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Short Communication

Influence of Fertigation, Microbial Consortium and Biostimulants on Bulb Yield of Tuberose (*Polianthes Tuberosa* L.) Cv. 'Prajwal'

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***Key words*:** Tuberose, Fertigation, Microbial consortium, Biostimulants, Bulb yield

Tuberose (*Polianthes tuberosa* L.) is one of the important tropical ornamental flower crops cultivated to different edaphic and climatic conditions across the country. It belongs to the family Amaryllidaceace and is native of Mexico. Tuberose is an important commercial cut as well as loose flower crop with attractive pearl white flower and possesses a pleasant fragrance, longer vase life of spikes, higher returns and wide adaptability to varied climate and soil. It has been cherished for the aromatic oil extracted from its fragrant white flowers. Tuberose blooms throughout the year and its clustered spikes are rich in fragrance and florets are star shaped. The dried bulbs of Tuberose are often used as a remedy for gonorrhoea. Nutrient management is an important and integral component of organic farming for the sustainable production of Tuberose. Under commercial cultivation of Tuberose, inadequate plant nutrition mainly causes stunted growth which may lead to decline of plant vigour and eventually lead to reduced productivity and higher cost of production. In recent years, fertigation has been proved to be the most economical technique for fertilizer application in many of the horticultural crops and has potential for more accurate and timely crop nutrition supply for better yield and improved quality [1]. Fertigation also reduces the wastage of fertilizer by increased fertilizer use efficiency and thus, helps in economizing the use of water, fertilizers in a more economical way, which reduces the cost of fertilizer and labour.

Indiscriminate and continuous use of chemical fertilizers has led to an imbalance of nutrients in soil which has an adverse effect on the soil health, affecting the yield and quality of the product. Therefore, use of organic fertilizers is an important component in tuberose cultivation. Many of the earlier studies demonstrated that the use of biofertilizers (or) microbial consortium, biostimulants like panchagavya and humic acid improves physio chemical and biological properties of soil and overall improvement of soil health besides improving the efficiency of applied nutrients. Biofertilizers are biologically active products containing certain strains of bacteria, algae or fungi as a single or composite culture [2]. They produce hormones and antimetabolites which promote root growth. Bio-stimulants are products of natural or organic in origin, which stimulates the plants to achieve their highest growth and yield potential, there by promote crop growth and yield.

Panchagavya, an organic product has the potential to promote growth and providing immunity in plant system. Humic acid is the main fractions of humic substances and the most active components of soil organic matter. Humic substances stimulate plant growth by accelerating respiration, by their effects on photosynthesis, by increasing water and nutrient uptake and by influencing the enzyme activities. Humic acids promote plant health and growth. The importance of humic acids lies in their ability to promote hormonal activity in plants. Keeping in view, the above facts, a field experiment was conducted to find out the influence of fertigation, microbial consortium and biostimulants on bulb yield of Tuberose.

A field experiment was carried out to study the effect of integrated nutrient management practices on bulb yield of Tuberose cv. "Prajwal' at T. Pudhpatti village, Reddiyarchatram block of Dindigul District, during 2015-16 and 2016-17. The experiment was laid out in randomized block design comprised nineteen treatments with three levels of fertigation viz., 125 per cent, 100 per cent and 75 per cent of RDF. Microbial consortium was applied @ 12.5 kg ha^{-1} as soil application and biostimulants viz., panchagavya (3 per cent and 4 per cent) and humic acid (0.4 per cent and 0.5 per cent) were foliar sprayed at monthly interval. Bulb yield parameters like number of bulbs $clump^{-1}$, number of bulblets $clump^{-1}$, bulb length (cm), bulb width (cm), bulb yield (kg $plot^{-1}$) and estimated bulb yield (t ha^{-1}) were recorded in randomly selected five plants and average values were taken for statistical analysis.

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Treatments details:

Treatments	Details
T_1	125 % recommended dose of fertilizer through fertigation (RDFTF)
T_2	125 % RDFTF + Microbial Consortium (MC) @ 12.5 kg ha^{-1}
T_3	125 % RDFTF + MC @ 12.5 kg ha^{-1} + Panchagavya @ 3 % +Humic acid @ 0.4 %
T_4	125 % RDFTF + MC @ 12.5 kg ha^{-1} + Panchagavya @ 3 % + Humic acid @ 0.5 %
T_5	125 % RDFTF + MC @ 12.5 kg ha^{-1}+ Panchagavya @ 4 % + Humic acid @ 0.4 %
T_6	125 % RDFTF + MC @ 12.5 kg ha^{-1} + Panchagavya @ 4 % + Humic acid @ 0.5 %
T_7	100 % RDFTF
T_8	100 % RDFTF + MC @ 12.5 kg ha^{-1}
T_9	100 % RDFTF + MC @ 12.5 kg ha^{-1} + Panchagavya @3 % + Humic acid @ 0.4 %
T_{10}	100 % RDFTF + MC @ 12.5 kg ha^{-1} + Panchagavya @ 3 % + Humic acid @ 0.5 %
T_{11}	100 % RDFTF + MC @ 12.5 kg ha^{-1} +Panchagavya @ 4 % + Humic acid @ 0.4 %
T_{12}	100 % RDFTF + MC @ 12.5 kg ha^{-1} + Panchagavya @ 4 % + Humic acid @ 0.5 %
T_{13}	75 % RDFTF
T_{14}	75 % RDFTF + MC @ 12.5 kg ha^{-1}
T_{15}	75 %RDFTF + MC @ 12.5 kg ha^{-1} +Panchagavya @ 3 % + Humic acid @ 0.4 %
T_{16}	75% RDFTF + MC @ 12.5 kg ha^{-1}+ Panchagavya @ 3 % + Humic acid @ 0.5 %
T_{17}	75 % RDFTF + MC @ 12.5 kg ha^{-1} + Panchagavya @ 4 % + Humic acid @ 0.4 %
T_{18}	75 % RDFTF + MC @ 12.5 kg ha^{-1} + Panchagavya @ 4 % + Humic acid @ 0.5 %
T_{19}	100 % Recommended dose of fertilizer (Soil application)

RDF: NPK 200:200:200 kg ha^{-1}

Significant variations were observed with regard to bulb yield parameters like number of bulbs $clump^{-1}$, number of bulblets $clump^{-1}$, bulb length, bulb width, bulb yield $plot^{-1}$, and bulb yield ha^{-1} in all treatments when compared to control (Table 1). Among the various treatments, the combined application of 100 per cent recommended dose of fertilizer through fertigation along with microbial consortium @ 12.5 kg ha^{-1} + panchagavya @ 3 per cent + humic acid @ 0.4 per cent (T_9) recorded maximum number of bulbs $clump^{-1}$ (10.22), number of bulblets $clump^{-1}$ (16.42), bulb length (6.63 cm), bulb width (2.92), bulb yield $plot^{-1}$ (10.35 kg) and bulb yield ha^{-1} (25.88 t) which was on par with 100 per cent recommended dose of fertilizer through fertigation + microbial consortium @ 12.5 kg ha^{-1} + panchagavya @ 3 per cent + humic acid @ 0.5 per cent (T_{10}), 100 per cent recommended dose of fertilizer through fertigation + microbial consortium @ 12.5 kg ha^{-1} + panchagavya @ 4 per cent + humic acid @ 0.4 per cent (T_{11}) and 100 per cent recommended dose of fertilizer through fertigation + microbial consortium @ 12.5 kg ha^{-1} + panchagavya @ 4 per cent + humic acid @ 0.5 per cent (T_{12}).

Table 1 Influence of fertigation, microbial consortium and biostimulants on bulb yield on tuberose (*Polianthes tuberosa* L.) cv. 'Prajwal'

Treatments	Number of bulbs $clump^{-1}$	Number of bulblets $clump^{-1}$	Bulb length (cm)	Bulb diameter (cm)	Bulb yield $plot^{-1}$	Bulb yield ha^{-1}
T_1	8.32	12.26	5.53	2.41	7.86	19.67
T_2	8.86	13.28	5.78	2.52	8.60	21.51
T_3	9.84	15.6	6.39	2.81	9.93	24.82
T_4	9.82	15.46	6.37	2.80	9.88	24.70
T_5	9.78	15.19	6.31	2.77	9.78	24.44
T_6	9.70	15.07	6.27	2.77	9.67	24.22
T_7	8.45	12.44	5.58	2.43	8.09	20.23
T_8	9.02	13.52	5.89	2.58	8.82	22.04
T_9	10.22	16.42	6.63	2.92	10.35	25.88
T_{10}	10.18	16.30	6.61	2.91	10.32	25.81
T_{11}	10.14	16.12	6.53	2.87	10.27	25.66
T_{12}	10.12	16.02	6.50	2.87	10.24	25.60
T_{13}	8.06	11.74	5.35	2.32	7.51	18.77
T_{14}	8.62	12.79	5.65	2.45	8.31	20.78
T_{15}	9.45	14.46	6.13	2.69	9.37	23.41
T_{16}	9.39	14.35	6.11	2.68	9.30	23.25
T_{17}	9.32	14.18	6.07	2.64	9.19	22.97
T_{18}	9.26	14.03	6.04	2.62	9.12	22.80
T_{19}	7.70	10.96	5.22	2.24	7.03	17.58
SEd	0.17	0.27	0.11	0.050	0.17	0.43
CD (0.05)	0.36	0.56	0.23	0.104	0.36	0.95

Application of 75 per cent recommended dose of fertilizer through fertigation combined with microbial consortium and bio-stimulant (panchagavya and humic acid) treatments recorded the maximum bulb yield (ranging from 22.80 to 23.41 t ha^{-1}) when compared with 100 per cent recommended dose of fertilizer through fertigation alone (20.23 t ha^{-1}). The minimum number of bulbs $clump^{-1}$ (7.70), number of bulblets $clump^{-1}$ (10.96), bulb length (5.22 cm),

bulb width (2.24 cm), bulb yield plot^{-1} (7.03 kg) and bulb yield ha^{-1} (17.58 t ha^{-1}) was registered at 100 per cent recommended dose of fertilizer through soil application (T_{19}).

Application of higher or required quantity of nitrogen resulted in higher bulb yield in Tuberose. The increase in bulb yield parameters with higher rates of nitrogen applications may be due to positive effect of nitrogen, which stimulates the vegetative growth and increases the translocation and accumulation of reserve food material in the new bulbs and thus resulting in the improvement of bulb length, width and weight [3-4]. Application of water and nutrients through fertigation system, results in greater translocation of photosynthetic materials from the leaves to sink sites resulting in better bulb yield [5-6]. A greater number of bulbs may be due to higher rate of photosynthesis contributing to increased availability of the metabolites for production of bulbs and bulblets apart from flower production [7]. Increase in bulb yield due to the application of biofertilizers might be due to the enhanced nitrogen availability to the plants which might have increased the average number of bulbs, bulblets, average diameter of bulb and weight of bulbs. The positive effect of biofertilizers on bulb yield in tuberose var. Shringar also reported by [8]. Humic substances are capable of chelating metal ions, such as Fe, Zn etc., retained in exchangeable form in the soil. These forms of nutrients are easily absorbed by the plants leading to improved metabolic activity that might have led to increase in number and size of bulbs [9-10].

SUMMARY

An experiment was conducted for two consecutive years during 2015-16 and 2016-17 at T. Pudhupatti village, Dindigul District of Tamil Nadu to study the influence of fertigation, microbial consortium and bio-stimulants on bulb yield of tuberose (*Polianthes tuberosa* L.) cv. 'Prajwal'. The treatments consisted three levels (125, 100 and 75 per cent) of recommended dose of fertilizer through fertigation (RDFTF), microbial consortium (MC) of 12.5 kg ha^{-1}, foliar spray of panchagavya (3 and 4 per cent) and humic acid (0.4 and 0.5 per cent). The results revealed that, 100 per cent recommended dose of fertilizer through fertigation + microbial consortium @ 12.5 kg ha^{-1} + panchagavya @ 3 per cent and humic acid @ 0.4 per cent recorded significantly higher number of bulbs, bulblets, length of bulb, diameter of bulb and bulb yield. Fertigation of recommended dose of fertilizer along with microbial consortium and foliar application of panchagavya and humic acid increased the bulb yield by 14 to 47 per cent, compared to the rest of the treatments. Therefore, an integrated approach with specific emphasis on fertigation, microbial consortium and biostimulants could be recommended for obtaining higher bulb yield in Tuberose.

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