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STUDIES ON THE EFFECT OF ORGANIC MANURES, BIOSTIMULANTS AND MICRONUTRIENTS ON CERTAIN GROWTH AND PHYSIOLOGICAL CHARACTERS OF TUBEROSE (*POLIANTHES TUBEROSA* L.) *CV.* PRAJWAL

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Abstract

The present investigation entitled "studies on the effect of organic manures, biostimulants and micronutrients on certain growth and physiological characters of tuberose (*Polianthes tuberosa* L.) *cv.* Prajwal" was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalainagar during 2017-2018. The different treatments included the combinations of vermicompost, poultry manure, neem cake, humic acid, seaweed extract, zinc and boron in different ratios. The data was analyzed statistically which showed significant effect of organic manures, biostimulants and micronutrients over control values. The maximum values of plant spread (sq.cm), leaf area (cm^2), chlorophyll content (mg g^{-1}) and dry matter production (g $plant^{-1}$) were observed in 50% RDF @ 100 : 100 : 100 kg of NPK ha^{-1} + vermicompost @ 5 t ha^{-1} + humic acid @ 0.2% + boron @ 1%. These findings lead towards beneficial and commercially feasible for the effective cultivation of tuberose (*Polianthes tuberosa* L.) *cv.* Prajwal under open field conditions in the coastal ecosystems.

Key words: Tuberose, organic manures, biostimulants, micronutrients, growth characteristics and physiological characteristics.

Introduction

Tuberose (*Polianthus tuberosa* L.) is one of the most important tropical bulbous flowering plants cultivated for the production of long lasting flower spikes. It is popularly known as Rajanigandha. It belongs to the family Amarylliaceae and it is native of Mexico. Commercial importance of tuberose is due to beauty of the flower, longer vase-life of spikes and aromatic oil extracted from its fragrant white flower (Alan *et al.*, 2007). The tuberose blooms throughout the year, florets are star-shaped, waxy and loosely arranged on spike that can reach up to 30 to 45 cm in length. There is high demand for tuberose concrete and absolute in international markets which fetch very good price. Flowers of the Single type (single row perianth) are commonly used as loose flowers, making garlands and essential oil etc, while the double varieties (more than two rows of perianth) are used as cut flowers, garden display and interior decoration (Anonymous 2016).

Organic manures not only provide major nutrients but micronutrients as well to the growing plants. It increase the organic matter content and hence improve the physical properties of soils including water holding capacity in sandy soils and drain ability in clayey soils. Organic materials are the safer sources of plant nutrients which have no detrimental effect to crops and soil. Cow dung, farm yard manure, poultry manure, vermicompost and green manure are excellent sources of organic matter as well as primary plant nutrients (Pieters, 2005). Among all the animal manures, poultry manure has the highest amount of NPK content. Optimal storage conditions for chicken manure includes it being kept in a covered area and retaining its liquid, because a significant amount of nitrogen exists in the urine. Tuberose is a gross feeder and requires a large quantity of NPK both in the form of organic and inorganic fertilizers (Amarjeet *et al.*, 2000). A plant biostimulant is any substance or microorganism applied to plants with the aim to enhance nutrition efficiency, abiotic stress tolerance and/or crop quality traits, regardless of its nutrients content. Micronutrients are essential for better growth of tuberose. The micronutrients are responsible in activating several enzymes (catalase, peroxidase, alcohol dehydrogenase,

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carbonic dehydrogenase, tryptophan synthease, etc.) and involve them self in chlorophyll synthesis and various physiological activities by which plant growth and development are encouraged. The use of growth stimulants, organic manures and micronutrients has brought about a sort of revolution in the floriculture industry. Present research work was planned to investigate the best effect of organic manures, biostimulants and micronutrients of tuberose under open field conditions in the coastal ecosystems.

Materials and Methods

The experiment was conducted in the agro-climatic conditions of Annamalai Nagar at floriculture yard, Department of Horticulture, Annamalai University, Chidambaram region features a hot summer climate with maximum temperature of 38^0c and minimum of 17.5^0c with annual average rainfall of 1235 mm and consider good for tuberose cultivation. The corms of the single variety of tuberose were sown after dipped in carbendazim fungicide 2 g litre^{-1} of water for 15 minutes. The treatments were replicated three times during the month of February. The certain growth parameters including plant height, number of leaves plant^{-1} and number of side shoots plant^{-1} were observed by using organic manures and foliar application of biostimulants and micronutrients. Randomized block design was used to evaluate the results statistically and LSD (least significant difference) at 5% were calculated according to the method described by Panse and Sukhatme (1978).

Results and Discussion

Growth characters

Plant spread (cm^2)

Different treatments significantly influenced the plant spread (Table 1). Among the different treatments, the maximum plant spread was observed in T_4 (50 % RDF@ 100: 100: 100 kg NPK ha^{-1}+ vermicompost @ 5 t ha^{-1} + humic acid @ 0.2 % + boron @ 1%) which recorded the value of 25.02 cm^2, which was followed by T_8 with the value of 24.33 cm^2. The lowest value on plant spread (15.67 cm^2) was recorded in T_{13} (control).

Leaf area (cm^2)

The results on the effect of various treatments on leaf area are presented in Table 1. Different treatments influenced the results significantly. Among the different treatments, the maximum leaf area was observed in T_4(50 % RDF@ 100: 100: 100 kg NPK ha^{-1}+ vermicompost @ 5 t ha^{-1} + humic acid @ 0.2 % + boron @ 1%) with the value of 43.44 cm^2, which was followed by T_8(43.05 cm^2). The lowest value of leaf area (32.19 cm^2) was recorded in T_{13} (control).

Physiological characters

Chlorophyll content (mg g^{-1})

The data on the effect of various treatments on chlorophyll content are presented in Table 2. Different treatments significantly influenced the chlorophyll content. Among the various treatments, T_4 (50 % RDF@ 100: 100: 100 kg NPK ha^{-1}+ vermicompost @ 5 t ha^{-1} + humic acid @ 0.2 % + boron @ 1%) recorded the maximum value of chlorophyll content (0.933 mgg^{-1}). However, it was closely followed by T_8 (0.894 mg g^{-1}). The lowest value (0.499 mg g^{-1}) was recorded in control (T_{13}).

Dry matter production (g plant^{-1})

The results on dry matter production per plant influenced by various treatments are presented in Table 2. Various treatments significantly influenced the dry matter production. The highest value in dry matter production (24.66 g plant^{-1}) was noticed in T_4 (50 % RDF @ 100: 100: 100 kg NPK ha^{-1} + vermicompost @ 5 t ha^{-1} + humic acid @ 0.2 % + boron @ 1%), followed by T_8 which recorded the value of 24.20 g plant^{-1}. The lowest value in dry matter production (16.30 g plant^{-1}) was observed in T_{13} (control).

Hence the results revealed that the higher carbohydrate accumulation in leaves facilitated by a favorably influenced combination of vermicompost, humic acid and boron application might have lead to higher photosynthetic activities and ultimately resulting in an increased plant spread and leaf area. The plant spread and leaf area is more directly related to the photosynthetic efficiency as reported by Hardeep Kumar *et al.,* (2003), Karuppaiah (2005) in African marigold, Ganesh *et al*. (2014) in tuberose and Tara Chand Saini *et al*., (2015) in chrysanthemum.

The chlorophyll is an essential component for photosynthesis and it occurs in chloroplasts as green pigments in all photosynthetic plant tissues. In the present work, T_4 (50 % RDF @ 100: 100: 100 kg NPK ha^{-1} + vermicompost @ 5 t ha^{-1} + humic acid @ 0.2 % + boron @ 1%) recorded higher chlorophyll content with the value of 0.933 mg g^{-1}. This is because the responses of the foliar humic acid fertilizer could related with a consecutive increased net photosynthetic rate due to the high content of chlorophyll and the improved chloroplast ultra structure (Hong-mei Fan *et al*., 2014). The significant variation in chlorophyll content might be due to the positive effects of vermicompost, humic acid and boron and its appropriate combination as reported by Hardeep Kumar

Table 1: Effect of organic manures, biostimulants and micronutrients on plant spread (cm^2) and leaf area (cm^2) in tuberose (*Polianthes tuberosa L.*) cv. Prajwal

Treatments	Plant spread (cm^2)	Leaf area (cm^2)
T_1- 50% RDF + vermicompost@ 5 t ha^{-1} seaweed extract@ 2%+ boron@ 1%	23.54	42.53
T_2- 50% RDF+poultry manure@ 10 t ha^{-1} +seaweed extract@ 2%+boron@ 1%	22.06	41.58
T_3- 50% RDF + neem cake@ 1t ha^{-1} + seaweed extract@ 2%+ boron @ 1%	20.12	40.52
T_4- 50% RDF + vermicompost@ 5 t ha^{-1} +humic acid@ 0.2% boron@ 1%	25.02	43.44
T_5- 50% RDF + poultry manure@ 10 t ha^{-1} + humic acid+ boron@ 1%	22.88	42.18
T_6- 50% RDF + neem cake@ 1t ha^{-1} + humic acid@ 0.2% + boron@ 1%	21.42	41.21
T_7- 50% RDF + vermicompost@ 5 t ha^{-1} + seaweed extract@ 2%+ zinc sulphate@ 0.5%	19.95	40.16
T_8- 50% RDF + poultry manure@ 10 t ha^{-1} + seaweed extract@ 2%+ zinc sulphate@ 0.5%	24.33	43.05
T_9- 50% RDF + neem cake@ 1t ha^{-1} + seaweed extract@ 2% $sq.m^{-1}$ + zincsulphate@ 0.5%	22.23	41.85
T_{10}- 50% RDF + vermicompost@ 5 t ha^{-1} + humic acid@ 0.2% + zinc sulphate@ 0.5%	20.75	40.86
T_{11}- 50% RDF + poultry manure@ 10 t ha^{-1} + humic acid@ 0.2% + zinc sulphate@ 0.5%	18.83	39.83
T_{12}- 50% RDF + neem cake@ 1t ha^{-1} + humic acid@ 0.2% + zinc sulphate @ 0.5%	24.16	42.82
T_{13}- Control	15.67	32.19
CD (0.05)	0.60	0.30
S.Ed	0.30	0.15

*NOTE: RDF- Recommended dosage of fertilizer @ 100:100:100 kg of NPK ha^{-1}, humic acid, seaweed extract , boron and zinc as foliar application

Table 2: Effect of organic manures, biostimulants and micronutrients on chlorophyll content (mg g^{-1}) and dry matter production (g $plant^{-1}$) in tuberose (*Polianthes tuberosa L.*) cv. Prajwal

Treatments	Chlorophyll content (mg g^{-1})	Dry matter production (g $plant^{-1}$)
T_1- 50% RDF + vermicompost@ 5 t ha^{-1} + seaweed extract @ 2%+ boron @ 1%	0.849	22.75
T_2- 50% RDF + poultry manure@ 10 t ha^{-1} + seaweed extract@ 2%+ boron@ 1%	0.760	20.85
T_3- 50% RDF + neem cake@ 1t ha^{-1} + seaweed extract@ 2%+ boron@ 1%	0.663	20.45
T_4- 50% RDF + vermicompost@ 5 t ha^{-1} + humic acid@ 0.2% + boron@ 1%	0.933	24.66
T_5- 50% RDF + poultry manure@ 10 t ha^{-1} + humic acid@ 0.2% + boron@ 1%	0.808	22.24
T_6- 50% RDF + neem cake@ 1t ha^{-1} + humic acid@ 0.2% + boron@ 1%	0.724	21.35
T_7- 50% RDF + vermicompost@ 5 t ha^{-1} + seaweed extract@ 2%+ zinc sulphate@ 0.5%	0.628	20.02
T_8- 50% RDF + poultry manure@ 10 t ha^{-1} + seaweed extract@ 2%+ zinc sulphate@ 0.5%	0.894	24.20
T_9- 50% RDF + neem cake@ 1t ha^{-1} + seaweed extract@ 2% $sq.m^{-1}$ + zinc sulphate@ 0.5%	0.772	21.82
T_{10}- 50% RDF + vermicompost@ 5 t ha^{-1} + humic acid@ 0.2% + zinc sulphate@ 0.5%	0.694	20.87
T_{11}- 50% RDF + poultry manure@ 10 t ha^{-1} + humic acid@ 0.2% + zinc sulphate@ 0.5%	0.590	19.53
T_{12}- 50% RDF + neem cake@ 1t ha^{-1} + humic acid@ 0.2% + zinc sulphate@ 0.5%	0.885	23.23
T_{13}- Control	0.499	16.30
CD (0.05)	0.02	0.40
S.Ed	0.01	0.20

*NOTE: RDF- Recommended dosage of fertilizer @ 100:100:100 kg of NPK ha^{-1}, humic acid, seaweed extract , boron and zinc as foliar application

et al., (2003) in tuberose, Patil *et al*., (2004) in *J. sambac* and Suseela *et al*., (2016) in tuberose (*Polianthus tuberose* L.) *cv.* Suvasini. In the present study, the higher dry matter production was observed in T_4 with the value of 24.66 g $plant^{-1}$. This might be due to the increased plant growth such as plant height, number of side shoots per plant, number of leaves per plant, plant spread and leaf area due to the maintenance of macro and micronutrient status of the plant as reported by Subrata Raha *et al*., (2015) in chrysanthemum. Similar findings were reported by Verma *et al*., (2011) that the dry matter production was influenced by the effect of vermicompost and the influence of humic acid on the dry matter production was reported by Hong-mei Fan *et al*., (2014).

Conclusion

In light of the above discussions, it could be concluded that foliar application of 50% RDF @ 50 : 50 : 50 kg NPK ha^{-1} + vermicompost @ 5 t ha^{-1} along with foliar application of humic acid @ 0.2% + boron @ 1% at 60 days interval from 60 DAP onwards was found better in increasing certain growth and physiological characters of tuberose cv. Prajwal.

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