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Effect of Foliar Application of PDKV Micrograde-II on Growth and Flower Yield of Gaillardia

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A B S T R A C T

The present investigation entitled "Effect of foliar application of PDKV Micrograde-II on growth, flower yield of gaillardia" was conducted during the *kharif* season of 2025–26 at the Horticulture Section, College of Agriculture, Nagpur. The experiment comprised of twelve treatment combinations consisting of four levels of PDKV Micrograde-II formulation [M_1 Water spray, M_2–0.5%, M_3–1.0% and M_4–1.5% Conc.] and three spraying times [S_1–30 DAT, S_2–60 DAT and S_3–90 DAT], laid out in a Factorial Randomized Block Design (FRBD) with replicated thrice. The results of the present study observed that foliar application of PDKV Micrograde- II formulation significantly influenced the vegetative growth and yield parameters of gaillardia. 1.5% PDKV Micrograde-II recorded the maximum plant height, stem girth, branches plant^{-1}, plant spread and leaf area, Whereas, 1.0% PDKV Micrograde-II micronutrient formulation recorded the maximum, flowers plant^{-1}, yield plant^{-1}and yield hectare^{-1}. At 90 DAT spraying times treatment was found to be the most effective for improving most of the vegetative growth as well as yield parameter. In respect of interaction effect maximum flower plant^{-1}, yield ha^{-1}, were recorded in the treatment combination foliar application of 1.0% PDKV Micrograde-II at 60 DAT.

Introduction

Gaillardia (*Gaillardia pulchella* Foug.) is an important annual ornamental loose flowercrop belonging to the family Asteraceae. It is widely cultivated for its attractive, brightly coloured flowers, prolonged flowering period, drought tolerance and adaptability to diverse agro-climatic conditions. Flowers are extensively used for garlands, floral decorations, landscaping and garden displays, making it a commercially important flower crop with good economic returns. Among the different production technologies, foliar application of

micronutrients playsa vital role in improving vegetative growth and flower yield. Micronutrients enhance chlorophyll synthesis, photosynthetic activity, enzyme activation and nutrient utilization, thereby promoting healthy plant growth and superior flower production. PDKV Micrograde-II is a balanced micronutrient formulation containing essential micronutrients required for optimum plant growth and development. Appropriate concentration and timely foliar application improve nutrient availability and utilization, resulting in enhanced growth, flowering, yield and flower quality. Therefore, optimization of micronutrient concentration and spraying time is essential for maximizing productivity and quality of gaillardia. Thus, present investigation has been made to foliar application PDKV Micrograde-II and spraying time for increasing the flower production.

Materials and Methods

The present investigation entitled "Effect of foliar application of PDKV Micrograde-II on growth, flower yield and quality of gaillardia" was carried out during the *kharif* season of the year 2025–26 at, College of Agriculture, Nagpur. The experiment was laid out in a Factorial Randomized Block Design with Factor (A) comprising four levels of PDKV Micrograde-II formulation [M_1–Water spray (Control), M_2–0.5%, M_3–1.0% and M_4–1.5%] and Factor (B) comprising three spraying times [S_1–30 DAT,S_2–60 DAT and S_3–90 DAT], with twelve treatment combinations and replicated thrice. Healthy insect and disease free seedlings were transplanted on a flat bed at a spacing of 60 cm × 45 cm. The recommended fertilizers dose i.e. 100:50:50 NPK kg ha^{-1}. While, half dose of N and full dose of P & K and remaining dose of N was uniformly applied to all the experimental plots. Various observations on growth, flowering, yield and quality parameters were recorded at proper stages and data were analysed as per the methods suggested by Gomez and Gomez (1984).

Results and Discussion

Growth parameters

Effect of PDKV Micrograde-II formulation

Maximum plant height (74.54 cm), branches $plant^{-1}$ (50.59), plant spread (73.09 cm), leaf area (80.07 cm^2) and stem girth (2.51 cm) were recorded with the foliar application of 1.5% PDKV Micrograde-II (M_4), which was statistically at par with 1.0% PDKV Micrograde-II (M_3). However, leaf area followed by 1.0% PDKV Micrograde-II. While, minimum plant height (64.96 cm), branches $plant^{-1}$(31.67), plant spread (45.80 cm), leaf area (64.93 cm^2) and stem girth (2.00 cm) were recorded in the water spray (M_1) treatment. Enhanced vegetative growth under higher concentrations of PDKV Micrograde-II may be attributed to the improved availability and uptake of micronutrients, particularly iron and zinc, which contribute to chlorophyll synthesis, photosynthetic activity, enzymatic processes, cell division and overall plant growth. Similar findings were reported by, Chopde *et al.,* (2016) in annual chrysanthemum, Thakur *et al.,* (2022) in chrysanthemum and Harish *et al.,* (2023) in gladiolus.

Effect of Spraying Time

Spraying time of PDKV Micrograde-II formulation significantly influenced the vegetative growth of gaillardia at the later stages of crop growth. Spraying at 90 DAT (S_3) was recorded maximum plant height (74.30 cm), stem girth (2.36 cm), plant spread (66.47 cm), leaf area (74.38cm^2) and branches $plant^1$ (44.26). Whereas lowest values for most growth parameters were recorded with S_1 (30 DAT). The improved growth under S_3 may be attributed to the timely availability of micronutrients during active crop growth, and nutrient utilization at proper time. Similar findings were reported by Tayade *et al.,* (2018) in tuberose, Tejas *et al.,* (2024) in annual chrysanthemum and Solav *et al.,* (2025) in tuberose.

Yield parameters

Effect of PDKV Micrograde-II formulation

Different formulations of PDKV Micrograde-II significantly influenced flower production of gaillardia. Highest flowers $plant^1$ (109.47), flower yield $plant^1$ (150.67 g) and flower ha^{-1} (74.14 q), were recorded with 1.0% PDKV Micrograde-II (M_3) which was at par with 1.5% PDKV Micrograde-II (150.40 g yield $plant^1$ and 73.98 q $hectare^{-1}$) and followed by flowers $plant^1$ (95.50). While, minimum flowers $plant^1$ (77.69), flower yield $plant^1$ (98.40 g) and flower ha^1 (48.57 q) were recorded under water spray (M_1). Increased flower production and yield under PDKV Micrograde-II may be attributed to the balanced supply of micronutrients, bud development and flower retention.

Table.1 Yield Parameters

Treatments	Plant height (cm) (150DAT)	Stem girth (cm) (150DAT)	Branches plant^{-1} (150DAT)	Plant spread (cm)	Leaf area (cm^2)	Number of flowers plant^{-1}	Yield plant^{-1} (g)	Yield ha^{-1} (q)
PDKV Micrograde-II (M)								
M_1-Water spray	64.96	2.00	31.67	45.80	64.93	77.69	98.40	**48.57**
M_2-0.5%	69.92	2.26	41.16	66.63	70.79	84.37	114.40	**56.28**
M_3-1.0%	72.82	2.39	46.47	69.68	73.01	109.47	150.67	**74.14**
M_4-1.5%	74.54	2.51	50.59	73.09	80.07	95.50	150.40	**73.98**
F'test	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**
SE (m)±	1.34	0.05	0.63	1.29	1.29	1.53	2.93	**1.18**
CD at 5%	3.92	0.15	1.83	3.77	3.78	4.50	8.58	**3.45**
Spraying time(S)								
S_1-30 DAT	67.60	2.18	39.93	59.70	69.30	88.52	120.90	**59.54**
S_2-60DAT	70.07	2.33	43.31	65.54	72.33	94.57	134.20	**65.46**
S_3-90DAT	74.03	2.36	44.26	66.47	74.38	92.18	130.30	**63.75**
F'test	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**
SE(m)±	1.16	0.05	0.70	1.11	1.12	1.33	2.53	**1.02**
CD at 5%	3.39	0.13	2.06	3.27	3.27	3.90	7.43	**2.92**
Interaction effect (MxS)								
F'test	**Sig.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**Sig.**	**N.S.**	**Sig.**
SE(m)±	2.31	0.09	1.41	2.23	2.23	2.66	5.07	**2.04**
CD at 5%	**6.78**	-	-	-	-	**7.80**	-	**5.97**

Table.2 Interaction effect of PDKV Micorgrade-II and spraying time on growth and flower yield of gaillardia.

Treatments	Plant height (cm) (150 Days)	Number of flowers plant^{-1}	Yield ha^{-1}
T1-M1S1	62.10	72.43	**42.76**
T2-M1S2	64.80	78.77	**49.19**
T3-M1S3	67.98	81.87	**49.67**
T4-M2S1	66.80	80.83	**50.00**
T5-M2S2	69.85	82.07	**57.45**
T6-M2S3	73.11	90.20	**61.60**
T7-M3S1	69.20	95.53	**69.46**
T8-M3S2	72.70	115.33	**78.83**
T9-M3S3	76.56	95.57	**73.66**
T10-M4S1	72.00	107.27	**75.94**
T11-M4S2	72.93	100.40	**76.34**
T12-M4S3	78.39	105.80	**70.11**
F'test	**Sig.**	**Sig.**	**Sig.**
SE(m)±	2.31	2.66	**2.04**
CDat5%	**6.78**	**7.80**	**5.97**

Similar findings were reported Solav *et al.,* (2025) in tuberose, Chopde *et al.,* (2016) in annual chrysanthemum, Rihne *et al.,* (2017) in gladiolus and Tejas *et al.,* (2024) in annual chrysanthemum.

Effect of Spraying Time

Spraying time of PDKV Micrograde-II significantly influenced flower production and yield of gaillardia. Spraying at 60 DAT (S_2) recorded the highest flowers plant^{-1} (94.57), yield plant^{-1} (134.20 g) and yield hectare^{-1} (65.46 q) which was at par at 90 DAT (92.18, 130.30 g yield plant^{1} and 63.75 q hectare^{-1}). While, minimum flowers plant^{1} (88.52), flower yield plant^{1} (120.90 g) and flower ha^{-1} (59.54 q), were recorded at 30 DAT S_1. The higher flower production and may be attributed to the timely availability of micronutrients during the flowering phase, enhancing photosynthesis, nutrient uptake, assimilate translocation and flower bud development. Similar findings were reported by Ganesh and Soorianthasundaram (2015) in tuberose.

Interaction effect

The interaction between PDKV Micrograde-II formulation and spraying time significantly influenced plant height and flower yield of gaillardia. Maximum plant height (78.39 cm) was recorded with the application of 1.5% PDKV Micrograde-II at 90 DAT (M_4S_3) However, highest flowers plant^{-1} (115.33) and flower yield (78.83 q ha^{-1}) were recorded with application of 1.0% PDKV Micrograde-II applied at 60 DAT (M_3S_2), Superior performance of these treatment combinations may be attributed to the optimum supply and efficient utilization of micronutrients at appropriate stages of crop growth.

Micronutrients play vital roles in chlorophyll formation, enzyme activation, photosynthetic activity and various physiological processes, thereby promoting vegetative growth and reproductive development Verma *et.al.* (2017) Timely foliar application may have enhanced nutrient absorption and utilization during critical growth and flowering stages, resulting in improved assimilate production and translocation towards developing flowers. Consequently, the optimum combination of PDKV Micrograde-II concentration and spraying time may have promoted better plant growth and flower development, leading to enhanced flower yield. Similar results were reported by Tejas *et al.,* (2024) in annual chrysanthemum and Solav *et al.,* (2025) in tuberose.

From the present investigation, it can be concluded that foliar application of PDKV Micrograde-II at anoptimum concentration and appropriate growth stage improved the overall growth, flowering and yield performance of gaillardia. Among the treatment combinations, 1.5% PDKV Micrograde-II applied at 90 DAT (M_4S_3) was most effective for vegetative growth. While, 1.0% PDKV Micrograde-II applied at 60 DAT (M_3S_2) was most effective for enhancing overall crop performance and flower yield.

Author Contributions

Aditi Prakash Hingankar: Investigation, formal analysis, writing—original draft. Seema A. Thakre: Validation, methodology, writing—reviewing. Yogesh B. Dharmik:—Formal analysis, writing—review and editing. Achal M. Upare: Investigation, writing—reviewing. Aditya M. Kadam: Resources, investigation writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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