Original Research Article

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON THE GROWTH ANDYIELD OF SNAKE GOURD (*Trichosanthes anguina* L.)

ABSTRACT

A field experiment was conducted from March to July 2020 at the Horticultural Farm of Sher-e-Bangla Agricultural University (SAU) in Dhaka, Bangladesh, to assess the impact of integrated nutrient management on the growth and yield of snake gourd (*Trichosanthes anguina* L.). The study employed a Randomized Complete Block Design with three replications, incorporating a total of 11 nutrient combinations. Various growth, reproductive, and yield parameters, including vine length, number of leaves per plant, leaf dimensions, flowering onset, fruit development, and yield metrics, were evaluated. The results consistently demonstrated positive effects across these parameters in response to different nutrient combinations. The highest recorded yield of snake gourd, at 50.10 t ha^{-1}, was observed in the T_{10}((OM ($CD_5PM_5V_2$ t ha^{-1}) + $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ Mg_7 kg ha^{-1} + Zn_6 kg ha^{-1}+ B_2 kg ha^{-1})treatment, while the lowest yield, at 14.72 t ha^{-1}, was associated with the T_0(control) treatment.This experiment underscores the potential of integrated nutrient management practices to enhance snake gourd production and maximize yield, offering valuable insights for agricultural practices in the region.

Key words: Snake Gourd, Cowdung, Poultry manure, Vermicompost, NPKS, Yield.

INTRODUCTION

Snake gourd (*Trichosanthes anguina* L.) belongs to Cucurbitaceae family, day neutral herbaceous and climbing type vegetable crops. In Bangladesh it is mainly grown in homestead area and field during summer season. It plays an important role during early kharif season to meet up acute shortage of vegetables. In addition, it has got tremendous export potentiality because of its excellent keeping quality [1]. Plant nutrition is one of the most important factors that increase production and balanced nutrition with macro and micro nutrients is regarded as an essential requirement for optimal plant growth and high-quality [2]. The total production of snake gourd during 2016-17 was 38692 m. ton on the area of 19130 acres of land [3] which indicates the low yield potentiality as compared to India and Thailand. Lack of nutritional combination is a major reason for low yield of this crop Bangladesh. For increasing the productivity an economical fertilizer package needs to be formulated which can provide all the essential elements through both organic and inorganic sources to get good quality, produce with higher production, keeping the production cost at sustainable level of an average farmer. Intensive use of only chemical fertilizers to achieve high production has created various problems. Continuous application of heavy doses of chemical fertilizers without organic manures has led to deterioration of soil health in terms of physical and chemical properties of soil, decrease in soil microbial activities, and also reduction in soil humus [4]. Therefore, present study is undertaken for evaluation of yield and growth of Snake gourd by using organic and inorganic fertilizer.

MATERIALS AND METHODS

Experimental Site and Design

The experiment was conducted at the Horticulture Farm of Sher-e- Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, during the month from March 2020 to July 2020.The single factor experiment was laid out in Randomized Complete Block Design(RCBD) with three replications. There were 33 plots altogether in the experiment. The size of each plot was 1.5m × 1.5m.

Plant Materials

The crop used in the experiment was Snake Gourd variety Pakunda which is a Bangladeshi local variety.

Treatment of the Experiment

The experiment consisted of various single factor:

T_0:control(No OM and inorganic fertilizer), **T_1**:OM($CD_{10}PM_{10}V_5$ t ha^{-1}),**T_2**: $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}(RDF),**T_3**:OM ($CD_5PM_5V_2$ t ha^{-1})+$N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}(RDF), **T_4:**OM ($CD_5PM_5V_2$ t ha^{-1}) + $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ Mg_7 kg ha^{-1}, **T_5**: OM ($CD_5PM_5V_2$ t ha^{-1}) + $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ Zn_6 kg ha^{-1}, **T_6**: OM ($CD_5PM_5V_2$ t ha^{-1})+$N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ B_2 kg ha^{-1}, **T_7**: OM ($CD_5PM_5V_2$ t ha^{-1})+$N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ Zn_6 + B_2 kg ha^{-1}, **T_8**:OM ($CD_5PM_5V_2$ t ha^{-1}) + $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+Mg_7 kg ha^{-1}+ Zn_6 kg ha^{-1}, **T_9**: OM ($CD_5PM_5V_2$ t ha^{-1}) + $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ Mg_7 kg ha^{-1} + B_2 kg ha^{-1} and**T_{10}**: OM ($CD_5PM_5V_2$ t ha^{-1}) + $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ Mg_7 kg ha^{-1} + Zn_6 kg ha^{-1}+ B_2 kg ha^{-1}.

Application of Manures and Fertilizers

Manures and fertilizers were applied to the experimental plot considering the recommended fertilizer doses of [5].

Table 1: Manures and fertilizers were applied at the following doses

Nutrient	Recommended dose/ha (kg)	Doze/plot (plot size: 2.25 m^2)										
		T_0	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T	T_9	T_{10}
N	80 kg	0	0	20g	20g	20g	20g	20g	20g	20g	20g	20g
P	35kg	0	0	40g	40g	40g	40g	40g	40g	40g	40g	40g
K	75 kg	0	0	34g	34g	34g	34g	34g	34g	34g	34g	34g
S	18kg	0	0	23g	23g	23g	23g	23g	23g	23g	23g	23g
Zn	6 kg	0	0	0	0	3g	0	0	3g	3g	0	3g
Mg	7 kg	0	0	0	0	0	0	3g	0	3g	3g	3g
B	1 kg	0	0	0	0	0	2.5g	0	2.5g	0	2.5g	2.5g
Cowdung	10000	0	2.2 kg	0	1.1 kg	1.1 kg	1.1 kg	1.1 kg	1.1 kg	1.1 kg	1.1 kg	1.1 kg
Poultry Manure	10000	0	2.2 kg	0	1.1 kg	1.1 kg	1.1 kg	1.1 kg	1.1 kg	1.1 kg	1.1 kg	1.1 kg
Vermicompost	5000	0	1 kg	0	500 g	500 g	500 g	500 g	500 g	500 g	500 g	500 g

Seed Sowing

Seeds were air-dried before sowing since water soaked to facilitate germination. The seeds of Snake Gourd were sown on 11 March, 2020. The seeds were treated with Bavistin before sowing the seeds to control the seed borne disease. Seeds were sown in well-prepared plot by maintaining row to row distance of 30 cm and plant to plant distance within the rows 10 cm (approximately).

Data Analysis

The data obtained for different characters were statistically analyzed by using MSTAT-C. The mean values of all the recorded characters were evaluated and analysis of variance was performed by the 'F' (variance ratio) test. The significance of the difference among the treatment of means was estimated by Duncan's Multiple Range Test (DMRT) at 5% level of probability [6].

RESULTS AND DISCUSSION

Vine length (cm)

Statistically significant influence was found in terms of vine length (cm) of snake gourd at all growth stages due to the application of different levels of organic and inorganic nutrients (Table 2). At vegetative stage the maximum vine length (69.36 cm) was recorded from T_{10} treatment, which was statistically identical (65.91 cm) with T_9 treatment and the lowest vine length (42.48 cm) was recorded from T_0 (control) treatment. At flowering stage the highest vine length (211.69 cm) was observed from T_{10} treatment, which was statistically identical (197.14 cm) with T_9 treatment and the lowest vine length (107.29 cm) was observed from T_0 (control) treatment. At fruiting stage, the maximum vine length (234.51 cm) recorded from T_{10} treatment and followed by T_9 (206.51 cm) treatment and the lowest vine length (112.43 cm) was observed from T_0. Vine length is a crucial indicator of plant growth and vigor. The treatment T10, which involved the application of OM ($CD_5PM_5V_2$ t ha^{-1}) + $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1} + Mg_7 kg ha^{-1} + Zn_6 kg ha^{-1} + B_2 kg ha^{-1} demonstrated the most substantial improvement in vine length at all stages. This finding is consistent with the work of [7] who reported enhanced plant growth and nutrient uptake with combined organic and micronutrient treatments.

Number of leaves plant^{-1}

Number of leaves plant^{-1} is an important parameter of crop plant because of its physiological role in photosynthetic activities. Statistically significant influence was found in terms of number of leaves plant^{-1} of snake gourd at all growth stages for different nutrient combination (Table 2). At vegetative stage the highest number of leaves plant^{-1} (56.14) was recorded from T_{10} treatment which was statistically similar with T_5 (49.10), T_8 (53.08) and T_9 (53.40 treatment and the lowest number of leaves plant^{-1} (28.23) was recorded from T_0 (control) treatment. At flowering stage, the highest number of leaves plant^{-1} (87.30) was recorded from T_{10} treatment which was statistically similar to T_9 (82.33) and T_8 (82.10) treatment and the lowest number of leaves plant^{-1} (45.78) was recorded from T_0 (control) treatment. The highest number of leaves plant^{-1} (93.24) at fruiting stage was recorded from T_{10}, which showed statistically identical results T_9 (89.87) treatment and statistically similar with T_6 (81.95), T_7 (83.31) and T_8 (86.39). The lowest number of leaves plant^{-1} (49.14) was recorded from T_0 (control) treatment at fruiting stage. The number of leaves is an essential indicator of plant health and vigor. Integrated nutrient management (INM) significantly influenced the number of leaves in snake gourd plants. Incorporation of organic matter, such as cow dung (CD) and poultry manure (PM), in treatments T_8 to T_{10} resulted in a substantial increase in the number of leaves compared to the control treatment (T_0).

Days required to first male flowering

Different levels of organic and inorganic fertilizers application showed statistically significant influence on days required to first male flowering of snake gourd (Table 2).The days required for the appearance of the first male flowers are critical factors influencing fruit set and yield. The maximum days required to first male flowering (60.06 days) was observed in T_0 (control) treatment whereas minimum days required to first male flowering (47.97 days) was observed in T_{10} treatment which showed statistically identical results to T_9 (48.12 days) treatment. INM treatments generally reduced the number of days to the first male flowers compared to the control. The minimum days to first fruit male flowering was recorded due to higher accessibility of nitrogen in the formof organic manure that induced protein production which might cause moremeristem cells and finally cell division leads to earliness. The present result is in consonance with [8].

Days required to first female flowering

Early fruit harvest is desirable for maximizing crop productivity. Similar to flowering, INM treatments accelerated the days to first fruit harvest compared to the control. The days required to first female flowering of snake gourd showed statistically significant variation for application of different levels of organic and inorganic nutrients (Table 2). The maximum days required to first female flowering (56.31 days) was recorded in T_0 (control) treatment, while the minimum days required to first female flowering (44.68 days) was observed from T_{10} treatment. These results imply that INM treatments can significantly expedite flowering, potentially leading to increased fruit set and yield.

Number of male flowers plant^{-1}

From the results of this experiment, it was observed that statistically significant variation was found among the different combination of organic and inorganic fertilizers in respect of number of male flowers plant^{-1} (Figure 1). The highest number of male flower plant^{-1} (79.85) recorded from T_{10} treatment application whereas the lowest number of male flowers plant^{-1} (55.98) was recorded from T_0 (control) treatment.

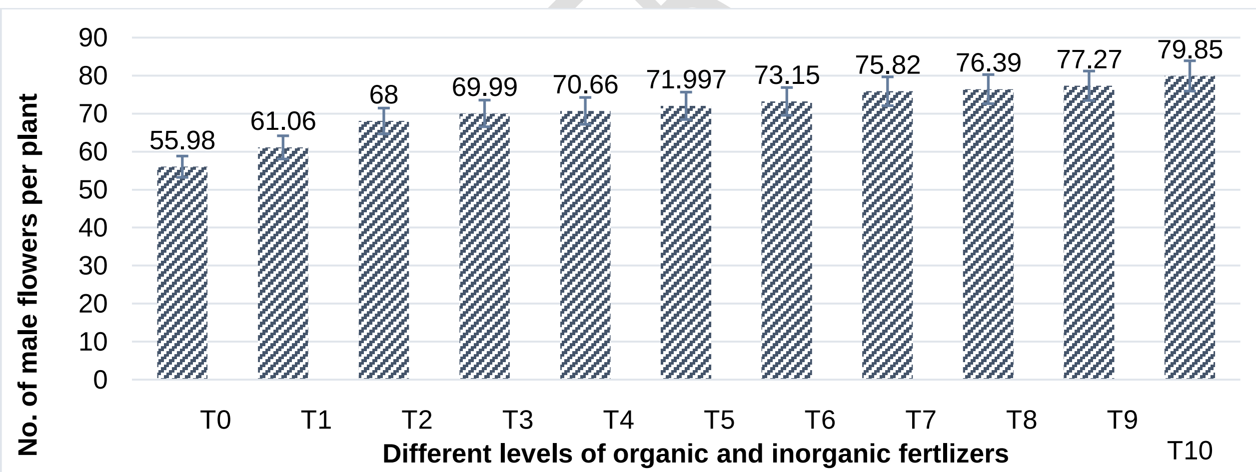

Figure 1. Effect of different levels of organic and inorganic fertilizers on number of male flowers plant^{-1} of snake gourd plant (*Trichosanthes anguina* L.).

Number of female flowers plant^{-1}

The number of female flowers plant^{-1} of snake gourd showed statistically significant influence with different levels of organic and inorganic fertilizer application (Figure 2). Experiment results showed that the maximum number of female flower plant^{-1} (25.65) was found from treatment T_{10}. On the other hand, minimum number of female flowers plant^{-1} (15.67) was found from T_0 (control).

Days required for first fruiting

Statistically significant variation was observed on days required for first fruiting of snake gourd influenced by different levels of organic and inorganic fertilizer application (Table 2). Results indicated that maximum days required for first fruiting of snake gourd (65.77 days) was recorded from T_0 (control) treatment and the minimum days required for first fruiting of snake gourd (54.41 days) was recorded from T_{10} treatment. The shortest time to first fruit harvest was observed in T_{10}, emphasizing the synergistic benefits of organic matter, RDF, and micronutrient supplementation in achieving early fruiting. The minimum days to first fruit harvest was recorded due to higher accessibility of nitrogen in the form of organic manure that induced protein production which might cause more meristem cells and finally cell division leads to earliness or maturity of fruits. The present result is in consonance with [8].

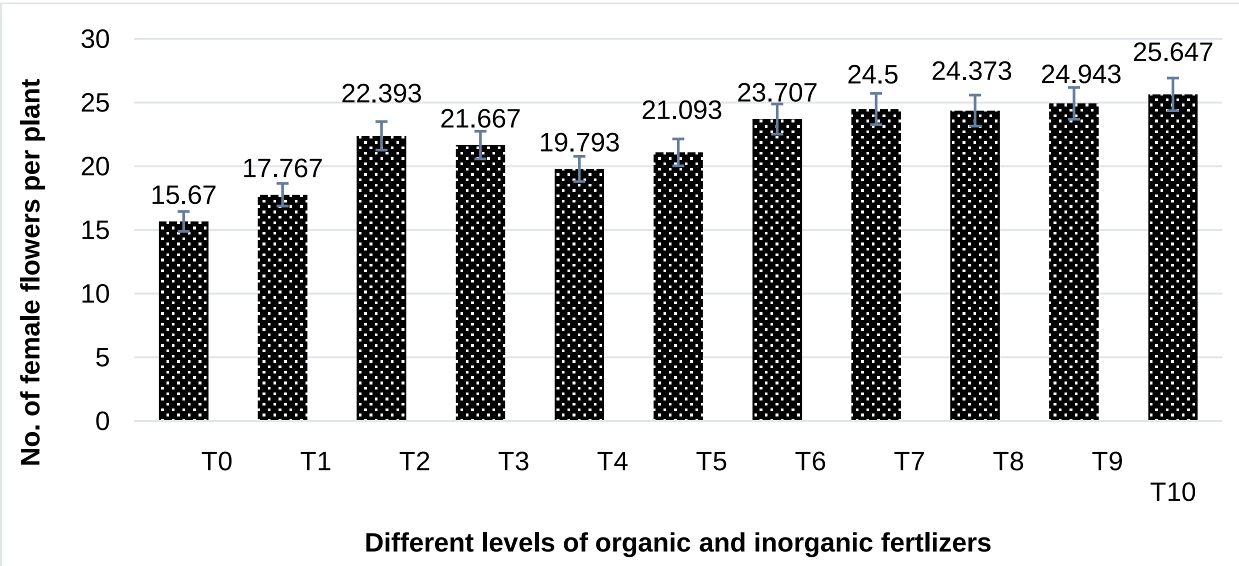

Figure 2. Effect of different levels of organic and inorganic fertilizers on number of female flowers plant^{-1} of snake gourd plant (*Trichosanthes anguina* L.).

Number of fruits plant^{-1}

The number of fruits per plant and overall yield are critical determinants of crop success and economic returns. The results presented in figure:3 reveal that integrated nutrient management positively influenced fruit production and yield in snake gourd. Experiment results showed that maximum number of fruits plant^{-1} (7.34) recorded from T_{10} treatment while minimum number of fruits plant^{-1} (3.48) counted from T_0 treatment.

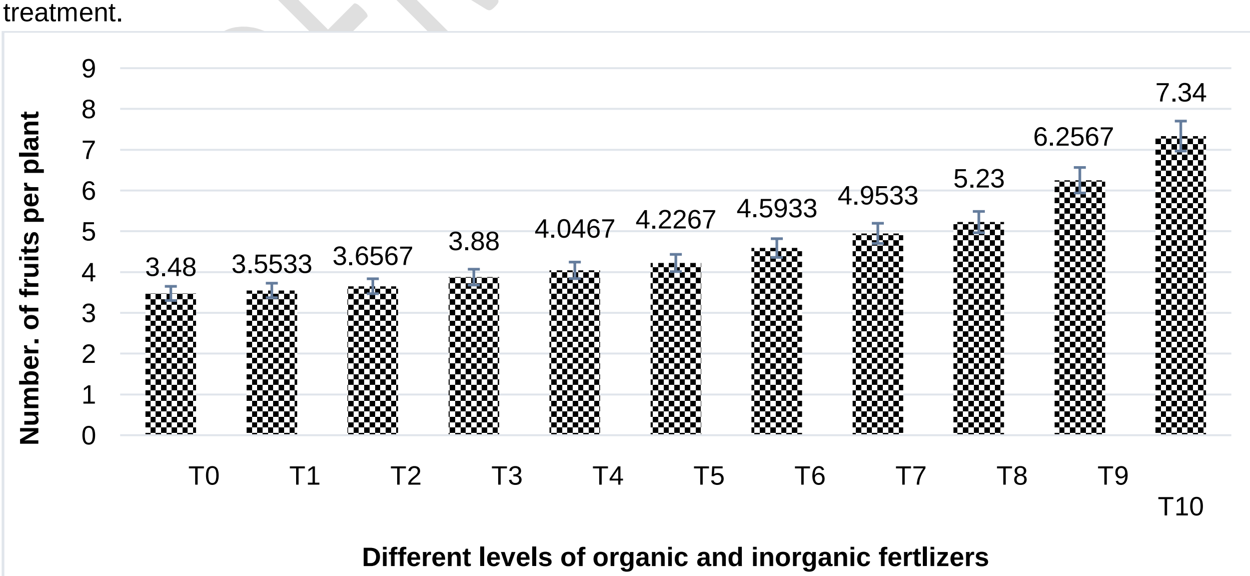

Figure 3. Effect of different levels of organic and inorganic fertilizers on number of fruits plant^{-1} of snake gourd plant (*Trichosanthes anguina* L.).

Yield (t ha^{-1})

Yield is a crucial parameter reflecting the overall success of a crop management strategy. INM treatments consistently outperformed the control in terms of yield. Treatments involving organic matter, RDF, and micronutrients (T_1 to T_{10}) exhibited significantly higher yields compared to the control (T_0). Statistically significant variation was noted on yield (t ha^{-1}) of snake gourd affected by different combinations of nutrient (Figure 4). Results revealed that the highest yield (50.10 t ha^{-1}) was recorded from T_{10} treatment and the lowest yield (14.72 t ha^{-1}) was recorded from T_0 treatment. These findings highlight the effectiveness of integrated nutrient management in enhancing snake gourd yield, particularly when combining organic inputs, recommended fertilizers and micronutrients.

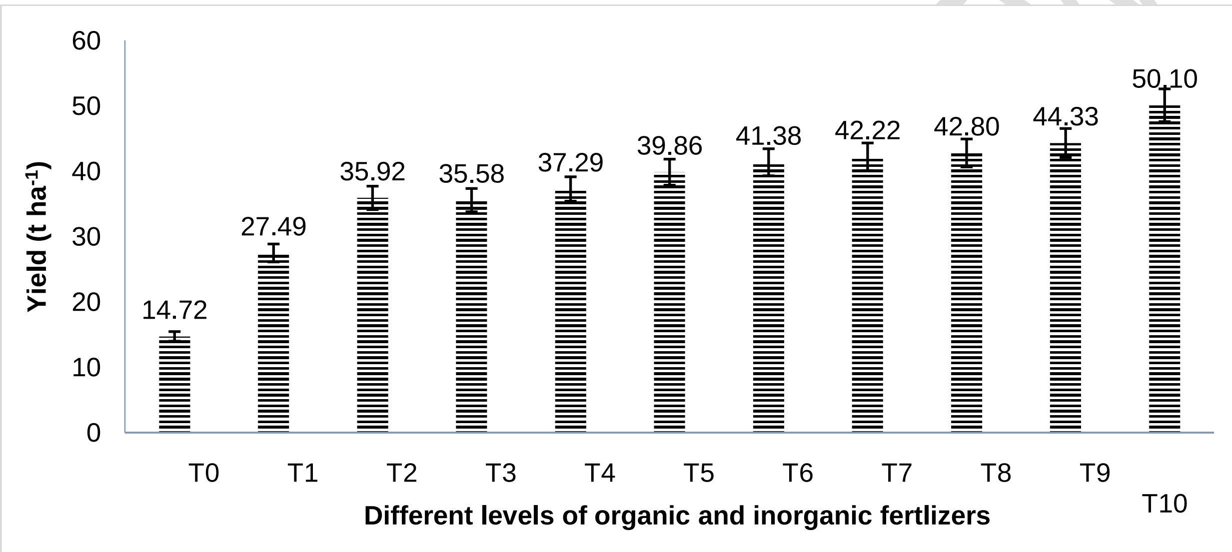

Figure 4. Effect of different levels of organic and inorganic fertilizers on Yield (t ha^{-1}) of snake gourd plant (*Trichosanthes anguina* L.).

Conclusion and Recommendation

The study shows that integrated nutrient management significantly improves the growth, flowering, and fruiting of snake gourd. The application of organic matter, essential nutrients, and micronutrients accelerates these processes, increasing fruit yield and overall production. This suggests that integrated nutrient management can enhance crop profitability. Further research is needed in different agro-ecological zones for regional adaptability and performance. The results are tentative and require more variables for confirmation.

Table 2. Effect of different levels of organic and inorganic fertilizers on vine length (cm), number of leaves plant^{-1} at different growth stages, days required for first male and female flowering and days required for first fruiting of snake gourd plant (*Trichosanthes anguina* L.).

Treatment	Vine length (cm)			Number of leaves per plant			Days required for first flowering		Days required for first fruiting
	Vegetative Stage(cm)	Flowering Stage(cm)	Fruiting stage (cm)	Vegetative Stage	Flowering Stage	Fruiting stage	Male	Female	
T_0	**42.48 g**	**107.29 d**	**112.43 e**	**28.23 g**	**45.78 g**	**49.14 g**	60.06 a	56.31 a	65.77 a
T_1	45.25 fg	112.80 d	117.58 e	34.58 fg	52.72 fg	56.17 fg	58.88ab	55.60 ab	64.57 b
T_2	45.87 fg	135.48 c	140.73 d	40.91 ef	61.60 ef	64.91 ef	57.78 bc	55.21 bc	64.09 b
T_3	50.41 ef	142.51 c	145.84 d	42.58 de	64.86 de	70.88 de	56.68 cd	55.10 bc	63.12 c
T_4	52.36 de	150.66 c	152.40 d	44.56 de	65.59 de	73.83 cde	56.29 d	54.19 c	61.96 d
T_5	55.09 cde	148.88 c	154.03 d	45.28 cde	71.93 cd	77.67 bcd	53.56 e	52.77 d	60.11 e
T_6	56.17 cd	149.13 c	155.55 d	49.10 abcd	72.44 bcd	81.95 abcd	52.11 f	50.72 e	58.70 f
T_7	60.21 bc	178.29 b	185.51 c	48.09 bcde	76.77 bc	83.31 abc	50.79 g	49.14 f	56.78 g
T_8	64.95 ab	195.63 ab	198.88 bc	53.08 abc	82.10 abc	86.39 ab	50.60 g	48.61f	56.68 gh
T_9	65.91 a	197.14 a	206.51 b	53.40 ab	82.33 ab	89.87 a	48.12 h	45.07 g	55.85 h
T_{10}	**69.36 a**	**211.69 a**	**234.51 a**	**56.14 a**	**87.30 a**	**93.24 a**	47.97 h	44.68 g	54.41 i
$LSD_{(0.05)}$	**5.6297**	**17.753**	**18.896**	**7.8564**	**10.247**	**11.554**	1.3179	**1.0291**	0.8947
CV%	**5.98**	**6.63**	**6.77**	**10.23**	**8.67**	**9.02**	**6.35**	**6.64**	**5.89**

In a column, means with similar letter (s) are not significantly different and those having dissimilar letter (s) are significantly different by LSD at 5% level of significance. Where, T_0: control (No organic manure and inorganic fertilizer), T_1:OM ($CD_{10}PM_{10}V_5$ t ha^{-1}), T_2:$N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}(RDF),T_3:OM ($CD_5PM_5V_2$ t ha^{-1})+$N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}(RDF),T_4:OM($CD_5PM_5V_2$ t ha^{-1})+$N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+Mg_7 kg ha^{-1},T_5:OM($CD_5PM_5V_2$ t ha^{-1})+$N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ Zn_6 kg ha^{-1}, T_6: OM ($CD_5PM_5V_2$ t ha^{-1}) + $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ B_2 kg ha^{-1}, T_7: OM ($CD_5PM_5V_2$ t ha^{-1})+ $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ Zn_6 + B_2 kg ha^{-1}, T_8: OM ($CD_5PM_5V_2$ t ha^{-1}) + $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ Mg_7 kg ha^{-1}+ Zn_6 kg ha^{-1}, T_9:OM($CD_5PM_5V_2$ t ha^{-1}) + $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ Mg_7 kg ha^{-1} + B_2 kg ha^{-1} andT_{10}: OM ($CD_5PM_5V_2$ t ha^{-1}) + $N_{80}P_{35}K_{75}S_{18}$ kg ha^{-1}+ Mg_7 kg ha^{-1}+Zn_6 kg ha^{-1}+ B_2 kg ha^{-1}.

REFERENCES

1.Podder R, Rasul MG, Islam AKMA, Mian MAK and Ahmed JU (2010). Combining ability and Heterosis in Snake gourd (*TricosanthesCucumminata* L). *Bangladesh J. Pl. Breed. Genet*. **23** (2): 01-06.

2. Zeka, N., Mero, G., Skenderasi, B. and Gjançi, S.(2014). Effects of nitrogen sources and levels on yield and nutritive values of spinach (*Spinacea oleracea* L.). *J. Int. Acad. Res. Multidisciplinary***2** (2): 327-337.

3. BBS (2016-2017) Year Book of Agricultural Statistics of Bangladesh, (2018). Bangladesh Bureau of Statistics.Ministry of Planning. Govt. of the people's Republic of Bangladesh.Dhaka.

4.Anjanappa M, Venkatesh J, Suresh Kumara B (2011). Influence of organic, inorganic and biofertilizers on flowering, yield and yield attributes of cucumber (Cv. Hassan Local) in open field condition. Karnataka *J Agric. Sci*.; **25**(4):493-497.

5. BARI (Bangladesh Agricultural Research Institute) (2022) Annual Report (2021-2022), BARI, Gazipur

6. Gomez, K. A. and Gomez, A. A. (1984). Statistical procedures for agricultural research. 2nd edition. John Willy and Sons, New York, pp. 28-192.

7. Mahale, A.G., Dodake, S.B., Kasture, M.C., Jadhav, S. C., Raut, S.V. , and Kambale, N.A. (2018). Effect of integrated nutrient management on snake gourd (*Trichosanthes anguina* L.) in lateritic soils of Konkan. *J. Pharmacognosy and Phytochemistry*. **7**(5): 1114-1118.

8. Kumar , S., Kumar , V., Prakash , S., Singh , M. K., Kumar , A., Singh , S. P., Kumar , D., andGangwar , V. (2023). Effect of Integrated Nutrients Management Practices on Growth Parameters of Pointed Gourd (*Trichosanthes dioica*). *Int. J. Env. and Climate Change*, **13(**8), 2133–2141.