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RESPONSE OF ORGANIC MANURES AND THEIR LEVELS ON GROWTH AND SPIKE YIELD OF TUBEROSE (*POLIANTHES TUBEROSA* L.) CV. PRAJWAL

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ABSTRACT

An investigation entitled "Response of organic manures and their levels on growth and spike yield of tuberose (*Polianthes tuberosa* L.) cv. Prajwal" was carried out at Deen Dayal Upadhyaya Centre of Excellence for Organic Farming (DDUCE-OF), CCS Haryana Agricultural University, Hisar during 2020-21. The experiment included three sources of organic manures *viz*., Farmyard manure (FYM), vermicompost, and poultry manure each applied at five levels i.e., control (0 kg/m²), 2 Kg/m², 3 Kg/m², 4 Kg/m², and 5 Kg/m². This study included three replications and fifteen treatments combinations in a split plot design. The results indicated that among different manures earliest initiation of sprouting (23.91 days) and complete sprouting (34.19 days) was occurred with the application of poultry manure while maximum values in terms of plant height (90.90 cm), length of leaves (55.03 cm), number of leaves per clump (159.00) and number of spikes per clump (1.38) were recorded when tuberose plots were fertilized with vermicompost. However, in case of levels of different organic manures, minimum number of days taken to initiation of sprouting (21.57 days), complete sprouting (31.68 days), maximum plant height (92.77 cm), length of leaves (59.05 cm), number of leaves per clump (167.75) and number of spikes per clump (1.83) were recorded with 4 Kg/m^2 level of organic manures. Thus, the growth and spike yield of tuberose cv. Prajwal were considerably enhanced by the application of vermicompost at a rate of 4 Kg/m^2.

Keywords **:** Organic manures, vermicompost, poultry manure, FYM, Tuberose, growth, yield.

Introduction

Tuberose (*Polianthes tuberosa* L.) commonly known as *Rajanigandha* is a significant bulbous flowering plant. Originating from Mexico, this member of the Amaryllidaceae family is grown as a half-hardy perennial in tropical and subtropical climates. Its florets are star shaped, waxy and loosely arranged on spike (Sivasankar *et al.*, 2018). Beyond its decorative appeal, tuberose has medicinal applications, including treatments for headaches, diarrhoea, rheumatism, and related discomforts (Naznin *et al.*, 2015). Tuberose cultivars are mainly of three types- single, semi-double and double. In double-flowered varieties, the entire spike is used as a cut flower, while single-flowered types are preferred for *garlands*, *gajras*, *venis*, *bangles*, and essential oil production. Single-flowered cultivars tend to have a stronger fragrance compared to double-flowered ones and are used for essential oil extraction, yielding a concrete percent of 0.08-0.11%, which is higher than that obtained from double-flowered varieties (Karim *et al.*, 2017).

This variety is derived from a cross between 'Shringar' and 'Mexican Single' and produces single flowers on tall, sturdy spikes. The flower buds exhibit a slightish pink colour, while the fully opened flowers are pure white (Baidya *et al.*, 2020). Organic matter consumption in agricultural systems decreased after the industrial revolution as a result of the broad use of

inorganic fertilizers. Recently, attention has shifted toward the environmental issues associated with excessive inorganic fertilizer use, such as soil structure degradation, loss of soil health, and environmental pollution. Consequently, there is increasing emphasis on the use of organic amendments including farmyard manure, various types of composts, vermicompost, and poultry manure as an effective strategy to mitigate environmental impact. In addition to maintaining soil fertility and enhancing nutrient uptake, these organic inputs can also assist manage soil-borne fungal pathogens (Kabir *et al.,* 2011).

Organic amendments are safe for both crops and soil, serving as reliable sources of essential plant nutrients. Sources such as cow-dung, compost, vermicompost, farmyard manure, poultry manure, and green manure not only supply organic matter but also provide primary plant nutrients and micronutrients. Among animal manures, poultry manure contains the highest levels of nitrogen, phosphorus, and potassium (NPK). Being a heavy feeder crop, tuberose requires substantial amounts of NPK supplied through both organic and inorganic fertilizers. The use of growth stimulants and organic manures has significantly transformed the floriculture sector (Priya *et al.,* 2020). Typically, farmers apply nitrogen, phosphorus, and potassium to boost crop yields, often neglecting micronutrients, which can be supplemented through organic manures. Some well-informed farmers use a combination of organic and inorganic fertilizers, but frequently in insufficient amounts, leaving soils deficient in micronutrients. Therefore, supplying nutrients through organic sources like compost and farmyard manure is an effective strategy for sustaining crop production. Organic manures enhance soil organic matter, improve water retention and aeration, reduce salinity, and strengthen soil structure (Kumar, 2014). The long-term fertility of the soil and the sustainability of agriculture are both enhanced and maintained by the use of organic manures. Without depleting the soil and the earth's natural resources, it is ecologically sound for increased levels of crop production and productivity. Organic manures degrade naturally and don't cause pollution (Choudhury and Sarangi, 2020). Determining how organic manures affect the growth and spike yield of tuberose (*Polianthes tuberosa* L.) cv. Prajwal was the goal of the current experiment.

Materials and Methods

The present experiment was conducted at Deen Dayal Upadhyaya Centre of Excellence for Organic Farming (DDUCE-OF), CCS Haryana Agricultural University, Hisar (Haryana) during 2020-21 crop season. The experiment involved three kinds of organic manures *viz.*, farmyard manure (FYM), vermicompost and poultry manure applied at five levels *viz.*, control (0 Kg/m^2), 2 Kg/m^2, 3 Kg/m^2, 4 Kg/m^2 and 5 Kg/m^2. A split-plot design comprising fifteen treatments combinations and three replications was employed. Prior to planting, the field was thoroughly prepared through multiple ploughings and harrowing. The soil was loamy, deficient in available nitrogen but rich in organic carbon, phosphorus, and potassium. Uniform bulbs of tuberose cv. Prajwal were planted in 1.5 m x 1.5 m plots at a spacing of 30 cm x 30 cm, or 25 bulbs per plot. During field preparation, the respective manures were applied according to treatment specifications and thoroughly incorporated into the soil. Standard cultivation practices were followed to ensure successful crop growth, and uniform cultural operations were maintained across all treatments. Seven randomly chosen and tagged plants of each replication, excluding bordered plants, were used to record observations on various growth and yield attributes such as number of days taken to initiation and completion of sprouting, plant height, number of leaves per plant, leaf length, and number of spikes per clump using standard procedure. Data on various growth of tuberose were recorded at appropriate growth stages. The number of days taken for initiation of sprouting was recorded from the date of planting to the appearance of the first visible sprout in each treatment, while completion of sprouting was noted from date of planting to when all planted bulbs exhibited sprouting. Using a meter scale, the height of the plant (cm) was measured from the base of the plant to the tip of the spike at full bloom stage. The number of leaves per clump was determined by counting all fully developed leaves from the same plants and the leaf length (cm) was measured using a measuring scale. The number of spikes per clump was noted as the total number of spikes produced per clump at the flowering stage. The recorded data was statistically analysed using split plot design (SPD) with OPSTAT software (Sheoran *et al.*, 1998) at 5% level of significance to evaluate treatment differences.

Result and Discussion

The findings of the present study, along with relevant discussions, have been summarized under the following headings: different organic manures and their levels significantly influenced all the growth parameters of tuberose *viz.,* number of days taken to initiation of sprouting, complete sprouting, plant height, leaf length and number of leaves per clump as shown in Table1. Number of spikes per clump was not significantly affected by organic manures and their

different levels (table 1). Among all organic manures, minimum number of days (23.91 days) taken to initiation of sprouting and complete sprouting (34.19 days) were recorded in poultry manure followed by vermicompost *i.e.,* (25.40 days) and (35.91 days) respectively. Initiation of sprouting (26.04 days) and complete sprouting (36.86 days) were delayed in plots fertilized with farmyard manure. The decrease in the number of days required for the initiation and completion of sprouting with poultry manure could be attributed to its effect on soil properties, as it improved the soil texture by making soil looser and more friable, preventing crust formation and enhancing water retention. Additionally, the faster availability of essential macro- and micronutrients, accelerated decomposition, and a more balanced carbon-to-nitrogen ratio may have promoted earlier bulb sprouting. Similar results were quoted by Kumar (2014) in tuberose, Suseela *et al.* (2016) in tuberose and Pradhan *et al.* (2017) in tuberose.

Maximum plant height (90.90 cm) was observed with vermicompost significantly followed by poultry manure (89.27 cm) while minimum plant height (86.43 cm) was recorded with farmyard manure. Similarly, maximum leaf length (55.03 cm) was observed with vermicompost significantly followed by poultry manure (53.59 cm) and minimum leaf length (49.64 cm) was noted with plants receiving farmyard manure. The highest number of leaves per clump (159.00) was observed with vermicompost significantly followed by poultry manure (157.40) whereas the lowest count (148.91) was recorded with farmyard manure. Although the number of spikes per clump was not significantly affected by organic manures, maximum number of spikes per clump (1.38) was recorded with vermicompost followed by poultry manure (1.35) and minimum number of spikes per clump (1.31) with farmyard manure. The enhancement in vegetative traits such as plant height, leaf length, number of leaves per clump, and number of spikes per clump can be attributed to vermicompost application, which significantly boosts soil enzymatic activities like urease, phosphodiesterase, phosphomonoesterase, and sulphatase and stimulates the growth of plant-promoting bacteria. It is a good source of micronutrients in addition to providing nitrogen, phosphate, and potash. The vermicompost's components may have made the crop plant's plant nutrients available, enabling the plants to flourish successfully and produce luxuriant growth. The present findings are in accordance with the reports of Madhuri *et al.* (2018) in tuberose, Elisheba and Sudhagar (2019) in tuberose, Meena *et al.* (2015) in tuberose, Munikrishnappa *et al.* (2011) in tuberose, Habib *et al.* (2016) in tuberose.

Number of days taken to initiation of sprouting and complete sprouting significantly reduced with every increase in level of organic manures along with increment in plant height (cm), leaf length (cm) and number of leaves per clump except number of spikes per clump which was found non-significant. Number of days taken to initiation of sprouting (21.57 days) and complete sprouting (31.68 days) significantly reduced with every increase in level up to 4 Kg/m^2 which was found significantly at par with level 5 Kg/m^2 here a slight but significant increase in number of days taken was observed. Maximum number of days taken to initiation of sprouting (30.19 days) and complete sprouting (41.71 days) was recorded from the control *i.e.,* 0 Kg/m^2. Maximum plant height (92.77 cm), number of leaves per clump (167.75) and leaf length (59.05 cm) were also observed with increase in level of organic manures up to 4 Kg/m^2 which was found significantly at par with level 5 Kg/m^2. However, minimum plant height (80.90 cm), number of leaves per clump (130.45) and leaf length (39.34 cm) were observed from control. It may be due to the fact that with every increase in level of organic manures, availability of macro and micro nutrients increased abundantly which assisted in the plant metabolic activity and in the early luxuriant growth and development of plant. The number of spikes per clump was not significantly influenced by different organic manures and their levels; however, the highest number of spikes was observed with organic manures at 4 Kg/m² level (1.83), followed by 3 Kg/m² (1.40), while the lowest number of spikes per clump was recorded in the control (0 Kg/m^2) (1.02) (Table 1).

Interaction among organic manures and their levels was found significant in influencing the number of days taken to initiation of sprouting, complete sprouting, plant height, leaf length and number of leaves per clump except number of spikes per clump (Table 1). Minimum number of days (19.00) taken to initiation of sprouting and for complete sprouting (29.48 days) were observed when poultry manure was applied @ 3 Kg/m^2 while maximum number of days taken in control i.e., 30.38 and 42.52 days respectively. Maximum plant height (96.82 cm), leaf length (62.95 cm) and number of leaves per clump (176.93) was recorded when vermicompost was applied @ 4 Kg/m^2 while minimum was observed in control as shown in Table 1. Interaction was found non-significant in case of number of spikes per clump. Among all manures, earlier initiation noticed with farmyard manure @ 5 Kg/m^2 (20.48 days), vermicompost 4 Kg/m^2 (20.00

days) and poultry manure 3 Kg/m^2 (19.00 days). Earliest complete sprouting was observed with farmyard manure @ 5 Kg/m^2 (30.10 days), vermicompost 4 Kg/m^2 (29.57 days) and poultry manure 3 Kg/m^2 (29.48 days). Maximum plant height was observed with farmyard manure @ 5 Kg/m^2 (91.28 cm), vermicompost 4 Kg/m^2 (96.82 cm) and poultry manure 3 Kg/m^2 (93.14 cm). Maximum leaf length was observed with farmyard manure @ 5 Kg/m^2 (57.34 cm), vermicompost 4 Kg/m^2 (62.95 cm) and poultry manure 3 Kg/m^2 (59.03 cm). Maximum number of leaves per clump was recorded with farmyard manure @ 5 Kg/m^2 (165.15), vermicompost 4 Kg/m^2 (176.93) and poultry manure 3 Kg/m^2 (169.33). Number of spikes per clump was found non-significant yet maximum number of spikes per clump was observed with all the manures @ 4 Kg/m^2. Vermicompost may have a positive impact on growth characteristics because it improves nutrition because it is enriched with major and micronutrients. Additionally, the presence of organic carbon and beneficial microorganisms in vermicompost improves soil structure, nutrient and water use efficiency (WUE), water-holding capacity (WHC), and soil porosity thus improving the soil's biological, chemical, and physical characteristics and promoting improved plant growth and development. The present findings are in harmony with the findings of Lal *et al*. (2010) in tuberose, Kabir *et al*. (2011) in tuberose, Shahjahan *et al*. (2016) in tuberose.

Table 1: Effect of organic manures and their different levels on growth and spike yield of tuberose cv. Prajwal

Parameters	Days taken to initiation of sprouting (Days)	Days taken for complete sprouting (Days)	Plant height (cm)	Length of leaves (cm)	Number of leaves per clump	Number of spikes per clump
Treatments	**Organic Manure**					
FYM (M_1)	26.04	36.86	86.43	49.64	148.91	1.31
Vermicompost (M_2)	25.40	35.91	90.90	55.03	159.00	1.38
Poultry manure (M_3)	23.91	34.19	89.27	53.59	157.40	1.35
C.D. (P = 0.05)	**0.82**	**0.10**	**0.82**	**0.39**	**0.70**	**NS**
Level						
Control (0 Kg/m^2) (L_1)	30.19	41.71	80.90	39.34	130.45	1.02
2 Kg/m^2 (L_2)	27.79	38.59	88.00	51.04	149.72	1.14
3 Kg/m^2 (L_3)	23.92	34.49	90.51	55.73	160.33	1.40
4 Kg/m^2 (L_4)	21.57	31.68	92.77	59.05	167.75	1.83
5 Kg/m^2 (L_5)	22.09	31.78	92.14	58.60	167.26	1.36
C.D. (P = .05)	**0.53**	**0.13**	**0.71**	**0.51**	**0.83**	**NS**
Interaction						
L_1M_1	30.38	42.52	80.66	39.11	130.35	1.00
L_1M_2	30.19	42.48	81.08	39.53	130.55	1.00
L_1M_3	30.00	40.14	80.97	39.39	130.46	1.05
L_2M_1	28.95	40.00	84.45	46.20	141.98	1.09
L_2M_2	28.10	38.81	89.59	52.78	151.79	1.14
L_2M_3	26.33	36.95	89.95	54.16	155.40	1.19
L_3M_1	27.00	37.81	86.03	50.22	148.25	1.38
L_3M_2	25.76	36.19	92.35	57.93	163.42	1.43
L_3M_3	19.00	29.48	93.14	59.03	169.33	1.38
L_4M_1	23.38	33.86	89.72	55.33	158.80	1.76
L_4M_2	20.00	29.57	96.82	62.95	176.93	1.91
L_4M_3	21.34	31.62	91.77	58.88	167.52	1.81
L_5M_1	20.48	30.10	91.28	57.34	165.15	1.33
L_5M_2	22.95	32.48	94.65	61.96	172.33	1.43
L_5M_3	22.86	32.76	90.50	56.49	164.29	1.33
C.D. (*P* = 0.05)	**1.04* 1.15****	**0.23* 0.22****	**1.33* 1.36****	**0.92* 0.87****	**1.51* 1.45****	**NS**

*=factor (L) at the same level of M **Factor (M) at the same level of L (L= Level, M= Manure)

Conclusion

Based on the findings of the present investigation, soil application with vermicompost at a rate of 4 Kg/m² may be considered most effective treatment combination for enhancing the vegetative growth and spike yield of tuberose. The maximum plant height (96.82 cm), length of leaves (62.95 cm), number of leaves per clump (176.93) and number of spikes per clump (1.91) were observed with the application of vermicompost at the level 4 Kg/m². Thus, the integration of vermicompost at 4 Kg/m² emerges as a sustainable and eco-friendly practice for obtaining higher growth and yield performance in tuberose cultivation.

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