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# Growth and Yield of Tuberose (*Polianthes tuberosa* L.) as Influenced by Nutrient Management

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**Abstract:**

*The present investigation was carried out to study the effect of organic amendments and fertilizer on growth, flowering and yield of tuberose at the Floriculture Research Field, Bangladesh Agricultural Research Institute, Gazipur from March, 2013 to May 2014. The*

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*experiment consisted of nine treatments namely: $T_1$= Farmyard manure (5 t/ha) + ½ RDF, $T_2$= Farmyard manure (10 t/ha) + ½ RDF, $T_3$= Poultry refuse (5 t/ha) + ½ RDF, $T_4$= Poultry refuse (10 t/ha) + ½ RDF, $T_5$= Vermicompost (5 t/ha) + ½ RDF, $T_6$= Vermicompost (10 t/ha) + ½ RDF, $T_7$= Bokashi (3 t/ha) + ½ RDF, $T_8$= Bokashi (5 t/ha) + ½ RDF and $T_9$ = Control (Recommended doses of fertilizer) ($N_{150}$ $P_{30}$ $K_{100}$ $S_{20}$ $B_1$ $Zn_1$ kg/ha). The experiment was conducted in Randomized Block Design (RCBD) with three replications. Application of organic amendments and fertilizer showed significant variations on most of the parameters. The maximum plant height, growth, number of leaves/plant, spike length, rachis length and yield of spikes per hectare was obtained with the use of 10 t vermicompost along with 50 percent recommended dose of fertilizer (RDF).*

**Key words**: Tuberose, Nutrient management, farmyard manure, vermicompost, Bokashi, Poulty refuse.

## INTRODUCTION

Tuberose (*Polianthes tuberosa* L.), which occupies place in ornamental horticulture belongs to Amaryllidaceae family was originated in Mexico and grown on large scale in Asia. Tuberose is a half hardy, bulbous perennial multiplying itself through bulb-bulblets, roots are mainly adventitious and shallow, the leaves are long narrow, linear, grass like, green and arise in rosette.

Nitrogen, phosphorus and potassium have a significant effect on spike production and floret quality. Duration of flower in the field was improved through using organic fertilizer (Islam, 2011). Poultry manure is an excellent organic fertilizer, as it contains high nitrogen, phosphorus, potassium and other essential nutrients (Garg and Bahla, 2008). Vermicompost has been shown to have high levels of total and available nitrogen, phosphorus, potassium, micronutrients, microbial and enzyme activities and growth regulators (Chauhan *et al.,* 2005).

Mustard oil cake is an excellent source of organic amendment can replace not only the use of chemical fertilizers but also replace the use of pesticides by suppressing pathogens and insects (Bose *et al*., 1999). Research works have shown that compost and other organic manures like bokashi, farmyard manure, cocodust, water hyacinth, mustard oil cake, vermicompost etc. can serve as soil amendments to improve soil nutrient status, water holding capacity as well as increase vase life (Roe, 1997; Kabir *et al.,* 2011). They also stabilize soil pH, increase soil organic matter and ultimately improve plant growth and yield.

## MATERIALS AND METHODS

The experiment was conducted at the Floriculture Research Field, Horticulture Research Centre of Bangladesh Agricultural Research Institute (BARI), Gazipur. The location of the site was about 35 km North of Dhaka city with $24.09^0$ N latitude and $90.26^0$ E longitude and elevation of 8.40 m from the sea level. The experimental field belongs to the Agro-ecological zone of AEZ-28 under Modhupur Tract of Bangladesh. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 1.8 m × 1.5 m accommodating 45 plants per plot. Two adjacent unit plots were separated by 60 cm space and there was 80 cm space between the blocks. Medium size (2.0-2.5 cm diameter) bulb of tuberose single cultivar (PT-001) was selected as experimental materials. The single ever blooming Mexican Tuberose is one of the most fragrant of cultivated plants. The experiment consisted of 9 treatments comprising of different level of organic amendments and fertilizer. $T_1$= Farmyard manure (5 t/ha) + $^1/_2$ RDF, $T_2$= Farmyard manure (10 t/ha) + $^1/_2$ RDF, $T_3$= Poultry refuse (5 t/ha) + $^1/_2$ RDF, $T_4$= Poultry refuse (10 t/ha) + $^1/_2$ RDF, $T_5$= Vermicompost (5 t/ha) + $^1/_2$ RDF, $T_6$= Vermicompost (10 t/ha) +

$^1/_2$ RDF, $T_7$= Bokashi (3 t/ha) + $^1/_2$ RDF, $T_8$ = Bokashi (5 t/ha) + $^1/_2$ RDF and $T_9$ = Control (Recommended doses of fertilizer (RDF) ($N_{150}$ $P_{30}$ $K_{100}$ $S_{20}$ $B_1$ $Zn_1$kg/ha) (Halder *et al*., 2007). Farm yard Manure is prepared basically using cow dung, cow urine, waste straw and other dairy wastes. Poultry refuse is basically a waste material which is organic in nature and comprises of urine and feces of animals which are related to poultry e.g. chicken. Poultry manure is a mixture of certain types of bedding material such as sawdust or wood shavings. This vermicompost was collected from Soil Science Division of BARI. Bokashi was made comprising fish meal, oil cake, bone meal, rice bran, poultry refuse @ 20 kg, 40 kg, 20 kg, 100 kg and 100 kg, respectively. Bkashi were collected from Vegetable Division of HRC, BARI which is high in NPK and other micronutrients. Well-decomposed cow dung, poultry manure, vermicompost, bokashi, P, K, B, S and Zn were applied during final land preparation as per treatment. N was applied in three installments at 35, 55 and 75 days after planting of bulbs. Five plants were selected randomly for data collection of different parameters of the plant. The recorded data on different parameters were statistically analyzed using 'MSTAT-C' software to find out the significance of variation resulting from the experimental treatments. The mean for the treatments was calculated and analysis of variance for each of the characters was performed by F (variance ratio) test. The differences between the treatment means were evaluated by Duncan's Multiple Range Test (DMRT) according to Steel *et al*., (1997) at 5% level of probability.

## RESULTS AND DISCUSSION

### Plant height

Plant height of tuberose showed statistically significant differences due to different level of organic amendments along

with half recommended dose of fertilizers at 30, 50, 70 and 90 DAP. At the different days after planting (DAP) the tallest plant (61.5 cm) was recorded from $T_6$ at 90 DAP. The shortest plant (46.0 cm) was recorded from $T_9$ (control i.e. absolute use of chemical fertilizer) (Figure 1). Plant height may be attributed to the presence and synthesis of gibberellins in vermicompost. This finding are in conformity with the findings of Kabir *et al.,* (2011).

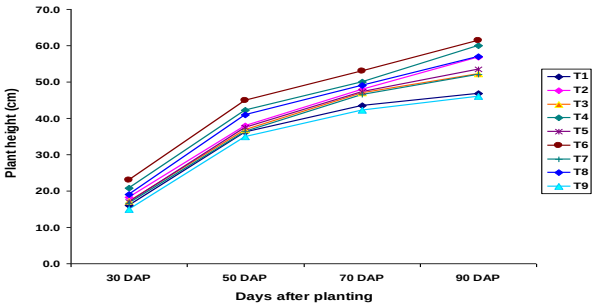


**Fig. 1 : Effect of organic amendments and fertilizer on plant height of tuberose**

## Days to sprouting

The variation among the treatments in respect of days to sprouting of bulb per plant was found significant (Table 1). The bulbs under $T_6$ (Vermicompost @ 10 t/ha + ½ RDF) took minimum time (6 days) to sprouting, while the bulbs of $T_9$ (Control) required maximum time (11 days). This is in line with the findings of Padaganur *et al.,* (2005) and Kabir *et al.*, (2011) in tuberose flowers.

## Leaf number

The result revealed that there was a significant variation in number of leaves per plant among the treatments studied (Table 1). The maximum number of leaves were found in $T_6$ (35.0) followed by $T_4$ (32.0). The lowest number of leaves/plant were found in control treatment (25.0). The results indicated

that essentiality of nitrogenous element in organic form enhanced to constitute chlorophyll which leads to better leaves over control treatment. Kumar (2004) reported that the profound effect of nitrogen fertilization on anatomical structure of tuberose.

**Plant spread (cm)**

The plant spread of tuberose plant is an important morphological character that influences the yield, because it is correlated with photosynthesis by the higher leaf area. There were significant differences among the treatment in respect of plant spread (Table 1). Maximum plant spread was recorded in $T_6$ (20.5 cm) which statistically similar to $T_4$ (20.0 cm). The minimum plant spread (12.0 cm) was observed in control treatment. Kulkarni (1994) and Patil (2000) has also reported similar results. The plant spread was found maximum with $T_6$ and $T_4$ treatment might be due to getting optimum nutrients resulting higher vegetative growth compared to other treatments.

**Number of plants per hill**

Different level of organic amendments and fertilizer showed a statistically significant difference for number of plants/hill at flower harvest under the present study (Table 1). The maximum (10.0) number of plants/hill was recorded at $T_6$ followed by $T_4$ (8.0). On the other hand the minimum (4.0) number of plants/hill was recorded in the plot with control condition i.e. absolute use of chemical fertilizer. The observed results are in agreement with the findings of Padaganur *et al.,* (2005) in tuberose. They reported that application of vermicompost with organic fertilizer had tremendous effects on plant growth and development in tuberose.

**Table 1. Effect of organic amendments and fertilizer on vegetative growth of tuberose**

| Treatments | Days to sprouting | Leaves/plant | Plant spread (cm) | Plants/hill |
|---|---|---|---|---|
| $T_1$ | 9.0 ab | 26.0 bc | 14.5 bc | 5.0 ab |
| $T_2$ | 9.0 ab | 28.0 bc | 16.5 b | 6.0 ab |
| $T_3$ | 9.0 ab | 30.0 b | 17.0 ab | 7.0 ab |
| $T_4$ | 8.0 ab | 31.0 ab | 20.0 a | 8.0 ab |
| $T_5$ | 8.0 ab | 30.0b | 18.0 ab | 7.0 ab |
| $T_6$ | 6.0 b | 35.0 a | 20.5 a | 10.0 a |
| $T_7$ | 9.0 ab | 28.0 bc | 16.05 b | 5.0 ab |
| $T_8$ | 9.0 ab | 26.0 bc | 14.0 bc | 5.0 ab |
| $T_9$ | 11.0 a | 24.0 c | 12.0 c | 4.0 b |
| **CV%** | **8.5** | **12.2** | **10.7** | **8.9** |

## Days required to 80% flowering

Days required to 80% flowering showed variation for different treatment (Table 2). The minimum days required for bulb planting to 80% flowering was recorded in $T_6$ (75 days) followed by $T_4$ (80 days). Time required to 80% flowering (90 days) was found to be delayed in control treatment (Table 2). The maximum time as recorded in this study was similar to those recorded by Nambisan and Krishnamm (1983). Vermicompost might have role in supply of macro and micronutrients, enzymes and growth hormones and provides micronutrients such as Zn, Fe, Cu, Mn etc. in an optimum level which help in proper flower development.

## Spike length

Length of flower spike for different treatments showed variation in tuberose. The longest (80.0 cm) length of flower spike was recorded in $T_6$ followed by $T_4$ (77.0 cm). The shortest spike length was found in control (72.0 cm) treatment. The increased spike length was probably due to the better vegetative and reproductive growth of the plant in $T_6$. Padaganur *et al.,* (2005) and Kabir *et al.*, (2011) also found that spike length was increased with the application of vermicompost along with RDF fertilizer.

**Rachis length**

Different treatments of organic amendments and fertilizer had significant effect on the length of rachis in tuberose (Table 2). The rachis length ranged from 22.0 to 34.0 cm. The maximum length of rachis was obtained in $T_6$ (34.0 cm), while the minimum length was found in $T_9$ (22.0 cm), which differed significantly from all other treatments. The results are in partial agreement with Kabir *et al.,* (2011) and Mazed *et al*., (2015) , where they reported that the length of rachis in flowers were increased with the use of organic amendments with fertilizer instead of synthetic fertilizer.

**Floret number**

The floret number is an important parameter of tuberose. Variation was recorded for number on floret/spike for different treatments under the investigation (Table 2). The maximum number of florets were found in $T_6$ (45). The lowest numbers of floret/plant were found in control treatment (36). This is in line with the findings of Patil (2000) in tuberose.

**Spike weight**

It was revealed from Table 2 that different treatment of organic amendments and fertilizer had significant effect on spike weight. The maximum weight of spike was obtained in $T_6$ (60.0 g) treatment followed by $T_4$ (55.0 g) treatment and the minimum in treatment $T_9$ (45.0 g) and was statistically comparable to the remaining treatments. Similar results were reported by Mazed *et al.,* (2015) in tuberose.

**Table 2. Effect of organic amendments and fertilizer on flowering of tuberose**

| Treatments | Days to required 80% flowering | Spike length (cm) | Rachis length (cm) | Floret number | Spike weight (g) |
|---|---|---|---|---|---|
| $T_1$ | 86.0 ab | 73.5 bc | 25.0 bc | 38.0 bc | 48.0 cd |
| $T_2$ | 81.0 bc | 76.0 ab | 26.7 bc | 42.0 ab | 50.0 c |
| $T_3$ | 82.0 bc | 75.0 b | 28.0 b | 40.0 b | 52.8 bc |
| $T_4$ | 80.0bc | 77.0 ab | 30.0 ab | 41.0 ab | 55.0 b |
| $T_5$ | 81.0 bc | 77.2 ab | 29.0 ab | 40.0 b | 53.4 bc |
| $T_6$ | 75.0 d | 80.0 a | 34.0 a | 45.0 a | 60.0 a |
| $T_7$ | 83.0 bc | 76.7 ab | 26.9 bc | 43.0 ab | 53.0 bc |
| $T_8$ | 85.0 b | 74.1 bc | 24.6 bc | 40.0 bc | 51.0 bc |
| $T_9$ | 90.0 a | 72.0 c | 22.0 c | 36.0 c | 45.0 d |
| **CV%** | **10.5** | **9.8** | **8.7** | **7.5** | **8.6** |

## Yield/ha

The maximum number of flowering spike 6,500.00 was produced in $T_6$ which was superior to other treatments. The second highest number of flowering spikes per hectare (640000) was recorded in $T_4$ (Figure 2). The phenomenon of more number of spikes might be due to slow and unremitting discharge of nitrogenous element from bulky organic manure and fertilizer which influenced to increase chlorophyll content importing dark green colour foliage resulted more food reserve that promoted number of spike per hill. Similar trend has also been reported by Kabir *et al.,* (2011) in tuberose flower.

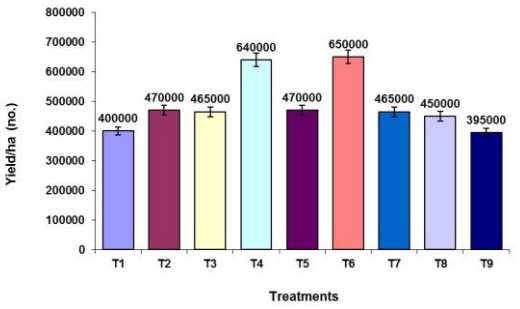


**Figure 2. Effect of organic amendments and fertilizer on flower yield of tuberose**

## CONCLUSION

It may be concluded that application of vermicompost @ 10 t/ha along with 50 percent recommended dose of fertilizer (RDF) showed significant improvement in vegetative growth, flowering and yield of flowering spike through increased of various nutrients in the soil. Therefore, it is beneficial for tuberose cultivation and may be recommended for flower production commercially.

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