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Exogenously applied plant growth regulators enhanced the yield and quality attributes of wheat (*Triticum aestivum* L.)

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Abstract
In the present investigation, a field experiment with nine treatments and three replications of each treatments was conducted with Randomized Block Design (RBD to explore effect of exogenously applied plant growth regulators on yield and quality traits of wheat crop. Wheat plants were sprayed with growth regulators at tillering and before anthesis stage, which were not only increase in the yield but also improve the quality components. The treatments were; Indole 3 Acetic Acid (IAA) 25 ppm and 50 ppm, Gibberellins (GA_3) 20 ppm and 40 ppm, Cytokinin (Kinetin) 5 ppm and 10 ppm, Alar 1000 ppm and 2000 ppm. Results showed a conspicuous improvement in yield and quality traits of plant growth regulator treated plants. The yield traits such as number of ears plant^{-1}, length of ear (cm), number of grains ear^{-1}, grain yield plant^{-1}, test weight and Harvest Index (HI) were found to be higher in IAA 50ppm treatment. Maximum protein content (%) was observed under the treatment of Kinetin 5 ppm. All the parameters were significantly influenced by plant growth regulators in respect to control.

Keywords: Wheat, plant growth regulator, yield, test weight, protein content

Introduction
Wheat (*Triticum aestivum* L.) is second most important staple food crop, which physiologically categorized as a C_3 plant. Due to increasing population and consumption patterns of foods, the demand of wheat increasing, while the area of cultivation declines with time of urbanization and industrialization. Poor quality of crops is another problem of crop grower. Among the wheat producing countries china rank 1st followed by India (FAOSTAT, 2016) [6]. Application of plant growth regulator opens a new dimension of investigation to enhance the yield and quality of crops. Plant growth regulators (PGRs) have capable to modifying growth and metabolism of plants. PGRs actively promotes plant growth and development under normal and stressful conditions. Although PGRs endogenously produce by plants but plants having well response to exogenous application. Growth regulator having capable to improve metabolism and yield attributes of plants. Indole acetic acid and gibberellic acid significantly affects various attributes of plant growth and development (Gherroucha *et al*. 2011) [8]. It is well known that the degree of leaf senescence is inversely proportional to cytokinin content, and exogenous application of kinetin helpful in increasing chlorophyll content as well (Sanaa *et al*. 2006) [12]. Therefore, present piece of work was carried out to ascertain the yield and quality responses of wheat cultivar to exogenously applied PGRs with their various concentrations.

Material and Methods
The field experiment was carried out at Student Instructional Farm, C.S. Azad University of Agriculture and Technology, Kanpur for the purpose to evaluate the effect of exogenously applied plant growth regulators on yield and quality of wheat cultivar (PBW-343). The treatments were: T1- Control**,** T2- IAA (25 ppm)**,** T3- IAA (50 ppm), T4- Gibberellic acid (20 ppm), T5- Gibberellic acid (40 ppm), T6- Kinetin (5 ppm), T7- Kinetin (10 ppm), T8- Alar (1000 ppm), T9- Alar (2000 ppm) and each treatment replicated three times. The desired quantity of each growth regulators e.g. IAA 25 mg & 50 mg, GA3 20 mg & 40 mg, Kinetin 5 mg & 10 mg, Alar 1000 mg & 2000 mg were weighed on a chemical balance and dissolved in

a few drops of alcohol and there after the alcoholic solution was added to 50 ml distilled water with constant stirring. This volume of solution was finally made up to one liter in volumetric flask. The solution was sprayed at 3-5 leaves stage, while second spraying was given at pre-anthesis stage.

Yield component measured at maturity time of the crop. Number of grains of main shoot ear was counted in each of the tagged plants separately. For test weight 1000 seeds were counted randomly and weighed on digital balance.

Harvest index is defined as the ratio of economic yield to total biological yield and expressed in percent. The harvest index of wheat was worked out using the following formula given by Beadle (1985) [3]. The HI was calculated as under:

$$\% \text{ HI} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

Protein content (%) in wheat grain was calculated by multiplying total nitrogen content by the factor 5.95. Nitrogen content was estimated by using instrument, Semi-automatic Nitrogen Analyzer (Model KEL PLUS + KEL FREEZ). This instrument work on the principle of micro kjeldahl method of nitrogen analysis (Kjeldahl, 1883) [9].

Result and Discussion

Table No. 1 represent the number of ears plant^{-1}, ear length, number of grain ear^{-1} and test weight of wheat crops. The result revealed that growth-regulators significantly influenced all above traits against control. Maximum number of ears plant^{-1} (7.0) was recorded under IAA 50 ppm and lowest value was recorded in control (4.0). Both concentration of GA_3 *i.e.* 20 ppm and 40 ppm and IAA 25 ppm possessed significantly more ear number plant^{-1} as compare to control. Plant growth regulator appreciating formation of fertile tiller in crops and thus, having involve to increasing ear number plant^{-1}. This finding is supported by the result of Gherroucha *et al*. (2003) [7].

Length of main ear is an important trait of yield, was also significantly influenced by PGRs treatment. IAA 50 and Alar 2000 ppm obtained similar value i.e. 9.5 cm, was longest ear followed by Alar 1000 ppm. As far as different doses of GA3 20 and 40 ppm differed significantly from control. IAA 25, Alar 1000 ppm also possessed positive impact on length of ear. Kinetin 5 ppm and 10 ppm was also significantly longer ear plant^{-1} with each other. Involvement of growth regulators to induces the cell division process appreciate the length of ear in crops. Alizadeh *et al*. (2010) and Biesaga-Koscielniak *et al*. (2012) [2, 4] also observed an improvement in ear length due to application PGRs.

Grains are economic part of major cereal that depend on synthesis and translocation of photosynthates toward productive part of the plants. Number of Grains ear^{-1} was significantly influenced by PGRs treatment. IAA 50 ppm (47.3) progressively increased the grain numbers ear^{-1} fallowed by IAA 25 ppm, while lowest data was recorded in control plant (38.16). However, Kinetin 10 ppm and kinetin 5 ppm were also significantly influenced grains number ear^{-1}. Individually GA3 40 ppm and both doses of Alar i.e. 1000, 2000 ppm was statistically similar grain number ear^{-1} but produced more grains number ear^{-1} as compare to control plant.

Test weight is also an important attribute of grain yield of wheat, which is weight of 1000-grains. It reflects the translocation efficiency of photosynthetic. Maximum test weight was observed in IAA 50 ppm (42.95 g) followed by IAA 25 (42.30). Other PGRs treatment also showed statically significant improvement in test weight. Increase in assimilation transport from source to sink, improves grain filling as well as weight of grain. Our statement is also similar with the observation of Nilesh *et al*. (2012), Rukasz and Michalek (2004) in barley, and Sanaa *et al*. (2006) [10, 11, 12] in wheat crop.

Table 1: Influence of growth-regulators on number of ears plant^{-1}, ear length, number of grain ear^{-1} at harvest stage in wheat

Treatments	Yield Attributes			
	No. of ear plant^{-1}	Length of ear (cm)	No. of grains ear^{-1}	Test Weight (g)
Control	4.0	7.9	38.2	38.52
IAA 25 ppm	5.6	8.9	45.2	42.30
IAA 50 ppm	7.0	9.5	47.3	42.95
GA_3 20 ppm	5.5	8.5	41.2	40.25
GA_3 40 ppm	5.3	9.0	42.6	40.98
KN 5 ppm	5.0	8.8	43.9	41.80
KN 10 ppm	4.3	8.5	44.4	42.19
Alar 1000 ppm	5.0	9.1	42.7	41.22
Alar 2000 ppm	5.6	9.5	42.8	41.35
SEm±	0.440	0.114	0.904	0.456
CD at 5%	0.934	0.242	1.917	0.968

Table 2 revealed that PGRs significantly appreciated grain yield plant^{-1} and found superior over the control. The maximum value of grain yield per plant was recorded by the treatment of IAA 50 ppm (12.1g) followed by Alar 2000 (11.3g), while minimum value (6.31g) under the control. Considering individual effect of other treatment i.e. GA_3 20 ppm and 40 ppm and Kinetin 5 ppm and 10 ppm had showed significantly more grain yield plant^{-1} in comparison to control, whereas, the difference between them was also found significant. Hence, all doses were produced more grain weight per plant. Cai *et al*. (2014) [5] also observed an improvement in grain yield due to application of PGRs on wheat crops.

Harvest index is the value of the ratio of economic yield and biological yield. Experimental data of harvest index (Table 2) revealed that all hormonal treatments significantly influenced the harvest index attribute of wheat plant. The highest value of harvest index was recorded in IAA 50 ppm (42.50%) followed by Alar 2000 ppm, while control plants had showed the lowest value (39.02%). All the concentrations of each growth regulators differed significantly from control in enhancing the harvest index. Regarding IAA, it's both concentration had significantly same effect but statistically superior over control. Rukasz and Michalek (2004) [11] clarifying our finding in barley.

Protein content of grain is an important quality attributes of wheat crop, and its directly proportion to nitrogen content. Maximum protein content (12.45%) was observed under the treatment of Kinetin 5 ppm, followed by Kinetin 10 ppm (12.18), while the untreated plant contained lowest amount of protein content (10.78). Regarding other treatment IAA 25 and 50 ppm and GA_3 20 and 40 ppm was also effective in appreciating protein content in comparison to control. Alar 1000 ppm and 2000 ppm also uplifted protein content but in minor way. Protein content is depending on the rate of the formation and translocation of amino acid from source to sink in crops. Similar finding also observed by Aldesuquy (2001) [1] in wheat.

Table 2: Influence of growth regulators on number of Grain yield plant^{-1} (g), harvest index (HI) (%), Protein content (%) at harvest stage in wheat

Treatments	Yield and Quality Attributes		
	Grain Yield Plant^{-1} (g)	HI (%)	Protein content (%)
Control	6.3	39.02	10.78
IAA 25 ppm	10.9	41.73	11.72
IAA 50 ppm	12.1	42.10	12.10
GA_3 20 ppm	9.2	40.92	12.06
GA_3 40 ppm	9.5	41.15	12.07
KN 5 ppm	8.9	40.86	12.45
KN 10 ppm	7.5	40.68	12.18
Alar 1000 ppm	10.4	41.38	11.61
Alar 2000 ppm	11.3	41.85	11.26
SEm±	0.517	0.226	0.178
CD at 5%	1.092	0.480	0.377

Conclusion

According to above outcome of the experiment, it may be inferred that the foliar application of IAA @ 50 ppm at pre tillering and anthesis stage appreciated the higher grain yield plant^{-1} of wheat crop while Kinetin, 5 ppm treatment improved the grain protein content. The enhancement of wheat grain yield plant^{-1} might be due to increase in number of ears plant^{-1}, number of spikelet ear^{-1}, number of grains ear^{-1}, and weight of grain, that was appreciating effect of IAA 50 ppm. Whereas the grain protein content which was enhanced by Kinetin might be due to its capacity to produce maximum nitrogen and its ability to direct the flow of amino acids from source towards the sink. Thus, it is suggested that foliar application of PGRs may be used on wheat crop for higher yield and better protein content.

References

1. Aldesuquy HS. Efficacy of indol-3-yl acetic acid on improvement of some biochemical and physiological aspects of wheat flag leaf during grain filling [*Triticum aestivum* L.]. Agrochimica (Italy). 2001; 45(½):1-13.
2. Alizadeh O, Haghighi BJ, Ordookhani K. The effects of exogenous cytokinin application on sink size in bread wheat (Triticum aestivum). African Journal of Agricultural Research. 2010; 5(21):2893-2898.
3. Beadle CL. Plant growth analysis. In Techniques in bio productivity and photosynthesis, Pergamon. 1985, 20-25p.
4. Biesaga-Kościelniak J, Kościelniak J, Filek M, Marcińska I, Krekule J, Macháčková I *et al*. The effect of plant growth regulators and their interaction with electric current on winter wheat development. Acta physiologiae plantarum. 2010; 32(5):987-995.
5. Cai T, Xu H, Peng D, Yin Y, Yang W, Ni Y *et al*. Exogenous hormonal application improves grain yield of wheat by optimizing tiller productivity. Field Crops Research. 2014; 155:172-183.
6. FAOSTAT. Statistical databases and datasets of the Food and Agriculture Organization of the United Nations, 2016. http://faostat. fao.org/. Accessed 16 May 2016.
7. Gherroucha H, Baka M, Moharid SA. Effect of foliar application with indol acetic acid and gibberellic acid and the interaction between them on growth and some physiological constituents of wheat plant grown under salinity conditions. Arab Universities Journal of Agricultural Sciences (Egypt). 2003; 11(1):69-85.
8. Gherroucha H, Fercha A, Ben Mekhlouf. Z Foliar application of Indol Acitic Acid (IAA) and Gebirilic acid (GA3) as well as interaction effect on growth yield and some physiological compositions of Triticum plant grown under salinity conditions. Agriculture and Biology Journal of North America. 2011; 2(2):358-367.
9. Kjeldahl J. A new method for the estimation of nitrogen in organic compounds. Z. Anal. Chem, 1883; 22(1):366.
10. Nilesh G, Chakrborti P, Rai AK, Gupta PC. Effect of Plant Growth Regulator on Growth Response and Yield Component in Wheat (Triticum aestivum L.) Crop. Research Journal of Agricultural Sciences. 2012; 3(1):204-208.
11. Rukasz I, Michalek W. Effect of foliar application of phytohormones on barley yielding. Annales Universitatis Mariae Curie-Sklodowska. Sectio E Agricultura (Poland). 2004; 59(4):1543-1548.
12. Sanaa AMZ, Mostafa MA, Shehata SAM. Physiological studies on the effect of kinetin and salicylic acid on growth and yield of wheat plant. Annals of Agricultural Science (Cairo). 2006; 51(1):41-55.