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Effect of Organic and Inorganic Fertilizer on Vegetative Growth Parameter of Lilium (*Lilium longiflorum*) cv. Pavia under Shade Net Condition

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Authors' contributions

This work was carried out in collaboration among all authors. Authors VMP, AK and KSD helped in research conceptualization. Author NK executed the field experiments and did comprehensive data collection. Author NK did research analysis and author VMP did data interpretations. Authors NK and VMP drafted the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation was under taken in the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, *(Allahabad).* During winter season of 2020-2021, 2021-2022 and Pooled. The experiment was

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layout in Randomized Block Design (RBD) with 13 treatments and each treatment replicated thrice. The treatments consist of different combinations of inorganic fertilizers (N, P and K) and organic fertilizers (FYM, Vermicompost and Poultry Manure) and control (No fertilizers and manures). The treatment T_5 50% RDF + FYM 14 t ha^{-1} was found the statistically significant compared to other treatment combination, which recorded highest plant height (23.68, 57.11 and 76.41 cm), spread area (8.19 cm^2, 15.54 cm^2 and 18.47 cm^2), Number of leaves (36.63, 57.11 and 76.41), Leaf area (15.03 cm^2, 15.63 cm^2 and 15.33 cm^2), Chlorophyll content (66.11 mg, 65.60 mg and 65.86 mg), followed by T_9 25% RDF + Vermicompost 6.9 t ha^{-1} and lowest yield was obtained from T_0 (control).

Keywords: Nitrogen; phosphorus; potash (Potassium); FYM; Vermicompost and poultry manure.

1. INTRODUCTION

Lilium sp. is an important genus for cut flowers, pot plants, and garden plants. It is widely cultivated across the world. “The genus Lilium belongs to the Liliaceae family, with over 100 species and over 9,400 cultivars divided into seven divisions” [1]. The Northern Hemisphere, specifically Asia, North America, and Europe, particularly China, Nepal, Korea, and Japan, houses the majority of the world's gene centers for this species. It is a financially significant genus for the production and sale of its cut flower in the global cut flower business [2].

Lilium produces large, appealing blooms in a variety of colours and forms, making them one of the best cut flowers. Lilium is considered as magnificent flowering potted plants which have a high decorative value in the landscape. Only three of the seven groups—Oriental hybrids, Asiatic hybrids, and cultivars of *Lilium longiflorum*—produced economically significant lily cultivars. At least 12 species from the Sinomartagon group underwent complex interspecific hybridization to produce Asiatic hybrids. Oriental hybrids are created when five species of the section Archelirion, to which *Lilium longiflorum* belongs, cross with one another. In addition to producing "LO" hybrids with "Asian" lilies, *L. longiflorum* also did so with "Oriental" lilies. The difficult cross-pollination of Asiatic and Oriental hybrids (also known as "OA" hybrids), two of the most significant lily clusters from a commercial standpoint, led to a breakthrough in lily breeding and hybridization. The availability of genetic variation in lilium for important characteristics has been greatly increased by intersectional crosses. The Netherlands produces lily bulbs on about 45% of its total farmland with Asian hybrids, 40% with Oriental hybrids, and 5% with cultivars of *L. longiflorum*. The *L. longiflorumx* Asiatic ('LA') hybrids, which are still relatively new, currently account for about 7% of the area used for lily production.

The quickest and clearest effect of nitrogen (N) on plant growth, which results in a high yield, is observed. “Due to the fact that it is a component of numerous amino acids, proteins, and chlorophyll, nitrogen is crucial for the growth of plants.” Lack of nitrogen inhibits growth and lessens fruiting and flowering.

“Phosphorus is an essential component for plant growth and development. Phosphorus is necessary to maintain the quality of flowers”. Phosphorus should be given as an initial dose, as P_2O_5 is fundamentally required for optimal root development. Potassium is necessary for strong roots and stems and for plant respiration. Also known as potash [3].

“Lily plants may be cultivated in soil with low phosphorus levels without losing yield or quality. As a result, this study was structured out to determine the optimal nitrogen (N) and phosphorus (P) levels necessary for improved flower and bulb output and quality in Asiatic lily [4].

Vermicomposting is known as an environmentally beneficial process of decomposing organic wastes, and its result, Vermicopost, contains growth stimulating chemicals, which improve plant development and soil fertility, Microbial populations and water holding ability.

Poultry manure is an effective soil amendment that supplies nutrients for growing crops while also improving soil quality when applied correctly, as a result of its large organic matter concentration paired with accessible nutrients such as “nitrogen (N), phosphorous (P), and potassium (K) for plant growth”.

Table 1. Effect of organic and inorganic fertilizers on vegetative growth parameter of Lilium cv. Pavia under shade net condition

Treatments	2020-2021						2021-2022						Pooled					
	Plant height (cm)			Plant Spared (cm^2)			Plant height (cm)			Plant Spared (cm^2)			Plant height (cm)			Plant Spared (cm^2)		
	25 DAP	50 DAP	75 DAP	25 DAP	50 DAP	75 DAP	25 DAP	50 DAP	75 DAP	25 DAP	50 DAP	75 DAP	25 DAP	50 DAP	75 DAP	25 DAP	50 DAP	75 DAP
T_0 Control	16.29	43.16	67.07	5.13	10.60	14.10	18.93	44.66	61.13	5.80	11.20	14.05	17.61	43.91	64.10	5.46	10.90	14.07
T_1 100% RDF @ (NPK 140:100:80 kg ha^{-1})	22.53	50.96	70.46	6.33	14.20	16.03	20.33	51.46	74.53	7.32	14.43	17.51	21.43	51.21	72.49	6.83	14.31	16.77
T_2 75% RDF + FYM 7 t ha^{-1}	22.55	51.76	71.10	6.50	14.46	16.80	21.40	51.13	73.33	7.93	15.07	18.01	21.97	51.45	72.21	7.21	14.77	17.40
T_3 75% RDF + Vermicompost 2.3 t ha^{-1}	19.70	52.90	68.96	7.26	14.90	17.03	21.30	52.13	72.33	8.49	14.78	18.15	20.50	52.51	70.65	7.88	14.84	17.59
T_4 75% RDF + Poultry manure 1.1 t ha^{-1}	19.80	51.06	70.58	6.53	14.46	17.16	20.86	50.80	71.60	8.03	15.45	18.63	20.33	50.93	71.09	7.28	14.95	17.90
T_5 50% RDF + FYM 14 t ha^{-1}	23.66	56.73	73.42	7.80	15.30	17.76	23.70	57.50	79.40	8.58	15.78	19.19	23.68	57.11	76.41	8.19	15.54	18.47
T_6 50% RDF + Vermicompost 4.6 t ha^{-1}	19.76	54.16	68.44	6.56	14.16	16.66	22.60	50.73	73.80	7.80	14.90	18.36	21.18	52.45	71.12	7.18	14.53	17.51
T_7 50% RDF + Poultry manure 2.3 t ha^{-1}	20.90	52.13	71.37	6.50	14.43	15.56	22.73	52.76	73.40	8.39	15.37	17.58	21.81	52.45	72.38	7.44	14.90	16.57
T_8 25% RDF + FYM 21 t ha^{-1}	21.72	53.03	68.99	6.60	13.80	16.76	20.66	50.76	72.33	7.61	14.53	17.55	21.19	51.90	70.66	7.10	14.16	17.15
T_9 25% RDF + Vermicompost 6.9 t ha^{-1}	23.36	54.56	72.33	7.53	15.20	17.10	23.30	55.83	74.66	8.49	15.50	18.99	23.33	55.20	73.49	8.01	15.35	18.05
T_{10} 25% RDF + Poultry manure 3.5 t ha^{-1}	20.64	53.56	71.56	6.60	12.50	16.66	21.86	48.53	75.26	8.10	14.50	18.56	21.25	51.05	73.41	7.35	13.50	17.61
T_{11} 9.3 t FYM + 3.1 t Vermicompost + 1.5 t Poultry manure ha^{-1} (33.33% FYM + 33.33% VC + 33.33% PM)	20.16	52.16	71.94	7.20	13.83	15.93	22.73	51.60	70.73	8.03	15.09	18.48	21.45	51.88	71.33	7.61	14.46	17.20
T_{12} 25% RDF + 7 t FYM + 2.3 t Vermicompost + 1.1 Poultry manure ha^{-1}	20.16	51.83	71.35	7.03	14.20	16.06	21.83	52.66	72.60	8.27	14.62	18.85	21	52.25	71.97	7.65	14.41	17.45
F- test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S. Ed (±)	**1.39**	**1.60**	**1.30**	**0.24**	**0.70**	**0.26**	**0.66**	**1.31**	**1.95**	**0.41**	**0.31**	**0.46**	**0.74**	**1.25**	**1.41**	**0.27**	**0.46**	**0.46**
C.D. (P= 0.05)	**2.81**	**3.31**	**2.66**	**0.48**	**1.44**	**0.53**	**1.30**	**2.65**	**3.94**	**0.84**	**0.64**	**0.93**	**1.51**	**2.54**	**2.85**	**0.55**	**0.93**	**0.93**

Table 2. Effect of organic and inorganic fertilizers on vegetative growth parameters of Lilium cv. Pavia under shade net condition

Treatments	2020-2021					2021-2022					Pooled				
	No. of leaves plant^{-1}			Leaf area (cm^2)	Chlorophyll (mg)	No. of leaves plant^{-1}			Leaf area (cm^2)	Chlorophyll (mg)	No. of leaves plant^{-1}			Leaf area (cm^2)	Chlorophyll (mg)
	25 DAP	50 DAP	75 DAP			25 DAP	50 DAP	75 DAP			25 DAP	50 DAP	75 DAP		
T_0 Control	19.93	48.30	60.16	12.66	55.60	21.33	49.16	64.73	12.76	56.84	20.63	43.91	64.10	12.71	56.22
T_1 100% RDF @ (NPK 140:100:80 kg ha^{-1})	30.53	55.06	67.20	13.76	60.36	39.26	50.56	69.06	14.10	63.88	34.90	51.21	72.49	13.93	62.12
T_2 75% RDF + FYM 7 t ha^{-1}	30.86	53.00	67.20	13.63	60.51	40.13	53.63	73.80	13.96	64.15	35.50	51.45	72.21	13.79	62.33
T_3 75% RDF + Vermicompost 2.3 t ha^{-1}	28.93	51.86	65.46	14.16	63.05	38.06	49.83	75.00	14.83	63.40	33.50	52.51	70.65	14.49	63.23
T_4 75% RDF + Poultry manure 1.1 t ha^{-1}	28.06	53.20	68.60	13.83	62.05	37.36	52.46	74.46	14.23	63.81	32.71	50.93	71.09	14.03	62.93
T_5 50% RDF + FYM 14 t ha^{-1}	32.20	56.53	73.76	15.03	66.11	41.06	58.50	80.60	15.63	65.60	36.63	57.11	76.41	15.33	65.86
T_6 50% RDF + Vermicompost 4.6 t ha^{-1}	29.73	54.93	69.20	13.63	62.16	34.63	56.56	78.60	14.30	64.62	32.18	52.45	71.12	13.96	63.39
T_7 50% RDF + Poultry manure 2.3 t ha^{-1}	26.66	54.00	69.23	13.36	60.86	38.80	56.13	76.53	13.83	64.92	32.73	52.45	72.38	13.59	62.89
T_8 25% RDF + FYM 21 t ha^{-1}	28.40	54.83	64.33	14.10	62.17	40.73	54.53	73.33	14.55	64.32	34.56	51.90	70.66	14.32	63.24
T_9 25% RDF + Vermicompost 6.9 t ha^{-1}	32.13	56.30	72.06	14.90	64.88	40.80	57.03	77.06	15.23	65.23	36.46	55.20	73.49	15.06	65.05
T_{10} 25% RDF + Poultry manure 3.5 t ha^{-1}	31.80	52.46	68.40	13.70	59.97	34.53	56.33	77.40	14.96	64.44	33.16	51.05	73.41	14.33	62.21
T_{11} 9.3 t FYM + 3.1 t Vermicompost + 1.5 t Poultry manure ha^{-1} (33.33% FYM + 33.33% VC + 33.33% PM)	27.33	52.63	65.76	14.16	61.46	38.00	53.76	73.33	15.00	63.81	32.66	51.88	71.33	14.58	62.63
T_{12} 25% RDF + 7 t FYM + 2.3 t Vermicompost + 1.1 Poultry manure ha^{-1}	30.13	53.30	65.40	14.23	61.81	40.73	56.83	78.00	15.23	63.74	35.43	52.25	71.97	14.73	62.77
F- test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S. Ed (±)	**1.69**	**1.74**	**1.41**	**0.35**	**0.92**	**2.10**	**0.97**	**2.00**	**0.36**	**0.22**	**1.84**	**1.25**	**1.41**	**0.26**	**0.95**
C.D. (P= 0.05)	**3.43**	**3.53**	**2.86**	**0.71**	**1.87**	**4.25**	**1.97**	**4.13**	**0.72**	**0.44**	**3.73**	**2.54**	**2.85**	**0.54**	**1.93**

Farmyard manure is a degraded mixture of animal waste products including faeces and urine, as well as litter and scraps from hay roughages fed to livestock. "It typically contains 0.5% N, 0.2% P_2O_5, and 0.5% K_2O". Biological life of soil flora and fauna is stimulated by FYM, an excellent source of organic carbon [5].

2. MATERIALS AND METHODS

The present investigation entitled, "Effect of Organic and Inorganic Fertilizer on Vegetative Growth Parameter of Lilium (*Lilium Longiflorum*) cv. Pavia under Shade Net Condition" was under taken in the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, *(Allahabad).* during winter season of 2020-2021, 2021-2022 and Pooled. The experiment was layout in Randomized Block Design (RBD) with 13 treatments and each treatment replicated thrice. The treatments consist of different combinations of inorganic fertilizers (N, P and K) and organic fertilizers (FYM, Vermicompost and Poultry Manure) and control (No fertilizers and manures). The treatments involved were T_{0-} Control, T_{1-} 100% RDF @ (NPK 140:100:80 kg ha^{-1}), T_{2-} 75% RDF + FYM 7 t ha^{-1}, T_{3-} 75% RDF + Vermicompost 2.3 t ha^{-1}, T_{4-} 75% RDF + Poultry manure 1.1 t ha^{-1}, T_{5-} 50% RDF + FYM 14 t ha^{-1}, T_{6-} 50% RDF + Vermicompost 4.6 t ha^{-1}, T_{7-} 50% RDF + Poultry manure 2.3 t ha^{-1}, T_{8-} 25% RDF + FYM 21 t ha^{-1}, T_{9-} 25% RDF + Vermicompost 6.9 t ha^{-1}, T_{10-} 25% RDF + Poultry manure 3.5 t ha^{-1}, T_{11-} 9.3 t FYM + 3.1 t Vermicompost + 1.5 t Poultry manure ha^{-1} (33.33% FYM + 33.33% VC + 33.33% PM), T_{12-} 25% RDF + 7 t FYM + 2.3 t Vermicompost + 1.1 Poultry manure ha^{-1} [6-9].

3. RESULTS AND DISCUSSION

Growth parameters: The data revealed that the combination of different organic and inorganic fertilizers affected growth parameter during winter season of 2020-2021, 2021-2022 and Pooled. like Plant height, Plant spread, Number of leaves per plant, Leaf area and Chlorophyll content of Lilium as shown in (Table 1 and 2). Significant difference in the Plant height, Plant spread, Number of leaves per plant, Leaf area and Chlorophyll content was recorded due to application of different combinations of organic fertilizers and inorganic fertilizers. The treatment T_5 recorded the maximum plant height (73.42, 79.40 and 76.41 cm), followed by T_9 (72.33, 74.66 and 73.49 cm) and the maximum Plant spread T_5 (17.76 cm, 19.19 cm and 18.47 cm), followed by T_9 (17.10 cm, 18.99 cm and 18.05 cm) the maximum number of leaves per plant T_5 (73.76, 80.60 and 76.41), followed by T_9 (72.06, 77.06 and 73.49) and the maximum Leaf area was T_5 (15.03 cm^2, 15.63 cm^2 and 15.33 cm^2), followed by T_9 (14.90 cm^2, 15.23 cm^2 and 15.06 cm^2) the percentage of chlorophyll content T_5 (66.11mg, 65.60mg and 65.86mg), followed by T_9 (64.88mg, 65.23mg and 65.05mg) which differed significantly from each other as well from other treatments. All cultural practices were followed regularly during crop growth and observations were recorded on growth characters i.e., plant height, plant spread, number of leaves per plant, leaf area and percentage of chlorophyll content were recorded from time to time. It was noticed that plant spread, number of leaves per plant, leaf area and percentage of chlorophyll content increased with increasing plant height successively with the increasing levels of inorganic fertilizer and organic fertilizer. Combination of inorganic fertilizer and organic fertilizer also recorded maximum plant height, plant spread, number of leaves per plant, leaf area and chlorophyll content also which helped the plants in better photosynthesis to attain vigor. Similar findings were found by Pahare et al. [10], in Asiatic lily and Singh *et al.,* [11] in carnation [12-17].

4. CONCLUSION

On the basis of present study, it is concluded that the application of T_5 50% RDF + FYM 14 t ha^{-1} resulted in maximum Plant height, Plant spread, Number of leaves per plant, Leaf area and chlorophyll content was found in maximum and the minimum was observed in T_0 (control).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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