



STUDIES ON IMPACT OF UREA, THIOUREA AND ZINC APPLICATION ON GROWTH YIELD QUALITY AND ECONOMIC OF WHEAT (*Triticum aestivum* L.)

C. B. Verma¹, Moh. Aslam², Ram Pyare³, V. K. Verma³, Vishram Singh³, Dhananjai Singh³,
Jitendra Singh³ and Harshita Sharma³

^{1&2}Dept. of Crop Physiology & Dept. of Agronomy

C.S. Azad University of Agriculture & Technology, Kanpur- 208002 (U.P.), India

ABSTRACT

The experiment was conducted during Rabi 2012-13 and 2013-14 to investigate the foliar application of zinc sulphate, urea and thiourea singly and in combination in wheat variety K-9465 under rainfed condition. The experiment was laid out in Randomized Block Design with three replication at Crop Research Farm of C.S. Azad University of Agriculture & Technology, Kanpur- 2. The eight treatments viz., foliar spray of water (control), foliar spray of zinc sulphate @ 0.5%, foliar spray of urea @ 2%, foliar spray of thiourea @ 500 ppm, foliar spray of zinc sulphate @ 0.5% + urea @ 2%, foliar spray of zinc sulphate @ 0.5% + thiourea @ 500 ppm, foliar spray of urea @ 2% + thiourea @ 500 ppm and foliar spray of zinc sulphate @ 0.5% + urea @ 2% + thiourea @ 500 ppm. Foliar spray of different concentration of solution was given at 25 and 65 days after sowing. Data summarized on pooled basis in this manuscript. Result revealed that the foliar application of zinc sulphate @ 0.5% + urea @ 2% + thiourea @ 500 ppm produced significantly growth attributes viz., plant height, leaf area/ plant at 50% flowering stage (cm²) and tillers/plant, physiological behavior viz., chlorophyll content (%) and RWC at 65-70 DAS (%) and yield attributes viz., length of ear on mother shut (cm), spikelet/ear, grains/ plant (g), straw/ plant (g), and test weight (g) were higher in comparison to control, respectively. The highest grain yield of wheat was recorded with foliar application of zinc sulphate @ 0.5% + urea @ 2% + thiourea @ 500 ppm over control treatment on the basis of pooled data. The economics viz., gross income and net return and quality aspects viz., protein and nitrogen content with used foliar spray of zinc sulphate @ 0.5% + urea @ 2% + thiourea @ 500 ppm were statistically and significantly more than rest foliar application, respectively.

Key Words: Spray of Water, Urea, thiourea, zinc, wheat crop

Introduction

Wheat (*Triticum aestivum* L.) is the second most important staple food crop of the world after rice, both in area and production. Wheat has a prominent position among the cereals that supplement nearly one third of the world population's diet by providing half of the dietary protein and more than half of the calories. Zinc deficient soils are common all over the world in both tropical and subtropical and temperate climates. Zinc deficiency is the most widespread micronutrient deficiency. Zinc is closely involved in nitrogen metabolism of the plant. Zinc is required for

synthesis tryptophan which is pre-cursor of IAA. It is involved in starch formation, starch content and activity of the enzyme starch synthesise reduced in zinc deficient plants and activation of enzymes related to carbohydrate metabolism, protein synthesis. To stimulate the photosynthesis activity of leaves in terminal drought like situation, which is important in inception and vertisols of rain fed conditions foliar nutrition with nitrogenous fertilizer is essential as roots fail to absorb nitrogen from dry soil profile. Nitrogen is a primary element and is special important in the formation of protein in plants. Thiourea applied might have improved

phloem loading of sucrose and enhance translocation of photosynthetic. Foliar applied thiourea has been resulted to be effective for enhancing wheat productivity under different environmental conditions. Keeping this view enhancing foliar applied zinc, urea and thiourea on growth yield quality and economic of wheat (*Triticum aestivum* L.) under rainfed conditions.

Materials and Methods

A field experiment was conducted during Rabi 2012-13 and 2013-14 to investigate the foliar application of zinc sulphate, urea and thiourea singly and in combination in wheat (*Triticum aestivum* L.) variety K-9465 under rainfed condition. The treatment consisted eight treatments viz., control (foliar spray of water), zinc sulphate @ 0.5%, urea @ 2.0%, thiourea @ 500 ppm, ZnSO₄ @ 0.5% + urea @ 2.0%, ZnSO₄ @ 0.5% + Thiourea @ 500 ppm, urea @ 2% + thiourea @ 500ppm, zinc sulphate @ 0.5% + urea @ 2.0% + thiourea @ 500 ppm applied foliar spray adopted, Factorial Randomized Block Design with three replications on widely used wheat (*Triticum aestivum* L.) variety K 9465 (Mandakini) were sown in Crop Research Farm of C.S. Azad University of Agriculture & Technology, Kanpur-2. The soil of experimental field was sandy loam having clay 19.8-29.9%, silt 25.9-26.4%, sand 51.3-52.0%, soil pH 7.6-7.7% and EC 0.43 mmhos/cm available zinc 0.5% available zinc was extracted by DPTA extract (Lindsay, W.L., 1972) and determined by atomic absorption spectrophotometer. Freshly prepared solutions of zinc sulphate were sprayed on foliage which was applied 25 and 65 DAS (days after sowing) which coincide the stage of active tillering with the help of hand sprayer each sub-plots, as per treatment was sprayed with adequate solution to quick requirement of the plants. Three plants from each plot were randomly selected and tagged for recording periodical growth observations. The crop was fertilized with recommended dose of fertilizers, viz. 150, 60, 60 kg N, P₂O₅ and K₂O/ha. Various stages and harvest stage and tagged separately. Chlorophyll intensity (%) was measured

by SPAD. Relative water content (%) was calculated by following formulae Weatherly, P.E. (1965).

$$RWC \% = \frac{\text{Fresh weight} - \text{oven dry weight}}{\text{Turgid weight} - \text{oven dry weight}} \times 100$$

Nitrogen content (%) in the plant material was estimated by using instrument Semi-automatic nitrogen analyzer of model Kel Plus. Protein content (%) calculated by this formula is an protein content (%) = Nitrogen content (%) 5.95. The tagged sample was dried in the oven at 80-85 °C for 8-10 hours to weigh the total dry matter production at different stages. Keeping this view enhancing foliar applied zinc, urea and thiourea on growth yield quality and economic of wheat (*Triticum aestivum* L.) under rainfed conditions.

Results and Discussion

(A) Growth attributes:

The data summarized in Table depicted that the growth characteristics as tillers/plant production increased progressively up to foliar application of zinc sulphate @ 0.5% + urea @ 2.0% + thiourea @ 500 ppm individually as well as in combination at plant growth over control (water). Whereas, significantly more plant height of wheat 8.1 cm (9.35%) recorded in zinc sulphate @ 0.5% + urea @ 2% + thiourea @ 500 ppm over control in present investigation. There for results also reported by Zakaria *et al.* 1997 and Verma *et al.* 2004.

(B) Physiological behaviour

The significantly higher chlorophyll intensity (41.82%) was observed by the foliar application of zinc sulphate @ 0.5% + urea @ 2.0% + thiourea @ 500 ppm over rest of treatments, respectively. Minimum chlorophyll intensity (38.12%) was observed in control with water spray applied in present study. Appraisal of data on RWC (%) as presented in table should that different foliar spray of treatment significantly increased the RWC (%) over control at 65.70 days of crop growth. The RWC (%) was significantly increased in Treatment

of zinc sulphate @ 0.5% + urea @ 2% + thiourea @ 500 ppm (72.13%) over control as water spray (61.61) on the basis of present pooled data. Here the significant differences was not observed among different foliar spray of nutritional booster through zinc sulphate @ 0.5% + urea @ 2% + thiourea @ 500 ppm gave more leaf area/ plant (55.9) at 50% flowering stage than other foliar spray (Zakaria *et al.* 1997).

(C) Yield attributes:

A critical examination the pooled data that foliar application of zinc (0.5%) + urea (2.0%) + thiourea (500 ppm) individually or in combination resulted enhanced the length of ear (cm) on mother shoot, spikelets/ear, grains/ plant, straw/plant (g) and test weight (g) were recorded significantly higher in comparison to control (water spray), respectively with percentage increments over control of 24.55, 57.66, 105.62, 99.29 and 6.46 in pooled study, respectively. These results are also reported by Sahu & Singh 1995.

(D) Yields:

The maximum photosynthatics was set in there by sink application of zinc sulphate @ 0.5% + urea 2.0% and thiourea 500 ppm were recorded significantly higher grain yield of 39.1 q/ha in comparison to control (water sprayed) of 29.3 q/ha with percentage increments over control of 33.45 in present pooled study. From the present study the foliar application in combination of zinc sulphate @ 0.5% + urea @ 2.0% + thiourea @ 500 ppm on wheat variety K-9465 (Mandakini) improved crop growth to enable then ensure higher yield buildup. These results of present study are in accordance to the result of other worker Burman *et al.* 2007 and Bukic *et al.* 2003 and Sahu and Singh (1995) have been reported to be effective for enhancing wheat productivity under different environmental condition.

(E) Economics

Applied foliar spray of zinc sulphate @ 0.5%

+ urea @ 2% + thiourea @ 500 ppm was a positive effect on gross and net income but significant response which brought about grain yields. Analytically more gross income was achieved in foliar spray of zinc sulphate @ 5% + urea @ 2% + thiourea @ 500 ppm than control as water spray. Net return was statistically more in foliar spray of zinc sulphate @ 0.5% + urea @ 2% + thiourea @ 500 ppm by amargin of Rs. 5444/ha (127.02%) under pooled study. These results are also reported by Verma *et al.* 2016 and Singh 2013.

(F) Quality aspects:

Data pertaining on nitrogen content (%) after harvesting from grain as presented in pooled data of wheat variety K-9465 (Mandakini) were recorded significantly maximum nitrogen content (2.3%) in comparison to control (water spray) 1.8%. The protein content were higher significantly in zinc sulphate (0.5%) + urea (2.0%) + thiourea (500 ppm) of 13.4% to control (water spray) of 10.49%, respectively. (Marlian *et al.*, 2009, Jyoti *et al.* 2013 and Sharma and Abrot 2007)

Table: Effect of zinc, urea and thiourea on growth, yield, economics and quality of wheat (*Triticum eastivum* L.).

Treatments	Growth attributes			Physiological aspect		Yield attributes					Yields		Economics		Qualities	
	Plant height (cm)	Tillers/ plant	Leaf area/ plant (cm ²)	Chlorophyll intensity (%)	RWC (%) 65-70 DAS	Mother shoot (cm)	Spiklets/ ear	Grains/ plant	Straw/ plant (g)	Test weight (g)	Yield (q/ha)	Grass income (Rs./ha)	Net return (Rs./ha)	Nitrogen (%)	Protein (%)	
Control (Water spray)	86.6	4.70	46.2	38.12	61.61	8.8	11.1	89	14.1	41.50	29.3	4390	4286	1.8	10.49	
Zinc sulphate	87.7	4.80	46.3	42.70	64.45	9.0	12.0	101	15.6	41.60	32.6	48.90	3891	2.2	12.82	
Urea	89.0	4.81	46.8	39.65	63.19	9.3	14.0	111	16.8	42.35	33.7	5050	4085	2.2	11.66	
Thiourea	87.9	4.83	47.8	39.04	64.60	9.7	13.0	119	17.0	42.50	34.6	5190	4250	1.9	11.07	
Zinc sulphate + urea	88.4	5.08	48.7	39.05	66.20	10.5	13.5	130	17.8	42.76	34.1	5260	4396	2.1	12.24	
Zinc sulphate + thiourea	91.2	5.50	52.2	39.47	66.22	10.9	15.5	148	18.1	43.50	36.0	5400	9750	2.0	11.66	
Thiourea + urea	91.8	5.10	52.6	41.59	68.23	11.2	16.5	170	24.3	43.60	37.6	5640	9740	2.1	12.24	
Zinc sulphate+urea+ thiourea	94.7	6.01	55.9	41.82	72.13	11.4	17.5	183	28.1	44.18	39.1	5860	9730	2.3	13.41	
SE (d)	1.1	0.56	3.87	0.56	1.09	0.3	0.90	3.0	0.50	0.50	1.05	-	-	0.10	0.80	
CD at 5%	2.3	NS	NS	1.37	2.59	1.1	0.20	6.5	1.08	1.21	2.79	-	-	0.30	1.40	

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