

“Effect of Micro-nutrient on plant growth and flower yield of Calendula (*Calendula officinalis* L.) Under Prayagraj Agro-climatic condition.”

Abstract

The present experiment was conducted to determine the “Effect different level of Micro-nutrients on plant growth and flower yield of Calendula (*Calendula officinalis* L.) Under Prayagraj Agro-climatic condition” cv. Calypso II in the Department of Horticulture, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, (U.P.), India. during the winter season November, 2021 to February, 2022. The experiment was conducted in Randomized Block Design (RBD), with ten treatments of different level of Micronutrients (Copper, Zinc and Manganese), with thrice replicated. The treatment T₇ (0.2% Manganese + RDF) found best in term of plant growth and yield with high benefit cost ratio of Calendula followed by treatment T₈ (0.4% Manganese + RDF) where as minimum Plant growth, flower yield and Cost Benefit Ratio was recorded in treatment T₀ (Control + RDF).

Keywords: *Calendula, Micro-nutrient, Copper, Zinc and Manganese, Growth, Flower yield and Benefit cost ratio.*

INTRODUCTION:-

Calendula (*Calendula officinalis* L.), the pot marigold, common marigold or Scotch marigold is a plant in the genus *Calendula* of the family **Asteraceae**. It is probably native to southern Europe, though its long history of cultivation makes its precise origin unknown, and it may possibly be of garden origin. It is also widely naturalized further north in Europe (north to southern England) and elsewhere in warm temperate regions of the world.

Calendula (*Calendula officinalis* L.) is an annual with bright yellow or orange daisy like flowers. The flowers are harvested while in full bloom and dried for use as a medicinal or culinary herb. The entire flower heads or the petals alone are used. Industrial oil may be expressed from the seeds and absolute oil is obtained from the flowers. It may be direct-seeded in the field and begins to flower in about two months. Harvest of calendula is time-

consuming because the flowers form over a long period of time and individual flowers mature quickly.

The yield of flowers depends on different attributes which are closely associated with nutrient uptake by the plant. Plants have nutritional requirements just like humans in order to grow, develop and complete their life cycle. The supply of nutrients to the plants should be balanced, ensuring not to over or under-fertilize. Nutrients are classified according to their importance to plants and are categorized as primary (N, P, K), secondary (Ca, Mg, S, Cl, Na), and micro-nutrients (Fe, Zn, Mn, Cu, Mo, B, Co).

MATERIALS AND METHODS:-

A field experiment entitled "Effect different level of Micro-nutrients on plant growth and flower yield of Calendula (*Calendula officinalis* L.) Under Prayagraj agro-climatic condition" was conducted in randomized block design (RBD) with 10 treatments with 3 replications at Departmental research field of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, during November, 2021 to February, 2022. The seeds of the Calendula flower are collected from the Sakata Seed India (P) Ltd. seed company, Gurugram, Haryana. Total number of treatments was 10 viz. T₀ (Control + RDF), T₁ (0.2% Copper + RDF), T₂ (0.4% Copper + RDF), T₃ (0.6% Copper + RDF), T₄ (0.2% Zinc + RDF), T₅ (0.4% Zinc + RDF), T₆ (0.6% Zinc + RDF), T₇ (0.2% Manganese + RDF), T₈ (0.4% Manganese + RDF), T₉ (0.6% Manganese + RDF).

Results and Discussion

The result of the experiment has been presented under the following heading.

A. Vegetative growth parameters:

The treatment T₇ has recorded maximum performance in all the parameters at 20, 40 and 60 Days respectively in ten treatments follows plant height (10.13, 14.39 and 18.21 cm.), plant spread (6.40, 17.20 and 30.60 cm².), number of leaves (11.93, 26.27 and 60.13), number of branches per plant (3.13, 7.47 and 19.27). The second performance was recorded by T₈ follows plant height (9.87, 14.18 and 17.82 cm.), plant spread (5.87, 17.13 and 30.20 cm².), number of branches (2.67, 7.27 and 19.00), number of leaves (10.87, 25.20 and 59.47). The minimum number of reading observed in T₃ as plant height (9.87, 13.46 and 16.76 cm.), number of branches (1.80, 6.67 and 17.07), and T₀ as number of leaves (8.67, 25.67 and 53.27), plant spread (5.13, 15.53 and 27.40 cm².), Similar results were finding Mn (0.30%) by Abou-Sreya *et al.*, (2016) in Calendula plants.

B. Flowering parameters:

The treatment T₇ has recorded maximum performance in all the parameters as follows flower diameter (6.03 cm.), weight of single flower (5.03 g.) and minimum number of days required for first flower bud emergence from planting (37.53 days). The second performance was recorded T₈ as follows in flower diameter (5.96 cm.), weight of single flower (4.97g.), minimum number of days required for flower bud emergence from planting (37.87 days). The minimum number of reading observed in T₀ as weight of single flower (4.13 g.) and number of days required for first bud emergence was maximum (41.67 days), as well as T₃ was recorded minimum flower diameter (5.20 cm.), Similar results were finding by Abou-Sreea *et al.*, (2016) in *Calendula* plants.

C. Yield parameters:

The treatment T₇ has recorded maximum performance in all the parameters as follows flower yield per plant (200.82 g.), flower yield per plot (1.20 kg.), flower yield per hectare (22.49 t.) and maximum record total number of flower/plant (39.87). The second performance was recorded by T₈ as follows flower yield per plant (190.86 g.), flower yield per plot (1.14 kg.), flower yield per hectare (21.37 t.), total Number of flower/plant (38.43). The minimum number of reading observed in T₀ flower yield per plant (122.21 g.), flower yield per plot (0.73 kg.), flower yield per hectare (13.68 t.), total number of flower/plant (29.57). Hiller (1995) and Walworth (1998) in separate investigation reported that yield and quality of potato increased with foliar applications of micronutrients such as manganese. Result were also finding by M. H. Rashed *et al.*, (2019) in Agricultural crop.

D. Economics of Cultivation:

Maximum Gross return, net returns and cost benefit ratio from flowers was found in the T₇ Maximum gross returns (Rs. 674700,00), Net Return (Rs. 389203,00) and Cost Benefit Ratio (1:2.36) followed by T₈ with gross return (Rs. 641100.00), net return (Rs. 345103.00) and cost benefit ratio (1:2.16) where as minimum Gross return (Rs. 410400.00) in T₀ and Net return (Rs. 123103.00), Cost benefit ratio (1:1.39) was recorded in treatment T₃.

Table 1: Effect different level of Micro-nutrients on Vegetative growth parameters of Calendula (*Calendula officinalis* L.)

Treatment Symbol	Plant Height (cm)			Number of Leaves/Plant			Plant Spread (cm)			Number of primary branches/plant		
	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS
T0	9.11	13.80	18.04	8.67	25.67	53.27	5.13	15.53	27.40	2.13	6.67	16.93
T1	9.24	12.68	15.75	9.13	25.13	52.73	5.27	15.13	26.93	2.13	6.67	16.80
T2	9.87	13.46	16.76	8.73	24.73	53.80	5.47	15.67	27.47	2.07	6.60	16.80
T3	9.80	12.35	14.98	9.33	25.13	55.47	5.27	14.80	25.73	1.80	6.67	17.07
T4	9.56	13.39	16.36	8.53	24.73	52.07	5.60	15.20	26.53	2.13	6.67	16.80
T5	9.43	12.78	17.07	9.20	26.27	54.47	5.27	14.73	26.60	2.13	6.80	18.07
T6	9.43	12.88	15.83	9.13	25.27	54.60	5.40	14.53	25.07	1.87	6.60	17.53
T7	10.13	14.39	18.21	11.93	26.27	60.13	6.40	17.20	30.60	3.13	7.47	19.27
T8	9.87	14.18	17.82	10.87	25.20	59.47	5.87	17.13	30.20	2.67	7.27	19.00
T9	9.42	13.87	16.37	10.73	26.80	58.53	5.87	16.93	29.40	2.53	7.13	18.87
F-Test	S	S	S	S	S	S	S	S	S	S	S	S
S.Ed(±)	0.29	0.56	0.93	0.53	0.64	2.61	0.09	0.93	1.26	0.12	0.28	0.91
C.V.	3.69	5.17	6.83	6.70	3.05	5.77	2.00	7.25	5.60	6.74	5.09	6.27
C.D. at 5%	0.61	1.19	1.96	1.11	1.34	5.49	0.19	1.95	2.65	0.26	0.60	1.90

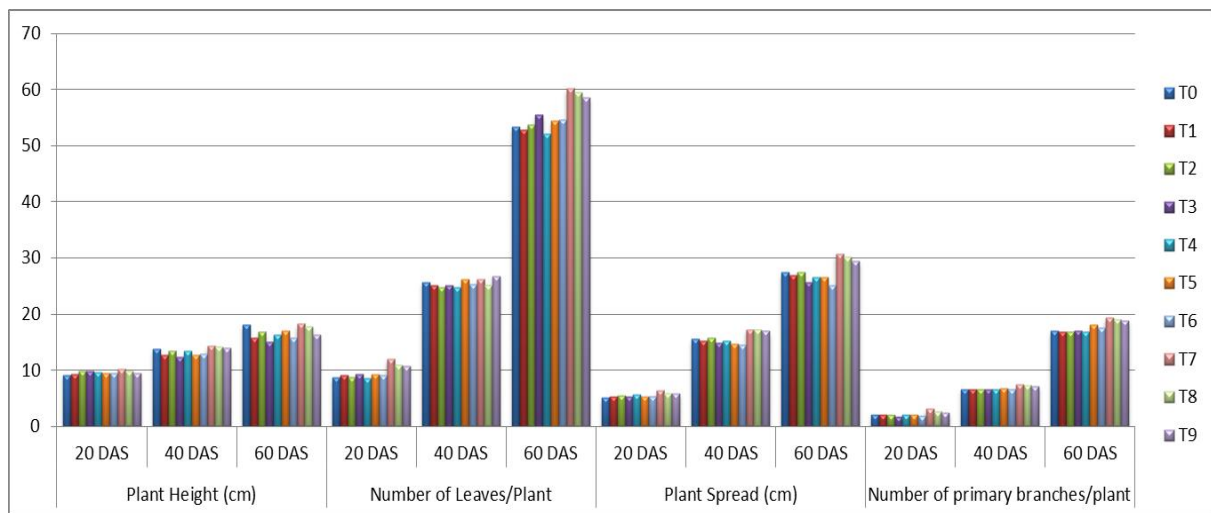


Fig 1: Graphical representation of table 1

Table 2: Effect different level of Micro-nutrients on earliness of flowering, flower yield and Benefit cost ratio of Calendula (*Calendula officinalis* L.)

Treatment Symbol	Number of days required for first flower bud emergence	Flower diameter (cm.)	Fresh weight of flower (g.)	Total Number of flowers/plant	Flower yield/plant (g.)	Flowers yield/plot (kg.)	Flower Yield (t./ha)	Net return (₹)	Cost Benefit ratio
T0	41.67	5.47	4.13	29.57	122.21	0.73	13.68	135403	1:1.49
T1	40.67	5.53	4.50	32.07	144.13	0.86	16.14	197203	1:1.69
T2	40.67	5.33	4.30	31.47	135.46	0.81	15.17	156103	1:1.52
T3	41.33	5.20	4.23	30.56	129.30	0.77	14.47	123103	1:1.39
T4	39.67	5.43	4.50	34.33	154.37	0.92	17.28	233503	1:1.82
T5	40.00	5.70	4.27	36.66	156.50	0.93	17.52	230803	1:1.78
T6	40.33	5.83	4.17	35.23	146.85	0.87	16.44	188503	1:1.62
T7	37.53	6.03	5.03	39.87	200.82	1.20	22.49	389203	1:2.36
T8	37.87	5.96	4.97	38.43	190.86	1.14	21.37	345103	1:2.16
T9	38.67	5.93	4.87	36.67	178.70	1.07	20.01	293803	1:1.95
F-Test	S	S	S	S	S	S	S		
S.Ed(±)	0.76	0.26	0.24	0.71	9.46	0.05	1.06		
C.V.	2.34	5.68	6.45	2.55	7.43	7.41	7.43		
C.D. at 5%	1.60	0.55	0.50	1.46	19.34	0.11	2.16		

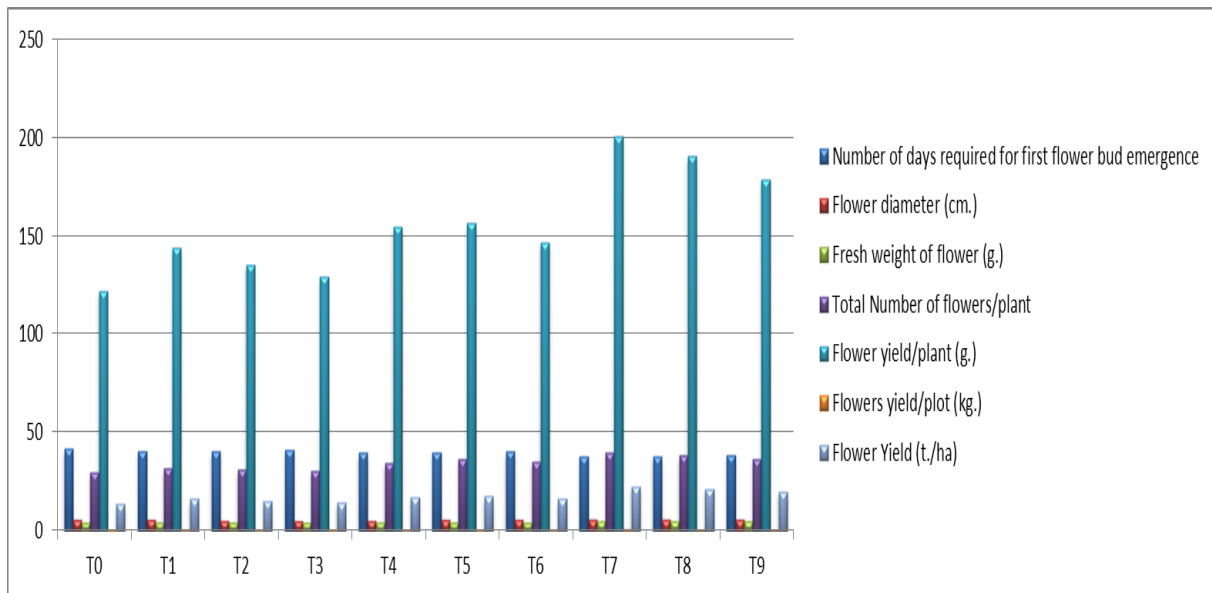


Fig 2: Graphical representation of table 2

Conclusion

Based on the present experimental results obtained it is concluded that the treatment T₇ (0.2% Manganese + RDF) found best in term of Plant Growth, flower yield, Gross return, Net return and Cost benefit ratio of Calendula followed by treatment T₈ (0.4% Manganese + RDF) where as minimum obtained recorded in treatment T₀ (Control + RDF).

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