Plant Archives Vol. 25, Supplement 1, 2025 pp. 96-99 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.supplement-1.014

FERTILIZATION AND HUMIC ACID APPLICAION ON GROWTH DYNAMICS AND MORPHOLOGICAL TRAITS OF DAHLIA (*DAHLIA VARIABILIS* L.)

Kedar Mahadev Gheware[1*], Nomita Laishram[1], Arvinder Singh[1], Sarabdeep Kour[2], Gurdev Chand[3], Ravinder Singh[4], R. K. Pandey[1], Ashutosh Sharma[1], Alok Patel[2] and Saurav Sharma[1]

[1]Division of Floriculture and Landscaping, SKUAST-Jammu -180009, (J&K), India
[2]Division of Soil Science and Agriculture Chemistry, SKUAST-Jammu -180009, (J&K), India
[3]Division of Plant Physiology, SKUAST- Jammu -180009, (J&K), India
[4]Institute of Biotechnology, SKUAST-Jammu-180009, (J&K), India
*Corresponding author *E-mail:* kedar.gheware.1997@gmail.com
(Date of Receiving : 03-10-2024; Date of Acceptance : 08-12-2024)

ABSTRACT

Humic acid helps in mobilisation of nutrients for plant growth and development in combination with inorganic fertilizers. The present research study the effects of humic acid on various growth parameters of Dahlia (*Dahlia variabilis* L.). It was conducted at the Division of Floriculture and Landscaping, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu (J&K) during 2023-2024. The experiment utilized a Factorial Randomized Completely Block Design (RCBD-Factorial) with eighteen treatment combinations with three replications to evaluate the effects of fertilizer rate (100%, 75% and 50%) and Humic acid (10, 20 and 30 $kgha^{-1}$, 0.1% and 0.2% foliar spray). Statistical analysis indicated that the highest values for plant height (89.05 cm), number of leaves per plant (83.06), number of branches per plant (9.33), stem length (57.38 cm) with F_2H_3 (75 % + Soil application of humic acid @ 20 kg ha^{-1}). Dahlia growth metrics showed significant improvements, especially with the F_2H_3 treatment, which generated excellent outcomes. These data demonstrated that various humic acid treatments can significantly improve particular growth of Dahlia plants.
Keywords: Dahlia, Humic acid, NPK, Productivity, Nutrient Uptake.

Introduction

Dahlia (*Dahlia variabilis* L.) is one of the most popular flower crops growing world-wide for its decorative blooms of varied colours to beautify gardens and cut flowers. (Wararkar *et al*., 2020). It belongs to the Asteraceae family and originates in Mexico. Dahlia is a genus of flowering plants of the Asteraceae family, with around 40 species. Approximately six Dahlia species have been produced for cultivation as attractive blooms and are popular in the floral business and gardens (Marina, 2015).

Fertilizers enhance plant growth and quality. Inoculation of soil with beneficial microorganisms promotes balanced nourishment for plants and increases root absorption of nitrogen and phosphorus as an interaction between phosphate solubilizing and nitrogen absorption (Kumar *et al*., 2019). Fertilizer use improves plant characteristics, both quantitatively and qualitatively. Plants are more capable to absorb vital nutrients, especially nitrogen and phosphorus, leading to greater growth and health (Bindraban *et al*., 2020).

Humic based fertilizers and mineral contents are the excellent combination which provides the ideal environmental condition for plant growth and development (Mawgoud *et al*., 2007; Sara *et al*., 2010). Humic acid (HA) is an active component of organic humus. It is not considered a fertilizer; rather, it is utilized as a soil conditioner or a plant bio stimulant. (Ngullie *et al*., 2014). Humic acid directly and indirectly affects plant growth and development (Chen *et al*., 2004).

Given the importance of the dahlia flower, a study was conducted to investigate the potential of fertilizers and humic acid on dahlia growth formation.

Materials and Methods

Location and Site

The experimental field of the Division of Floriculture and Landscaping, SKUAST, Jammu is located at 32o 40' N latitude and 74o 58' E longitude, at an elevation of 332 m above mean sea level. Agro-climatically, the site reflects Jammu and Kashmir's Zone V, which has a subtropical climate. The region experiences hot, dry summers, a hot and humid rainy season, and freezing winters. Summer temperatures can reach 45ºC (May-June), while winter temperatures can drop to 1ºC.

Treatment Details

The effect of different humic acid treatments on growth of dahlia. Treatments comprised of Two factor with different level,

Fertilizer Treatment - 3

F_1-100 % RDF, F_2-75 % RDF, F_3-50 % RDF

Humic Acid Dose's – 6

H_1- Control, H_2 - Soil application of humic acid @ 10 kg ha^{-1}, H_3 - Soil application of humic acid @ 20 kg ha^{-1}, H_4 - Soil application of humic acid @ 30 kg ha^{-1}, H_5- Humic acid foliar spray @ 0.1 %, H_6 - Humic acid foliar spray @ 0.2 %

Statistical Analysis

Data for each parameter was recorded and statistically analysed using SPSS software, including two-way analysis of variance (ANOVA).

Results

The study assessed the impact of various humic acid doses and fertilizer treatments on Dahlia (*Dahlia variabilis* L.) vegetative growth characteristics results clearly showed that among humic acid treatments soil application at 20 kg ha^{-1} (F_2H_3) under 100% RDF, surpassed other treatments in enhancing plant height (89.05 cm), number of leaves/plants (83.06), number of branches/plants (9.33), stem length (57.38 cm). The analysis confirmed that both humic acid doses and fertilizer levels significantly affected vegetative growth characteristics, with the interaction between these factors being notably significant. These findings suggest that soil-applied humic acid, especially at higher doses, enhances Dahlia's vegetative growth characteristics when paired with optimal fertilization.

Discussion

Plant height

This emphasizes the need of integrated methods, demonstrating humic acid's ability to boost the efficacy of nutrient-rich fertilizers for increased agricultural yields. The luminous efficacy of humic acid and NPK on vegetative development, concluded that plant growth metrics performed differently in response to humic acid and NPK application rate, and the plants grew more effectively. These results are consistent with the ones observed by Fan *et al*. (2015) in cut chrysanthemum, While the similar results were obtained by El-Nashar (2021) in calendula, Khan *et al*. (2020) in zinnia, Memon *et al*. (2014) in zinnia, Mohammadipour *et al*. (2012) in marigold, Nazarova *et al*. (2022) in marigold.

Number of leaves

Humic acid's role in enhancing nutrient availability and soil health, coupled with RDF's balanced nutrient provision, led to a significant increase in the number of leaves on the ornamental flowering crop. The combined application of these treatments likely stimulated more robust plant growth and development, resulting in a greater leaf count and overall improved plant health. The similar results were reported by Mohammadipour *et al*. (2012) who concluded that the humic acid, increased the number of marigolds leaves which could be due to positive mineral effects and the hormonal activity of humic acid on vegetative growth. While the similar results were obtained by El-Nashar, (2021) in calendula, Ahmad *et al*. (2019) in pot marigold. The similar results were observed by Hasan, 2019 on marigold, Nikbakht *et al*. (2008) in gerbera, Kamari *et al*. (2010) in marigold, Khan *et al*. (2020) in zinnia, Ahmad *et al*. (2013) in gladiolus, Najarian *et al*. (2022) in geranium, Nazarova *et al*. (2022) on marigold. Khodakhah *et al*. (2014) in tuberose.

Number of branches

Humic acid's role in enhancing nutrient uptake and soil health, combined with RDF's balanced nutrient supply, significantly improved the number of branches in the ornamental flowering crop. The synergistic effect of these treatments likely facilitated more robust plant growth and branching, resulting in a denser and more aesthetically pleasing plant structure. This integrated approach not only produces healthier plants but also enhances the overall ornamental appeal by promoting a greater number of branches. The similar results were obtained by Hasan, 2019 in pot marigold, Nikbakht *et al*. (2008) in gerbera, Kamari *et al*. (2010) in marigold, Khan *et al*. (2020) in zinnia.

Stem length (cm)

The application of humic acid is known to enhance soil fertility and improve nutrient uptake by plants, leading to better growth and flowering. Humic acid's ability to chelate nutrients and increase microbial

activity in the soil likely contributed to improved plant vigor and enhanced flower production. The obtained results are in harmony with those detected by Babarabie *et al*. (2020) in tuberose.

Conclusion

The current study concluded that the findings of the experiment, it can be concluded that humic acid applied as soil drench at the rate of 20 kg. ha^{-1} can promote growth of *Dahlia variabilis* L. cv. Zail Singh.

Table 1: Effect of humic acid and fertilization on plant height and stem length of Dahlia (*Dahlia variabilis* L.)

Plant height (cm)						Stem length (cm)					
Humic Acid Dose's		Fertilizer Treatment			Mean	Humic Acid Dose's		Fertilizer Treatment			Mean
		F_1	F_2	F_3				F_1	F_2	F_3	
		100 % RDF	75 % RDF	50 % RDF				100 % RDF	75 % RDF	50 % RDF	
H_1	Control	80.44	71.56	**68.37**	73.46	H_1	Control	39.28	39.29	**34.91**	37.83
H_2	Soil application of humic acid @ 10 kg ha^{-1}	82.89	84.56	72.54	80.00	H_2	Soil application of humic acid @ 10 kg ha^{-1}	42.42	44.43	38.66	41.84
H_3	Soil application of humic acid @ 20 kg ha^{-1}	83.87	**89.05**	75.53	82.82	H_3	Soil application of humic acid @ 20 kg ha^{-1}	43.83	**57.38**	38.88	46.70
H_4	Soil application of humic acid @ 30 kg ha^{-1}	83.60	86.56	76.69	82.29	H_4	Soil application of humic acid @ 30 kg ha^{-1}	44.72	55.05	38.75	46.17
H_5	Humic acid foliar spray @ 0.1 %	82.15	77.85	70.98	76.99	H_5	Humic acid foliar spray @ 0.1 %	42.26	40.44	36.62	39.78
H_6	Humic acid foliar spray @ 0.2 %	82.60	78.83	71.51	77.65	H_6	Humic acid foliar spray @ 0.2 %	42.52	41.47	37.12	40.37
	Mean	82.59	81.40	72.60			**Mean**	42.50	46.34	37.49	
Factors		**CD (0.05)**	**SE±(m)**			**Factors**		**CD (0.05)**	**SE±(m)**		
Fertilizer (F)		2.24	0.78			**Fertilizer (F)**		2.29	0.80		
Humic Acid Dose's (H)		3.16	1.10			**Humic Acid Dose's (H)**		3.24	1.13		
Interaction (F x H)		5.48	1.91			**Interaction (F x H)**		5.61	1.95		

Table 2: Effect of humic acid and fertilization on number of leaves and number of branches of Dahlia (*Dahlia variabilis* L.)

Number of leaves						Number of branches					
Humic Acid Dose's		Fertilizer Treatment			Mean	Humic Acid Dose's		Fertilizer Treatment			Mean
		F_1	F_2	F_3				F_1	F_2	F_3	
		100 % RDF	75 % RDF	50 % RDF				100 % RDF	75 % RDF	50 % RDF	
H_1	Control	63.74	60.26	44.58	56.20	H_1	Control	7.83	6.92	**6.45**	7.06
H_2	Soil application of humic acid @ 10 kg ha^{-1}	66.21	76.11	49.43	63.92	H_2	Soil application of humic acid @ 10 kg ha^{-1}	8.48	9.24	7.07	8.26
H_3	Soil application of humic acid @ 20 kg ha^{-1}	68.67	**83.06**	50.30	67.34	H_3	Soil application of humic acid @ 20 kg ha^{-1}	9.02	**9.33**	7.13	8.49
H_4	Soil application of humic acid @ 30 kg ha^{-1}	67.56	82.71	53.24	67.84	H_4	Soil application of humic acid @ 30 kg ha^{-1}	8.92	9.26	7.30	8.49
H_5	Humic acid foliar spray @ 0.1 %	65.29	63.32	**43.38**	57.33	H_5	Humic acid foliar spray @ 0.1 %	8.17	7.51	6.83	7.50
H_6	Humic acid foliar spray @ 0.2 %	65.70	64.62	45.41	58.58	H_6	Humic acid foliar spray @ 0.2 %	8.25	7.79	7.00	7.68
	Mean	66.20	71.68	47.72			**Mean**	8.44	8.34	6.96	
Factors		**CD (0.05)**	**SE±(m)**			**Factors**		**CD (0.05)**	**SE±(m)**		
Fertilizer (F)		2.95	1.03			**Fertilizer (F)**		0.34	0.12		
Humic Acid Dose's (H)		4.17	1.45			**Humic Acid Dose's (H)**		0.49	0.17		
Interaction (F x H)		7.22	2.51			**Interaction (F x H)**		0.84	0.29		

References

Ahmad I., Saquib R.U., Qasim M., Saleem M., Khan A.S. and Yaseen M. (2013). Humic acid and cultivar effects on growth, yield, vase life, and corm characteristics of gladiolus. *Chilean J. Agric. Res*., **73(4)**, 339–344.

Ahmad S., Khan J., and Jamal A. (2019). Response of pot marigold to different applied levels of humic acid. *J. Hortic. Plant Res*., **5**, 57–60.

Babarabie M., Zarei H., Badeli S., Danyaei A., and Ghobadi F. (2020). Humic acid and folic acid application improve marketable traits of cut tuberose (*Polianthes tuberosa*). *J. Plant Physiol. Breed*., **10(1)**, 85–91.

Bindraban P.S., Dimkpa C.O., and Pandey R. (2020). Exploring phosphorus fertilizers and fertilization strategies for improved human and environmental health. *Biol. Fertil. Soils*, **56(3)**, 299–317.

Chen Y., Nobili M.D., and Aviad T. (2004). Stimulatory effects of humic substances on plant growth. *Soil Organic Matter in Sustainable Agriculture*, 103–129.

El-Nashar Y.I. (2021). Effect of levels of humic acid at different times on improvement of the growth of calendula (*Calendula officinalis* L.) plant. *Alex. Sci. Exch. J.*, **42(3)**, 665–675.

Fan H.M., Li T., Sun X., Sun X.Z., and Zheng C.S. (2015). Effects of humic acid derived from sediments on the postharvest vase life extension in cut chrysanthemum flowers. *Postharvest Biol. Technol*., **101**, 82–87.

Hasan A.M. (2019). Effect of foliar application of humic acid and benzyladenine on growth and flowering of pot marigold (*Calendula officinalis* L.). *J. Univ. Duhok*, **22(1)**, 69–77.

Kamari S.S., Peyvast Q., and Olfati J. (2010). Effect of organic fertilizer and foliar application of humic acid on marigold. *J. Hortic. Sci*., **24(2)**, 149–153.

Khan I.U., Amin N.U., Shah S.H.A., Khan M., Ahmad S., and Shah S.A.A. (2020). Response of zinnia cultivars to different levels of humic acid. *Sarhad J. Agric*., **37(2)**, 706–713.

Khodakhah B., Nabigol A., and Salehi B. (2014). The effect of different levels of humic acid and salicylic acid on growth characteristics and qualities of tuberose. *Adv. Environ. Biol*., **8(16)**, 117–123.

Kumar N., Prasad V.M., and Yadav N.P. (2019). Effect of chemical fertilizers and biofertilizers on flower yield, tuberous root yield, and quality parameters in dahlia (*Dahlia variabilis* L.) cv. Kenya Orange. *J. Pharmacogn. Phytochem*., **8(4)**, 2265–2267.

Marina L.J. (2015). Cultivation of the dahlia. *Cultivos Tropicales*, **36(1)**, 103–110.

Mawgoud A.M.R., Greadly N.H.M., Helmy Y.I., and Singer S.M. (2007). Responses of tomato plants to different rates of humic-based fertilizers and NPK fertilization. *J. Appl. Sci. Res*., **3**, 169–174.

Memon S.A., Bangulzai F.M., Keerio M.I., Baloch M.A., and Buriro M. (2014). Effect of humic acid and iron sulphate on growth and yield of zinnia (*Zinnia elegans*). *J. Agric. Technol*., **10(6)**, 1517–1529.

Mohammadipour E., Golchin A., Mohammadi J., Negahdar N., and Zarchini M. (2012). Effect of humic acid on yield and quality of marigold (*Calendula officinalis* L.). *Ann. Biol. Res*., **3(11)**, 5095–5098.

Najarian A., Souri M.K., and Nabigol A. (2022). Influence of humic substances on vegetative growth, flowering, and leaf mineral elements of *Pelargonium x hortorum. J. Plant Nutr*., **45(1)**, 107–112.

Nazarova A.A., Fadkin G.N., Cherkasov O.V., Borychev S.N., and Shemyakin A.V. (2022). The influence of highly dispersed humic acids on the growth and decorative qualities of *Tagetes patula* L. *In IOP Conf. Ser.: Earth Environ. Sci*., **1045(1)**, 012007.

Ngullie C.R., Tank R.V., and Bhander D.R. (2014). Effect of salicylic acid and humic acid on flowering, fruiting, yield, and quality of mango (*Mangifera indica* L.) cv. KESAR. *Adv. Res. J. Crop Improv*., 5, 136–139.

Nikbakht A., Kafi M., Babalar M., Xia Y.P., Luo A., and Etemadi N.A. (2008). Effect of humic acid on plant growth, nutrient uptake, and postharvest life of gerbera. *J. Plant Nutr*., **31(12)**, 2155–2167.

Sara T., Omella F., Silvia Q., and Serenella N. (2010). Humic substances' biological activity at the plant-soil interface: From environmental aspects to molecular factors. *Plant Signal. Behav*., **5(6)**, 635–643.

Wararkar S.M., Sarvanan S., and Prasad V.M. (2020). Effect of integrated nutrient management on growth, flowering, and yield of dahlia (*Dahlia variabilis* L.) cv. Kenya White. *Plant Arch*., **20(1)**, 3292–3296.