were soaked in water for 24 hours and wrapped with a piece of thin cloth for five hours. These moistened seeds were spread over the polythene sheet for two hours and these seeds were shown 10 seeds/pot.

Seed germination test and vigour index

For determination of seedling vigour index 5 seedlings were randomly selected from each pot and their individual shoot and root length were measured. The vigour of the seedlings was determined by following the formula of Abdul-Baki and Anderson (1973). Vigor index = [mean of root length (cm) + mean of shoot length (cm)] × percentage of seed germinations.

Data analysis

The experiment was carried out following Randomized Block Design (RBD) with three replicates and 10 chili plants were used in each replicates. Data on growth, yield and yield contributing parameters were recorded and statistically analyzed with the help of computer package program SPSS (SPSS Inc., Chicago, IL, USA) for DMRT and correlation matrix test.

Results and discussion

The present experiment was conducted to assay the effect of different doses of bio compost, cow dung compost alone and their combination with NPK fertilizers on growth, yield and yield contributing characters of chili and the results are presented in Table 1-3.

Seed germination percentage and vigour index

The seed germination percentage was significantly (P=0.05) affected by the application of different doses of bio compost, cow dung compost and NPK fertilizers. The seed germination percentages of chili were ranged from 60.32 to 98.91 (Table 1). The highest seed germination (98.91 %) was recorded in bio compost (3 kg/pot) + NPK (T_1) treatment, that was statistically similar with bio compost (3 kg/pot) (T_4) treatment and the lowest seed germination was recorded in control (T_{15}). The vigour index of chili was ranged from 281.31 to 868.65. The highest (868.65) vigour index was recorded in bio compost (3 kg/pot) + NPK (T_1) treatment that was significantly different from other treatments. The lowest (281.31) vigour index was also recorded in control (T_{15}). From this above findings it may be concluded that combination of bio compost (3 kg /pot) and NPK (T1) can increase seed germination % and vigour index of chili. In a similar study Rahman *et al.* (2010) found that application of *Trichoderma* compost with NPK fertilizers significantly increased the germination percentages and vigour index of chili.

Table 1. Effect of bio compost, cow dung compost (without bacteria) and NPK fertilizers on germination (%) and vigour index of chili at 7 days after sowing.

Treatments	Germination (%)	Shoot length	Root length	Vigour index
T_1	98.91 a	5.92 a	3.88 a	868.65 a
T_2	94.47 b	4.83 ab	3.74 ab	797.78 c
T_3	90.12 d	4.56 ab	3.65 ab	749.49 e
T_4	97.58 a	4.88 ab	3.81 ab	845.97 b
T_5	92.19 c	4.72 ab	3.68 ab	775.91 d
T_6	89.31 d	4.12 abc	3.42 ab	674.38 h
T_7	86.38 e	4.84 ab	3.78 ab	738.39 f
T_8	82.59 g	3.98 bc	3.49 ab	616.95 i
T_9	81.18 gh	3.91 bc	3.43 ab	593.22 j
T_{10}	84.49 f	4.65 ab	3.57 ab	691.45 g
T_{11}	81.35 gh	3.89 bc	3.18 ab	571.47 k
T_{12}	80.31 hi	3.79 bc	2.87 ab	527.47 l
T_{13}	73.37 j	3.77 bc	2.82 ab	485.29 m
T_{14}	79.31 i	3.72 bc	2.88 ab	448.47 n
T_{15}	60.32 k	2.21 c	1.93 b	281.31 o

In a column, figure having same letter(s) do not differ significantly by DMRT at the 5% level.

T_1 = bio compost (3kg/pot) + NPK, T_2 = bio compost (2 kg/pot) + NPK, T_3 = bio compost (1.5kg/pot) + NPK, T_4 = bio compost (3kg/pot), T_5 = bio compost (2kg/pot), T_6 = bio compost (1.5 kg/pot), T_7 = cow dung compost (3kg/pot) + NPK, T_8 = cow dung compost (2 kg/pot) + NPK, T_9 = cow dung compost (1.5kg/pot) + NPK, T_{10} = cow dung compost (3kg/pot), T_{11} = cow dung compost (2kg/pot), T_{12} = cow dung compost (1.5kg/pot), T_{13}= NPK, T_{14}=bacterial suspension, T_{15}= control (only soil).

Table 2. Effect of bio compost, cow dung compost and NPK fertilizers on growth characters of chili.

Treatments	Plant height (cm) at 60 DAS	Leaf no at 60DAS	Primary branch at 60DAS	Secondary branch at 60DAS	Root number at 60 DAS	Root length at (cm) 60 DAS	Number of days for first flower initiation	Number of flower at the maximum flowering time
T_1	36.89 a	82.17 a	7.68 a	84.92 a	88.82 a	16.38 a	63.89 m	52.68 a
T_2	34.52 bc	80.52 a	7.12 ab	80.54 c	80.46 c	14.21 b	66.22 l	48.18 c
T_3	31.41 de	75.33 c	6.73 ab	73.94 f	73.78 d	10.45 d	72.12 j	41.78 f
T_4	35.28 ab	81.31 a	7.53 a	82.48 b	82.18 b	15.91 a	65.54 lm	50.54 b
T_5	33.46 c	78.58 b	6.98 ab	78.24 d	78.94 c	13.58 bc	69.49 k	46.23 d
T_6	30.78 e	74.71 c	6.18 abc	70.82 g	70.12 e	8.63 e	75.48 i	34.92 g
T_7	32.81 cd	76.12 c	6.86 ab	76.14 e	75.16 d	12.38 c	71.81 j	44.12 e
T_8	29.92 e	72.92 d	5.63 bcd	68.55 h	68.59 e	7.91 ef	78.17 h	30.45 h
T_9	26.65 fg	66.34 f	4.58 cde	64.63 j	58.28 i	7.18 efg	88.63 e	18.28 j
T_{10}	28.12 e	70.36 e	4.63 cde	66.76 i	65.84 f	7.44 efg	80.21 g	28.98 h
T_{11}	25.57 g	64.91 f	3.89 de	62.48 k	66.92 f	6.82 efg	96.29 d	15.21 k
T_{12}	24.96 g	62.94 g	3.34 e	58.94 l	64.16 g	6.48 fg	98.41 c	11.48 l
T_{13}	27.52 f	68.91 e	4.42 cde	65.56 ij	62.48 h	6.32 fg	82.37 f	20.86 i
T_{14}	20.16 h	40.92 h	3.12 e	52.32 m	49.96 j	6.18 fg	102.92 b	8.22 m
T_{15}	12.38 i	16.32 i	2.94 e	48.91 n	46.16 k	5.98 g	126.21 a	6.91 m

In a column, figure having same letter(s) do not differ significantly by DMRT at the 5% level.

T_1 = bio compost (3kg/pot) + NPK, T_2 = bio compost (2 kg/pot) + NPK, T_3 = bio compost (1.5kg/pot) + NPK, T_4 = bio compost (3kg/pot), T_5 = bio compost (2kg/pot), T_6 = bio compost (1.5 kg/pot), T_7 = cow dung compost (3kg/pot) + NPK, T_8 = cow dung compost (2 kg/pot) + NPK, T_9 = cow dung compost (1.5kg/pot) + NPK, T_{10} = cow dung compost (3kg/pot), T_{11} = cow dung compost (2kg/pot), T_{12} = cow dung compost (1.5kg/pot), T_{13}= NPK, T_{14} = bacterial suspension, T_{15} = control (only soil).

Growth characters

After 60 days plant height, leaf number, primary branch, secondary branch, root number, root length and flower number were highest for bio compost (3 kg/pot) + NPK (T_1) treatment and lowest for T_{15} (control) treatment, with a significant difference ($p<0.05$). Application of bio compost (3 kg/pot) and NPK exhibited significantly influenced the required days for first flower initiation. The short duration of days required for first flower initiation in the same treatment and the highest days were required for control and bacterial suspension treatment. The results are fully agreement with the findings of Rahman *et al.* (2010). The similar result Ali and Zahan (2001) found that application of vermicompost with NPK significantly increased the plant growth of sesame and ladies finger. The same result were found Kabir (1998) and Azad (2000) who stated that combine application of manures and chemical fertilizers performed the highest plant height of cabbage. Bongkyoon (2004) reported that the plant height of tomato was higher when vermicompost and NPK fertilizer were used. Rini and Sulochana (2006) studied that growth promotion and yield was more pronounced when *T. harzianum* (TR20) + and *Pseudomonas fluorescens* (P28) were applied in conjunction with one another in chili. In a similar study Ashrafi *et al.* (2010) found that application of organic manure and NPKS significantly increased plant height, grain, husk, straw and root of rice.

Table 3. Effect of bio compost, cow dung compost and NPK fertilizers on yield and yield contributing characters of chili.

Treatments	Fruit number	Fruit length (cm)	Fresh fruit weight (gm) (5fruits/plant)	Dry fruit weight (gm) (5fruits/plant)	Number of seeds/fruit	100 seed weight	Yield/plant
T_1	62.38 a	8.61 a	23.98 a	3.58 a	289.78 a	0.96 a	24.49 a
T_2	58.54 bc	7.93 a	19.73 c	2.98 abc	272.91 abc	0.89 c	21.26 b
T_3	52.89 d	5.27 bc	14.72 ef	2.46 abcde	258.12 bcde	0.79 f	15.48 e
T_4	60.18 b	8.54 a	21.87 b	3.26 ab	278.98 ab	0.91 b	23.21 a
T_5	57.59 c	6.19 b	17.48 d	2.56 abcd	268.29 abc	0.87 d	19.53 c
T_6	48.23 e	4.89 bcd	13.93 f	2.39 abcde	256.36 bcde	0.75 g	13.93 ef
T_7	54.31 d	5.29 bc	15.98 de	2.49 abcd	260.18 bcd	0.81 e	17.81 d
T_8	45.13 f	4.56 bcd	12.98 fg	2.54 abcd	249.63 cde	0.71 h	12.62 fg
T_9	28.92 i	3.51 cde	7.36 i	1.54 cde	237.75defg	0.58 k	8.28 i
T_{10}	40.17 g	4.12 cd	11.36 g	2.13 abcde	246.32cdef	0.69 i	11.18 gh
T_{11}	22.73 j	4.39 bcd	6.59 ij	1.46 de	229.98efgh	0.52 l	7.26 ij
T_{12}	19.58 k	3.31 de	5.46 j	1.38 de	220.54fgh	0.49 m	6.18 j
T_{13}	31.29 h	3.83 cde	9.58 h	1.98 abcde	240.18cdef	0.65 j	10.64 h
T_{14}	13.38 l	3.26 de	4.89 j	1.12 de	212.34ghi	0.28 o	4.18 k
T_{15}	10.12 m	2.23 e	4.98 j	0.98 e	190.45 i	0.23 n	2.29 l

In a column, figure having same letter(s) do not differ significantly by DMRT at the 5% level.

T_1 = bio compost (3kg/pot) + NPK, T_2 = bio compost (2 kg/pot) + NPK, T_3 = bio compost (1.5kg/pot) + NPK, T_4 = bio compost (3kg/pot), T_5 = bio compost (2kg/pot), T_6 = bio compost (1.5 kg/pot), T_7 = cow dung compost (3kg/pot) + NPK, T_8 = cow dung compost (2 kg/pot) + NPK, T_9 = cow dung compost (1.5kg/pot) + NPK, T_{10} = cow dung compost (3kg/pot), T_{11} = cow dung compost (2kg/pot), T_{12} = cow dung compost (1.5kg/pot), T_{13} = NPK, T_{14} = bacterial suspension, T_{15} = control (only soil).

Yield and yield contributing characters

The highest total number of fruit, fresh fruit weight, dry fruit weight and number of seeds per fruit, 100 seed weight and yield/plant was recorded for bio compost (3 kg/pot) + NPK (T_1) treatment and the lowest for T_{15} (control) treatment. From this result it was observed that combine treatment with bio compost (3 kg/pot) and NPK was increased the yield of chili. These increases might be related to the positive effect of compost and microorganisms in increasing the root surface are per unit of soil volume, water-use efficiency and photosynthetic activity, which directly affects the physiological processes and utilization of carbohydrates. These suggestions are confirmed by analysis of bio compost which illustrates the higher levels nutrients and organic matter was in compost. Similar results were obtained by Zaied *et al.* (2003) on wheat. Rykobst *et al.* (1993) noted that application of S with NPK increased tuber yield of potato. Abdelaziz *et al.* (2007) reported that application of compost and microorganisms could replace conventional NPK fertilizers in the cultivation of rosemary (*Rosmarinus officinalis*), and consequently minimize environmental pollution by these compounds. Bongkyoon (2004) mentioned that the application of NPK and vermicompost showed an increment in the average tuber weight per plant.

Table 4. Correlation matrix among different parameters of Chili as influenced by treatments.

Parameters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.00														
2	0.963**	1.00													
3	0.869**	0.736**	1.00												
4	0.966**	0.885**	0.901**	1.00											
5	0.949**	0.877**	0.852**	0.969**	1.00										
6	0.808**	0.638**	0.883**	0.900**	0.883**	1.00									
7	-0.969**	-0.94**	-0.79**	-0.946**	-0.90**	-0.751**	1.00								
8	0.911**	0.798**	0.907**	0.974**	0.933**	0.913**	-0.916**	1.00							
9	0.935**	0.847**	0.901**	0.974**	0.928**	0.864**	-0.946**	0.991**	1.00						
10	0.832**	0.685**	0.911**	0.878**	0.875**	0.932**	-0.738**	0.852**	0.818**	1.00					
11	0.885**	0.742**	0.915**	0.959**	0.927**	0.948**	-0.865**	0.974**	0.954**	0.920**	1.00				
12	0.762**	0.643**	0.875**	0.773**	0.749**	0.752**	-0.676**	0.759**	0.757**	0.850**	0.811**	1.00			
13	0.854**	0.769**	0.819**	0.872**	0.859**	0.818**	-0.820**	0.864**	0.865**	0.802**	0.851**	0.656**	1.00		
14	0.971**	0.923**	0.866**	0.986**	0.953**	0.827**	-0.966**	0.957**	0.976**	0.809**	0.924**	0.744**	0.848**	1.00	
15	0.929**	0.808**	0.918**	0.985**	0.953**	0.947**	-0.906**	0.981**	0.966**	0.917**	0.990**	0.800**	0.861**	0.954**	1.00

** Significant at 5% level

1=60 days plant height, 2=leaf number after 60 days, 3= primary branch after 60 days, 4= secondary branch after 60 days, 5=root number after 60 days, 6=root length after 60 days, 7 = no. of days for first flower initiation, 8= number of flower at maximum flowering time, 9= number of fruit, 10 = fruit length, 11 = fresh fruit weight, 12 = Dry fruit weight, 13 = number of seeds per fruit, 14 = 100 seed weight, 15 = yield/plant.

Correlation matrix

The correlation matrix among different plant parameters are presented in Table 4. The correlation matrix showed that yield per plant of chili had significant and positive correlation with plant height (r = 0.929**), number of leaf per plant (r = 0.808**), number of primary branch (r = 0.918**), secondary branch (r = 0.985**), root number (r = 0.953**), root length (r = 0.947**), total number of flower at maximum flowering time(r = 0.981**), total number of fruit (r = 0.966**), fruit size (r = 0.917**), fresh fruit weight (r = 0.990**), dry fruit weight (r = 0.800**), number of seed/ fruit (r = 0.861**) and hundred seed weight (r= 0.954**) and yield was significant and negative correlation with number of days required for first flower initiation (r = -0.906**). This results indicated that yield of chili depends on plant height, number of leaf/plant, number of primary and secondary branch, number of flower, total number of flower at maximum flowering time, total number of fruit, fruit size, fresh fruit weight, dry fruit weight and hundred seed weight. The results are fully agreement with the findings of Rahman *et al.* (2010). In the similar study Alam *et al.* (2007) reported that growth and yield of red amaranth were significantly increased with the application of vermicompost and NPKS and that was significantly and positively correlated with total dry matter, plant height, leaf length and stem length.

Conclusion

From the above findings, it can be concluded that the compost produced by bacteria and kitchen waste has high nutrient values which can be used effectively as bio compost or soil amended and this compost also can reduce the application of organic fertilizer. Moreover, integrated application of bio compost or combination of bio compost and NPK showed better performance and gave the highest yield. So, bio compost can play a vital role in depletion of chemical fertilizer or increasing of soil fertility and this integrated approach can contribute to improve crop production.

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