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Original Research Article

Yield Attributes and correlation of Late Sown Wheat (*Triticum aestivum* L.) as affected by Growth Regulators

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A B S T R A C T

In the present study, a pot experiment with twelve treatments and four replications of each treatments was conducted with Completely Randomised Design (CRD) in wire net house, department of Crop Physiology, C. S. Azad Uni. of Agriculture and Technology, Kanpur, (U.P) to explored new approach for yield and quality enhancement under late sown condition. Wheat seedligs were sprayed with growth regulators with different concentrations at two successive growth stages (At after germination and before Anthesis stage). Which were not only appreciate the yield but also increase the quality components of the wheat crop. The treatments were; Gibberellic Acid (GA_3), 20 and 40 ppm, Kinetin, 5, 10 and 15 ppm, Naphthlene Acetic Acid (NAA), 20, 40 and 60 ppm and Thiourea, 400, 800 and 1200 ppm. Results showed a conspicuous increase in yield components in treated plant. Thiourea 1200 possessed a significant more number of ear/plant, ear lenght (cm), number of spikelets/ear. However, Thiourea 1200 ppm and NAA 60 ppm resulted highest grain number/ear, test weight (g), yield/plant (g) and Harvest Index (%). Other treatments also had positive response over all the recorded traits. Positive correlation was noticed among all the yield attributes.

Keywords

Foliar application, Wheat, Growth regulators, Yield and Quality

Introduction

Wheat (*Triticum aestivum* L.) is second most important staple food crop in the world and is physiologically a C_3 plant. Globally, it is the most important human food grain and ranks second in total production as a cereal crop behind maize; the third being rice. Wheat is widely cultivated as a cash crop because it produces a good yield per unit area, grows well in a temperate climate even with a moderately short growing season crop. Delayed sowing of wheat is a main problem to reduce the yield as it exposes the crop at high temperature stress at anthesis and grain filling stage. Regmi *et al*., (2002) reported a yield decline in wheat when it was sown after the third week of November. A major reason for late sowing is the late harvest of the preceding crops.

At late sown, the inputs applied to the wheat crop were not efficiently utilized and resulted in reduced yield (Hobbs and Gupta, 2002). All the growth stages, such as tillering, flowering, and grain filling are adversely affected by the shortened growing period. The reduction in the optimum growth period caused by a rise in temperature leads to leaf senescence resulting in a photosynthetic rate that is too low to meet plant carbon economy (Sharma-Natu *et al*., 2006). As a result, it

affects two important yield parameters, i.e., the number of grains per ear and grain weight (Ugarte *et al*., 2007). This reduction in growth can be compensated by cultivating short-duration varieties that are generally low yielding. The other effective approach is the exogenous application of plant growth regulators (PGRs) involved in promoting plant growth and development under normal and stressful conditions.

In the present study, an attempt was made to find out the effect of growth regulating substances with their various concentrations on physiology of growth, metabolism and yield of wheat under late sown condition. These growth regulators are likely to play an important role in many aspects of crop production. They added a new dimension to the possibility of obtaining high yield. In principle the availability of exogenous growth hormones to modify plants growth offer great opportunity, again the high activity and concentration offer favorable cost consideration in their use.

Materials and Methods

The present research work was carried out in cemented pots each having a capacity to hold 8 kg of air dried soil in wire net house. The soil of the experimental pots was sandy loam with average fertility. Since the studies were carried out in pots, Completely Randomized Design (CRD) was adopted for the experiment. All the growth regulators involved three concentrations except GA_3 which had only 2 concentration, were applied at two different growing stages at after germination and before anthesis stages. Each treatment replicated four times. The silent features of plant growth regulators used in the experiment are furnished below:

T1- Control
T2- Foliar application of Gibberellic acid (20 ppm)
T3- Foliar application of Gibberellic acid (40 ppm)
T4- Foliar application of Kinetin (5 ppm)
T5- Foliar application of Kinetin (10 ppm)
T6- Foliar application of Kinetin (15 ppm)
T7- Foliar application of NAA (20 ppm)
T8- Foliar application of NAA (40 ppm)
T9- Foliar application of NAA (60 ppm)
T10- Foliar application of Thiourea (400 ppm)
T11- Foliar application of Thiourea (800 ppm)
T12- Foliar application of Thiourea (1200 ppm)

Results and Discussion

Number of ears per plant is a yield attributing character. Its increment is due to Thiourea 1200 ppm followed by NAA 40 ppm. The others treatments also had a supporting influence on ear number. Work done by Nilesh (2012) and Sahu (1995) accompanied our result with regards that more assimilates are transported from source to sink.

The other wheat yield supporting character is ear length which was significantly maximized by the Thiourea 1200 ppm followed by its lower concentrations. NAA also significantly appreciated the length of ear of wheat. The other growth regulators also had improving effect on ear length in comparison to control. The finding given by Biesaga-Koscielriak (2012) assisting our research.

Grain number per ear is a yield uplifting trait which is mainly influenced by the Thiourea 1200 ppm concentration followed by Thiourea 800 and 400 ppm respectively. The others growth regulators *viz.*, NAA, GA_3 and Kinetin also have an assisting result. The above finding coinciding with the result given by Sahu *et al., (*1995).

An over view on test weight, which is weight of 1000-grains, revealed that Thiourea, 1200 ppm has an uplifting effect on test weight of wheat crop under late sown condition. Its decreasing concentrations also have an accomplishing effect on 1000 grain weight.

Table.1 Effect of foliar applied Growth regulators on number of Ears/plant, Length of Ear (cm) and Number of Grains/Ear of wheat under late sown condition

S. No.	Treatments	Yield Attributes		
		Number of ear/plant	Length of ear (cm)	No. of Grain/ear
1	Control	2.8	10.0	38.0
2	GA_3 20 ppm	3.0	11.1	45.8
3	GA_3 40 ppm	3.3	13.1	47.6
4	KN 5 ppm	3.1	10.5	40.2
5	KN 10 ppm	3.2	11.0	41.9
6	KN 15 ppm	3.4	11.5	42.7
7	NAA 20 ppm	3.2	12.2	49.2
8	NAA 40 ppm	3.4	12.7	52.8
9	NAA 60 ppm	3.6	13.0	54.6
10	TU 400 ppm	3.5	13.2	53.6
11	TU 800 ppm	3.7	13.5	55.0
12	TU 1200 ppm	3.8	13.7	60.3
	S.E(diff.)	**0.21**	**0.22**	**0.60**
	C.D at 5% P	**0.43**	**0.45**	**1.23**

Table.2 Influence of foliar spray of Growth regulators on Test Weight (g), Grain Yield/plant (g) and Harvest Index (%) of wheat under late sown condition

S. No.	Treatments	Yield Attributes		
		Test Weight (g)	Grain Yield/Plant (g)	Harvest index (%)
1	Control	35.00	3.10	31.72
2	GA_3 20 ppm	35.44	3.40	31.92
3	GA_3 40 ppm	35.48	3.78	33.30
4	KN 5 ppm	35.46	3.65	35.88
5	KN 10 ppm	35.50	3.99	35.14
6	KN 15 ppm	35.75	4.18	35.06
7	NAA 20 ppm	35.80	3.97	36.48
8	NAA 40 ppm	36.00	4.21	35.49
9	NAA 60 ppm	36.20	4.56	35.43
10	TU 400 ppm	36.25	4.37	41.35
11	TU 800 ppm	36.50	4.54	42.08
12	TU 1200 ppm	37.00	4.66	42.67
	S.E(diff.)	**0.30**	**0.07**	**0.03**
	C.D at 5% P	**0.61**	**0.14**	**0.06**

Table.3 Correlation Coefficient among different characters influenced by growth regulator in wheat crop under late sown condition

	1	2	3	4	5	6
1. No. of ear/plant		0.836**	0.947***	0.945***	0.983***	0.828***
2.Length of ear			0.815**	0.846**	0.829**	0.700*
3. No. of grain/ear				0.964***	0.955***	0.846**
4. Test Weight					0.914***	0.887**
5. Grain Yield/plant						0.796**
6. Harvest Index						

'r' value at 5 % = 0.576*; At 1 % = 0.708**; At 0.1% = 0.868***

The other growth regulator also have an assisting effect on increment of test weight of wheat grains. The controlled plant had lower test weight value. The major origin of higher test weight is due to highest assimilates transport from the source to sink point of the wheat crop. Our work is also confirmed by the research work done by Nilesh (2012) and Sanaa *et al.,* (2006).

Per plant grain yield is considered as economic part of the plant which is depend upon the synthesis and transport of photo-assimilate toward the productive part of the plants was mainly incremented by the foliar application of Thiourea, 1200 ppm following Thiourea, 800 and 400 ppm respectively. NAA, 60 ppm also has a positive effect on grain yield per plant. Other treatments also gave positive response in yield. Foremost outlook given by Amal Fadl Abdelkader *et al.,* (2012) favoured our debate.

The value of harvest index which is the ratio of economic yield and biological yield is improved by Thiourea, 1200 ppm followed by its lower doses *i.e.* 800 and 400 ppm respectively. Following Thiourea, NAA also enhanced the Harvest Index value of wheat crop under late sown condition. Other treatments *viz.,* Kinetin and GA_3 also have constructive power in comparison to control plant. The central cause of amplified Harvest Index was owed to construction of more assimilates which participate in the establishment of economic yield in comparison to biological yield. Clarification prearranged by Sahu *et al.,* (2006), Rukasz and Michalek (2004) supporting the result.

Correlation

Among the correlated characters, number of ear/plant is positively correlated with ear length, number of grain/ear, test weight (g), grain yield (g)/plant and Harvest Index (%).Number of grains/ear is positively correlated with test weight (g) and grain yield (g)/plant. Test weight (g) show positive correlation with Grain yield/plant (g). This result is also favored by the discussion given by Gupta *et al.,* (1999), Aycecik and Yildirim (2006), Muhammad Munir *et al.,* (2007).

According to above outcome of the experiment, it may be inferred that the foliar application of Thiourea 1200 ppm at after germination and pre-anthesis stage appreciated the number of ear/plant, ear length (cm), number of grains/ear, Test Weight (g), Yield/plant (g) and Harvest Index (%) of wheat crop under late sown condition. However, NAA 60 ppm also gave positive response for number of grains/ear,

Test Weight (g), Yield/plant (g) and Harvest Index (%).The enhancement of grain yield (g)/plant of wheat plant was due to increase in number of ear, number of grains/ear and harvest index. There were positive correlation among all the given traits.

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