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Effect On Foliar Application Of Thio-Urea On Morpho-Physiological And Yield Potential In Different Wheat [*Triticum Aestivum L.*] Cultivars Under Drought And Irrigated Conditions

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Abstract: *The field experiments were conducted at Student Instructional Farm of CSAUAT Kanpur, during Rabi 2016-17 and 2017-18. The objective of investigation was to study the effect of foliar applied thio-urea with different doses on plant traits (morphological, yield and its components) of two wheat varieties under drought and irrigated condition. It was designed in split-split plot design with three replications. The two conditions i.e., drought (I_0) and irrigated (I_1) conditions were allocated in the main plots and two wheat varieties i.e., V_1 (K-1006) and V_2 (K-307) in sub plot and for each five chemical treatments were applied as foliar spray at heading stages by 500 ppm (T_3) and 1000 ppm thio-urea (T_4), along with control (T_0) in sub-sub plots. The significantly higher grain yield (5.30 & 5.26 gm) with best morpho-physiological. Next to this were 500ppm thio-urea (T_3) i.e., 5.12 & 5.08, 1000ppm thio-urea (T_4) i.e., 5.08 & 5.03 as compare to control (T_0) i.e., 4.39 & 4.35 gm. Among cultivars, maximum responsive was K-1006 (V_1) in most of traits and gave significantly higher grain yield (5.26 & 5.30) and and minimum in K--307 (V_2) i.e., 5.08 & 5.12 gm with both concerning experimental years.*

Key Words: *Growth parameter, yield parameter, foliar spray on thio-urea, drought and irrigated conditions.*

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I. INTRODUCTION

Wheat [*Tritium aestivum* L.] is one of the most important cereal crops of the world. Bread wheat is the major staple food source for a large part of global population. It is second most important cereal crop after maize and plays an important role in national food security. It has originated from the Levant region of the New East and Ethiopian Highlands, but now cultivated worldwide. Wheat is the world′s most outstanding crop that excels all other cereals both in area and production, known as king of cereals. It is also one of the most nutritious cereals and its contribution to human diet puts it in the first rank of plants that feed the world **(Costa *et al.*, 2013)**. Wheat consumption worldwide is estimated to 817 million tons by 2030 and production would need to increase at 22.6-43.6% in different countries at the current production level to meet the estimated consumption demand. India is the largest wheat producing country in the world after China. The wheat production has increased manifold from 6.60 million tonnes at the time of independence to 97.44 million tonnes in 2016-17. The productivity has witnessed an increase by 473 per cent *i.e.* from 670 kg/ha to 3172 kg/ha during the above period. Despite delayed sowing, the country recorded 30.71 million hectares. **(Anonymous, 2016-17),** clearly indicates the strength of systematic and planned wheat research in the country. It may be recalled that the total wheat production of the country during 1947-48 was just 5.6 million tons with average productivity of less than one t/ha. Wheat consumption in India estimated to surpass 110 million tons of wheat will be needed by 2020.

Drought is the most prevailing problem and the factor known to be serious for its impacts on crop limitations **(Souza *et al*., 2004)**. This kind of abiotic stress often occurred as consequence of the reduction of the water level that reaches earth due to extreme atmospheric conditions which frequently cause water loss via transpiration and evaporation. Generally, water scarcity resulted from either drought or soil salinity influenced crop plant's morphology, physiology and could lead to cellular and organelles deformation. Specific impacts of drought on biochemical and molecular processes lead to stomata closure with consecutive decrease in rates of transpiration, pigment content, photosynthesis, caused protein alterations and ended with growth inhibition.

II. MATERIAL AND METHODS

All facilities related to study were available at the Experimental Research Student Instructional Farm of C. S. Azad University of Agriculture and Technology Kanpur. Geographically Kanpur is located of 26.30^0 N

Longitude of 80.15^0 E and above 127 meters sea level. It lies in the sub-tropical regions where wheat is grown in the Rabi seasons. A total dose of 150 kg/ha Nitrogen, 80 kg/ha Phosphorus and 60 kg/ha Potash, through urea

The experiment consisted of two conditions in main plot, drought (I_0) and irrigated (I_1), two varieties in sub plot (V_1) K-1006 and (V_2) K-307, three treatments in sub-sub plot (T_0) control, (T_3) 500ppm thio-urea and (T_4) 1000ppm thio-urea foliar spray at heading stage. These three treatment combinations were replicated in three replications in split-split plot design. Observations were recorded on growth characteristics viz. plant height (cm) and productive tiller per plant at heading stage, yield and yield attributes viz. main spike length (cm), grain number per spike, grain weight per spike (gm) and grain yield per plant (gm). All the data on growth parameter and yield attributes characters were statically analyzed by the methods suggested by **Fisher (1937)**.

III. RESULTS AND DISCUSSION

The morphological traits were presented by Tables in 1. According to both the years significantly higher plant height was recorded at heading stage. In wheat variety K-307 treated with thio-urea 500ppm and thio-urea at 1000ppm plant height was observed 110.3 cm and 110.5cm as compared to control 79.0cm. and productive tillers per plant was recorded 20.0 and 19.0 in comparison to control 13.0. These increases may be ascribed to the role of foliar spray with potassium nitrate on increasing photosynthetic activity which accounts much for high translocations of photo assimilates from leaves to the grains. The other studies have shown that the application of potassium fertilizer mitigates the adverse effect of drought on plant growth in faba beans and sugar cane that confirmed results of this study by **Sudama *et al*. (1998)**.

The foliar spray with thio-urea effect of irrigation on growth characters might be attributed due to beneficial effect on water cell turgidity, cell elongation, photosynthesis and respiration, uptake of nutrients and translocation of photosynthesis to the actively growing plant parts by **Singh *et al*. (2002)**. Water deficit is a common abiotic stress adversely affecting crop production; meaningful orthogonal contrast of drought and irrigated confirmed the same. Our study observed that foliar application thio-urea to wheat plant under water deficit condition on growth stage and heading stage enhanced crop growth and development.

In present study plant height was decreased under water deficit condition; as reported by (**Freeha *et al.*, 2011)**. Plant height may be reduced due to dehydration of protoplasm; decrease in relative turgidity associated with turgor loss and decreased cell expansion and cell division **(Pal *et al.*, 2012)**. During vegetative stage the growth means, the growth of the leaves and tillers mainly, while the stem elongates very slowly and it gains its maximum height at the time of onset of floral initiation. A possible reason for much reduced plant height with drought at flowering stage than at vegetative or grain filling. The drought affected plant height due to hormonal imbalance (cytokinin, abscisic acid) which effect growth due to changes in cell wall extensibility, reported by **(Zhao *et al*., 2006)**. The adverse effect of water stress may also be decreased by increasing the availability of water to the plant due to reduction in transpiration by partial closure of stomata **(Abida *et al.*, 2013).** It has been suggested that plant mineral nutrient status plays a vital role in improving the resistance of plant to stress conditions **Nadim *et al.* (2013)**.

The data pertaining on yield and its attributes as presented in Tables 2-3., revealed that it varied significantly and non- significantly higher in thio-urea 500ppm and thio-urea 1000ppm during both the years. The main spike length 10.6 and 10.5 cm and compared to control 8.5cm, grain number per spike 42.9 and 42.0 at least control 39.9, grain weight spike^{-1} 2.60 and 2.54 g at lowest control 2.03 g, grain yield per plant 5.30 and 5.12 g at minimum control 4.13 in minimum drought and maximum in irrigated condition both years of experimentation.The spike length was adversely affected by water deficit between stem elongation and ear formation stage. The reduced ear length at anthesis is due to reduced number of nodes and less node to node distance on the rachis. Moreover it was also observed by **Taban *et al.* (2000)** that under environmental stress conditions the spike length remains stable.

Reduced canopy was developed when crop faced water stress before grain filling or at flowering stage that can be improved by enhancing plant stress tolerance by CMS (cell membrane stability). The decrease in number of spikelet per spike at flowering stage was highest; it may be due to reduced root growth about the time of spike formation that resulted in reduced nutrient uptake. The reduced number of spikelet per year may be due to limited photosynthetic activity before spike emergence because spikelet per spike are determined before spike emergence Drought stress at flowering or grain filling stage adversely affected the plant production by causing drastic decrease in number of grains per spike. The numbers of grains per spike were decreased adversely under water stress. The flowering stage proved to be the most sensitive to water deficit and produced the decreased number of grains per spike and less number of flowers to set seed. The reduced number of grains may be due to low number of spikelet per spike and spike length under drought. Drought stresses either at vegetative or flowering stage considerably decreased grain yield and yield components in wheat. Plant fresh and dry biomass reduced under water deficit conditions. This reduced biomass may create the disorder in the remobilization of the assimilates from source to mature grain (sink) resulted in short and shriveled kernel or it may be due to disturbed grain growth pattern or its improper position between and within the spikelet under drought stress showing assimilate limitation as reported by **Bavita *et al.*, (2015)**.

IV. CONCLUSION

The results summarized as irrigated condition (I_1), variety K-1006 (V_1) among varieties, 500ppm thio-urea (T_3) among treatments were found significantly superior for most of morphological *i.e.,* plant height (cm) and productive tillers plant^{-1} heading. The summarized as irrigated condition (I_1), variety K-1006 (V_1) among varieties, 500ppm thio-urea (T_3) among treatments were found significantly superior for most of yield components *i.e.,* main spike length (cm), grain number spike^{-1}, grain weight spike^{-1} (g) and grain yield plant^{-1} (gm) after harvesting were examined significant also for irrigated condition (I_1) and 500ppm thio-urea (T_3) but variety K-1006 (V_1) for yield per pose and other traits in (V_2) K-307 variety during both corresponding years. Finally, it may be concluded that significantly higher grain yield plant^{-1} (5.30 and 5.26) with best morpho-physiological traits can be obtained by foliar application of thio-urea 500ppm (T_3) with both condition of sowing *i.e.,* irrigated (I_1) and drought (I_0) of wheat crop. Next to this were 1000ppm thio-urea (T_4) *i.e.,* 5.12 and 5.08, as compare to control (T_0) *i.e.,* 4.50 and 4.13. Among cultivars, maximum responsive was K-1006 (V_1) in most of traits and gave significantly higher grain yield (5.30 and 5.26) and minimum in K-307 (V_2) *i.e.,* 5.12 and 5.08 with both concerning experimental years.

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Table No. 1. Effect on foliar application of thio-urea on growth parameter.

		2016-17						2017-18					
Treatments		Plant Height (cm)			Productive Tillers/Plants			Plant Height (cm)			Productive Tillers/Plants		
		Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)	Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)	Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)	Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)
I_0	V_1	79.0	87.0	84.0	13.0	15.0	14.0	79.5	87.5	85.0	14.0	16.0	15.0
	V_2	81.7	87.7	83.3	12.0	16.0	15.0	82.0	88.0	84.0	13.0	15.0	14.0
I_1	V_1	103.0	107.7	106.7	16.0	20.0	18.0	104.0	108.0	107.0	15.0	19.0	17.0
	V_2	103.0	106.7	110.3	17.0	20.0	19.0	103.5	107.0	110.5	16.0	20.0	18.0
Factors		I	V	T	I	V	T	I	V	T	I	V	T
SE (d)		1.45	1.00	1.83	0.24	0.41	0.72	1.18	0.66	0.44	0.13	0.13	0.16
C.D. at 5%		6.24	NS	5.09	1.04	NS	1.46	5.07	NS	1.22	0.57	NS	0.32

Table No. 2. Effect on foliar application of thio-urea on yield parameter.

		2016-17						2017-18					
Treatments		Main Spike length (cm)			Grain Number/Spike			Main Spike length (cm)			Grain Number/Spike		
		Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)	Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)	Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)	Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)
I_0	V_1	8.5	9.1	8.8	39.9	41.1	40.4	8.7	9.4	9.0	40.0	41.4	40.7
	V_2	8.9	9.5	9.2	40.5	41.9	41.2	9.0	9.6	9.4	40.8	42.2	41.5
I_1	V_1	9.8	10.5	10.3	40.9	42.0	41.7	9.9	10.6	10.5	41.2	42.9	42.0
	V_2	9.3	9.9	9.8	40.0	41.4	41.2	9.5	10.3	10.1	40.5	41.8	41.6
Factors		I	V	T	I	V	T	I	V	T	I	V	T
SE (d)		0.22	0.12	0.07	0.19	0.23	0.24	0.09	0.10	0.16	0.04	0.02	0.19
C.D. at 5%		0.95	NS	0.15	NS	NS	0.48	0.41	0.28	0.33	0.17	0.04	0.39

Table No. 3. Effect on foliar application of thio-urea on yield parameter.

		2016-17						2017-18					
Treatments		Grain Wt./Spike (gm)			Grain Yield/Plants (gm)			Grain Wt./Spike (gm)			Grain Yield/Plants (gm)		
		Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)	Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)	Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)	Control (T_0)	500ppm Thio-urea (T_3)	1000ppm Thio-urea (T_4)
I_0	V_1	2.03	2.15	2.09	4.13	4.36	4.23	2.06	2.18	2.12	4.15	4.40	4.25
	V_2	2.03	2.16	2.10	4.30	4.51	4.41	2.07	2.20	2.15	4.35	4.55	4.45
I_1	V_1	2.19	2.55	2.49	4.50	5.26	5.08	2.22	2.60	2.54	4.55	5.30	5.12
	V_2	2.17	2.53	2.47	4.46	5.08	5.03	2.20	2.55	2.50	4.50	5.12	5.08
Factors		I	V	T	I	V	T	I	V	T	I	V	T
SE (d)		0.15	0.19	0.06	0.21	0.31	0.13	0.02	0.02	0.03	0.02	0.04	0.07
C.D. at 5%		NS	NS	0.12	NS	NS	0.26	0.9	NS	0.07	0.09	NS	0.14

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