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INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND FLOWER YIELD OF TUBEROSE (*POLIANTHES TUBEROSA* L.) *CV.* PRAJWAL

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Abstract

An investigation on "Influence of integrated nutrient management on growth and flower yield of tuberose (*Polianthes tuberosa* L.) *cv.* Prajwal" was carried out in the floriculture yard, Department of Horticulture, Annamalai University, Annamalainagar, Tamil Nadu during 2017 - 2018. The treatments comprise of different combinations of recommended dose of fertilizers (RDF), vermicompost, poultry manure, farm yard manure (FYM), *Azotobacter* and phosphate solubilising bacteria (PSB). The results revealed that the maximum values for the growth attributes *viz*., plant height (36.24, 51.75 and 58.45 cm), number of side shoots (6.82, 9.79 and 11.23), number of leaves (49.85, 70.71 and 99.17) on 90,120 and 150 DAP respectively, leaf area (90.30 and 98.76 cm^2) on 90 and 120 DAP respectively and flower yield $plant^{-1}$ (189.06 g $plant^{-1}$) were recorded in the plots which received the application of 75 % RDF + *Azotobacter* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}. From the results of this experiment, it is concluded that application of 75 % recommended dose of fertilizer along with *Azotobacter* @ 2 kg ha^{-1} and PSB @ 2 kg ha^{-1} was beneficial in increasing the growth attributes and flower yield of tuberose.

Key words: Tuberose, vermicompost, poultry manure, FYM, *Azotobacter*, PSB.

Introduction

Tuberose (*Polianthes tuberosa* L.) commonly known as 'Rajnigandha' belongs to family Amaryllidaceae. It is one of the most important commercial bulbous ornamentals of sub-tropical and tropical areas and is always in great demand for its attractive and fragrant spikes as well as for producing its loose flowers. It occupies a very selective and special position to flower loving people because of its prettiness, elegance and sweet pleasant fragrance. It has a great economic potential for loose and cut flower trade and essential oil industry (Alan *et al*., 2007). The flowers remain fresh for quite a long time and stand distance transportation and fill a useful place in the flower market (Patil *et al.,* 1999).

Plant nutrition is an important aspect for good vegetative growth and also to increase the yield with better quality of flowers. Due to increased and continuous applications of chemical fertilizers, the soil fertility is being decreased besides disruption of its various physico – chemical and biological properties. Past experiences clearly indicated that no single source of input can meet out the twin challenge to maintain higher productivity besides, sustaining the environment. Thus, it warrants for popularizing the concept of "Integrated nutrient supply system" (IPNS) which involves the conjoint use of different sources of nutrients such as chemical fertilizers, organic manures and biofertilizers.

The world elite society is giving emphasis on utilization of organic wastes, farm yard manures, compost, vermicompost and poultry manures as the most effective measure to save the environment to some extent (Pieters, 2005). Biofertilizers are less expensive, eco-friendly and sustainable and they do not require non-renewable source of energy during their production. Biofertilizer usually consists of live or latent cells of micro-organisms which include biological nitrogen fixers, P-solubilizing, mineralization of nitrogen and transformation of several elements into available forms. VAM fungi, *Azotobacter*, *Azospirillum* and phosphate solubilizing bacteria are commonly applied biofertilizers in horticultural crops (Zaredost *et al.,* 2014). Hence, biofertilizers can be used as an alternative to the excessive use of inorganic fertilizers to maintain the soil health, fertility status as well as increasing the productivity of tuberose.

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In flower production, crop management practices involving judicious combination of inorganic fertilizes, organic manure and growth promoting microorganism can be made viable and feasible for augmenting yield potential and quality flowers. Keeping this in view, the study was conducted to standardize the integrated nutrient management practice to maximize the growth and flower yield of tuberose.

Materials and Methods

The present investigation on "Influence of integrated nutrient management on growth and flower yield of tuberose (*Polianthes tuberosa* L.) *cv.* Prajwal" was carried out in the floriculture yard, Department of Horticulture, Annamalai University, Annamalainagar, Tamil Nadu during 2017 - 2018. Healthy and matured uniform size bulbs of tuberose var. Prajwal were procured from a farmer's field at Kadagathur area, Dharmapuri district, Tamil Nadu. The bulbs were stored temporarily in area under a cool shady place and utilized for the present study. The experiment was laid out by following the principles of randomized block design with ten treatments replicated thrice. The treatment schedule is as follows: T_1 - 100 % RDF (200:200:200 kg NPK ha^{-1}), T_2 - 75 % RDF + Vermicompost 25 %, T_3 - 75 % RDF + Vermicompost 15 %, T_4 - 75 % RDF + Poultry manure 25 %, T_5 - 75 % RDF + Poultry manure 15 %, T_6 - 75 % RDF + FYM 25 %, T_7 - 75 % RDF + FYM 15 %, T_8 - 75 % RDF + *Azotobacter* @ 2 kg ha^{-1}, T_9 - 75 % RDF + PSB @ 2 kg ha^{-1}, T_{10} - 75 % RDF + *Azotobacter* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}.

The experimental area was ploughed thoroughly with tractor drawn disc plough and cultivator to bring it to a fine tilth. Basal dose of fertilizers and organic manures were incorporated during land preparation. The healthy and matured uniform sized bulbs were transplanted in an experimental plot and planted at a depth of 3-4 cm adopting a spacing of 45 × 20 cm. The recommended dose of fertilizers was applied to the selective plots according to the treatments. Two third of nitrogen along with full doses of P and K were applied as basal at the time of planting. One third of nitrogen was top dressed at one month after planting. Urea, super phosphate and muriate of potash were used to supply N, P and K respectively. Certain gaps were observed one week after transplanting due to mortality; such gaps were filled by gap filling with existing bulbs. Biometric observations like plant height, number of side shoots, number of leaves, leaf area and flower yield $plant^{-1}$ were recorded at various stages of crop growth. In each treatment five plants were tagged and used for observation. The mean value of the tagged plants was worked out and expressed for each character. The statistical analysis of data was carried out for the experiment as suggested by Panse and Sukhatme (1985).

Results and Discussion

Growth is one of the essential parameters for the attribution of yield. Various growth attributes like plant height, number of side shoots, number of leaves, and leaf area have a significant influence on the yield; hence, these parameters were considered for the study.

In the present study, the maximum plant height during the different stages of observation (36.24, 51.75 and 58.45 cm on 90,120 and 150 DAP respectively) was recorded with the application of T_{10} (75 % RDF + *Azotobacter* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}), while the minimum plant height was recorded with T_9 (75 % RDF + PSB @ 2 kg ha^{-1}) (Table 1). The increase in plant height may be due to favorable action of biofertilizers (*Azotobacter*) which resulted in more availability of nitrogen and certain growth substances like auxins, gibberellins, vitamins and organic acids secreted by bioinoculants. The effect of *Azotobacter* on plant height in tuberose was also confirmed by the work carried out by Yadav *et al*., (2005) in tuberose.

The maximum number of side shoots (6.82, 9.79 and 11.23 on 90,120 and 150 DAP respectively) (Table 1) and leaves $plant^{-1}$ (49.85, 70.71 and 99.17 on 90,120 and 150 DAP respectively) (Table 2) was recorded with the application of T_{10} (75 % RDF + *Azotobacter* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}), while the minimum number of side shoots and leaves $plant^{-1}$ were recorded with T_9 (75 % RDF + PSB @ 2 kg ha^{-1}). Similar results were also reported by Gupta *et al.,* (1999) who had recorded maximum number of branches $plant^{-1}$ and yield when *Azotobacter* and PSB in combination with 75 percent nitrogen was applied in marigold. The promotive effect of N and P on plant growth might be due to increased metabolic transport, photosynthesis and cell multiplication in marigold. The significant increase in branches $plant^{-1}$ might be due to the growth regulator like NAA and cytokinins released by *Azotobacter* and PSB which have resulted in breaking of apical dominance and accelerated higher number of branches. The increased nitrogen nutrition (fixed by *Azotobacter*) might also have accelerated the process of cell division and differentiation. The above results are corroborated with the findings of Thumar *et al*., (2013) in African marigold.

Similar observation was recorded by Yadav *et al.,* (2005) on tuberose *cv.* Double. The PSB, *Azotobacter* or Azospirillium alone or in combination produces growth

Table 1: Influence of integrated nutrient management on plant height (cm) and number of side shoots plant^{-1} in tuberose (*Polianthes tuberosa* L.) *cv.* Prajwal.

Treatments	Plant height (cm)			Number of side shoots plant^{-1}		
	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	150 DAP
T_1 - 100 % RDF (200:200:200 kg NPK ha^{-1})	31.97	45.75	53.35	5.87	8.08	10.53
T_2 - 75 % RDF + Vermicompost 25 %	30.88	43.54	51.75	5.69	7.54	10.08
T_3 - 75 % RDF + Vermicompost 15 %	29.35	39.86	51.22	5.53	6.32	9.50
T_4 - 75 % RDF + Poultry manure 25 %	33.37	48.35	55.48	6.19	8.80	11.14
T_5 - 75 % RDF + Poultry manure 15 %	30.92	43.62	51.93	5.32	6.47	8.00
T_6 - 75 % RDF + FYM 25 %	30.18	41.56	51.45	5.67	6.98	9.00
T_7 - 75 % RDF + FYM 15 %	29.03	38.51	50.41	5.12	6.58	8.25
T_8 - 75 % RDF + *Azotobacter* @ 2 kg ha^{-1}	29.28	39.85	51.11	5.31	6.16	8.85
T_9 - 75 % RDF + PSB @ 2 kg ha^{-1}	28.77	37.35	49.72	4.93	5.83	7.27
T_{10} - 75 % RDF + *Azotobacter* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}	36.24	51.75	58.45	6.82	9.79	11.23
SEd	0.14	0.43	0.16	0.09	0.16	0.23
CD (P=0.05)	0.26	0.87	0.30	0.18	0.32	0.44

Table 2: Influence of integrated nutrient management on number of leaves plant^{-1}, leaf area (cm^2) and flower yield plant^{-1} (g plant^{-1}) in tuberose (*Polianthes tuberosa* L.) *cv.* Prajwal.

Treatments	Number of leaves plant^{-1}			Leaf area (cm^2)		Flower yield plant^{-1} (g plant^{-1})
	90 DAP	120 DAP	150 DAP	90 DAP	120 DAP	
T_1 - 100 % RDF (200:200:200 kg NPK ha^{-1})	41.13	54.19	90.17	69.79	87.03	168.35
T_2 - 75 % RDF + Vermicompost 25 %	37.63	48.72	85.31	63.54	80.26	160.21
T_3 - 75 % RDF + Vermicompost 15 %	34.52	46.86	79.76	53.94	74.26	149.72
T_4 - 75 % RDF + Poultry manure 25 %	44.95	61.29	95.17	78.09	92.88	176.80
T_5 - 75 % RDF + Poultry manure 15 %	37.77	48.73	88.31	63.66	83.91	161.90
T_6 - 75 % RDF + FYM 25 %	31.65	45.56	77.76	58.30	71.02	154.58
T_7 - 75 % RDF + FYM 15 %	28.98	43.95	71.24	49.97	61.76	144.80
T_8 - 75 % RDF + *Azotobacter* @ 2 kg ha^{-1}	31.64	45.52	74.74	53.71	67.76	149.21
T_9 - 75 % RDF + PSB @ 2 kg ha^{-1}	26.45	42.45	67.22	47.64	52.86	138.52
T_{10} - 75 % RDF + *Azotobacter* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}	49.85	70.71	99.17	90.30	98.76	189.06
SEd	0.56	0.73	1.64	1.15	2.30	3.06
CD (P=0.05)	1.13	1.45	3.19	2.30	4.59	6.14

promoting substances such as IAA or GA like substances Vitamin B_{12}, thiamine, riboflavin (B_2) etc, which might have helped to increase number of leaves. All these factors contribute to cell multiplication, cell enlargement and differentiation which could have resulted in better photosynthesis and ultimately exhibited better vegetative growth. Thus the number of leaves in the treatment increased significantly in comparison to control. Srivastava and Govil (2007) reported increased number of leaves in gladiolus cv. American Beauty with the application of biofertilizers *viz*. *Azotobacter* and PSB.

The maximum leaf area (90.30 and 98.76 cm^2 on 90 and 120 DAP) was recorded with the application of T_{10} (75 % RDF + *Azotobacter* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}), while the minimum leaf area plant^{-1} (cm^2) was recorded with T_9 (75 % RDF + PSB @ 2 kg ha^{-1}) (Table 2). The increase in leaf area with application of biofertilizers (*Azotobacter* and PSB) might be due to release of growth regulators like cytokinins by biofertilizers, these growth promoting substances might have resulted in increased cell division and elongation leading to enhanced leaf expansion, thus leading to increased leaf length and leaf width which in turn resulted in higher leaf area. These findings are in close agreement with the findings of Airadevi (2012) in chrysanthemum.

Significant increase in the loose flowers yield plant^{-1} (189.06 g plant^{-1}) was obtained when applied with T_{10} (75 % RDF + *Azotobacter* @ 2 kg ha^{-1} + PSB @ 2 kg ha^{-1}), while the lowest flower yield was recorded in T_9 (75 % RDF + PSB @ 2 kg ha^{-1}) (Table 2). This might be due to the fact that, biofertilizers produces growth promoting substances such as IAA, GA, vitamin B 12, thiamine, riboflavin etc., which might have enhanced the soil fertility, thus enhanced the root and shoot development and their by growth. Thereafter it might have influenced the reproductive phase and induced flowering which resulted in increased flower yield plant^{-1}. This is in agreement with the findings of Singh *et al.,* (2015) in marigold.

From the results of this experiment it is concluded that application of 75 % recommended dose of fertilizer along with *Azotobacter* @ 2 kg ha^{-1} and PSB @ 2 kg ha^{-1} was beneficial in increasing the growth attributes and flower yield of tuberose *cv.* Prajwal.

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