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Effect of integrated nitrogen management on growth, flowering and flower yield of gaillardia (*Gaillardia pulchella* Foug.) cv. LORENZIANA under middle Gujarat conditions

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ABSTRACT : A field experiment on effect of integrated nitrogen management on growth, flowering and flower yield of gaillardia (*Gaillardia pulchella* Foug) cv. LORENZIANA under middle Gujarat conditions was conducted at Horticulture Research Farm, Department of Horticulture, B.A. College of Agriculture, Anand Agricultural University, Anand during the year 2009–10. The treatments comprised of organic fertilizers, biofertilizer and three level of nitrogen (100, 75 and 50 kg N/ha) including control 100 kg N/ha + FYM 10 t/ha were tried in Randomized Block Design with three replications. The results revealed that application of 75 kg N/ha + vermicompost 3.75 t/ha produced significantly maximum plant height (73.33 cm), number of branches per plant (36.98) and plant spread (72.68 cm in north - south direction and 68.59 cm in east - west direction). Same treatment recorded significantly minimum days for first flower initiation, 50 per cent flowering, maximum number of flowers per plant, maximum flower diameter as well as weight of individual flower. Significantly maximum flower yield per plant and hectare were recorded in the same treatment. The treatment of 50 kg N/ha + FYM 20 t/ha obtained maximum shelf-life of flower (1.80 days) as compared to control.

KEY WORDS : Organic fertilizer, Biofertilizer, Nitrogenous fertilizer, Gaillardia

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Gaillardia (*Gaillardia pulchella* Foug) is one of important commercial cultivated flower crop growing in India as well as in Gujarat. It is used for making garland, veni, bouquets in marriages, festivals, religious and official ceremonies and for worshiping God.

The successful commercial cultivation of gaillardia depends on many factors amongst nutrition plays an important role. No single source of nutrient is capable of supplying plant nutrients in adequate amount and in balance proportion. Thus, integrated nitrogen management is a strategy for advocating judicious and efficient use of nitrogenous fertilizers with matching addition of organic fertilizers and biofertilizer. Such practices reduce the amount of inorganic fertilizers, control pollution in part at least caused due to use of high doses of fertilizers and protection of natural resources. Therefore, the present investigation was carried out on effect of integrated nitrogen management on growth, flowering and flower yield of gaillardia (*Gaillardia pulchella* Foug) cv. LORENZIANA under middle Gujarat conditions.

RESEARCH METHODS

The present investigation was carried out at the

Horticulture Research Farm, Department of Horticulture, B.A. College of Agriculture, Anand Agricultural University, Anand during the year 2009–10. The experiment was laid out in a Randomized Block Design with twelve treatments and three replications. The treatments comprised of organic fertilizers, biofertilizer and nitrogenous fertilizers. The details of experimental treatments were: T_1 : 100 kg N/ha + FYM 10t/ha (control), T_2 : 75 kg N/ha + FYM 15t/ha, T_3 : 50 kg N/ha + FYM 20t/ha, T_4 : 100 kg N/ha + vermicompost 2.5 t/ha, T_5 : 75 kg N/ha + vermicompost 3.75 t/ha, T_6 : 50 kg N/ha + vermicompost 5.0 t/ha, T_7 : 100 kg N/ha + castor cake 1.0 t/ha, T_8 : 75 kg N/ha + castor cake 1.5 t/ha, T_9 : 50 kg N/ha + castor cake 2.0 t/ha, T_{10} : 100 kg N/ha + *Azotobacter* @ 5ml/lt, T_{11}: 75 kg N/ha + *Azotobacter* @ 5ml/lt, T_{12} : 50 kg N/ha + *Azotobacter* @ 5ml/lt. The seedlings of gaillardia were transplanted in the plot at the spacing of 45 × 30 cm. A light irrigation was given immediately after transplanting for better establishment of seedlings in the field. Nitrogenous fertilizers were applied in the form of urea, single superphosphate and muriate of potash. The half dose of N was top-dressed after one month of planting. FYM, vermicompost and castor cake was weighed as per treatment and applied in respective plots as a basal dose, two days prior to transplanting. Liquid biofertilizer *i.e., Azotobacter* were applied by seedling dipping method (5ml/lt) was prepared and roots of the seedlings were dipped in this solution for 15 minutes as per the treatments and transplanted in the field.

Statistical analysis :

The obtained data was analyzed by statistical significant at P<0.05 level, S.E. and C.D. at 5 per cent level by the procedure given by (Panse and Sukhatme, 1994).

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads:

Effect on growth parameters :

The data presented in Table 1 revealed that the growth attributes *viz.*, plant height, number of branches per plant and plant spread were found to be significant with combined application of organic fertilizers, biofertilizer and nitrogenous fertilizers. The maximum plant height (73.33 cm), number of branches per plant (36.98) and plant spread in N-S and E-W directions (72.68 cm and 68.59 cm, respectively) were recorded with the application of 75 kg N/ha + vermicompost 3.75 t/ha. An increase growth parameters might be due to more availability of organic carbon for multiplication of useful soil micro-organisms. Vermicompost also enhanced the microflora and enzymatic activity which might have augmented the plant growth. These results are in accordance with those reported by Saiyad *et al.* (2010); Ghadage *et al.* (2010); Sunitha *et al.* (2007) and Gaur *et al*. (2008) in marigold and Kulkarni *et al.* (1996) in China aster.

Table 1 : Effect of integrated nitrogen management on growth parameters of gaillardia (*Gaillardia pulchella* Foug) cv. LORENZIANA

Tr. No	Treatments	Plant height (cm)	Number of branches per plant	Plant spread (cm)	
				(N-S)	(E-W)
T_1	100 kg N/ha + FYM 10 t/ha (control)	56.06	23.51	57.70	51.15
T_2	75 kg N/ha + FYM 15 t/ha	68.14	31.67	67.93	62.04
T_3	50 kg N/ha + FYM 20 t/ha	65.67	30.45	65.04	59.33
T_4	100 kg N/ha + Vermicompost 2.5 t/ha	72.21	34.48	72.28	68.22
T_5	75 kg N/ha + Vermicompost 3.75 t/ha	73.33	36.98	72.68	68.59
T_6	50 kg N/ha + Vermicompost 5.0 t/ha	71.24	33.00	69.21	65.37
T_7	100 kg N/ha + Castor cake 1.0 t/ha	63.19	27.29	62.78	56.32
T_8	75 kg N/ha + Castor cake 1.5 t/ha	61.54	26.67	61.35	55.30
T_9	50 kg N/ha + Castor cake 2.0 t/ha	58.25	24.57	60.99	54.53
T_{10}	100 kg N/ha + *Azotobacter* @ 5ml/lt	70.57	32.27	68.98	63.52
T_{11}	75 kg N/ha + *Azotobacter* @ 5ml/lt	65.23	29.26	64.40	58.60
T_{12}	50 kg N/ha + *Azotobacter* @ 5ml/lt	64.51	28.11	63.22	56.79
	S.E. ±	2.29	1.94	2.46	2.91
	C.D. (P=0.05)	6.70	5.70	7.22	8.54
	C.V. (%)	6.01	11.27	6.50	8.41

Effect on flowering parameters :

It is evident from the data (Table 2) that application of 75 kg N/ha + vermicompost 3.75 t/ha remarkably took minimum days taken for first flower initiation (53.20), days required for 50 per cent flowering (61.51 days), maximum flower diameter (6.27 cm) and weight of individual flower (3.47 g) as compared to other treatments. This might be due to the altered C:N ratio which helped in balanced management of vegetative and reproductive phases and promote early flowering. Vermicompost enhances the microbial enzymatic activity in soil, which stimulated root growth and induced changes in root morphology, which in turn affected the assimilation of the nutrients. These results are in conformity with the results of Karetha *et al.* (2011); Kulkarni *et al.* (1996) in gaillardia and Nethra *et al.* (1999) in China aster.

Effect on yield parameters :

It is clear from the Table 3 that significantly maximum number of flowers per plant (95.86), flower yield per plant (333.18 g) and per hectare (24.67 t) were recorded with the treatment 75 kg N/ha + vermicompost 3.75 t/ha as compared to control and other treatments. This might be due to the fact that when vermicompost

Table 2 : Effect of integrated nitrogen management on flowering parameters of gaillardia (*Gaillardia pulchella* Foug) cv. LORENZIANA

Tr. No.	Treatments	Days taken for first flower initiation	Days required for 50 % flowering	Flower diameter (cm)	Weight of individual flower (g)
T_1	100 kg N/ha + FYM 10 t/ha (control)	64.48	72.87	3.74	2.79
T_2	75 kg N/ha + FYM 15 t/ha	60.48	66.40	5.41	3.21
T_3	50 kg N/ha + FYM 20 t/ha	61.14	68.17	4.66	3.11
T_4	100 kg N/ha + Vermicompost 2.5 t/ha	55.16	63.03	5.63	3.45
T_5	75 kg N/ha + Vermicompost 3.75 t/ha	53.20	61.51	6.27	3.47
T_6	50 kg N/ha + Vermicompost 5.0 t/ha	56.90	64.78	5.47	3.39
T_7	100 kg N/ha + Castor cake 1.0 t/ha	62.85	69.89	4.49	2.91
T_8	75 kg N/ha + Castor cake 1.5 t/ha	63.16	70.77	4.32	2.87
T_9	50 kg N/ha + Castor cake 2.0 t/ha	63.88	71.86	4.22	2.84
T_{10}	100 kg N/ha + *Azotobacter* @ 5ml/lt	57.26	65.16	5.43	3.29
T_{11}	75 kg N/ha + *Azotobacter* @ 5ml/lt	61.86	68.86	4.59	2.98
T_{12}	50 kg N/ha + *Azotobacter* @ 5ml/lt	62.07	69.26	4.57	2.95
	S.E. ±	2.14	2.18	0.32	0.12
	C.D. (P=0.05)	6.27	6.39	0.93	0.34
	C.V. (%)	6.15	5.57	11.20	6.49

Table 3 : Effect of integrated nitrogen management on yield parameters of gaillardia (*Gaillardia pulchella* Foug) cv. LORENZIANA

Tr. No	Treatments	Number of flowers per plant	Flower yield per plant (g)	Flower yield per hectare (t)
T_1	100 kg N/ha + FYM 10 t/ha (control)	65.89	218.56	16.19
T_2	75 kg N/ha + FYM 15 t/ha	84.33	275.26	20.38
T_3	50 kg N/ha + FYM 20 t/ha	81.67	260.01	19.25
T_4	100 kg N/ha + Vermicompost 2.5 t/ha	92.21	299.83	22.20
T_5	75 kg N/ha + Vermicompost 3.75 t/ha	95.86	333.18	24.67
T_6	50 kg N/ha + Vermicompost 5.0 t/ha	90.17	294.03	21.77
T_7	100 kg N/ha + Castor cake 1.0 t/ha	72.64	234.09	17.34
T_8	75 kg N/ha + Castor cake 1.5 t/ha	69.57	231.25	17.13
T_9	50 kg N/ha + Castor cake 2.0 t/ha	67.71	223.96	16.59
T_{10}	100 kg N/ha + *Azotobacter* @ 5ml/lt	87.68	287.14	21.26
T_{11}	75 kg N/ha + *Azotobacter* @ 5ml/lt	78.89	243.13	18.01
T_{12}	50 kg N/ha + *Azotobacter* @ 5ml/lt	75.81	238.41	17.66
	S.E. ±	4.13	19.86	1.55
	C.D. (P=0.05)	12.10	58.24	4.54
	C.V. (%)	8.91	13.15	13.85

was applied with balanced dose of nitrogenous fertilizer, increased the availability of essential plant nutrients which enhanced root and shoot development and thereby growth. Thereafter, it might have influenced the reproductive phase and induced flowering and yield. These findings corroborate with the results obtained by Sowmyamala and Nagaraju (2013) in gaillardia, Gaur *et al*. (2008) in marigold and Kulkarni *et al.* (1996) and Nethra *et al*. (1999) in China aster.

Conclusion :

From the above findings, it can be concluded that combined application of vermicompost @ 3.75 t ha^{-1} and 75 kg N/ha of nitrogenous fertilizer were found beneficial for getting higher growth, flowering and flower yield of gaillardia.

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