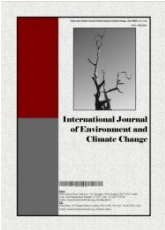

International Journal of Environment and Climate Change

12(9): 356-361, 2022; Article no.IJECC.87437
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Influence of Plant Growth Regulator (TA-41) on Growth and Yield of Wheat (*Triticum aestivum* L.)

Md Kaifee [a*], Joy Dawson [a], Rahul Sharma [a] and Piyush Pushkar [a]

[a] Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj – 211007, Uttar Pradesh, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2022/ v12i930835

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/87437

Original Research Article

Received 15 February 2022
Accepted 25 April 2022
Published 26 April 2022

ABSTRACT

A field experiment was carried out during *rabi* season of 2021, at crop research farm of Department of Agronomy at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India. The experiment was entitled as "Influence of plant growth regulator (TA-41) on growth and yield of wheat (*Triticum aestivum* L.)". The experiment was laid out in randomized block design (RBD) which consisted of seven treatments and replicated thrice viz., T_1: Control (No application), T_2: TA-41 at 5.0 liter in 200 liter of water in 1 hectare, T_3: TA-41 at 7.5 liter in 200 liter of water in 1 hectare, T_4: TA-41 at 10.0 liter in 200 liter of water in 1 hectare, T_5: TA-41 at 200 ml in 15 liters of water [full tank], T_6: TA-41 at 300 ml in 15 liters of water [full tank] and T_7: TA-41 at 400 ml in 15 liters of water [full tank]. he result of experiment showed that growth parameters viz., plant height (90.77 cm) significantly higher in treatment T_2 with application of TA-41 at 5.0 liter in 200 liter of water in 1 hectare and dry weight (17.73 g), number of spikes/m^2 (442.67), grains/spike (55.56), grain yield (6.88 t/ha) and straw yield (15.7 t/ha) were recorded significantly maximum in treatment T_7 with application with TA-41 at 400 ml in 15 liters of water [full tank]. Maximum gross returns (1,85,732.00 INR/ha), net returns (1,32,637.47 INR/ha) and benefit: cost ratio (2.5) were also obtained highest in treatment T_7 with application with TA-41 at 400 ml in 15 liters of water [full tank].

Keywords: Wheat; plant growth regulator (TA-41); growth parameters; yield attributes; yield and economics.

**Corresponding author: E-mail: md.kaifee99@gmail.com;*

1. INTRODUCTION

Wheat (*Triticum aestivum* L.) is an annual plant of poaceae family and one of the most important and strategic crops in the world contributing nearly about 30% of global cereal production with an area of 306 million hectares and average productivity of 3.21 tonnes/ha [1]. Wheat grain is the major food of people and supply roughly 70% calories and 80% protein of human diet. It contains 12 % protein which is higher than other cereals [2]. It acts as a staple food especially for north and north western part of India and rank fourth in production after Russia, USA and China and produced 101.20 million tonnes of wheat from an area of 29.55 million hectares with an average yield of 34.24 quintals/ha in 2018-19. The major wheat producing states include Punjab, Haryana, Uttar Pradesh and Madhya Pradesh. Punjab is called the "Granary of India" and produces 20% of India's wheat. During 2018-19 it was grown on area of 3.52 million hectares with production of 18.21 million tonnes and productivity of 51.73 quintals/ha [3].

The use of plant growth regulators may be one of the best possible ways to achieve spectacular progress in crop production and productivity. Exogenous application of plant growth regulators offer unique opportunities of scaling plants to any size and alter physiological processes in the plant to increase seed yield and quality. Partitioning of dry matter to seeds is considered to be a major determinant for agricultural yield. This is dependent on the efficiency of photosynthates translocation in crop during grain filling period when developing grains are the storing sink. It has been reported that plant growth regulators plays important role in greater partitioning of photosynthates towards reproductive sink thereby, improving the harvest index. Plant growth regulators are biochemical compounds which stimulates plant growth and productivity when applied, even in small quantities at appropriate plant growth stages. These are being extensively used in agriculture to enhance the productivity in field crops. Their central role in plant growth and development is through nutrient allocation and source-sink transitions. Since climate change and degrading natural resources are projected to amplify the stresses, particularly soil moisture deficit, high temperature and soil salinity. Plant growth regulators are likely to play a crucial role in plant growth regulation [4].

2. MATERIALS AND METHODS

During *rabi* season of 2021, a field experiment was conducted out at the Crop Research Farm of the Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (Allahabad) U.P. India. Soil of experimental plot was sandy loam, having nearly neutral soil reaction (pH 6.9), electrical conductivity (0.29 dS/m), available nitrogen (278.93 kg/ha), available phosphorous (10.8 kg/ha) and available potassium (206.4 kg/ha). The experiment was conducted in Randomized Block Design consisting of 7 treatment combinations with 3 replications and was laid out with the different treatments allocated randomly in each replication viz., T_1: Control (No application), T_2: TA-41 at 5.0 liter in 200 liter of water in 1 hectare, T_3: TA-41 at 7.5 liter in 200 liter of water in 1 hectare, T_4: TA-41 at 10.0 liter in 200 liter of water in 1 hectare, T_5: TA-41 at 200 ml in 15 liters of water [full tank], T_6: TA-41 at 300 ml in 15 liters of water [full tank] and T_7: TA-41 at 400 ml in 15 liters of water [full tank]. Test variety (DBW187) was sown on 3rd week of November 2021 with a spacing of 22.5 x 5 cm. Fertilizers were applied as band placement, for which 4-5 cm deep furrows were made along the seed rows with a hand hoe. The nutrient sources were urea, single super phosphate (SSP), and murate of potash (MOP). The recommended dose of fertilizers in the ratio of 120:60:40 kg N:P:K/ha was applied according to the treatment details. After germination, the gaps were filled up by dibbling of seed at 10 days after sowing. Seedlings were thinned out in order to maintain spacing of 22.5 x 5 cm. Manual weeding was done with the help of khurpi at 30 and 45 days after sowing to minimize the crop weed competition. Application of TA-41 was applied two times through soil drenching and foliar spray at tillering and booting stages. The field was maintained in a moist condition and for this, four irrigations were provided, one as pre sowing and other at growth stages. The crop was harvested separately from each plot taking 1.0 m^2 area on March 23rd 2022, i.e., 123 days after sowing. Thereafter, the produce from net plot was tied in bundles separately and then tagged. The tagged bundles were allowed for sun drying in field and after drying on the threshing floor, the weight of bundles was recorded for obtaining biological yield. The data collected were plant height, plant dry weight, number of spikes/m^2, number of grains/spikes, test weight, grain yield, straw yield and harvest index.

3. RESULTS AND DISCUSSIONS

3.1 Influence of Plant Growth Regulator (TA-41) on Plant Height of Wheat

Growth parameters are important when assessing plant growth because a plant's height is a measure of its vegetative growth which directly relates to biological yield (grain + straw). Among all the treatments, in T_2 with application of TA-41 at 5.0 liter in 200 liter of water in 1 hectare was found significantly superior (Table 1). At 100 days after sowing, maximum plant height (90.77 cm) was recorded in treatment T_2 with application of TA-41 at 5.0 liter in 200 liter of water in 1 hectare as compared with other treatments. However, treatment T_4 with application of TA-41 at 10.0 liter in 200 liter of water in 1 hectare and treatment T_5 with application of TA-41 at 200 ml in 15 liters of water [full tank] were statistically at par with treatment T_2 with application of TA-41 at 5.0 liter in 200 liter of water in 1 hectare. This is due to retardant properties of plant growth regulators results a significant reduction in plant height during the entire growing season even with the higher dose of nitrogen. Similar findings were recorded by Rajala et al. [5], Kesarwani et al. [6].

3.2 Influence of Plant Growth Regulator (TA-41) on Dry Weight of Wheat

Maximum plant dry weight (17.73 g) was recorded in treatment T_7 with application of TA-41 at 400 ml in 15 liters of water [full tank] as compared with other treatments (Table 2). However, treatment T_6 with application of TA-41 at 300 ml in 15 liters of water [full tank] was statistically at par with treatment T_7 with application of TA-41 at 400 ml in 15 liters of water [full tank]. The highest dry weight was recorded in the maturity stage due to the mass accumulation of the crop and also the dry weight increased with application of plant growth regulator, might be due to the better growth of healthy seedlings. Similar findings were also reported by Kumar and Yadav [7].

3.3 Influence of Plant Growth Regulator (TA-41) on Yield Attributes and Yield of Wheat

3.3.1 Number of spikes/m^2

Number of effective spikes/m^2 showed significant difference among all treatments. Whereas, maximum number of effective spikes/m^2 (442.67) was observed in treatment T_7 with application of TA-41 at 400 ml in 15 liters of water [full tank] except in treatment T_6 with application of TA-41 at 300 ml in 15 liters of water [full tank] was found to be statistically at par with in treatment T_7 with application of TA41 at 400 ml in 15 liters of water [full tank].

3.3.2 Number of grains/spike

Number of grains/spike was recorded significantly maximum (55.56) observed in treatment T_7 with application of TA-41 at 400 ml in 15 liter of water [full tank]. However, treatment T_4 with application of TA-41 at 10.0 liter in 200 liter of water in 1 hectare, treatment T_5 with application of TA-41 at 200 ml in 15 liter of water [full tank] and in treatment T_6 with application of TA-41 at 300 ml in 15 liter of water [full tank] were found to be statistically at par with in treatment T_7 with application of TA-41 at 400 ml in 15 liter of water [full tank].

3.4 Grain Yield

Significantly higher grain yield (6.88 t/ha) of wheat was found in treatment T_7 with application of TA-41 at 400 ml in 15 liter of water [full tank], which was superior over all other treatments. The higher grain yield could be due to more dry matter accumulation in grain and no of grains per spikes because of application of plant growth regulator. Such finding was also supported by the Rahman et al. (2011), Shekoofa and Emam [9].

3.5 Straw Yield

Significantly maximum straw yield (15.70 t/ha) was recorded in treatment t_7 with application of ta-41 at 400 ml in 15 liter of water [full tank] which was found superior over all other treatments as compared with other treatments.

Table 1. Influence of plant growth regulator (TA-41) on plant height of wheat

		Plant height (cm)				
Treatment Symbols	**Treatments**	**20 DAS**	**40 DAS**	**60 DAS**	**80 DAS**	**100 DAS**
T_1	Control (without any treatment)	3.93	14.17	44.99	86.49	89.68
T_2	TA-41 at 5.0 liter in 200 liter of water in 1 hectare	4.48	14.26	41.38	86.49	90.77
T_3	TA-41 at 7.5 liter in 200 liter of water in 1 hectare	4.25	14.43	40.47	87.44	89.90
T_4	TA-41 at 10.0 liter in 200 liter of water in 1 hectare	4.18	14.53	40.31	85.00	90.39
T_5	TA-41 at 200 ml in 15 liters of water [full tank]	4.42	14.49	40.87	89.73	90.10
T_6	TA-41 at 300 ml in 15 liters of water [full tank]	4.08	13.99	39.24	86.51	89.50
T_7	TA-41 at 400 ml in 15 liters of water [full tank]	3.97	14.82	40.02	86.13	88.57
	SEm ±	0.27	0.63	1.07	0.83	0.32
	CD (5%)	-	-	3.29	2.55	1.00

Table 2. Influence of plant growth regulator (TA-41) on dry weight/plant of wheat.

		Dry weight (g)				
Treatment Symbols	**Treatments**	**20 DAS**	**40 DAS**	**60 DAS**	**80 DAS**	**100 DAS**
T_1	Control (without any treatment)	0.19	1.38	4.22	13.90	14.57
T_2	TA-41 at 5.0 liter in 200 liter of water in 1 hectare	0.26	1.50	4.79	14.23	15.52
T_3	TA-41 at 7.5 liter in 200 liter of water in 1 hectare	0.30	1.73	5.46	14.49	16.19
T_4	TA-41 at 10.0 liter in 200 liter of water in 1 hectare	0.31	1.89	5.94	14.60	16.38
T_5	TA-41 at 200 ml in 15 liters of water [full tank]	0.33	1.74	5.59	14.56	16.09
T_6	TA-41 at 300 ml in 15 liters of water [full tank]	0.42	2.00	6.51	15.05	16.66
T_7	TA-41 at 400 ml in 15 liters of water [full tank]	0.44	2.37	6.43	16.26	17.73
	SEm ±	0.06	0.13	0.30	0.44	0.40
	CD (5%)	-	0.39	0.94	1.35	1.24

Table 3. Influence of plant growth regulator (TA-41) on yield attributes and yield of wheat

Treatment Symbols	Treatments	No. of spikes/m^2	No. of grains/spike	Test weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest Index (%)
T_1	Control (without any treatment)	347.33	42.52	34.67	4.42	11.05	28.63
T_2	TA-41 at 5.0 liter in 200 liter of water in 1 hectare	380.00	45.91	35.00	5.18	12.17	29.94
T_3	TA-41 at 7.5 liter in 200 liter of water in 1 hectare	405.00	47.59	37.33	5.53	12.18	31.23
T_4	TA-41 at 10.0 liter in 200 liter of water in 1 hectare	405.33	53.67	39.67	6.27	12.87	34.88
T_5	TA-41 at 200 ml in 15 liters of water [full tank]	381.00	49.78	37.67	6.22	12.72	32.84
T_6	TA-41 at 300 ml in 15 liters of water [full tank]	437.33	54.48	38.67	6.45	12.92	33.53
T_7	TA-41 at 400 ml in 15 liters of water [full tank]	442.67	55.56	40.33	6.88	15.70	29.71
	SEm ±	19.19	2.51	1.47	0.32	0.08	2.23
	CD (5%)	19.14	7.73	-	0.99	0.26	-

4. CONCLUSION

It is concluded that treatment T_7 with application of TA-41 at 400 ml in 15 liters of water [full tank] was found to be the best that recorded highest plant dry weight, spikes/m^2, grains/spike, grain yield and straw yield. It also fetched the maximum gross return, net return and benefit: cost ratio. Since, the finding based on the research done in one season the experiment may be repeated to confirm the findings.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

ACKNOWLEDGEMENT

The authors are thankful to Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj – 211007, Uttar Pradesh, India for providing use necessary facilities to undertake the studies.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. FAO (Food and Agriculture Organization). Worldwide regulations for mycotoxins in food and feed in 2003. FAO Food and Nutrition Paper no. 81. FAO, Rome, Italy. 2017:1728-3264.
2. Kumar A, Urmila. Impact of biofertilizers in enhancing growth and productivity of wheat: A review. Int. J. Chem. Stud. 2011;6:360-62.
3. ICAR, IIWBR. Directorate report AICRP On wheat and barley 2018-19 Ed: G.P. Singh ICAR, Indian institute of wheat and barley research, Karnal, Haryana, India. 2019:72.
4. Rao SR, Vardhini BV, Sujatha E, Anuradha S. Brassinosteroids-A new class of phytohormones. Current Science. 2002;82: 1239-1245.
5. Rajala A, Peltonen-Sainio P, Onnela M, Jackson M. Effects of applying stem shortening plant growth regulators to leaves on root elongation by seedlings of wheat, oat and barley: mediation by ethylene. Plant growth Regulation. 2002;38:51-59.
6. Kesarwani A, Singh VP, Kumar R, Pandey DS. Improving the lodging losses in wheat crop using growth regulators. National Agronomy Congress. 2018: 134-135.
7. Kumar R, Yadav DS. Effect of zero tillage in conjunction with nitrogen management in wheat (*Triticum aestivum* L.) after rice (*Oryza sativa*). Indian Journal of Agronomy. 2005;50(1): 54-57.
8. Rahman MA, Sarker MAZ, Amin MF, Jahan AHS and Akhter MM . Response of wheat variety Prodip to different doses and split applications of nitrogen fertilizer. Bangladesh Journal of Agricultural Research. 2011;36:2:231-240.
9. Shekoofa A, Emam Y. The increase of wheat grain yield due to the application of cycocel results from the increase of the number of spikes per square meter. Journalof Agriculture Science and Technology. 2008;(10):101-108.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/87437