

## Effect of cattle manure and poultry litter on growth and yield of Red Amaranth

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**Abstract:** The experiment was carried out to evaluate the effect of cattle manure and poultry litter on the growth and yield of red amaranth. There were five treatment consisting of control (No manures), cattle manure (10t/ha), poultry litter (5t/ha), Cattle manure+ Poultry litter (5 t/ha+2.5 t/ha) and Cattle manure+ Poultry litter (10 t/ha+5 t/ha). All the treatment significantly influenced most of the growth and yield components of red amaranth. The plant height, shoot length, root length, leaf number and yield were highest where cattle manure (10t/ha)+ poultry litter (5 t/ha) was applied. All the above parameters were lowest where no manures were applied (control). The results of the experiments demonstrated that yields of red amaranth under cattle manure+ poultry litter(10 t/ha+ 5 t/ha) treatments was 11.77 t/ha. Highest organic matter status of soil (2.445%) was also recorded in the same treatment. From these results it was clear that cattle manure+ poultry litter(10 t/ha+ 5 t/ha) was the best for soil quality, growth and yield of red amaranth.

**Key words:** Red amaranth, cattle manure, poultry litter.

### Introduction

Bangladesh is one of the least developed countries of the world with an area of 147570 sq. Kilometers (BBS, 2003). The population is 149.7 million with a growing rate of 1.48% per annum (UNDP, 2004). The agriculture sector is the single largest contributor to income and employment generation and a vital element in the country's challenge to achieve self-sufficiency in food productions reduce rural poverty and foster sustainable economic development. Chemical fertilizers are indispensable for the crop production of modern agriculture. Use of chemical fertilizers accelerates the depletion of soil organic matter and impairs physical and chemical properties of soil. Organic sources are the major components of sustainable agriculture. There are many organic sources in Bangladesh. The production of cattle manure in the country is about 225 million tons; while other animals and poultry excreted 9.3 million tons litter per years (BBS, 2004). Therefore, the present study was undertaken to evaluate the effect of cattle manure and poultry litter on growth and yield of red amaranth as well as fertility status of soil.

### Materials and Methods

The experiment was laid out in randomized complete block design with three replications. The total number of plots for red amaranth was 15. The size of a unit plot was 1.0m× 1.0m. Inter-block and inter-plot spacing was 0.50m and 0.50m, respectively.

Five treatments viz. No manures (T<sub>0</sub>), T<sub>1</sub> = Cattle manure (10 t/ha), T<sub>2</sub> = Poultry litter (5 t/ha), T<sub>3</sub> =Cattle manure+ poultry litter (5t/ha+2.5t/ha), T<sub>4</sub> = Cattle manure+ poultry litter (10t/ha+5t/ha), were used in this experiment.

Data on plant height (cm), shoot length (cm), root length (cm), leaves/plant, yield/plot(gm), were taken. in case of soil parameters soil pH was measured by using a glass electrode pH meter. The soil- water ratio was maintained at 1:2.5 as described by Ghosh *et al.* (1983).

Organic carbon of the soil sample was estimated by the wet oxidation method of Black . The underlying principle of this method is to oxidize the organic matter with an excess of K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> in presence of concentrated H<sub>2</sub>SO<sub>4</sub> to titrate the residual k<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution with 0.5 MFeSO<sub>4</sub>. The organic carbon with Van Bemmelen conversion factor 1.724 (Ghosh *et al.*, 1983).

The total soil nitrogen was determined by micro-Kjeldahl method as outlined by Jackson (1962) through the digestion of organic matter with concentrated H<sub>2</sub>SO<sub>4</sub>.H<sub>2</sub>O<sub>2</sub> and catalyst mixture of potassium sulphate, copper sulphate and selenium powder in the ratio of 10:1:1. After completion of digestion, 40% NaOH was added with digestion mixture for distillation. Finally the distillate was titrated with standard H<sub>2</sub>SO<sub>4</sub> until the color changed from green to pink. The amount of N was calculated using the following formula. %N = (T-B) ×N×1.4/S. Where, T = Sample titration value (ml) of standard H<sub>2</sub>SO<sub>4</sub>, B=Blank titration value of standard H<sub>2</sub>SO<sub>4</sub>, N=Normality of standard sulphuric acid, S=Sample weight in gram.

The collected data were compiled and tabulated in proper form and were subjected to statistical analysis. The analysis of variance was done following the computer package MSTAT. The mean differences were adjudged by DMRT (Gomez and Gomez, 1984) and ranking was indicated by letters.

### Results and Discussion

The present study was carried out to investigate the effect of cattle manure and poultry litter on properties of soil and the growth, yield and quality to red amaranth.

#### Effect of cattle manure and poultry litter on soil properties

**Soil pH:** The pH of the post harvest soil was influenced by the application of different treatments and it was ranged from 5.427 to 6.327 (Table 1). The maximum numerical value (6.327) of soil pH was observed from control (T<sub>0</sub>) treatment and minimum numerical value(5.227)was observed in T<sub>4</sub> treatments where cattle manure + poultry litter (10t/ha+5t/ha) were applied (Table1). All the treatments except T<sub>1</sub> slightly decreased the soil pH as compared to pre-plant soil. Decrease in soil pH within 1to 4 months was probably due to the production of organic acids during organic manure decomposition or by nitrification (Chen and Avenimelech, 1986). This might be due to organic matter released organic acids through decomposition leading to a decreasing effect on soil pH.

**Organic carbon:** The cattle manure and poultry litter significantly influenced the organic carbon of the post harvest soil. The maximum organic C (1.410%) was obtained in T<sub>4</sub> treatments and minimum organic C (1.237%) was recorded in control (T<sub>0</sub>) treatments (Table

1). In the present study highest organic carbon was obtained where cattle manure + poultry litter (10 t/ha + 5 t/ha) were applied and this treatment was more efficient than other organic treatments. Organic carbon increased

due to the application of organic manure (Mathew and Nair, 1997). Increase in organic carbon level of soil after application of farmyard manure and green manure. Similar results were also reported by Gao and Chang (1996).

**Table 1.** Effect of cattle manure and poultry litter on soil properties

Treatment	pH	Organic Carbon (%)	Organic Matter (%)	Total Nitrogen (%)
T <sub>0</sub>	6.327a	1.237c	2.157c	0.080e
T <sub>1</sub>	6.120a	1.3327b	2.280b	0.141d
T <sub>2</sub>	5.427b	1.357ab	2.349ab	0.152b
T <sub>3</sub>	6.121a	1.347b	2.339ab	0.145c
T <sub>4</sub>	5.277b	1.410a	2.445b	0.162a
CV (%)	3.87	2.60	2.27	2.33

Figure(s) in the column having common letter(s) do not differ significantly whereas figures having dissimilar letters differ significantly at 5% level of probability. T<sub>0</sub> = No manures, T<sub>1</sub> = Cattle manure (10 t/ha), T<sub>2</sub> = Poultry litter (5 t/ha), T<sub>3</sub> = Cattle manure+ poultry litter (5t/ha+2.5t/ha), T<sub>4</sub> = Cattle manure+ poultry litter (10t/ha+5t/ha).

**Organic matter:** The organic matter content of the post harvest soil found to be significantly increased in all treatments as compared to the initial soil except control (T<sub>0</sub>). Soil organic matter content due to the treatment ranged from 2.157-2.445% after harvesting of crops. The maximum value of organic matter content (2.445%) was recorded in T<sub>4</sub> treatments where as minimum value (2.157%) was observed from control (T<sub>0</sub>) treatments. So it can be stated that T<sub>4</sub> was more efficient than other organic manure treatments. Nearly Similar result was supported by (Azim, 1999) where it was showed that application of organic manures increased the organic matter content in soil.

**Total nitrogen in soil:** There was significant effect of cattle manure and poultry litter on the total N of post harvest soils. The highest N content (0.162%) was obtained where cattle manure + poultry litter (10 t/ha + 5 t/ha) was applied and lowest value (0.080%) was obtained from control treatment (Table 1). The data indicated that cattle manure and poultry litter showed better performance

in maintaining total N in soil. Application of organic manure increases the total N content in soil reported by Abdel and Hussain (2001). Hence it can be stated that addition of full dose cattle manure with full dose poultry litter may be regarded as the best practiced during crop cutting due to ensure productivity of soils in Bangladesh.

**Effect of cattle manure and poultry litter on growth and yield of red amaranth**

**Plant height (cm):** The plant height of red amaranth was significantly influenced by different treatments. The maximum plant height (31.28 cm) was observed in T<sub>4</sub> (full dose cattle manure+ full dose poultry litter) treatment and lowest plant height (21.00 cm) was obtained in control (T<sub>0</sub>). Table 2 showed that poultry litter was superior to cattle manure and mixed organic manures produced best result than that of single one. Jin *et al.* (1996) reported that the application of cattle manure increased plant height of red amaranth. Similar results were also found by Budhan *et al.* (1991) in rice.

**Table 2.** Effect of cattle manure and poultry litter on the growth and yield of red amaranth

Treatment	Plant height (cm)	Shoot length (cm)	Root Length (cm)	Number of leaves/plant	Yield/plot (kg)	Yield (t/ha <sup>-1</sup> )
T <sub>0</sub>	21.00 d	16.37 d	5.410c	10.28c	0.5533b	5.533b
T <sub>1</sub>	25.25 c	21.36c	6.423b	14.77b	0.6467b	6.467b
T <sub>2</sub>	28.00 a	23.20 a	7.023ab	17.28 ab	1.087a	10.87a
T <sub>3</sub>	27.00 b	22.44b	6.627b	12.22ab	1.097a	10.97a
T <sub>4</sub>	31.28 a	23.91 a	7.650 a	17.94a	1.177a	11.77a
CV (%)	7.12	9.15	7.34	9.53	23.49	23.21

Figure(s) in the column having common letter(s) do not differ significantly whereas figures having dissimilar letters differ significantly at 5% level of probability. T<sub>0</sub> = No manures, T<sub>1</sub> = Cattle manure (10 t/ha), T<sub>2</sub> = Poultry litter (5 t/ha), T<sub>3</sub> = Cattle manure+ poultry litter (5t/ha+2.5t/ha), T<sub>4</sub> = Cattle manure+ poultry litter (10t/ha+5t/ha).

**Shoot length (cm):** Significant shoot length was recorded from the different levels of treatments. Combined effect of both cattle manure and poultry litter on shoot length was more significant than others. The maximum shoot length (23.91 cm) was appeared from the cattle manure+ poultry litter (10t/ha+ 5t/ha) treatment and lowest shoot length

(16.37 cm) were obtained from control. Hence it can be stated that mixed organic manures were more efficient than other single organic manures. The result might be due to higher N level in organic manures that soil received over control. Nearly similar result was obtained by Islam (2006) from poultry manure.

**Root length (cm):** Plant root length was increased significantly due to various treatments. At 45 days the maximum root length (7.650 cm) was recorded in T<sub>4</sub> (full dose cattle manure+ full dose poultry litter) treatment and maximum root length (5.410 cm) was observed from control (T<sub>0</sub>) treatment. So it is from the study that combinations of poultry litter and cattle manure (T<sub>4</sub>) produced better result than that of other treatments. More or less similar result was supported by Samsunnahar (2006) in case of red amaranth.

**Leaf Number:** Leaf number varied significantly among the treatments. The results shown in the table 2, it was obvious that maximum leaf number/plant (17.94) was recorded from cattle manure+ poultry manure (10t/ha+5t/ha) treatment. On the other hand minimum value of leaf number/plant (10.28) was found in control treatment. Poultry litter, 1/2dose cattle manure+1/2dose poultry litter also showed significant effect on leaf number. Nearly similar result was obtained by Islam *et al*, (2006) from organic manures and chemical fertilizers alone and in combination. In the present study, highest significant result was obtained in full dose cattle manure+ full dose poultry litter, because combination of cattle manure and poultry litter is more efficient than single application of organic manures (Ansari, 2005).

**Yield (t/ha):** Table 2 revealed that maximum yield/plot (1.187kg) was recorded from cattle manure + Poultry litter (10t/ha+5t/ha), where as control treatments showed lowest yield/plot(.5533kg). Table2 showed that, in case of production of red amaranth, T<sub>1</sub>: cattle manure (10t/ha), T<sub>2</sub>: poultry litter (5t/ha), T<sub>3</sub> and T<sub>4</sub> produced statistically identical yield although numerically different. From the result, it was found that T<sub>4</sub> gave the best performance. Results shown in Table1, also cleared that maximum and minimum yield (t/ha) of red amaranth was estimated as the value of 11.77 t/ha and 5.333 t/ha from T<sub>4</sub> and control treatment. Samsunnahar (2006) obtained maximum result from poultry manure+ inorganic fertilizer which was less than the result of the present study because mixed of organic manures are more efficient than mixed of organic and inorganic fertilizers.

The study revealed that T<sub>4</sub> treatment resulted the highest performance of vegetables (Red amaranth) yield attributes such as plant height, shoot length, root length, leaf number etc . In all cases minimum value of above parameters were recorded in control treatment where no organic manures were used. The results of soil analysis also indicated that T<sub>4</sub> treatment ensured highest value of organic carbon, organic matter and total nitrogen. Control treatment produced lowest value of soil organic carbon, organic matter and total nitrogen. P<sup>H</sup> was decreased in four

treatments than control which indicated that addition of more organic acids due to apply of organic manures.

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