Eco. Env. & Cons. 29 (1) : 2023; pp. (106-110)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i01.016

Effect of Humic acid on the Growth Attributes of Wheat (*Triticum aestivum* L.) Crop in sandy loam soil of Gwalior region of Madhya Pradesh, India

Geetanjali Sharma[1], Luxmi Kant Tripathi[2], Dinesh Baboo Tyagi[3], Nikita Nehal[4] and Rajkumar Chaurasiya[5]

[1,3,4] School of Agriculture, ITM University, Sithouli, Jhansi Road, Gwalior 475 001, M.P., India
[2]College of Agriculture Sciences, Teerthanker Mahaveer University Moradabad, U.P., India
[5]Department of Agriculture Sciences, IES University, Bhopal, M.P., India

(Received 10 July, 2022; Accepted 27 September, 2022)

ABSTRACT

A field experiment was conducted during *Rabi* season 2019-2020 to study the Effect of humic acid on the growth and yield attributes of wheat crop in sandy loam soil of Gwalior region of Madhya Pradesh, on Crop Research Centre, School of Agriculture (SoAg.), ITM University Gwalior M.P., India. The experiment was laid out in a Factorial Randomized Block design (F-RBD) replicated three times with three levelsof Recommended Dose of Fertilizer (RDF), i.e. (RDF @ 0, 50 and 100 %) and two levels of Humic Acid (HA) (HA @ 500 ppm and 1250 ppm) thereby making eight treatment combinations with 24 plots. Treatments were; $\mathbf{T_1}$- Absolute control, $\mathbf{T_2}$ -RDF @ 100 %, $\mathbf{T_3}$-RDF @ 0 % +HA_1 @ 500 ppm, $\mathbf{T_4}$-RDF @ 0 % + HA_2 @ 1250 ppm, $\mathbf{T_5}$-RDF @ 50 % +HA_1 @ 500 ppm, $\mathbf{T_6}$-RDF @ 50 % +HA_2 @ 1250 ppm, $\mathbf{T_7}$-RDF @ 100 % +HA_1 @ 500 ppm and $\mathbf{T_8}$-RDF @ 100 % + HA_2 @ 1250 ppm. Among the different levels of Recommended Dose of Fertilizer (RDF) and humic acid were recorded the highest values for all parameters viz; plant population m^{-2}, plant height (cm), numbers of tillers per m^{-2}, numbers of leaves per $culm^{-2}$, root length (cm), dry weight (g) and fresh weight (g) of the plant under the treatments T_8- RDF @ 100 % + HA_2 @ 1250 ppm concentration. The means value for all parameters are; plant population m^{-2} (16.86 and 16.00 at 30 and 60 DAS), plant height (10.03, 58.05 and 76.08 cm at 30, 60 and 90 DAS), numbers of tillers per m^{-2}(5.88 and 7.02 at 30 and 60 DAS), numbers of leaves per $culm^{-2}$ (3.90, 4.94 and 3.59 at 30, 60 and 90 DAS), Root length -7.01, 9.00, 11.06 and 12.03 cm, Dry weight of plant-^{1}0.39, 5.31 and 37.54 g and Fresh weight of plant-^{1}4.01, 40.01 and 350.71 g in 30, 60 90 DAS and harvest stage.

Keywords: *Humic acid, Growth parameters, Sandy loam soil, Wheat.*

Introduction

India, being blessed and enriched with a diverse agro-ecological condition, ensuring food and nutrition security to a majority of the Indian population through production and steady supply particularly in the recent past, is the second largest producer of wheat worldwide (Sharma and Sendhil, (2015); Sharma *et al.* (2015) and Sharma and Sendhil, 2019). The crop has been under cultivation in about 30 million hectares (14% of global area) to produce the all-time highest output of 99.70 million tonnes of wheat (13.64% of world production) with a record average productivity of 3371 kg/ha (Singh *et al*. (2021). Hav-

([1]M. Sc. (Ag.) Agronomy Scholar, [2]Assistant Professor, [3]Associate Prof., [4]Assistant Prof., [5]Assistant Prof.)

ing a significant share in the consumption of food basket with a 36% share in the total food grains produced from India and ensuring not only food security but also nutrition security, wheat is extensively procured by the government and distributed to a majority of the population; it ensures not only food security but also nutrition security. Cereal is one of the cheapest sources of energy and provides a major share of protein (20%) and calorie intake (19%) from consumption (Sharma and Sendhil, 2015). The cultivated area under wheat at the national level has shown an increasing trend, from 29.04 million hectares to 30.54 million hectares with a magnitude of 1.5 million hectares (5%) net gain in terms of area. Uttar Pradesh has the largest share ofthe area with 9.75 million hectares (32%), followed by Madhya Pradesh (18.75%), Punjab (11.48%), Rajasthan (9.74%), Haryana (8.36%) and Bihar (6.82%). However, a major expansion in the wheat area was observed in the states such as Jharkhand (51%), Madhya Pradesh (27%), and Rajasthan (13%) Sendhil *et al*. (2012). State-wise comparison of area and production for 2017–2018 showsthat Uttar Pradesh, Punjab, Madhya Pradesh, and Haryana were the major contributors to the national production. The current production from these states is around 29 million tonnes which has to be doubled by 2050 with an overall production target of 140 million tonnes ICAR-IIWR. Vision 2050 (2015); Sharma *et al*. (2013) and Sharma *et al*. (2013). *Production constraints are manifold and vary from crop to crop and between regions. Burgeoning population vis-à-vis increasing demand for food; growing competition for cultivable land, irrigation water and energy; intensive cropping especially in the Indo-Gangetic Plains resulting in the irrational use of resources; pest-environment interaction; reduction of natural resource base; declining total factor productivity; and yield plateau are the prominent challenges put forth against crop production ICAR-IIWR. Vision 2050 (2015); Sharma et al. (2013); Sharma et al. (2013).* To manage agriculture production in unfavorable soil conditions by enriching their organic matter, various options are found in literature, for example, crop rotation, green manures, residue or animal manures incorporation and humic acid application (Sharif *et al*., 2004). All these options basically aim at improving soil conditions for growth and quality of crop.

The addition of humic acid to the soil leads to increased absorption of nutrients by the plant as it acts as a medium for transporting nutrients from the soil to the plant especially in the event of drought (Asal *et al*., 2015), as it increases the strength of the root group growth and improves it by increasing dry and wet weight and increasing lateral branching of the roots, It increases the plant's protein content and increases the number of beneficial microorganisms in the soil (Cimrin and Yilmaz, 2005). It also breaks down heavy soil granules and improves their physical, chemical, and biological properties by destroying clay particles and increases the soil's ability to retain water, which is safe and highly soluble. In the water, it is easy to add it with quick effectiveness and does not leave any harmful effects on humans and plants, as it increases the development of chlorophyll and the collection of sugars, amino acids and enzymes and helps in photosynthesis, and its role is similar to the role of oxen in cell division, which encourages plant growth, and humic acids reduce. One of the problems of excess salinity, which causes toxicity to the plant and thus burning the roots resulting from this increase. Humates stimulate microorganisms and therefore are conducive to humus restoration Omar *et al*. (2020).

Materials and Method

A field experiment was conducted during *Rabi* (winter) season of 2019-2020 to study the "Effect of humic acid on the growth and yield attributes of wheat (*Triticum aestivum* L.) crop in sandy loam soil of Gwalior region of Madhya Pradesh" onthe crop researchcentre, Department of Agronomy, School of Agriculture (SoAg.), ITM University Gwalior, M.P., India. ITM University is situated approximately 10 km in the outskirts away from the Gwalior city. The experimental site is located in the Sub-tropical region with 26^{0}14N longitude and 78^{0}14 E latitude with an elevation of 206 m above the mean sea level (MSL). Soil samples at (0-15 cm depth) were taken from the experimental site before the sowing of the crop for physical and chemical analysis (Table 1). The experiment was laid out in a Factorial Randomized Block Design(F-RBD) replicated three times with three levelsof Recommended Dose of Fertilizer (RDF), i.e. (RDF @ 0%, 50%, and 100 %) and two levels of Humic Acid (HA) (HA @ 500 ppm and 1250 ppm) thereby making eight treatment combinations with 24 plots. Treatments were; T_1- Absolute control, T_2 -RDF @ 100 %, T_3-RDF @ 0 % +HA_1 @ 500ppm, T_4-RDF @ 0 % + HA_2 @ 1250 ppm, T_5-RDF @ 50 % +HA_1 @ 500 ppm, $\mathbf{T_6}$-RDF @ 50 % +HA_2 @ 1250 ppm, $\mathbf{T_7}$-

Table 1. Initial Physico-chemical properties of experimental field

S. N.	Component	Value
1.	Sand (%)	58.30
2.	Silt (%)	19.55
3.	Clay (%)	23.15
4.	Textural class	Sandy Clay Loam
5.	Pore space (%)	35.30
6.	CEC (Cmol (+)Kg^{-1}	15.14
7.	pH	7.60
8.	Electrical Conductivity (dSm^{-1})	0.32
9.	Organic Carbon (%)	0.45
10.	Available Nitrogen (kg ha^{-1})	197
11.	Available Phosphorus (kg ha^{-1})	19.0
12.	Available Potassium (kg ha^{-1})	241.0

RDF @ 100 % +HA_1 @ 500 ppm and **T_8**-RDF @ 100 % + HA_2 @ 1250 ppm. The calculated quantity of fertilizer to supply prescribed levels of nutrients as per treatments combination was applied plot wise. The weighed quantities of the recommended dose of fertilizer as per treatment (50 % of each plot treatment^{-1}) were applied at the time of sowing of wheat crop. Urea, Single Super Phosphate (SSP), and Muriate of potash (MOP), respectively were used as a source of nitrogen, phosphorous and potassium respectively. The second dose of RDF (100% each plot treatment^{-1}) was applied top dressed at 25 days after sowing for growing wheat crop.

Results and Discussion

The result shown in the Table 2 disclosed a significant difference between treatments of humic acid of all growth attributes like plant population m^{-2} (16.86 and 16.00 at 30 and 60 DAS), plant height (cm) (10.03, 58.05 and 76.08 at 30, 60 and 90 DAS), numbers of tillers per m^{-2}(5.88 and 7.02 at 30 and 60 DAS) and numbers of leaves per $culm^{-2}$ (3.90, 4.94 and 3.59 at 30, 60 and 90 DAS) was noted maximum under the treatment T_8- RDF @ 100 % + HA_2 @ 1250 ppm concentration whereas the minimum plant population m^{-2} (14.97 and 14.07 at 30 & 60 DAS), plant height (cm) (8.04, 48.03 and 73.05 at 30, 60 and 90 DAS), numbers of tillers per m^{-2} (4.04 and 5.03 at 30 & 60 DAS) and numbers of leaves per $culm^{-2}$ (3.03, 4.00 and 2.97 at 30, 60 and 90 DAS) was noted under the treatment T_1-Absolute control. The reason may be due to the effect of humic acid in increasing the vital activity of the plant increasing the absorption rate of the nutrients and thus increasing the growth rate of the plant or maybe the reason due to the hormonal effect of humic acid on the cell cytoplasm and the cellular wall, which leads to increase the speed of cell division and growth and thus increase the height of the plant. These results are in agreement with (Hashim, 2018), as for the leaf area (cm^2) the reason may be due to the role of Humic acid in providing the largest amount of food that transferred to the leaves and which was positively reflected on the expansion of leaves cells and thus increased the area of flag leaf and this result agrees with (Al-Fahdawi, 2017) and (Hashim, 2018) who found that the area of the flag leaf of other field crops increasing by spraying concentration from humic acid.

Humic acid treatments were significant with the increase in the level of humic acid, there were increased results noted in all studied traits. The result presented in the (Table 3) shows that the effect of

Table 2. Effect of humic acid on the plant population $meter^{-2}$, plant height (cm), number of tillers $meter^{-2}$ and number of leaves per $culm^{-1}$

Treatments Detail	Plant population m^{-2} at 30 & 60 DAS		Plant height (cm) at 30, 60 & 90 DAS			No. of tillers m^{-2} at 30 & 60 DAS		No. of leaves $culm^{-1}$ at 30, 60 & 90 DAS		
T_1	14.97	14.07	8.04	48.03	73.05	4.04	5.03	3.03	4.00	2.97
T_2	16.22	15.53	9.66	53.00	75.66	5.30	6.47	3.76	4.70	3.39
T_3	15.22	14.63	8.68	49.25	73.39	4.37	5.49	3.13	4.24	3.07
T_4	15.46	14.85	8.82	50.33	73.89	4.55	5.73	3.28	4.34	3.12
T_5	15.77	15.03	9.00	51.48	74.82	4.85	6.01	3.45	4.52	3.16
T_6	16.05	15.11	9.24	52.54	75.13	5.03	6.29	3.62	4.65	3.29
T_7	16.56	15.72	9.77	56.66	75.80	5.45	6.62	3.82	4.85	3.46
T_8	16.86	16.00	10.03	58.05	76.08	5.88	7.02	3.90	4.94	3.59
SEm (±)	0.213	0.215	0.188	0.963	0.688	0.160	0.224	0.189	0.093	0.118
CD @ 5 %	0.647	0.653	0.571	2.922	2.088	0.485	0.679	0.574	0.283	0.357

Table 3. Effect of humic acid on the root length (cm) dry and fresh weight of plant (g)

Treatment detail	Root length (cm) at 30, 60, 90 DAS & harvest stage				Dry weight of plant (g) at 30, 60 & 90 DAS			Fresh weight of plant (g) at 30, 60 & 90 DAS		
T_1	6.02	8.03	10.03	11.00	0.31	3.94	30.84	3.00	30.03	303.58
T_2	6.67	8.81	10.77	11.78	0.36	4.76	35.54	3.81	37.55	333.26
T_3	6.15	8.20	10.15	11.12	0.32	4.13	31.75	3.14	32.34	311.61
T_4	6.23	8.32	10.28	11.30	0.33	4.25	32.38	3.31	34.38	317.25
T_5	6.43	8.51	10.54	11.45	0.34	4.62	33.18	3.54	35.48	324.58
T_6	6.56	8.71	10.62	11.67	0.36	4.68	34.14	3.75	36.38	327.96
T_7	6.86	8.92	10.91	11.91	0.37	4.81	36.62	3.90	38.27	343.26
T_8	7.01	9.00	11.06	12.03	0.39	5.31	37.35	4.01	40.01	350.71
SEm (±)	0.173	0.194	0.197	0.196	0.009	0.101	0.620	0.176	0.699	4.809
CD @ 5 %	0.525	0.589	0.598	0.595	0.026	0.308	1.881	0.533	2.119	14.589

humic acid treatment on the root length, dry weight, and fresh weight of plant were found witha maximum mean value under the treatment T_8- RDF @ 100 % + HA_2 @ 1250 ppm (Root length -7.01, 9.00, 11.06 and 12.03 cm) (Dry weight of plant - 0.39, 5.31 and 37.54 g) and (Fresh weight of plant- 4.01, 40.01 and 350.71 g) in 30, 60 90 DAS and harvest stage and the minimum values were recorded under the treatment T_1- Absolute control (Root length -6.02, 8.03, 10.03 and 11.00 cm) (Dry weight of plant –0.31, 3.94 and 30.84 g) and (Fresh weight of plant- 3.00, 30.03 and 303.58 g) in 30, 60 90 DAS and harvest stage. Kauser *et al*., (1985). Chen and Aviad (1990) also reported that the effects of humic substances on plants are often greater on roots. Stimulation of root growth, increased proliferation of root hairs, and enhancement of root initiation by humic acids. The increased root and leaf dry weight, root diameter, root length as well as leaf fresh weight, and leaf crude proteins in forage turnip were reported by Albayrak and Camas (2005). The increases the strength of the root group growth and branching of the roots, increases the plant's protein content, and increases the number of beneficial microorganisms in the soil reported (Cimrin and Yilmaz, 2005) and also reported that HA application has a stimulating effect on shoot growth (Goatley and Schmidt, 1990).

Conclusion

The study concludes that the addition of humic acid to the 100 percent recommended dose of fertilizers increases all the growth parameters of wheat significantly. If growth parameters are increased hence, as a result, we can expect significantly more yields in form of wheat grain and straw.

References

Albayrak, S. and Camas, N. 2005. Effects of different levels and application times of humic acid on root and leaf yield and yield components of forage turnip (*Brassica rapa* L.). *J. Agron*. 4(2): 130-133.

Asal, M.W., Badr, E.A., Ibrahim, O.M. and Ghalab, E.G. 2015. Can humic acid replace part of the applied mineral fertilizers? A study on two wheat cultivars grown under calcareous soil conditions. *International Journal of Chem Tech Research*. 8(9): 20-26.

Chen, Y. and Aviad, T. 1990. Effects of humic substances on plant growth. In: MacCarthy, P., Clapp, C.E., Malcolm, R.L., Bloom, P.R. (Eds.) *Humic Substances in Soil and Crop Sciences: Selected Readings*. ASA and SSSA, Madison, WI, pp: 161-186.

Cimrin, K.M. and Yilmaz, I. 2005. Humic acid applications to lettuce do not improve yield but do improve phosphorus availability. *Acta Agriculture Scandinavia*, Section B, *Soil and Plant Science*. 55: 58–63.

ICAR-IIWBR. Vision 2050. Karnal: 2015 ICAR-Indian Institute of Wheat and Barley Research; pp. 1-48.

Kauser, A. Malik, Azam, A. 1985 Effect of Humic acid on wheat crop (*Triticum asestivum* L.) seedling growth. *Environmental and Experimental Botany.* 25 (3): 245-252.

Khan, R.; Rashid, A.; Khan, M.S. and Ozturk, E. 2010. Impact of humic acid and chemical fertilizer application on growth and grain yield of rainfed wheat (*Triticum aestivum* L.). *Pakistan J. of Agri. Res*. 23(3- 4): 113- 121.

Omar A., Ahmed Al-Timimi, Layth Khudhair Hassan and Iman Sahib Salman, 2020. impact of potassium humic acid on growth and yield components of some bread wheat (*triticum aestivum* L.) Genotypes. *Plant Archives* Vol. 20, Supplement 2: 4138-4141.

Sendhil, R., Balaji, S.J., Ramasundaram, P., Kumar, A., Singh, S. and Chatrath, R. 2018. Doubling farmer's income by 2022: Trends, challenges, pathway and strategies. Research Bulletin No: 40. Karnal: ICAR-

Indian Institute of Wheat and Barley Research. pp. 1-54.

Sendhil, R., Singh, R. and Sharma, I. 2012. Exploring the performance of wheat production in India. *Journal of Wheat Research.* 4: 37-44.

Singh, S.K., George, P.J., Singh, A.K. and Singh, A.K. 2021. Effect of sowing methods and nutrient resources on growth, yield attributes, grain yield and soil health of wheat (*Triticum aestivum* L.). *The Pharma Innovation Journal.* 10(7): 1054-1058.

Sharif, M.; Ahmad, M.; Sarir, M.S. and Khattak, R.A. 2004. Effect of organic and inorganic fertilizers on the yield and yield components of maize. *Pak. J. Agric.* 20(1): 11–16.

Sharma, I. and Sendhil, R. 2015. Domestic production scenario of wheat. In: Souvenir of Roller Flour Millers Federation of India Platinum Jubilee Celebration; pp. 18-20.

Sharma, I. and Sendhil, R. 2019. Wheat Production in India-A Decadal Synopsis [Internet]. 2016. Available from: http://www.FnBnews.com [Accessed: 15 January 2019].

Sharma, I., Chatrath, R. and Sendhil, R. 2013. Challenges, target and strategies for sustainable wheat production for food security and nutrition. *Indian Farming.* 63 (3-6) : 17.

Sharma, I., Sendhil, R. and Chatrath, R. 2015. Regional disparity and distribution gains in wheat production. In: *Souvenir of 54th AIW&B Workers Meet; Gujarat: Sardarkrushinagar Dantiwada Agricultural University.*

Sharma, I., Sendhil, R. and Singh, R. 2013. India's food production towards 2050—Challenges, opportunities and strategies. Agriculture Today pp-146-151.

Vaughan, D., Malcolm, R.E. and Ord, B.G. 1985. Processes in plants. In: Vaughan, D., Malcolm, R.E. (Eds.), *Soil Organic Matter and Biological Activity*, Martinus Nijhoff/Dr W Junk Publishers, Dordrecht Boston, Lancaster, pp. 77-108.