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SYNERGISTIC EFFECTS OF COMBINED APPLICATION OF MICRONUTRIENTS ON FLORAL PARAMETERS OF AFRICAN MARIGOLD CV. PUSA NARANGI GAINDA

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ABSTRACT

The present investigation was conducted during 2022-23 at Centre of Agricultural Education Research Farm, Faculty of Agricultural Sciences, AMU, Aligarh, Uttar Pradesh in synergistic effects of combined application of micronutrients on floral parameters of African Marigold cv. Pusa Narangi Gainda. The experiment was laid out in Randomized Block Design with three replications. Performance of micronutrients was studied for twelve quantitative traits *viz.*, days taken to flower bud initiation, bud length (cm), days taken to opening of first flower, flower diameter (cm), number of flowers per plant, number of flowers per plot, fresh flower weight (g), flower yield per plot (kg), duration of flowering (days), dry weight (g) per flower, dry weight (g) per plant, and number of seeds per flower. The study investigated the influence of four selected micronutrients *viz.* zinc (0.4%), ferrous sulphate (0.6%), borax (0.8%), manganese (1%) and their interactions on the field of African Marigold cv. Pusa Narangi Gainda. The micronutrients and their combinations were applied as foliar spray in two different intervals (one at 20 days after transplanting and other at 40 days after transplanting). Among the treatments, plants sprayed with $FeSO_4$ @ 0.6% + $MnSO_4$ @ 1% recorded, highest flower diameter (cm) 6.61, maximum flower weight (8.40 g), maximum flower yield per plot (3.26 Kg), and maximum dry weight per plant (43.65 g).
***Keywords* :** Marigold, micronutrients, African marigold, flower yield, narangi gainda.

Introduction

Marigold is a significant flowering plant. They are often used to make garlands, for aesthetic purposes, and for other things including oil extraction and therapeutic purposes. Mary is related with the common word "marigold" which is derived from "Mary's Gold." of the biblical narratives (Singh, A.K., 2014). The market offers both loose flowers and floral garlands for sale. Marigold is primarily utilized for adornment and is incorporated into landscape planning due to its changing height and color. Because of their value, marigolds are known as a poor man's crop. It may be cultivated all year round, however the wet and winter seasons are the most prevalent in eastern Uttar Pradesh. It can also be produced in the summer.

Micronutrients play an important role in the development, blossoming, and quality of floral crops, besides other factors. Zinc encourages the storage of more carbohydrates through photosynthesis, which may contribute to the early flowering of plants. The marigold crop reacts favorably to micronutrients, particularly zinc. According to Kumar *et al*. (2010) and Balakrishnan *et al*. (2007), zinc has a role in plant biosynthesis, flowers the amount of auxin in the environment by contributing to the synthesis of tryptophan, a precursor to auxin. Marigold also absorbs zinc in ionic form.

The function of manganese is regarded as being closely associated with that of iron as it also supports the movement of iron in the plant. It also helps in chlorophyll formation as well as acts as catalyst in oxidation and reduction reaction within plant tissues. Thus as a constituents of enzymes, it helps in respiration and in protein synthesis in chloroplast.

Plant activities including sugar translocation, membrane permeability, leaf photosynthesis, and cell growth all involve the element borax. Protein, amino acid, and nitrate metabolism, cell wall production, extension and division, and nitrogen fixation. Additionally, it has a direct impact on fruit abscission, flower growth, pollen germination, fertilization, and seed development. The meristematic parts of plants, such as root tips, developing leaves, and buds, contain the important ingredient borax.

Additionally, iron is a crucial micronutrient that influences the characteristics of the plant and is essential for respiration and photosynthesis. According to studies, iron is a crucial nutrient for the development of plant tissues. Numerous physiological anomalies, including chlorosis, burning, and resetting, among others, can be brought on by an iron deficiency. Iron has a role in the development of chlorophyll as well. Additionally, iron plays a crucial role in the activation of a number of enzymes. The physiological growth of flowers is influenced by the administration of iron and zinc, which also reduces the amount of ethylene and abscisic acid. As a result, the flowers' shelf life and aesthetic appeal are boosted.

Materials and Methods

The present investigation was carried out at the Centre of Agricultural Education Research Farm, Faculty of Agricultural Sciences, Aligarh Muslim University, Aligarh (UP), during the year 2022-23. The experiment site was situated at 27.88 N latitude, 78.20 E longitude and above the 178 meter mean sea level. Aligarh is situated in the middle portion of doab or the land between the Ganga and Yamuna River. Aligarh is 126 km south east of Delhi. The weekly mean maximum and minimum temperature ranged from 30 to 43.23^{o}C and 5.1 to 25.4^{o}C, respectively, while the average maximum and minimum temperature during the crop period were 31^{o}C and 20.5^{o}C respectively, similarly, the weekly mean relative humidity ranges from 67.6 to 89.3% with an average of 79.4%. A total rainfall of 863.31 mm was received in 31 rainy days during the crop growth period. The treatment combinations involved in the study were eleven in numbers i.e. T_0 (Distilled Water as Control), T_1 ($ZnSO_4$ 0.4%), T_2 ($FeSO_4$ 0.6%), T_3 (Borax 0.8%), T_4 ($MnSO_4$ 1%), T_5 ($ZnSO_4$ 0.4% + $FeSO_4$ 0.6%), T_6 ($ZnSO_4$ 0.4% + Borax 0.8%), T_7 ($ZnSO_4$ 0.4% + $MnSO_4$ 1%), T_8 ($FeSO_4$ 0.6% + Borax 0.8%), T_9 ($FeSO_4$ 0.6% + $MnSO_4$ 1%) and T_{10} (Borax 0.8% + $MnSO_4$ 1%). For spraying, four micronutrients with different concentration ($ZnSO_4$ @ 0.4%, $FeSO_4$ @ 0.6%, $MnSO_4$ @ 1.0%, Borax @ 0.8%) were prepared. 33.3g of Zinc sulphate was dissolved in 100ml of distilled water, neutralized with lime water, and then made into a volume of 1,000 ml to create a stock solution with a concentration of 0.4%.

Similarly, for making 0.6%, 0.8%, 1.0% solution of iron, borax, and manganese respectively was dissolved in 100 ml by adding distilled water and neutralized by lime water then made volume to 1000 ml by adding distilled water.

The data related to yield parameters namely: days taken to flower bud initiation, bud length (cm), days taken to opening of first flower, flower diameter (cm), number of flowers per plant, number of flowers per plot, flower yield per plot (kg), fresh flower weight (g), duration of flowering (days), dry weight (g) per flower, dry weight (g) per plant and number of seeds per flower were recorded as per the procedure described below were recorded for the analysis.

Result and Discussion

An effort to evaluate the experimental results that were published in relation to the inquiry into the effects of micronutrients on flower yield in African marigold (*Tagetes erecta*). The results showed that there are considerable differences between the majority of the treatments, and an effort was made to discuss the differences seen in flower yield. The following headings describe the pertinent considerations in accordance with the observed variances noted during the investigation.

The data reveals a significant effect on initiation of bud due to various micronutrients doses in african marigold and their interactions. Early bud initiation from the date of transplanting was reported in the ZnSO4 @ 0.4% + $MnSO_4$ @ 1% (34.67 days), which is followed by $FeSO_4$ @ 0.6% + Borax @ 0.8% (34.89 days). While maximum days to bud initiation were reported in Borax @ 0.8% (43.66 days). Applying zinc and manganese together increases photosynthetic efficiency and speeds up the production of growth hormones, or auxins. This gives the plant the energy surplus and hormonal cues it needs to go from vegetative development to blooming considerably more quickly. The outcomes are in consistent with those of Gupta and Kumar (2015) in African marigold and Patokar *et al.* (2017) in marigold.

The bud length in marigold was significantly influenced due to various doses of micronutrients and their interactions. Maximum bud length in African marigold were found with ZnSO4 @ 0.4% (4.58 cm), which is followed by control (4.40 cm). While the lowest bud length were reported in $ZnSO_4$ @ 0.4% +Borax @ 0.8% (3.67 cm). In the floral tissues, zinc stimulates the production of tryptophan, a precursor to auxins, which encourages quick cell division and elongation. The marigold buds' overall length and physical dimensions are directly increased by this hormonal boost and enhanced nutrient delivery. Similar results were seen in rose cv. Cardinal and Whisky Mac, which are consistent with Yonis *et al.* (2013).

Table 1 : Effect of Micronutrients on Flower Yield Attributing Traits in African Marigold (*Tagetes erecta* L.) cv. "Pusa Narangi Gainda"

Sl. No.	**Treatments**	**Days taken to flower bud initiation**	**Days taken to opening of first flower**	**Bud length (cm)**	**Flower diameter (cm)**	**Number of flowers per plant**	**Number of flowers per plot**
1	Control	40.89	52.33	4.40	6.21	39.11	391.99
2	$ZnSO_4$ @ 0.4%	41.55	52.55	4.58	6.40	43.22	388.01
3	$FeSO_4$ @ 0.6%	40.55	52.44	3.97	6.13	43.55	391.95
4	Borax @ 0.8%	43.66	54.44	3.96	6.04	41.33	371.97
5	$MnSO_4$ @ 1%	35.78	46.55	3.68	5.81	42.77	384.93
6	$ZnSO_4$ @ 0.4% + $FeSO_4$ @ 0.6%	38.55	49.89	3.72	5.84	38.78	349.02
7	$ZnSO_4$ @ 0.4% +Borax @ 0.8%	42.44	53.55	3.67	5.75	30.33	272.97
8	ZnSO4 @ 0.4% + $MnSO_4$ @ 1%	34.67	44.78	4.10	6.21	42.66	383.94
9	$FeSO_4$ @ 0.6% + Borax @ 0.8%	34.89	48.00	4.26	6.25	41.00	369.00
10	$FeSO_4$ @ 0.6% + $MnSO_4$ @ 1%	37.67	50.11	3.85	6.61	43.89	395.98
11	Borax @ 0.8% + $MnSO_4$ @ 1%	38.11	51.00	3.96	6.23	43.66	392.94
	Mean	**38.98**	**49.69**	**4.01**	**6.13**	**40.94**	**372.06**
	Minimum	**34.67**	**44.78**	**3.67**	**5.75**	**38.78**	**272.97**
	Maximum	**43.66**	**54.44**	**4.58**	**6.61**	**43.89**	**395.01**
	CV %	**7.0**	**8.43**	**7.54**	**8.87**	**7.24**	**0.78**
	SEm±	**1.59**	**2.45**	**0.17**	**0.31**	**1.71**	**1.69**
	CD 5%	**4.66**	**NS**	**0.51**	**NS**	**5.02**	**4.97**
	CD 1%	**6.33**	**NS**	**0.69**	**NS**	**6.82**	**6.75**

Early flower initiation were noted in ZnSO4 @ 0.4% + $MnSO_4$ @ 1% (44.78 days) treatment which is followed by $MnSO_4$ @ 1% (46.55 days). while maximum days of flower initiation were noted in Borax @ 0.8% (54.44 days) treatment. Zinc (ZnSO4) regulates plant growth hormones, promoting early flowering, while Manganese (MnSO4) supports enzyme activity and nutrient metabolism. This combo likely triggered early flower initiation by enhancing hormone balance and nutrient availability. The results were also obtained by Jat *et al.* (2007) in marigold, and Khosa *et al.* (2011) in gerbera.

The maximum flower diameter was noted with $FeSO_4$ @ 0.6% + $MnSO_4$ @ 1 % (6.61 cm) followed by $ZnSO_4$ @ 0.4% (6.40 cm). While the lowest flower diameter was reported in $ZnSO_4$ @ 0.4% +Borax @ 0.8% (5.75 cm). Iron ($FeSO_4$) boosts chlorophyll synthesis, enhancing photosynthesis, while Manganese (MnSO4) supports enzyme activity and cell growth. Together, they likely promoted cell expansion and nutrient accumulation, resulting in larger flower diameter. The outcomes are consistent with those of Balakrishanan *et al.* (2007), shah *et al.* (2016), and Saini *et al.* (2015).

The maximum number of flowers per plant were recorded with dose of $FeSO_4$ @ 0.6% + $MnSO_4$ @ 1 % (43.89) followed by Borax @ 0.8% + $MnSO_4$ @ 1% (43.66), while lowest number of flowers were recorded with $ZnSO_4$ @ 0.4% +Borax @ 0.8% (30.33). Maybe there are more flowers because there is more tryptophan being produced, which is a precursor to auxin. Increased auxin production may promote vegetative development by suppressing the plant's juvenile stage. Increase the production of food products, which may have contributed to an increase in floral output (Muthumanickam, 1999). To fertilize different field and floricultural crops, foliar spray is more efficient. The results are consistent with those of shah *et al.* (2016) for marigold.

The maximum number of flowers per plot were reported in $FeSO_4$ @ 0.6% + $MnSO_4$ @ 1 % (395.98), which is followed by Borax @ 0.8% + $MnSO_4$ @ 1% (392.94). Lowest number of flowers per plot were recorded with $ZnSO_4$ @ 0.4% +Borax @ 0.8%

(272.97). Iron ($FeSO_4$) and Manganese ($MnSO_4$) likely worked together to enhance plant growth, flower initiation, and overall plant health, leading to more flowers per plot. This combo supports photosynthesis and nutrient uptake, promoting robust flowering. The results are consistent with those of shah *et al.* (2016) for marigold, Younis *et al.* (2013) for rose, kode *et al.* (2015) for rose, and Halder *et al.* (2007) for gladiolus.

Maximum fresh weight of flower was reported in the treatment application of $FeSO_4$ @ 0.6% + $MnSO_4$ @ 1% (8.40 g) followed by $FeSO_4$ @ 0.6% + Borax @ 0.8% (8.27 g), while minimum fresh weight of flower was reported in $ZnSO_4$ @ 0.4% (6.86 g). Iron and Manganese's synergistic effect likely boosted photosynthesis, nutrient uptake, and water retention, resulting in heavier, healthier flowers with higher fresh weight. Similar result was observed by shah *et al.* (2016) in marigold and Patel *et al.* (2017) in tuberose.

The maximum yield of flowers per plot were reported in $FeSO_4$ @ 0.6% + $MnSO_4$ @ 1% (3.26 kg), followed by Borax @ 0.8% + $MnSO_4$ @ 1% (3.10 kg). while lowest yield of flowers per plot were observed in $ZnSO_4$ @ 0.4% +Borax @ 0.8% (2.07 kg). Iron ($FeSO_4$) boosts photosynthesis and overall plant health, while Manganese ($MnSO_4$) enhances enzyme activity and nutrient uptake. This combo likely led to more vigorous growth, better flower formation, and increased flower yield per plot. The results were also obtained by Jat *et al.* (2014), kakade *et al.* (2009) in china aster, Mathew *et al.* (2004) in marigold.

The observations regarding duration of flowering clearly showed that different levels of different micronutrient of African marigold (*Tagetes erecta*) significantly affect the duration of flowering. Maximum days of duration of flowering was recorded with ZnSO4 @ 0.4% + $MnSO_4$ @ 1% (68.11 days) which is followed by $MnSO_4$ @ 1% (66.44 days). While the lowest days of duration of flowering were recorded in Borax @ 0.8% (57.44 days). Zinc ($ZnSO_4$) regulates plant growth and development, while Boron (Borax) is crucial for flower formation and longevity. Together, they likely enhanced flower duration by promoting healthy flower development, pollination, and senescence regulation, leading to prolonged flowering.

The maximum dry weight of flower was recorded with $FeSO_4$ @ 0.6% + Borax @ 0.8% (1.04 g) followed by $FeSO_4$ @ 0.6% + $MnSO_4$ @ 1% (1.01 g), while the lowest dry weight of flower was recorded with $ZnSO_4$ @ 0.4% (0.87 g). Rathore *et al*. (2011) in African marigold cv. Pusa Basanti Gainda also reported similar results.

The maximum dry weight of plant was recorded with $FeSO_4$ @ 0.6% + $MnSO_4$ @ 1% (43.65 g), followed by Borax @ 0.8% + $MnSO_4$ @ 1% (42.78 g). While the lowest dry weight of plant was recorded with $ZnSO_4$ @ 0.4% +Borax @ 0.8% (29.42 g). Iron ($FeSO_4$) enhances chlorophyll synthesis and photosynthesis, while Manganese ($MnSO_4$) plays a crucial role in enzyme activation and electron transport. Together, they likely boosted plant growth and biomass accumulation, resulting in higher dry weight. Manganese's role in lignin biosynthesis might have also contributed to stronger plant structure. Rathore *et al.* (2011) in African marigold cv. Pusa Basanti Gainda also reported similar results.

The maximum number of seeds per flower was recorded with $FeSO_4$ @ 0.6% + Borax @ 0.8% (296.66), which is followed by Borax @ 0.8% + $MnSO_4$ @ 1% (296.11). while the lowest number of seeds were recorded in $ZnSO_4$ @ 0.4% +Borax @ 0.8% (277.55). Enhanced seed germination in African Marigold due to iron's role in chlorophyll synthesis and boron's involvement in cell wall formation and flower development. This synergy might have improved nutrient uptake and utilization, leading to increased seed yield. Phetpradap *et al.* (1994) in dahlia and, Mohanty *et al.* (2015) also reported similar outcomes.

Table 2 : Effect of Micronutrients on Flower Yield Attributing Traits in African Marigold (*Tagetes erecta* L.) cv. "Pusa Narangi Gainda"

Sl. No.	Treatments	Fresh flower weight (g)	Flower yield per plot (kg)	Duration of flowering (Days)	Dry weight (gm) per flower	Dry weight (gm) per plant	Number of seeds per flower
1	Control	7.84	2.75	65.33	0.98	38.32	289.55
2	$ZnSO_4$ @ 0.4%	6.86	2.70	61.33	0.87	38.18	291.66
3	$FeSO_4$ @ 0.6%	7.50	2.93	62.33	0.94	40.93	283.77
4	Borax @ 0.8%	7.72	2.87	57.44	0.96	39.67	280.33
5	$MnSO_4$ @ 1%	7.94	3.05	66.44	0.97	41.48	278.44
6	$ZnSO_4$ @ 0.4% + $FeSO_4$ @ 0.6%	7.89	2.75	62.55	0.99	38.39	279.22
7	$ZnSO_4$ @ 0.4% +Borax @ 0.8%	7.61	2.07	59.66	0.97	29.42	277.55

8	ZnSO4 @ 0.4% + $MnSO_4$ @ 1%	7.94	3.04	68.11	0.98	41.80	278.33
9	$FeSO_4$ @ 0.6% + Borax @ 0.8%	8.27	3.05	65.00	1.04	42.69	296.66
10	$FeSO_4$ @ 0.6% + $MnSO_4$ @ 1%	8.40	3.26	65.44	1.01	43.65	291.55
11	Borax @ 0.8% + $MnSO_4$ @ 1%	7.91	3.10	64.11	0.98	42.78	296.11
	Mean	**7.81**	**2.87**	**63.43**	**0.97**	**39.76**	**286.56**
	Minimum	**6.86**	**2.07**	**57.44**	**0.87**	**29.42**	**277.55**
	Maximum	**8.40**	**3.26**	**68.11**	**1.04**	**43.65**	**296.66**
	CV %	**12.82**	**14.83**	**5.37**	**19.61**	**1.30**	**1.55**
	SEm±	**0.57**	**0.22**	**1.96**	**0.08**	**2.16**	**3.34**
	CD 5%	**1.70**	**0.64**	**5.77**	**0.23**	**6.34**	**9.80**
	CD 1%	**2.32**	**0.88**	**7.85**	**0.32**	**8.62**	**13.32**

Conclusion

The micronutrients had a significant impact on the flower yield parameter in marigold. The experiment finding indicate that the treatment $FeSO_4$ @ 0.6% + $MnSO_4$ @ 1% was most effective in flower diameter, number of flowers per plant, fresh flower weight, number of flower per plot, flower yield per plot.

References

Balakrishnan, V.M., Jawaharlal, M., Kumar, T.S. and Ganga, M. (2007). Response of micro-nutrients on flowering, yield and xanthophyll content in African marigold (*Tagetes erecta* L.). *Journal of Ornamental Horticulture*, **10**(3), pp. 153-156.

Gupta, A.K, and Kumar, A. (2015). Effect of micro-nutrients on flowering and yield attributes of African marigold. *Research in Environment and Life Sciences*, **8**(2), 289-290.

Halder, N. K., Ahmed, R., Sharifuzzaman, S. M., Bagam, K. A., and Siddiky, M. A. (2007). Effect of boron and zinc fertilization on corm and cormel production of gladiolus in grey terrace soils of Bangladesh. *Int. J. Sustain. Crop Prod*, **2**(5), 85-89.

Jat, R. N., Khandelwal, S. K., and Gupta, K. N. (2007). Effect of foliar application of urea and zinc sulphate on growth and flowering parameters in African marigold (*Tagetes erecta* Linn.). *Journal of Ornamental Horticulture*, **10**(4), 271-273.

Kakade, D.K., Rajput, S.G. and Joshi, K.I. (2009). Effect of foliar application of Fe and Zn on Growth, flowering and yield of China aster [*Callistephus chinensis* (L.) Nees]. *Asian Journal of Horticulture*, **4**(1), 138-140.

Khosa, S.S., Younis, A., Rayit, A., Yasmeen, S. and Riaz, A. (2011). Effect of foliar application of macro and micro-nutrients on growth and flowering of *Gerbera jamesonii* L. American-Eurasian *Journal of Agriculture and Environment Sciences*, **11**(5), 736-757.

Kumar, S., and Haripriya, K. (2010). Effect of foliar application of iron and zinc on growth flowering and yield of Nerium (*Nerium odorum* L.). *Plant Archives*, **10**(2), 637-640.

Mathew, R., Dashora, L.K. and Verma, P. (2004). Effect of growth retardants and micronutrients on growth and yield of African marigold (*Tagetes erecta* L.) cv. Pusa Basanti Gainda. *Sci. Hort.*, **9**, 213-218.

Mohanty, C. R., Mohanty, A., and Parhi, R. (2015). Effect of planting dates and pinching on seed traits in African Marigold cv. Sirakole. *Agricultural Science Digest-A Research Journal*, **35**(4), 285-289.

Muthumanickam, D., K. Rajamani and M. Jawaharlal. (1999). Effect of micronutrients on flower production in gerbera. *J. Orn. Hort*., **2**, 131-132.

Patel, T.D., Viradia, R.R., Tejashwini, C.R., Patel, H.V. and Patel, U.R. (2017). Studies on effect of foliar application of micronutrient on growth, flowering quality and yield of Tuberose (*Polianthes tuberosa* L.) cv. Prajwal. *International Journal of Chemical Studies*, **5**(6), pp. 93-97.

Patokar, M. J., Chopde, N., and Kuchanwar, O. (2017). Effect of micronutrients (Zn and Fe) as a foliar spray on growth and flower production of marigold. *Plant Archives*, **17**(1), 312-314.

Phetpradap, S., Hampton, J. G., and Hill, M. J. (1994). Effect of hand pinching and plant growth regulators on seed production of field grown hybrid dahlia. *New Zealand journal of crop and horticultural science*, **22**(3), 313-320.

Rathore, I., Mishra, A., Moond, S. K., & Bhatnagar, P. (2011). Studies on effect of pinching and plant bioregulators on growth and flowering of marigold (*Tagetes erecta* L.) cv. Pusa Basanti Gainda. *Progressive Horticulture*, **43**(1), 52-55.

Saini, Tara Chand, Polara, N.D. and Bajad, A.A. (2015). Effect of micronutrients (Fe and Zn) on growth of chrysanthemum (*Chrysanthemum morifolium* Ramat.). *Asian Journal of Horticulture*, **10**(2), 216-221.

Shah ST, Ullah S, Khan N, Sajid M, Rab A, Amin NU, Iqbal A, Naeem A, Iqbal M, Haq SU, Rahman S. Effect of zinc as a foliar spray on growth and flower production of Marigold (*Tagetes erecta* L.). *Pure and Applied Biology*. 2016;**5**(4),1.

Singh, A.K. (2014). Breeding and biotechnology of flowers, vol. 1 commercial flowers. New Delhi, India, New India Publishing Agency.

Younis, A., Riaz, A., Sajid, M., Mushtaq, N., Ahsan, M., Hameed, M., and Nadeem, M. (2013). Foliar application of macro-and micronutrients on the yield and quality of Rosa hybrida cvs. Cardinal and Whisky Mac. *African Journal of Biotechnology*, **12**(7), 70.