EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON THE FLOWER YIELD OF TUBEROSE (*Polianthes tuberosa* L.) CV. PRAJWAL

B. Pamela Elisheba and R. Sudhagar

Department of Horticulture, Faculty of Agriculture, Annamalai University, Chidambaram – 608 002, Tamil Nadu, India.

ABSTRACT

A field experiment was conducted at the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar to study the effect of integrated nutrient management on the flower yield of tuberose (*Polianthes tuberosa* L.) cv. Prajwal. The trial was laid out in randomized block design consisting of eleven treatments with three replications. The treatments include a combination of recommended doses of fertilizers along with the organic fertilizers such as the farm yard manure and vermicompost, foliar sprays of panchagavya, humic acid and effective microorganisms. Among the various treatments, the plants receiving a combination of 75 % RDF + Vermicompost @ 5 t ha^{-1} + Humic Acid @ 0.2 % (T_9) was found to be best in all the yield attributes, *viz*., days to fifty per cent flowering (100.34 days), number of spikes per plant (4.75), spike length (57.36 cm), rachis length (20.94 cm), number of florets per spike (33.12), floret length (6.88 cm), floret diameter (4.50 cm), hundred florets weight (101.71 g), flower yield per plant (79.73 g $plant^{-1}$), flower yield per plot (1.12 kg $plot^{-1}$), flower yield per hectare (9.01 t ha^{-1}) and number of bulbs per plant (5.01).

Key words : Vermicompost, panchagavya, humic acid, Effective microorganisms

INTRODUCTION

Tuberose (*Polianthes tuberosa* L.) is popularly known as *Rajanigandha* in Hindi, occupies a prime position among commercial ornamental bulbous flower crops, because of its highly fragrant white flowers which can be used in various ways. It is commercially cultivated for use in cut flower and loose flower trades and also for extraction of highly valued essential oils. Among the commercial flower growers, the cultivation of tuberose has been found to be a profitable enterprise. This fragrant bulbous plant blooms profusely in summer and winter seasons. It is commercially cultivated for cut and loose flowers used for garland making, decoration and also the flowers are good source of essential oils (Yadav *et al*., 2003). It has good export potentiality because of more popular than ever in Europe, where the flowers are not available during winter months. More recently, attention is focussed on the global environmental problems. The world elite society is giving emphasize on utilization of

organic wastes as the most effective measure to save the environment to some extent. Thus integrated nutrient management is a strategy for advocating judicious and efficient use of chemical fertilizers with matching addition of organic manures like FYM, vermicompost and other organic inputs like panchagavya, humic acid and effective micro organisms (EM).

MATERIALS AND METHODS

The trial was conducted in a randomized block design in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar. The experiment included eleven treatments namely, T_1 (100% RDF i.e., 200:200:200 kg NPK ha^{-1}); T_2 (T_1 + FYM @ 25 t ha^{-1}); T_3 (75% RDF + FYM @ 25 t ha^{-1}); T_4 (T_1 + Vermicompost @ 5 t ha^{-1}); T_5 (75% RDF + Vermicompost @ 5 t ha^{-1}); T_6 (75% RDF + FYM @ 25 t ha^{-1} + Panchagavya @ 3%); T_7 (75% RDF + Vermicompost @ 5 t ha^{-1} + Panchagavya @ 3%); T_8 (75% RDF + FYM @ 25 t ha^{-1} + Humic Acid @ 0.2%); T_9 (75% RDF + Vermicompost @ 5 t ha^{-1} + Humic Acid @ 0.2%); T_{10} (75% RDF + FYM @ 25 t ha^{-1} + EM @ 1: 1000 dilution); T_{11} (75% RDF + Vermicompost @ 5 t ha^{-1} + EM @ 1: 1000 dilution) with three replications.

Healthy and matured uniform size bulbs of tuberose var. Prajwal were procured from a farmer's field at Nilakottai area, Dindigul district, Tamil Nadu. The bulbs were stored temporarily in area under a cool shady place and utilized for the present study. After the tillage operations, the basal dose of fertilizers and organic manures were incorporated during land preparation. The recommended dose of fertilizers was applied to selective plots according to the treatments. Urea, super phosphate and muriate of potash were used to supply N, P and K respectively. The organic inputs such as the Farmyard manure, vermicompost, pancahagavya, humic acid and Effective microorganisms were applied according to the treatments. Foliar application of Panchagavya, humic acid and effective microorganisms were done according to treatment schedule commencing from 30 days after transplanting. Three foliar sprays were given during the period of experimentation. Plants are ready to harvest at 90-110 days after planting and harvesting was done by manually at weekly intervals.

RESULTS AND DISCUSSION

Yield is a complex phenomenon which is controlled by the interaction of morphological and physiological parameters and it can also be manipulated by genetic factors or cultural operations. The results regarding the flowering parameters showed significantly maximum number of spikes per plant (4.75), spike length (57.36 cm), rachis length (20.94 cm), number of florets per spike (33.12), floret length (6.88 cm), floret diameter (4.50 cm), hundred florets weight (101.71 g), flower yield per plant (79.73 g $plant^{-1}$), flower yield per plot (1.12 kg $plot^{-1}$), flower yield per hectare (9.01 t ha^{-1}), number of bulbs per plant (5.01) and minimum days to fifty percent flowering (100.34 days) (Table 1 & 2).

The results regarding the fifty per cent flowering shows greater influence due to the treatment combination including vermicompost @ 5 t ha^{-1} and humic acid @ 0.2 % with 75% RDF. Similar findings were reported by Gangadharan and Gopinath (2000) in gladiolus cv. White Prosperity and of Sreenivas *et al*. (1998) in china aster. Chang *et al*. (2012) in a study on lilium, found that the application of humic acid leads to eight days earlier than the start of blooming in controls. This might be due to the better nutritional status of the plant, which was favoured by the treatments. Increased production of leaves might help to elaborate more photosynthates and induce flowering stimulus, thus effecting early initiation of flower bud formation. Among the treatments, the number of spikes $plant^{-1}$ and the number of florets $spike^{-1}$ were found to be high in plants treated with 75 % RDF, vermicompost @ 5 t ha^{-1} and foliar spray of humic acid @ 0.2 %. These results are in line with the reports of Kabir *et al*. (2011) in tuberose, Mamta Bohra and Ajit Kumar (2014) in chrysanthemum, by the use of vermicompost.

The increase in number of flowers $plant^{-1}$ might be due to the increased allocation of photosynthates towards the economic part and due to the hormonal balance in the plant system. The increase in fruit length and fruit weight may be attributed to the increase in the number of cells as well as elongation of individual cells. This might be rendered possible through better translocation of soluble ions under optimum level (Amirthalingam and Balakrishnan, 1988).

The spike length and rachis length were found to be significantly superior by the application of vermicompost @ 5 t ha^{-1} along with humic acid spray @ 0.2 % and 75 % RDF. These results are in accordance with the findings of Padaganur *et al*. (2005), Verma *et al*. (2011) and Mamta Bohra and Ajit Kumar (2014) in chrysanthemum by using vermicompost. The maximum rachis length was reported in tuberose by using humic acid @ 1000 ppm by Behnam Khodakhah *et al*. (2014). The improvement in quality of spikes was mainly due to castings of earthworms along with macro and micro nutrients (Gravilov, 1962 and Bano *et al*., 1987).

The application of vermicompost @ 5 t ha^{-1} and humic acid spray @ 0.2 % and 75 % RDF showed higher increase in floret length and floret diameter. The results of the present study confirmed the earlier findings of Anjana Sisodia and Anil Singh (2015) in gladiolus, Weena Nilawonk and Arnat Tancho (2015) in Jasmine.

The imposition of vermicompost @ 5 t ha^{-1} and foliar spray of humic acid @ 0.2 % along with 75 % RDF showed higher increase in hundred florets weight. The increase in the average flower weight, number of flowers $plant^{-1}$ and average yield of flower $square\ meter^{-1}$ might be due to the presence of growth promoting substances like essential plant nutrients, vitamins, enzymes and antibiotics in vermicompost. These findings are in conformity with the findings of Mamta and Bohra and Ajit Kumar (2014) in chrysanthemum.

The treatment combination of humic acid spray @ 0.2 %, vermicompost @ 5 t ha^{-1} and 75 % RDF recorded highest yield of flowers $hectare^{-1}$. Similar findings were reported by Padaganur *et al*. (2005) in tuberose. The increase in spike yield $plot^{-1}$ and $hectare^{-1}$ might be due to increased number of spikes $plant^{-1}$, number of florets $spike^{-1}$ and fresh weight of florets in the above said treatments. This increase in yield parameters could be attributed to increase in vegetative growth characters.

The significant differences in flower production when vermicompost along with fertilizers might be due to the fact that it presents the nutrients in most available form, which made it possible for the plants to grow and put forth luxuriant growth which in turn helped the plants to produce more photosynthesis to produce high flower yields. Similarly increased yields due to incorporation of vermicompost along with fertilizers were reported by Patel (1992), Kulkarni *et al*. (1994) in china aster. This increased yield due to foliar spray of humic acid could be attributed to quinine groups, which act as hydrogen acceptors and serve as activators of oxygen during photosynthesis and stimulate the plant growth resulting in higher yield. Similar observations were also made earlier by Haripriya *et al.* (2002) in tuberose.

The maximum number of bulbs was recorded with the treatment i.e. 75 % RDF, vermicompost @ 5 t ha^{-1} and humic acid @ 0.2 %. The results are in accordance with the findings of Kabir *et al*. (2011) which reported that the application of organic manures had significant effect on bulb characters such as number of side bulbs $plant^{-1}$, bulb length, diameter and bulb yield both $plant^{-1}$ and $hectare^{-1}$. These results are consistent with the result of Marban *et al*. (2008) who reported that application of organic manures with chemical fertilizers increased bulb yield. The higher bulb yield in organic fertilizers applied plants than chemical fertilizers might be due to more assimilate by greater number of leaves.

Table 1 : Effect of integrated nutrient management on days to fifty per cent flowering, no. of spikes plant^{-1}, spike length, rachis length, no. of florets spike^{-1}, floret length, floret diameter, hundred florets weight in tuberose cv. Prajwal

Treatments	Days to fifty per cent flowering	No. of spikes plant^{-1}	Spike length	Rachis length	No. of florets spike^{-1}	Floret length	Floret diameter	Hundred florets weight
T_1	100.89	2.06	44.65	16.13	26.74	4.11	2.05	89.84
T_2	97.23	2.91	46.23	17.32	28.32	4.92	2.45	92.33
T_3	98.41	2.34	45.48	16.64	27.60	4.55	2.20	91.58
T_4	93.89	3.55	49.19	18.77	30.45	5.46	3.25	95.06
T_5	94.95	3.21	47.65	18.38	29.77	5.34	3.01	94.14
T_6	92.41	4.01	51.83	19.84	31.66	6.08	3.92	98.82
T_7	91.05	4.45	56.16	20.45	32.54	6.55	4.21	100.47
T_8	91.69	4.18	53.74	20.06	31.89	6.21	4.01	100.30
T_9	90.34	4.75	57.36	20.94	33.12	6.88	4.50	101.71
T_{10}	96.36	3.01	46.89	17.93	29.16	5.11	2.91	93.31
T_{11}	93.03	3.90	50.33	19.42	31.04	5.94	3.56	98.20
S.E. ±	0.25	0.03	0.49	0.07	0.09	0.05	0.03	0.07
C.D.(P=0.05)	0.52	0.06	1.02	0.14	0.18	0.11	0.06	0.14
C.V.%	0.32	1.02	1.19	0.44	0.35	1.19	1.09	0.09

Table 2 : Effect of integrated nutrient management on flower yield plant^{-1}, flower yield plot^{-1}, flower yield hectare^{-1} and bulbs plant^{-1} in tuberose cv. Prajwal

Treatments	Flower yield plant^{-1} (g plant^{-1})	Flower yield plot^{-1} (kg ha^{-1})	Flower yield hectare^{-1} (t ha^{-1})	Number of bulbs plant^{-1}
T_1	47.86	0.67	5.32	2.05
T_2	54.29	0.76	6.03	2.90
T_3	51.43	0.72	5.71	2.30
T_4	62.86	0.88	6.98	3.56
T_5	60.00	0.84	6.67	3.20
T_6	68.57	0.96	7.62	4.03
T_7	74.29	1.04	8.25	4.97
T_8	71.43	1.00	7.94	4.44
T_9	77.86	1.09	8.65	5.01
T_{10}	57.14	0.80	6.35	3.01
T_{11}	65.71	0.92	7.30	3.98
S.E. ±	0.69	0.01	0.05	0.01
C.D.(P=0.05)	1.43	0.03	0.11	0.03
C.V.%	1.02	0.87	1.79	0.49

REFERENCES

Haripriya, K., S. Kamalakannan, C. T. Sathappan, T. Umamaheshwari and P. Poonkodi. 2002. Influence of humic acid on flower production in tuberose (*Polianthes tuberosa* L.). In: *National seminar on Recent trends on the use of humic substances for sustainable Agriculture, Department of Soil Science and Agrl. Chemistry, Annamalai University during February*, **27-28**.p.13.

Kulkarni, B. S. 1994. Effect of vermiculture on growth and yield of china aster cv. Ostrich Plume Mixed. *M.Sc. (Hort.) Thesis, University of Agricultural Sciences, Dharwad.*

Patel, R. B. 1992. Vermiculture experience in horticulture. *Key Note Papers and Extended Abstracts of Congress on Traditional Science and Technology of India. Indian Institute of Tech., Bombay*, **7**: 15-16.

Patil, P. R., B. S. Reddy, S. R. Patil and B. S. Kulkarni. 1999. Effect of community planting and fertilizer levels on growth and flower yield of tuberose (*Polianthes tuberosa* L.) cv. Double. *South Indian Hort*. **47(1-6):** 335-338.

Saba Ambreen Menon, Fazal Muhammad Bangulzai, Muhammad Ibrahim Keerio, Muhammad Ayub Baloch and Mahmooda Buriro. 2014. Effect of humic acid and iron sulphate on growth and yield of Zinna (*Zinnia elegans*). *J. Agricul. Tech*., **10(6):**1517-1529.

Yadav, B.S., V.P. Ahlawat and S.K. Sehrawat. 2003. Effect of nitrogen and zinc on growth and spike production of tuberose. *Haryana J. Hort. Sci*., **32(3&4):** 216-218.

Gangadharan, G. D. and G. Gopinath. 2000. Effect of organic and inorganic fertilizers on growth, flowering and quality of gladiolus cv. White Prosperity. *Karnataka J. Agrl. Sci.,* **13(2):** 401-405.

Sreenivas, K. V., J. V. Narayanagowda and P. Narayanaswamy. 1998. Effects of different organic manures on growth and flower yield of china aster. *Karnataka J. Agric. Sci.,* **11(3):** 858-861.

Chang, L., Y. Wu, W. Xu, A. Nikbakht and Y. Xia. 2012. Effects of calcium and humic acid treatment on the growth and nutrient uptake of Oriental lily. *African J. Biotech.,* **11(9):** 2218-2222.

Kabir, A. K. M. R., M. H. Iman, M. M. A. Mondal and S. Chowdhury. 2011. Response of tuberose to Integrated Nutrient Management. *J. Environ. Sci. & Natural Resources.*, **4(2):** 55-59.

Mamta Bohra and Ajit kumar. (2014). Effect of organic manures and Bioinoculants on vegetative and floral attributes of Chrysanthemum cv. Little darling. *Int. Quarterly J. Life Sci.,* **9(3):** 1007-1010.

Marban, L., L. Giuffre, M. Riat and R. Romaniak. 2008. Comparison of conventional fertilization and organic manures use for basil cultivation. *J. Applied Hort.,* **10:** 87-90.

Amirthalingam, S. and R. Balakrishnan. 1988. Studies on the effect of Azospirillum, nitrogen and NAA on growth and yield of chilli (*Capsicum annuum* L.) cv. K.1. South Indian Hort., 36 : 218.

Padaganur, V. G., A. N. Mokashi and V. S. Patil. 2005. Flowering, flower quality and yield of tuberose (*Polianthes tuberosa* L.) as influenced by vermicompost, farm yard manure and fertlizers. *Karnataka J. Agric. Sci.,* **18(3):** 729-734.

Verma, S. K., G. Angadi, V.S. Patil, A.N. Mokashi, J.C. Mathad and U.V. Mummigatti. 2011. Growth, yield and quality of chrysanthemum (Chrysanthemum morifolium Ramat.) Cv. Raja as influenced by integrated nutrient management. *Karnataka J. Agrl. Sci.,* **24(5):** 681-683.

Behnam Khodakhah, Amrollah Nabigol and Behrooz Salehi. 2014. The effect of different levels of humic acid and salicylic acid on growth characterstics and qualities of tuberose. *Adv. in Env.Bio.***, 8(16):** 118-123.

Gravilov, K. 1962. Role of earthworms in the enrichment of soil by biologically active substances.*Vaprosy Eicologi.,* **7:** 34.

Bano, K., R. D. Kale and G. M. Gajanan. 1987. Culturing of earthworms *Eudrillus eugeniae* for wormcast production and assessment of wormcast as biofertilizer, *J. Soil. Bio & Ecology.,* **7:** 98-105.

Anjana Sisodia and Anil K Singh. 2015. Effect of Farm Yard Manure, Vermicompost and Trichoderma on flowering and corm attributes in gladiolus. *Bangladesh J. Bot.*, **44(2):** 309-314.

Weena Nilawonk and Arnat Tancho. 2015. Influence of Vermicompost and compost application to the growth and yield of jasmine and rose in Chiang Mai, Thailand. *Environ. & Bio. Sci., Indonesia***.**