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Effects of organic manures and chemical fertilizers on the yield of brinjal and soil properties

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Abstract

A field experiment was conducted at the Horticultural Farm of Bangladesh Agricultural University (BAU), Mymensingh during the period from December 2004 to April 2005 to evaluate the effect of manures and fertilizers on the yield of brinjal. There were five treatments consisting of organic, inorganic and combined sources of nutrients, of which the combined treatment (60 % organic +40% inorganic) showed the best performances. The maximum branching (20.1) with the highest number fruits/plant (15.2), fruit length (14.1 cm) and fruit diameter (4.3 cm) were found combined application of manures and fertilizers. The highest yield (45.5 t ha^{-1}) was also obtained from the combined application of organic and inorganic sources of nutrients. Application of mustard oil cake or poultry manure alone gave better performance compared to only chemical fertilizers. The organic matter content and availability of N, P, K and S in soil were increased by organic matter application. On the other hand soil pH was increased with chemical application than organic.

Keywords: Manure, Fertilizer, Yield, Brinjal, Soil properties

Introduction

Brinjal (*Solanum melongena*) is cultivated widely in Bangladesh. Unfortunately its yield is low. One of the major causes of low yield may be that the organic matter content as well as nutrient status of soils have declined over time. Maintenance of soil fertility is a prerequisite for long-term sustainable agriculture where organic manuring (Cowdung, poultry manure and mustard oil cake) can play a vital role in the sustenance of soil fertility and crop production (Jablonska, 1990).

Cowdung and poultry manures are the two suitable manures, but it is not possible to meet the nutritional requirements from the organic sources only. The potentialities of organic source is very limited to afford higher crop production due to slow release of plant nutrients from organic matter. Only one fifth to half of the nutrient supplied from manure was recovered and reminder was released any by 24 hours per annum (Miah, 1994). This may be concern for fertility maintenance but is obviously a barrier for higher plant nutrition uptake. To overcome this problem application of organic manures in combination with inorganic fertilizers, called integrated nutrient management, can play important role in brinjal cultivation. Integrated nutrient use has assumed great significance in vegetable production. This practice sustains the productivity of soils under highly intensive cropping systems (Singh and Yadav, 1992). Moreover the applicaiton of organic matter as a source of some portion of required nutrients will have positive impact on soil physical and chemical properties which ultimately will increase the productivity. Subbiah *et al.* (1985) obtained higher yields of tomato and eggplant with combined use of FYM and fertilizers. Considering the above facts, the present study was therefore under taken to investigate the effects of organic manure and inorganic fertilizer alone or in combination on yield and yield contributing characters of brinjal and on soil properties.

Materials and Methods

The experiment was carried out in a Randomized Complete Block Design (RCBD) from December 2004 to April 2005 at the Horticulture Farm of Bangladesh Agricultural University (BAU), Mymensingh. The test crop was brinjal (cv. Shingnath). The treatments, were T_1 (Cowdung @ 22857 kg ha^{-1}) , T_2 (mustard oil cake @1600 kg ha^{-1}), T_3 (poultry manure @ 5000 kg ha^{-1}), T_4 (chemical fertilizers @ 174 kg urea ha^{-1} , 125 kg TSP ha^{-1} and 50 kg MoP ha^{-1}) and T_5 (20% cowdung + 20% mustard oilcake + 20% poultry manure + 40% N+ P +K fertilizers). The N, P and K contents of the manures were tested in the laboratory and according to the results, the doses of manures were set in such a way that all the treatments contain same amount of N, P and K. Five plants were selected randomly from each unit plot to record yield contributing characters.

To study the effect of treatments on the physical and chemical properties of soil, the samples were tested in the soil testing laboratory of the Department of Soil Science, BAU. Soil pH was measured by glass electrode pH meter; organic carbon by wet oxidation method; Total N by micro kjeldahl method; exchangeable K and available S and P by standard method (Page *et. al*., 1989).

The collected data were analyzed statistically by F-test to examine the treatment effects and the mean differences were adjudged by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Results and Discussion

Effect of organic and inorganic farming on crop growth

It was observed that the application of organic and inorganic fertilizers solely or combinedly had a great influence on the vegetative growth of the crop. The highest number of branches $plant^{-1}$ (20.1) was recorded from the treatment T_5 containing 60% manures and 40% fertilizers (Table 1). Whereas, the lowest branching and leaves were found with T_1 (cowdung). Only organic manures could not increase the vegetative growth of plants and the reason may be that they released nutrients at a slower rate. On the other hand, the only application of inorganic fertilizer was also less effective than the combined application. These results were in conformity with the findings of Rahman *et al.* (1998) who found that the vegetative growth and yield of berry was the highest with the combined application of manures and fertilizers. For eggplant, the integrated use of urea and poultry manure also resulted in a higher nutrient uptake (Jose *et al.* ,1988).

Effect of organic and inorganic farming on flowering and fruiting

From the data it appeared that flowering and fruiting of brinjal were positively influenced by sources of nutrients applied. The maximum number of flowers (94.2) $plant^{-1}$ was produced by T_5 treatment (Table 1).The maximum number of fruits (15.2) $plant^{-1}$ was also noted with T_5 (combined treatment) (Fig. 1). In both the cases the lowest value was obtained from the treatment T_1 (cowdung only). The maximum length of fruits (14.1 cm) and the maximum fruit diameter (4.3 cm) was recorded with the combined treatment T_5 (Table 1). The maximum fruit weight (1.97 kg) was also obtained from T_5 treatment (Fig. 2).

The results were such that although the application of only organic manures maintained the good health of soil, they were slow to release adequate nutrients timely. From the other side, only inorganic fertilizers application could affect the soil health, which in turn may affect flowering and fruiting. So the combined application of manures and fertilizers may supply the nutrients timely and also maintain the suitable condition for flowering, fruiting and their growth. The finding is supported by Shelke *et. al.* (1999), who found the highest fruit yield with replacing of 60 % Urea-N by Poultry manure. Jablonska (1990) and Hosmani (1993) also reported that the combined use of organic maures and nitrogen resulted in higher yields of tomato, eggplant,pepper and chilli than either N fertilizer or organic sources used alone.

Table 1. Effect of organic and chemical fertilizer on growth, yield and yield contributing characters of brinjal

Treatment	No. of branches plant^{-1}	Length of fruit (cm)	Diameter of fruit (cm)	No. of Fruits/plant	Fruit weight/plant (kg)	Fruit yield (t/ha)
T_1	15.20^{d}	10.01^{e}	2.52^{c}	11.70^{c}	1.49^{b}	36.65^{c}
T_2	17.30^{bc}	12.05^{c}	2.96^{b}	13.10^{b}	1.72^{ab}	40.00^{b}
T_3	18.50^{b}	13.42^{b}	3.09^{b}	14.40^{a}	1.88^{a}	42.00^{b}
T_4	16.67^{c}	11.03^{d}	2.77^{bc}	12.20^{bc}	1.53^{b}	39.50^{b}
T_5	20.10^{a}	14.11^{a}	4.30^{a}	15.20^{a}	1.97^{a}	45.50^{a}
CV(%)	4.65	3.01	6.76	4.94	9.14	4.75

T_1=Cowdung, T_2=Mustard oil cake, T_3= Poultry manure, T_4=Chemical fertilizer, T5= organic + inorganic

Effect of organic and inorganic farming on fruit yield

Different types of organic and inorganic fertilizers had great effect on the yield of brinjal. The result revealed that the maximum fruit yield (45.5 t/ha) was recorded from plant grown with the T_5 (combined) treatment and the lowest was obtained from T_1 (cowdung), followed by T_4 (inorganic fertilizers) (Fig. 3). The reasons for such type of results may be that the combined application supplies the nutrients continuously and rapidly. This result is in agreement with the observation of Devi *et al.* (2002). They observed that treatment with 50 %N +25 % poultry manure + biofertilizer resulted in the highest yield (27.57 t/ha) and benefit cost ratio (7.27:1) in brinjal.

Effect of organic and inorganic farming on soil properties

The chemical properties of soil were influenced by different sources of soil nutrients (organic and chemical). Soil p^H varied significantly with the treatments and it decreased with organic manures application and combined application but increased with only chemical fertilizer application (Table 2). The result is supported by Yadav *et. al. (*2002). Soil organic matter was decreased by chemical fertilizer application but was increased with all types of organic manure application and that was recorded the highest with combined application (Table 2). The result is supported by Wells *et. al*. (2000).

Availability of major plant nutrients like N, P, K and S were also affected by organic cultivation of brinjal (Table 2). In all cases the nutrient availability increased and the highest availability of N, P and S was found from poultry manure and the highest availability of K was from cowdung followed by poultry manure. In all the cases the lowest value was found from chemical fertilizer application. The result might be due to improvement of other physical and chemical properties for organic manure application compared to the chemical fertilizer application.

Table 2. Effect of organic and inorganic farming of brinjal on chemical properties of soil

Treatments	Soil pH	Organic matter (%)	Total N (%)	Available P (ppm)	Exchangeable K (me/100g)	Available S (ppm)
T1	6.01^{c}	2.05^{cd}	0.16^{bc}	13.12^{b}	0.17^{a}	12.75^{ab}
T2	6.27^{ab}	2.67^{bc}	0.16^{ab}	13.59^{b}	0.16^{b}	12.09^{ab}
T3	6.13^{bc}	3.06^{ab}	0.17^{a}	14.91^{a}	0.17^{a}	13.50^{a}
T4	6.38^{a}	1.82^{d}	0.16^{c}	13.10^{b}	0.15^{c}	12.19^{b}
T5	6.19^{abc}	3.57^{a}	1.16^{bc}	13.55^{b}	0.16^{bc}	12.80^{ab}
CV (%)	2.04	4.06	3.09	5.08	3.47	5.28
Initial value	6.36	1.98	0.12	12.95	0.142	12.02

T_1= Cowdung; T_2= Mustard oil cake; T_3= Poultry manure; T_4= Chemical fertilizer; T_5= organic + Chemical

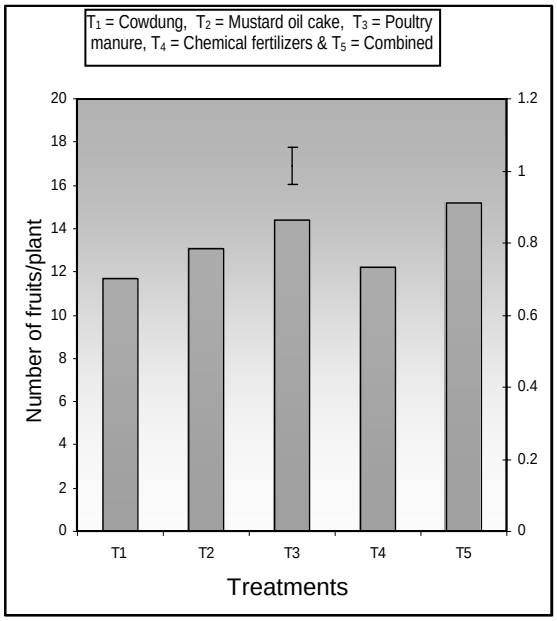

Fig. 1. Effect of different treatments on number of fruits/plant. The vertical bar indicates LSD value at 0.05 levels

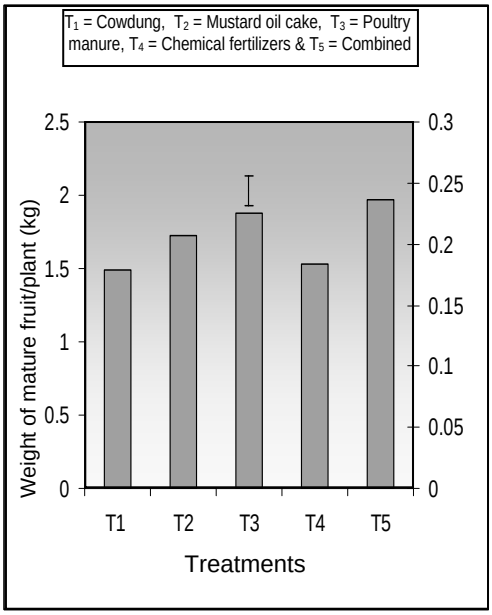

Fig.2 Effect of different treatments on weight of mature fruit/plant. The vertical bar indicates LSD value at 0.05 levels

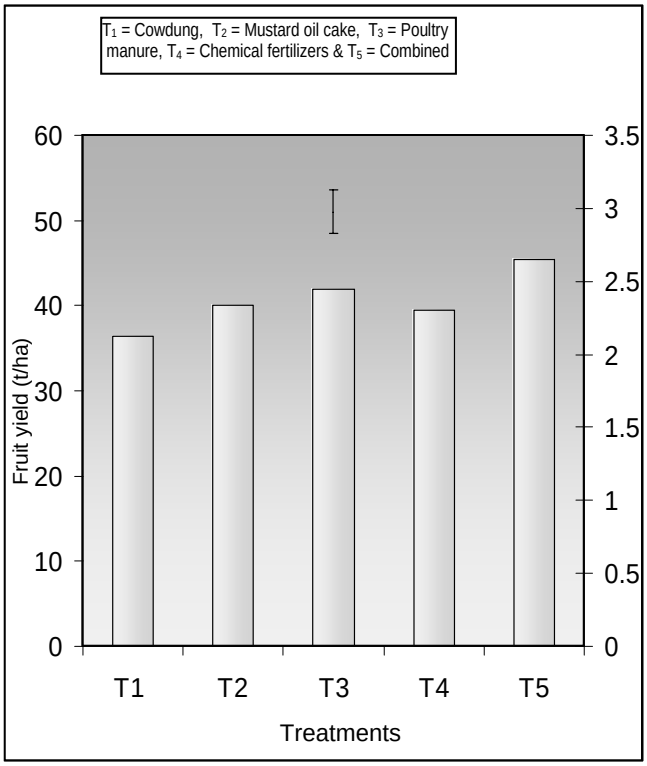

Fig. 3. Effect of different treatments on fruit yield. The vertical bar indicates LSD value at 0.05 levels

From the above discussion it may be concluded that in brinjal production combined application of organic and inorganic sources of nutrients can be more productive and this will also sustain the fertility and productivity of soil. For determination of an appropriate ratio of organic and inorganic sources the experiment may be repeated at different locations.

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