Effect of organic manures, inorganic fertilizers and micronutrients on vegetative and floral characters of tuberose (*Polianthes tuberosa L.*) cv. 'Suvasini'

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Abstract- An experiment was laid out with four spacing's (30x20cm, 30x30cm, 45x20 cm, 45x30 cm), three bulb sizes (<2.0 cm, 2.0-3.0 cm and >3.0 cm) and two depths of planting (2.5cm and 6.0cm) in a randomized block design with three replications to study their individual and interaction effects on vegetative growth and flower yield in tuberose cv. Suvasini. All vegetative growth parameters except total chlorophyll content and all spike quality parameters spike for girth were found significantly influenced with wider spacing (45x30cm). Longivity of the spike on the field was found significantly maximum (15.77 days) with wider spacing (45x30cm), whereas, spike yield per plot (107.83) and per hectare (2.72 lakh ha^{-1}) were found significantly maximum with optimum spacing (30x30 cm). The large bulb size (>3.0cm) recorded significant increase in all growth and spike parameters and spike yield per hectare. Planting the bulbs at shallow depth (2.5cm) resulted in the early sprouting, flower spike emergence, floret opening and spike girth. The length of spike, number of spikes per plot and hectare and longevity of spike in field increased significantly at deeper depth (6.0 cm). The bigger sized bulbs (more than 3.0 cm) planted at optimum spacing (30x30 cm) and at 6.0 cm depth of planting was found best to get maximum commercial advantage for achieving higher flower yield.

Index Terms- Tuberose, organic manures, inorganic fertilizers and micronutrients, flower yield.

I. INTRODUCTION

Tuberose (*Polianthes tuberosa* L.) is one of the most beautiful bulbous tropical flowering plant and commonly called as "Rajnigandha (Bengali), Gu-e-chari (Hindi), and Nela sempangi (Telugu)". Tuberose occupies a very selective and special position among the ornamental bulbous plants which are valued much by the aesthetic world for their serene beauty of the flower spikes, bright snow-white flowers and delicacy of fragrance to transform the entire area into a nectarine and joyous one. The lingering delightful fragrance and excellent keeping quality are the predominant characteristics of this crop. It has a great economic potential for cut and loose flower trade and essential oil industry. The spikes are excellent for vase and other floral decorations. The spikes lasts long in vase for 10-15 days [1]. The natural flower oil of tuberose is one of the most expensive raw material for perfume industry. To meet the ever increasing domestic market demand and to tap the export potential of fresh flowers and the value added products from tuberose, there is a need to increase the productivity of this crop.

Fertilizers have great influence on growth and flower production in tuberose. Effect of chemical fertilizers and organic manures on tuberose production has been reported by several authors for different geographical regions [2], [3] and [4]. Nitrogen, phosphorus and potassium have a significant effect on spike production and floret quality [5]. Poultry manure is excellent organic manure, as it contains high nitrogen, phosphorus, potassium and other essential nutrients [6]. Vermicompost has been shown to have high levels of total and available nitrogen, phosphorus, potassium, micronutrients, microbial and enzymatic activities and growth regulators [7]. Hence the research work has been done to study the fertilizers, organic manures and micronutrients on growth and yield of tuberose cv. Suvasini.

II. RESEARCH METHODOLOGIES

The present investigation was carried out at the Horticultural College and Research Institute, Venkataramannagudem, Andhra Pradesh. An experiment was laid out with about 10 treatments as given in the table 1. in a randomized block design with three replications to study their individual and interaction effects on vegetative growth and flower yield in tuberose cv. Suvasini.

Table 1: Treatment Details:

T1	Recommended Dose of Fertilizers (RDF) 100%
T2	RDF 50% + FYM 25 % + Neem cake 25 %
T3	RDF 50% + Vermicompost 25 % + Neem cake25 %
T4	RDF 50% + Poultry manure25 % + Neem cake 25 %
T5	RDF 50% + FYM 50%
T6	RDF 50% + Vermicompost 50%
T7	RDF 50% + Poultry manure 50%
T8	RDF 100% + Zinc 2% at 30, 60 DAP

T9	RDF 100% + Iron 2% at 30,60 DAP
T10	Control (without any application of manures and fertilizers).

Manures (Equivalent to RDF Nitrogen):

Farm Yard Manure (FYM) used at the rate of 30 t ha^{-1}, Vermi compost was at 6.6 t ha^{-1}, Poultry manure was at 10 t ha^{-1} and Neem cake was at 5 t ha^{-1}.

Recommended Dose of NPK (RDF) =200:150:100 Kg NPK / ha (Kishore and Singh, 2006)

Micronutrients: Zinc sulphate 2% foliar spray at 30, 60 days after planting, Iron sulphate 2% foliar spray at 30, 60 days after planting.

In inorganic treatments (100% and 50% of recommended dose of fertilizers) nitrogen, phosphorus and potassium nutrients were applied in the form of urea, single super phosphate and muriate of potash respectively.

Different organic manures like FYM, vermicompost, neem cake and poultry manure were applied as per the treatments to respective plots. Vermicompost was obtained by culturing *Eisenia foetida* earthworms on farm and other weed waste along with fresh animal dung was used. Farm yard manure was obtained by composting different crop residues along with animal dung and used in fully decomposed form. Poultry droppings were collected from cages type of poultry units and allowed to decompose fully and used. Neem cake was obtained by crushing of neem seed kernels and used.

Farm yard manure, vermi compost, neem cake and poultry manure was incorporated in the soil according to the treatment combinations of respective plots at 15 days before sowing of bulbs.

In case of chemical fertilizers half dose of nitrogen and full dose of phosphorus and half potash were applied as basal dose. The remaining half dose of nitrogen and potash were applied in two spilt doses at interval of 30 and 60 days after application of basal dose. After application of manures and fertilizers uniform size bulbs of 2-3 cm were planted with a common spacing of 30x30 cm at a uniform depth of 4 cm in all the treatmental plots.

Zinc sulphate 2% solutions were prepared by dissolving 20 g of zinc sulphate in one liter of water. Iron sulphate 2% solutions were prepared by dissolving 20 g respectively in one liter of water. Respective solutions were applied by foliar spraying at 30 and 60 days after planting.

III. RESULT AND DISCUSSION

The data regarding the effect of different organic manures, inorganic fertilizers and micronutrients on growth characters of tuberose cv. Suvasini is presented in Table 2. The data indicated that application of organic manures, inorganic fertilizers and micronutrients significantly influenced the vegetative characters at all growth stages of plant. Among different treatments application of 50% recommended dose of fertilizers in combination with poultry manure 50% (T_7) recorded significantly less number of days for sprouting and 50% sprouting of bulbs. This might be due to application of poultry manure have improved soil texture by making soil loose which might have avoided formation of soil crust and might have increased the water holding capacity which in turn encouraged early sprouting of bulbs. The readily available nutrients from 50% RDF might have helped in building up of nutrition in bulbs, which might have indirectly helped early sprouting. Similar results were also reported by [8].

The data recorded in Table 2 revealed that number of leaves, leaf area index and total chlorophyll content per plant at all stages of plant growth are significantly increased by application of recommended dose of fertilizers 50% in combination with poultry manure 50% (T_7) . This might be due to presence of high quantity of readily available nitrogen (uric acid) in poultry manure. Moreover nitrogen is an essential element for chlorophyll synthesis and accumulation and also due to available micronutrient status. Similar results were also reported by [9] in tuberose. [10] reported that number of leaves was significantly increased with the application of half of chemical fertilizers along with 20 t/ha poultry manure in tuberose than only chemical fertilizers. Similar results were also reported by [11] in rose that increased vegetative characters by application of poultry manure due to improved soil physical conditions and micronutrients status. [12] reported significant increase in leaf emergence due to application of poultry manure in rose. These results were in confirmation with [13] as observed that improvement in the leaf area can be attributed to optimum level of nutrient availability to plants through chemical fertilizers and organic manures in chrysanthemum. Control (T_{10}) recorded more number of days for sprouting of bulbs and 50% sprouting of bulbs and less values in all growth parameters. RDF alone recorded more number of days for sprout emergence and 50% sprouting of bulbs and less number of leaves, leaf area index and total chlorophyll content per plant compared to RDF with organic manure combinations. Similar results were observed during both the years of study.

The data pertaining to the effect of organic manures, inorganic fertilizers and micronutrients on spike characters of tuberose cv. Suvasini is presented in Table 3 indicated that application of RDF 50% in combination with poultry manure 50% recorded less number of days to 50% flower spike emergence. The earliness may be due to increased nutrient availability and growth promoting substances in the soil from combined application of organic manures and inorganic fertilizers which might have enhanced the uptake of nutrients and water by the plants in turn favored the boosting of initial growth of the plant which might have stimulated the early flowering. Similar results were obtained by [11] in rose and [14] in tuberose.

Spike length, number of florets, number of spikes per clump ,per plot and per hectare were significantly influenced by the application of RDF 50% in combination with poultry manure 50% followed by RDF 50% in combination with poultry manure 25% and neem cake 25% as shown in table 3. This might be attributed to slow and sustained release of nutrients from poultry manure and neem cake. [15] also indicated that poultry manure is a good source of nitrogen and other nutrients. The C: N ratio of poultry manure is narrower than others which could help to release nitrogen at slower rate which is helpful for plant growth at later stages of the plant. These organic sources contain nitrogen in complex organic form which requires the

mineralization process to be executed for bringing nitrogen in available form. This process is essentially a soil microbiological process carried out by the soil heterotrophic micro flora which is a slow process. As a result the entire nitrogen becomes available to the plants over an extended period of time. These results are in conformity with the findings of [16] and [11] in rose,[17] and[10] in tuberose. Maximum number of florets per spike was recorded by application of RDF 50% in combination with poultry manure 25% and neem cake 25% might be due to fast release of nutrients and increased levels of both macro and micronutrients and more absorption area. These factors increased the plant growth and leaf area by which more photosynthates produced and resulted in production of more number of florets per spike. These results were also found to be in conformity with findings of [18] and [19] in marigold.

The increased spike yield could be due to increase in the yield attributing characters such as number of leaves, leaf area index, and total chlorophyll content. The increased spike yield might be due to application of poultry manure in combination with chemical fertilizers might be attributed to higher mineralization of various essential elements due to increased microbial activity and organic colloids resulting in better availability and uptake of these elements ultimately resulting in increased photosynthetic activity. The increased photosynthetic activity in turn would have increased assimilation of photosynthates resulting in a higher C:N ratio [20]. An increase in the higher C: N ration might have helped in increasing number of spikes, number of florets per spike, spike weight and spike yield per plot. Similar results were also reported by [11] as reported that poultry litter performed the best in respect of flower characters and flower yield followed by cow dung and vermicompost in tuberose. These results are in accordance with [17] who reported that poultry litter performed better in flower yield than cow dung in tuberose.

In this study the treatment T_1 (100% RDF) and T_{10} (control) recorded less spike yield. The reduction of spike yield may be due to poor initial vegetative growth leading to reduction in yield attributing characters. Efficacy of the inorganic fertilizers was pronounced when they are combined with organic manures was the probable remedy for this problem. Similar results were obtained by [21] as reported that lowest flower yield with only chemical fertilizers due to production of fewer florets per spike.

The above results revealed that the higher vase life with application of 50% RDF in combination with 25% poultry manure along with 25% neem cake may be attributed to consistent and slow release of nutrients throughout the growing period. Increased nutrient uptake by plants resulted greater water conducting tissues which in turn lead to maintaining turgidity. Similar results were also reported by [22]) and [15] in tuberose.

IV. CONCLUSION

Based on the results of experiment, it could be concluded that application of 50% RDF along with poultry manure 50% was found promising for good growth and higher spike yield with best quality. The above results indicated that there is ample scope for substitution of inorganic fertilizers with organic manures.

Therefore, an integrated approach with specific emphasis on organic manures along with chemical fertilizers and micro nutrients may be encouraged to produce maximum vegetative growth, spikes with best quality considering soil health in view for popularizing the cultivation of tuberose cv. Suvasini.

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