



## Growth and yield of okra influenced by different types of fertilizers and netting

MA Muqtadir, MA Islam\*, T Haque, A Nahar

Department of Horticulture, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

### Abstract

An experiment was conducted at the Horticulture Farm of Bangladesh Agricultural University, Mymensingh during the period from March 2017 to June 2017 with a view to evaluate the effect of different types of fertilizer and netting on the growth and yield of okra. The experiment consisted of 4 levels of fertilizer following cow dung 15 t/ha ( $F_1$ ), inorganic fertilizer (NPK) ( $F_2$ ), combined application of cow dung (2/3) + inorganic fertilizer (1/3) ( $F_3$ ), control ( $F_4$ ) and 2 levels of mosquito netting ( $N_0$  = control with no netting,  $N_1$ =blue colour Netting). The experiment was laid out in Randomized Complete Block Design (RCBD) with 3 replications. Overall, the growth like plant height, leaf length, pod length, pod diameter and pods numbers of okra was found higher from the combined effect of  $F_3N_1$  which was significantly different from other treatments combination. The lowest growth and yield of okra was found from the treatment combination of  $F_4N_0$  (control). First flowering were observed in  $F_3N_1$  at 39 days after planting of okra seeds. The control treatment without net gave the lowest production of okra compared to combination of inorganic fertilizer and cow dung with netting. In case of fertilizers effect, the highest yield (16.06 t/ha) was found from  $F_3$ . Blue colour net gave the highest yield (10.99 t/ha) compared to without net (8.88 t/ha). The highest yield of okra (17.55 t/ha) was found from the combined effect of  $F_3N_1$  which was 78.52% higher compared to control treatment combination  $F_4N_0$  (3.77 t/ha).

**Key words:** Cow dung, inorganic fertilizers, net, okra, yield

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\*Corresponding Author: [ashrafulmi@bau.edu.bd](mailto:ashrafulmi@bau.edu.bd)

### Introduction

Okra (*Abelmoschus esculentus* L.) under the family Malvaceae is also known as Lady's finger, considered one of the most important summer vegetables in Bangladesh. It is rich sources of vitamins, calcium, potassium, and other minerals and a mucilaginous preparation from the pod can be used as a blood plasma replacement. It is one of the most important warm season fruit vegetables grown throughout the tropics and recognized as one of the world's oldest cultivated crops (Anonymous, 2007). It plays a vital role in human diet (Saifullah and Rabbani, 2009).

The sustainability of conventional agriculture in Bangladesh is under threat from the continuous

degradation of land and water resources, as well as declining yield due to indiscriminate use of agro-chemicals. Use of synthetic fertilizers and pesticides in agricultural production increased tremendously after the green revolution (Goutam *et al.*, 2011). Environmental impacts of excessive applications of chemical fertilizers in Bangladesh have been reported (Muhibullah *et al.*, 2005). Excessive use of chemical fertilizers causes unforeseen environmental impacts and sensitivity to pests and diseases through the oversupply of nitrogen (Chen, 2006). Organic farming practices are the potential way to decrease the negative environmental impact of excessive amounts of chemical fertilizers (Aksoy, 2001 and

Chowdhury, 2004). Organic fertilizers are environmental friendly and improve soil health, water-holding capacity, high cation exchange capacity and low bulk density and they foster diverse population of beneficial soil microorganisms (Bulluck *et al.*, 2002, and Mohammad *et al.*, 2013).

Crop production is hampered due to increase in air temperature and intensity of solar radiation because of the climate changes and urbanization. One of the ways to cope with this trend is to protect the crops. Colour-shade net is an effective way, because it influences the microclimate to which the plant is exposed and offer physical protection against excessive radiation, insect pests (Shahak *et al.*, 2004).

Many physiological processes, from the emergence of seedlings to fruit development and maturity depend on the quantity and quality of the light. Application of shading net is one of the important factors that greatly influences the growth and yield of okra (Kyriakopoulou *et al.*, 2012). Akhter *et. al.*, (2019) found the highest yield of okra from the combined effect of vermin compost and netting which was 56.74% higher compared to control treatment combination.

Soil fertility of Bangladesh is reducing day by day due to applying excessive amount chemical fertilizers and pesticides for insects and diseases control. Combination of netting and fertilizers can help to increase yields during hot, sunny periods. It might be the opportunity to reduce the amount of inorganic fertilizers and improve the soil quality. Considering this, our plan was to find out the better combination of fertilizers (cow dung and inorganic fertilizer) with net on the growth and yield of okra.

## **Materials and Methods**

The experiment was conducted at the Horticulture Farm of Bangladesh Agricultural University (BAU), Mymensingh during the period from March, 2017 to June, 2017. It belongs to the Old Brahmaputra Flood Plain under AEZ (Agro Ecological Zone) 9. It was fertile

and well drained and slightly acidic with pH (6.85), having low organic matter with good irrigation facilities. One okra variety was used as the experimental material for this experiment named 'Momotaz Hybrid F1'. The seeds were collected from Notun Bazar in Mymensingh District. The variety is developed by Partex Agro Limited. Seeds were sown through dibbling method on 09 March 2017, maintaining 45 cm plant to plant and 60 cm line to line distance.

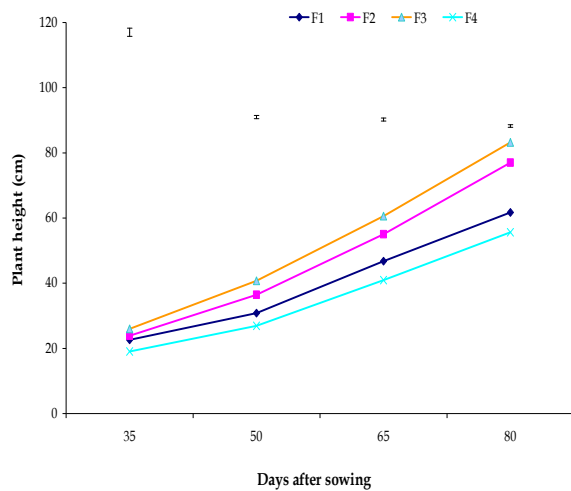
The experiment was considered of two factors experiments. Factor A (net-N), N<sub>0</sub>: Control (no net); N<sub>1</sub>: Net (blue color) and factor B (different types of fertilizers-F); F<sub>1</sub>: Cow dung (15 t/ha), F<sub>2</sub>: inorganic fertilizers (Urea = 174 kg/ha, TSP = 150 kg/ha, MoP = 150 kg/ha, according to FRG, 2012), F<sub>3</sub>: Combined application of 2/3rd cow dung (F<sub>1</sub>) and 1/3rd inorganic (F<sub>2</sub>) and F<sub>4</sub>: control were used in this experiment. The entire quantity of cow dung (15 t/ha) was applied just after opening the land. Full dose of TSP was applied to the soil at the final land preparation. Urea and MoP were applied as side dressing in 3 equal installments. The two-factor experiment was laid out in Randomized Complete Block Design (RCBD) with three replications where plot size was 4.32 m<sup>2</sup> (2.4 m x 1.8 m). Intercultural operations like weeding, gap filling etc. were done when necessary. To control insect-pest, bio pesticide (mixture of onion, garlic, neem leaves & fruits paste) @ 50 mL/L was sprayed at an interval of 15 days.

Five plants were selected randomly from each plot for collection of data and the average value was considered as one replication in case of each parameters. Plant height from the ground to the tip of stem and leaf length (4<sup>th</sup> no. of leaf) were measured at 35, 50, 65, 80 days after sowing. Number of fruits, days to first flowering, pod length (cm) and diameter (cm) were recorded. Pods were collected after every 2-3 days interval and total ten harvests recorded from the end of April to June, 2017. Yield per plot was converted to ton per hectare. The collected data were analyzed with the help of a computer package programme MSTAT-C and means were separated by using LSD test.

## Results and Discussion

**Effect of fertilizer on growth and yield of okra:** In the present study, growth and yield of okra were significantly influenced by different types of fertilizer application. Plant height (83.20 cm), number of leaves per plant (28.00) and leaf length (26.07 cm) were significantly higher at 80 days after sowing (Figure 1, 2 and Table 1) from F<sub>3</sub> fertilizer treatment (mixed of cow dung and inorganic fertilizer) compared to other treatment.

The application of F<sub>3</sub> took less days for first flowering (39 days) and first pod harvest (47.67 days) after sowing, and it was also accounted for enhancing yield parameters like number of pods per plant (17.08), pod length (17.67 cm), pod diameter (1.83 cm), individual wt. of pod (25.34 g) pod yield (16.06 t/ha) (Table 2 and Figure 3). On the other hand, control plot gave the lowest performance considering the growth and yield of okra. Prabu *et al.*, (2002) observed that the yield (14.17 t/ha) increased by 22.48% with the application of cow dung and inorganic fertilizers together.

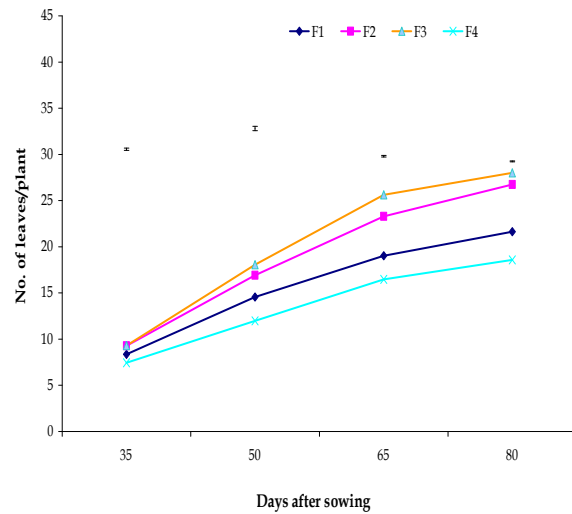


**Figure 1.** Effect of different fertilizers on plant height of okra at different days after sowing. Vertical bars represent LSD at 5% level of significance. F<sub>1</sub>=Cow dung (15 t/ha); F<sub>2</sub>=Inorganic (NPK); F<sub>3</sub>=Mixed (1/3 inorganic+2/3 cow dung); F<sub>4</sub>=Control.

**Table 1.** Effect of different fertilizers on leaf length of okra at different days after sowing (DAS).

Fertilizer doses	Length (cm) of leaves at different DAS			
	35	50	65	80
F <sub>1</sub>	10.70	14.93	18.57	20.00
F <sub>2</sub>	12.07	18.00	21.70	23.47
F <sub>3</sub>	13.17	21.07	24.23	26.07
F <sub>4</sub>	9.53	13.33	15.33	16.60
LSD <sub>0.05</sub>	0.29	0.16	0.32	0.56
Level of significance	**	**	**	**

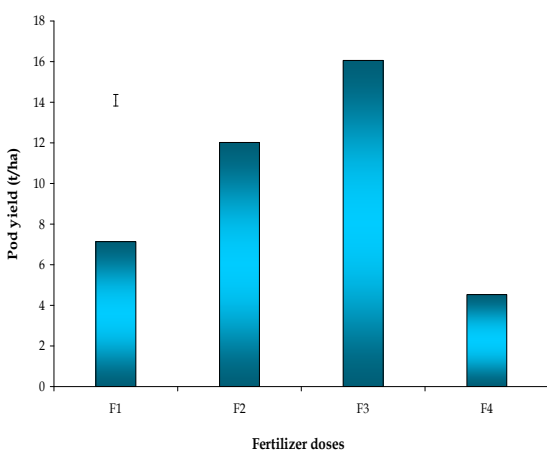
\*\*=Significant at 5 % level of probability, F<sub>1</sub>= Cow dung (15 t/ha); F<sub>2</sub>=Inorganic (NPK); F<sub>3</sub>=Mixed (1/3 inorganic+2/3 cow dung); F<sub>4</sub>= Control.



**Figure 2.** Effect of different fertilizers on number of leaves per plant of okra at different days after sowing. Vertical bars represent LSD at 5% level of significance. F<sub>1</sub>=Cow dung (15 t/ha); F<sub>2</sub>=Inorganic (NPK); F<sub>3</sub>=Mixed (1/3 inorganic + 2/3 cow dung); F<sub>4</sub>=Control.

**Table 2.** Effect of different fertilizers on yield and yield contributing characters of okra

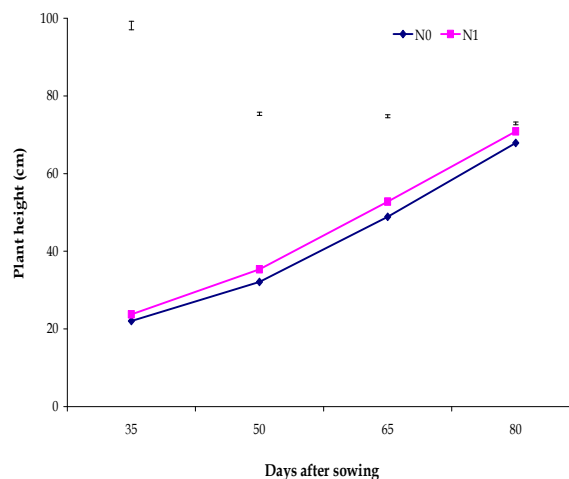
Fertilizers	Days required for 1st flowering	Days required for 1st pod harvest	No. of pods/plant	Individual weight of pod (g)	Pod length (cm)	Pod diameter (cm)	Pod yield/plot (kg)
F <sub>1</sub>	41.00	48.67	11.84	16.26	13.35	1.46	3.09
F <sub>2</sub>	39.83	48.33	14.70	22.02	15.90	1.74	5.19
F <sub>3</sub>	39.00	47.67	17.08	25.34	17.67	1.83	6.94
F <sub>4</sub>	42.67	50.33	10.30	11.80	12.95	1.44	1.96
LSD <sub>0.05</sub>	0.92	0.70	0.10	0.13	0.19	0.04	0.10
Level of significance	**	**	**	**	**	**	**



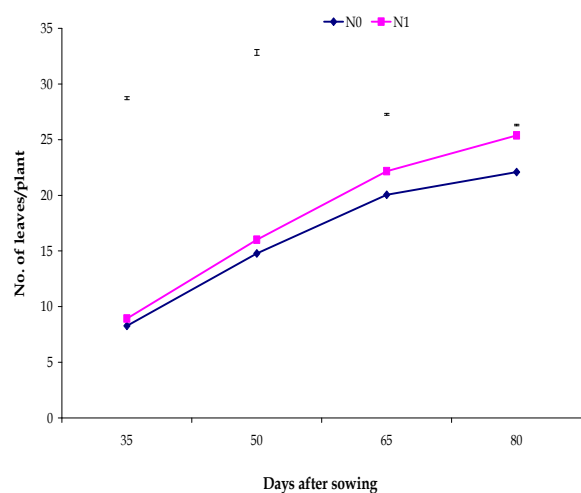
**Figure 3.** Effect of different fertilizers on yield of okra. Vertical bar represents LSD at 5% level of significance. F<sub>1</sub>=Cow dung (15 t/ha); F<sub>2</sub>=Inorganic (NPK); F<sub>3</sub>=Mixed (1/3 inorganic+2/3 cow dung); F<sub>4</sub>=Control.

**Effect of netting on the growth and yield of okra:** The effect of netting on growth and yield of okra is highly significant. Plant height (70.89 cm), number of leaves per plant (25.38) and leaf length (21.87 cm) were significantly higher at 80 days after sowing in case of netting (Figure 4, 5 and Table 3). The application of netting (N<sub>1</sub>) took less days for first flowering (40.25 days) and first pod harvest (48.42 days) after sowing and it significantly augmented yield parameters like number of pods per plant (14.23), pod length (15.31

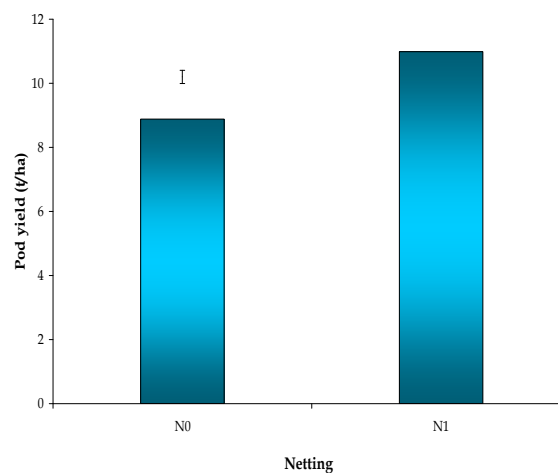
cm), individual wt. of pod (19.89 g), pod diameter (1.65 cm) and pod yield (10.99 t/ha) (Table 4 and Figure 6). On the other hand, control (without netting = N<sub>0</sub>) plot gave the lowest performance considering the growth and yield of okra. Plant height increment at the early stage of growth in maize by shade nets was also reported by Duhr and Dubas (1990). Aldazabal and Zamora (2000) also reported higher numbers of tomato fruits under shade net.



**Figure 4.** Effect of netting on plant height of okra at different days after sowing. Vertical bars represent LSD at 1% level of significance. N<sub>0</sub>= control, N<sub>1</sub>= netting.



**Figure 5.** Effect of netting on number of leaves per plant of okra at different days after sowing. Vertical bars represent LSD at 5% level of significance. N<sub>0</sub>= control; N<sub>1</sub>= netting.



**Figure 6.** Effect of netting on yield of okra. Vertical bar represents LSD at 1% level of significance; N<sub>0</sub>= control, N<sub>1</sub>= netting.

**Table 3.** Effect of netting on leaf length okra at different days after sowing (DAS).

Netting	Length (cm) of leaves at different DAS			
	35	50	65	80
N <sub>0</sub>	10.37	16.70	19.72	21.20
N <sub>1</sub>	12.37	16.97	20.20	21.87
LSD <sub>0.05</sub>	0.20	0.10	0.17	0.16
Level of significance	**	**	**	**

\*\*=Significant at 5 % level of probability, N<sub>0</sub>= Control, N<sub>1</sub>=Netting.

**Growth and yield of okra**

**Table 4.** Effect of netting on yield of okra

Netting	Days required for 1st flowering	Days required for 1st pod harvest	No. of pods/plant	Average weight of pod (g)	Pod length (cm)	Pod diameter (cm)	Pod yield/plot (kg)
N <sub>0</sub>	41.00	49.08	12.73	17.82	14.63	1.58	3.84
N <sub>1</sub>	40.25	48.42	14.23	19.89	15.31	1.65	4.75
LSD <sub>0.05</sub>	0.65	0.49	0.07	0.09	0.13	0.03	0.07
Level of significance	**	**	**	**	**	**	**

\*\*=Significant at 5% level of probability, N<sub>0</sub>=Control, N<sub>1</sub>=Netting.

**Combined effect of fertilizer and netting on the growth and yield of okra:** In case of combined effect of plant height, numbers of leaves per plant and leaf length were significantly influenced by different types of fertilizer application and netting (Table 5). The effect of combined application of fertilizers and netting on growth and yield of okra was highly significant (Table 5 and 6). Better growth and yield were obtained from combined fertilizer treatments F<sub>3</sub> (mixed of cow dung and inorganic fertilizer) compared to other treatment combinations. The application

of F<sub>3</sub>N<sub>1</sub> took less days for first flowering (38.67 days) and first pod harvest (47.33 days) after sowing, and also other parameters like pods per plant (17.67), pod length (18.08 cm), pod diameter (1.90 cm), individual wt. of pod (26.82 g) and pod yield (17.55 t/ha) were higher in the F<sub>3</sub>N<sub>1</sub> treatment (Table 6 and Figure 7). From this combination, the highest plant height reached to 84.63 cm at 80 days after planting. On the other hand, control plot gave the lowest performance considering the growth and yield of okra.

**Table 5.** Combined effect of different fertilizers and netting on plant height, no. leaves per plant and length of leaves of okra at different days after sowing.

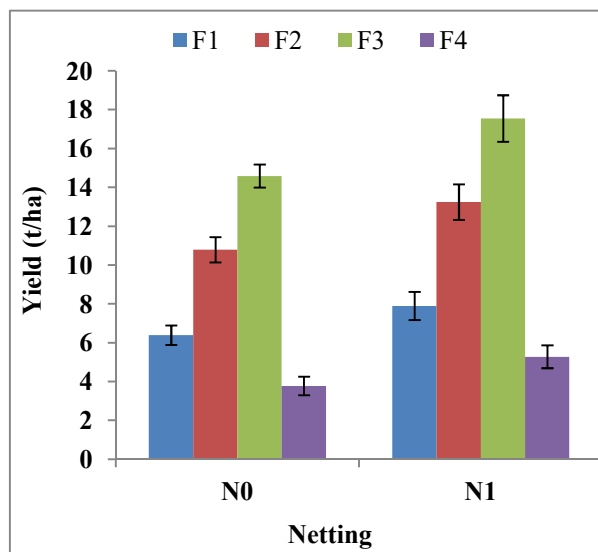
Treatment combination	Plant height (cm) at different days after sowing				No. of leaves/plant at different days after sowing				Length (cm) of leaves at different days after sowing			
	35	50	65	80	35	50	65	80	35	50	65	80
N <sub>0</sub> F <sub>1</sub>	21.67	29.80	46.13	60.80	8.20	14.07	18.87	21.07	9.53	14.80	18.47	19.80
N <sub>0</sub> F <sub>2</sub>	23.67	34.73	53.74	75.33	8.87	16.93	21.93	24.47	11.00	17.93	21.33	22.87
N <sub>0</sub> F <sub>3</sub>	24.80	38.27	58.73	81.77	8.87	17.67	24.60	25.87	12.93	21.00	23.87	25.60
N <sub>0</sub> F <sub>4</sub>	17.93	25.67	37.00	53.60	7.13	10.40	14.80	16.93	8.00	13.07	15.20	16.53
N <sub>1</sub> F <sub>1</sub>	23.53	31.87	47.47	62.60	8.53	15.07	19.20	22.20	11.87	15.07	18.67	20.20
N <sub>1</sub> F <sub>2</sub>	24.07	38.20	56.32	78.67	9.67	16.93	24.67	29.00	13.13	18.07	22.07	24.07
N <sub>1</sub> F <sub>3</sub>	27.20	43.20	62.40	84.63	9.73	18.47	26.67	30.13	13.40	21.13	24.60	26.53
N <sub>1</sub> F <sub>4</sub>	20.20	28.13	44.93	57.67	7.73	13.53	18.13	20.20	11.07	13.60	15.47	16.67
LSD <sub>0.05</sub>	2.38	0.90	0.87	0.75	0.37	0.71	0.25	0.18	0.40	0.19	0.34	0.31
Level of significance	**	**	**	**	**	**	**	**	**	**	**	**

\*\*=Significant at 5% level of probability, F<sub>1</sub>=cow dung (15 t/ha); F<sub>2</sub>=inorganic (NPK); F<sub>3</sub>=mixed (1/3 inorganic+2/3 cow dung); F<sub>4</sub>=control, N<sub>0</sub>=control; N<sub>1</sub>=netting.

**Table 6.** Combined effect of different fertilizers and netting on yield and yield contributing characters of okra.

Treatment combination	Days required for 1st flowering	Days required for 1st pod harvest	No. of pods/plant	Average weight of a pod (g)	Pod length (cm)	Pod diameter (cm)	Pod yield/pl ot (kg)
N <sub>0</sub> F <sub>1</sub>	41.67	49.00	10.93	15.81	12.95	1.44	2.76
N <sub>0</sub> F <sub>2</sub>	40.00	48.67	13.80	21.10	15.75	1.72	4.66
N <sub>0</sub> F <sub>3</sub>	39.33	48.00	16.49	23.87	17.25	1.75	6.30
N <sub>0</sub> F <sub>4</sub>	43.00	50.67	9.71	10.50	12.55	1.42	1.63
N <sub>1</sub> F <sub>1</sub>	40.33	48.33	12.75	16.70	13.75	1.47	3.41
N <sub>1</sub> F <sub>2</sub>	39.67	48.00	15.60	22.93	16.05	1.75	5.72
N <sub>1</sub> F <sub>3</sub>	38.67	47.33	17.67	26.82	18.08	1.90	7.58
N <sub>1</sub> F <sub>4</sub>	42.33	50.00	10.90	13.10	13.35	1.46	2.28
LSD <sub>0.05</sub>	1.30	0.98	0.14	0.18	0.27	0.06	0.15
Level of significance	**	**	**	**	*	*	**

\*\*=Significant at 5% level of probability, F<sub>1</sub>=Cow dung (15 t/ha); F<sub>2</sub>=Inorganic (NPK); F<sub>3</sub>=Mixed (1/3 inorganic+2/3 cow dung); F<sub>4</sub>=Control, N<sub>0</sub>=Control; N<sub>1</sub>=Netting.



**Figure 7.** Combined effect of fertilizer doses and netting on yield of okra. Vertical bars represent the mean value  $\pm$  SE (standard error). F<sub>1</sub>=Cow dung (15 t/ha); F<sub>2</sub>=Inorganic (NPK); F<sub>3</sub>=Mixed (1/3 inorganic + 2/3 cow dung); F<sub>4</sub>=Control; N<sub>0</sub>=Control; N<sub>1</sub>=netting.

Only the control condition and cow dung (15 t/ha) with or without net did not give the highest production of okra. On the other hand, inorganic fertilizer (F<sub>2</sub>) gave the better yield compared to the only application of cowdung and control (F<sub>1</sub> and F<sub>4</sub>) with or without net. Pod yield was found higher from the netting with the treatment of mixed application of cow dung and inorganic fertilizers (F<sub>3</sub>N<sub>1</sub>) compared to other treatment combinations. In this combination, number of pods per plant, individual weight of pod and pod length and diameter are found significantly higher compared to other treatments combination (Table 6 and Figure 7). These results clearly show the reasons of higher yield from the combination of F<sub>3</sub>N<sub>1</sub>. Islam *et. al.*, (2017a,b) also support the result, where the highest yields of cabbage and tomato were found from the mixed application of organic and inorganic fertilizer. Similar results were found in brinjal (Ullah *et. al.*, 2008). It might be the reason of the nutrient supply to plant from both organic and inorganic fertilizers. Inorganic fertilizers help quickly release the nutrient for plant and organic fertilizer (cow dung) release the macro and micronutrient slowly for the plant. On the other hand,

this result is motivating to reduce the application of inorganic fertilizer which can help to improve the soil quality for the sustainable production of crops. In case of netting, spinach production was found higher under different colored shade nets such as red, green, black, white along with control (Meena and Vashisth, 2014), which support the result of the present study. In the present experiment, relative humidity (RH) and temperature were found not influenced significantly inside and outside of net.

For getting better production of okra, judicious application of fertilizers is one of the important factor. Netting is an important aspect of crop production to maximize the yield. From this experiment it is clear that the growth and yield of okra were highly influenced upon the application of different fertilizers and netting. These two factors either singly or in combination influence the growth, yield and quality of okra. In this experiment, the highest yield per hectare was obtained at the combination from combined application of cow dung (2/3) + inorganic (1/3) fertilizers with netting (blue coloured). On the other hand, the lowest yield per hectare was obtained at the combination from without any fertilizer and netting. However, further studies of different coloured shade nets are needed to draw a precise conclusion.

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