RESEARCH ARTICLE

Physiological Traits and Productivity of Wheat (*Triticumaestivum L.*) in Relation to Foliar Spray of Zinc, Urea, and Thiourea under Rainfed Condition

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10.18805/ag.A-4458

Abstract

Combined foliar application of Z_nSO_4 (0.5%) +urea (2%) + thiourea (500 ppm) twice at 45 and 65 days after sowing (DAS) under rainfed condition on widely evaluated two wheat varieties resulted in significantly higher plant height (cm), leaf area (cm^2), number of tillers, dry matter accumulation, chlorophyll content In leaf, yield and its component over water sprayed control as well as treatments. Among wheat varieties, K-9351 was found more responsive as it yielded (38.5 q/ha) then K-8027 (33.1 q/ha).

Keywords: Physiological traits, Productivity wheat, Thiourea foliar spray, Urea, Zinc.

Agricultural Science Digest (2019)

Introduction

Wheat (*Triticumaestivum* L.) is the second most important staple food crop of the world next to rice, both in area and production. Wheat is grown in India over an area of about 29.64 Mha with the production of 92.46 m tons with national productivity in about 3.12 tons/ha. A large potential for increasing wheat productivity lies in UP. It has about 10% of the wheat area under high yielding verities (22.5 q ha/ha) which is lower than Punjab (36.7 q/ ha) and Haryana (34.1 q/ ha). In India, widespread deficiency of micronutrients is no more uncommon, particularly in agricultural crops. Ever since the discovery of zinc as an essential plant nutrient (Maze, 1919). It is a fact that nutrients play an important role in different metabolic functions of the plant. Thus, protein, carbohydrates, and fat metabolism as also their analogous compounds are all influenced by deficiency or toxicity of zinc available to plant. It, therefore, becomes essential for normal healthy and normal plant growth and reproduction. Zinc is optimal proportion must be made available to plant for yield maximization through their active participation in a number of enzymes, either as an integral part of it or as a prosthetic group and cofactor help in normal production of different metabolites at the right time and the right place. Some important ones include carbonic anhydrate, alcohol dehydrogenase, D-lactic cytochrome, C-reductase and aldolase (Welch *et al*. 1982). Physiological and metabolic processes of the plant including photosynthesis adversely affected by water stress and terminal drought, the photosynthetic activity of leaves are hampered for want of nitrogen and the grain filling is affected. To stimulate the photosynthesis activity of leaves is the terminal drought-like situation, which is rampant in inception and vertisols of rainfed conditions the foliar nutrition with nitrogenous fertilizes is essential as roots fail to absorbed nitrogen from dry soil profile. Growth promotion under application of thiourea might be an account of increased photosynthetic efficiency as well as due to its positive impact on translocation of photosynthetic assimilates towards the active sink. Thiourea might have improved phloem loading of sucrose and hence translocation of photosynthate (Sahu and Singh, 1985).

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How to cite this article: Verma, C., B. (2019). Physiological Traits and Productivity of Wheat (*Triticumaestivum L.*) in Relation to Foliar Spray of Zinc, Urea, and Thiourea under Rainfed Condition. Agri Sci Diges, 39(2):124-127.

Source of support: Nil

Conflict of interest: None

Submitted: 15/06/2015 **Accepted:** 28/11/2016

Materials and Methods

The field experiments were conducted during *two rabi* seasons of 2010–2011 and 2011–2012 at crop research form block "A" Chandra Shekhar Azad University of Agriculture and Technology Kanpur, Uttar Pradesh, India under rainfed condition. The soils of experimental sites loam sand having pH 7.7 and 7.8, Ec 0.39 an 0.44 $^{DSM-1}$ and organic carbon 0.32% and 0.35% HClextractable zinc 1.5 ppm, respectively. The average maximum and minimum temperature of 29.9 and 19.7 and rainfall maximum and minimum 33.5 and 19.4 mm during the experimental periods. The treatments comprised eight combinations of concentration of zinc, urea and thiourea viz, T_{0-} control (water spray), T_{1-} Z_nSO_4 (0.5%), T_2 urea (2.0%), T_3 thiourea (500 ppm), $T_4Z_nSO_4$ (0.5%) +urea (2.0%), T_5-Z_nSO_4 (0.5%) + thiourea (500 ppm), T_6 urea (2%) +thiourea (500 ppm), $T_7Z_nSO_4$ (0.5%), +urea (2.0%) +thiourea (500 ppm) with widely accepted of wheat varieties viz, K-9351 and K-8027. All eight treatments were tried in a randomized block design with

three replications. A uniform dose of NPK 120:60:40 Kg/ha. Through diammonium phosphate was applied as basal to all treatment plots, half quantity of nitrogen should be supplied at the time of secondary and top dressing of urea. Sowing of seed 100 kg/ha should be done at pre irrigation during two years respectively uniforms 23 cm and plant to plant distance were maintained by Kudal. Spraying of zinc, urea, and thiourea at different concentrations as per treatment was done on plant foliage twice, i.e., 45–50 and 65–70 days after sowing in each year by using 800-liter solution/ha. The small amount of tepal was added to the solution as a wetting agent in a zinc sulfate solution. At harvest plant height (cm), a number of tillers/plant, leaf area /plant (cm^2) 60 DAS and 90 DAS, was measured during both the years by the method as described by Lazarove (1965). Ear length (cm), number of spikelets/ear were taken randomly. Test weight of 1000 grains weight (g), grain yield q/ha. Were calculated during both the years. Chlorophyll content mg/g of fresh weight in leaf was determined by using the method Arnon *et al*. (1949). Dry matter accumulation of plant pre- and post-anthesis was taken in the years of experimentation period. The climates of Kanpur is subtropical and semi-arid with mean pacification of about 33.5 and 19.4 mm rain and 29.9°C and 19.7°C maximum and minimum of temperatures' in the experimental times.

Results and discussion

Perusal of data presented in (Table 1) revealed that plant height (cm), tiller production and leaf area of both wheat varieties were significantly influenced by foliar spray (T_7) Z_nSO_4 (0.5%) + urea (2.0%) + thiourea (500 ppm) in both wheat varieties were significantly influenced by foliar spray of Z_nSO_4, urea and thiourea above or in combination as compared to water sprayed control. Among different treatment combined foliar spray (T_7) of Z_nSO_4 (0.5%) + urea (2%) +thiourea (500 ppm) under rainfed condition in both wheat varieties significantly increased the plant height, tiller production, leaf area, and chlorophyll content compared to other treatments and control. It might be because of more availability of applied nutrients due to the combined foliar spray of Z_nSO_4, urea, and thiourea, which exerted beneficial effects on vegetative growth of the plant. As regards wheat variety K-9351 appeared superior and proved more superior as it showed higher tiller number and leaf area at 60 and 90 DAS while K-8027 showed higher plant height. The interaction effect appeared nonsignificant. These results are in close conformity with the findings of (Pathak and Pandey, 2010).

A perusal of Table 2, regarding of dry matter/plant (g) parenthesis, post anthesis and harvest revealed that significantly proved that application of (T_7) treatment Z_nSO_4 (0.5%) + urea (2.0%) + thiourea (500 ppm) in both the years of wheat varieties. As regard wheat variety K 9351 appeared superior and proved more responsive as it showed higher tiller number and leaf area at 60 and 90 DAS while K8027 showed higher plant height. Dry matter production (g) per plant was significantly higher in compression to other treatment and water spread to control. The interaction effect was significantly higher pre-anthesis and post-anthesis. These results are also conformity by Sahu and Singh (1995). Table 3 results revealed that length of ear (cm), number of spikelet's per ear ,test weight (g) and grain yield quintal per hectare produced were higher treatment applied (T_7) @Z_nSO_4 (0.5%) + urea (2.0) + thiourea (500 ppm) both wheat verities were

Table1: Influence of zinc,urea and thiourea on plant height(cm), tiller production/plant and leaf area/plant(cm^2) of wheat (*Triticumaestivum* L.) under rai fed condition (pooled data of 2011–2012 and 2012–2013)

SN treatments	*Plant height (cm)*	*Tillers (No.)*	*Leaf area/plant*	
1. Factor A (varieties)			60	90
K-9351	80.5	5.4	318.2	312.4
K-8027	105.5	4.7	282.9	298.2
SE (diff)	1.7	0.2	2.4	1.7
CD	3.5	0.3	4.8	3.5
2.Factor B(nutrional booster)	90.2	4.4	263.3	283.4
Z_nSO_4 (0.5%)	90.9	4.6	281.6	295.5
Urea (2%)	94.2	4.8	272.1	289.8
Thiourea (500 ppm)	91.3	5.3	293.8	311.2
Z_nSO_4 (0.5%) + urea (2%)	93.4	5.1	284.2	300.5
Z_nSO_4 (0.5%) + thiourea (500 ppm)	93.2	5.2	367.8	312.1
Urea (2%) + thiourea (500 ppm)	94.1	5.3	306.4	320.1
Z_nSO_4 (0.5%) + urea (2%)+ thiourea (500 ppm)	96.8	5.4	333.4	328.9
SE (Diff)	1.0	0.3	3.2	3.5
CD	2.2	NS	NS	NS
Intraction effect	NS	NS	NS	NS

Table 2: Influence of zinc, urea and thiourea on drymatter/plant, preanthesis, postanthesis and harvest (g) of wheat *(Triticumaestivum* L.*)* under rain fed condition (pooled data of 2011–2012 and 2012–2013)

	Dry matters/ Plant (g)		
SN treatments	*Preanthesis*	*Postanthesis*	*Harvest*
1. Factor A (varieties)			
K-9351	11.4	13.9	16.8
K-8027	12.6	13.9	13.9
SE (diff)	0.1	0.1	0.1
CD	0.3	0.3	0.2
2. Factor B (nutrional booster) control	10.0	10.7	15.6
Z_nSO_4 (0.5%)	11.2	12.8	16.1
Urea (2%)	11.2	12.0	16.2
Thiourea (500 ppm)	12.1	14.1	16.4
Z_nSO_4 (0.5%) + urea (2%)	11.6	14.2	17.0
Z_nSO_4 (0.5%) + thiourea (500 ppm)	12.8	14.9	17.2
Urea (2%) + thiourea (500 ppm)	12.9	15.4	17.3
Z_nSO_4 (0.5%) + urea (2%)+ thiourea (500 ppm)	14.2	17.1	17.4
SE (Diff)	0.3	0.3	0.1
CD	0.6	0.6	0.2
Intraction effect Varities/nutritional booter	0.8	0.9	0.5

Table 3: Influence of zinc,urea and thiourea on length of ear (cm), spikelets no., test weight (g) and grain yield (q/ha) of wheat (*Triticumaestivum* L.) under rain fed condition (pooled data of 2011–2012 and 2012–2013)

SN treatments	*Length of ear (cm)*	*Spikelets No.*	*Test grain Wt. (g)*	*Yield (q/ha)*
1. Factor A (varieties)				
K-9351	10.1	15.7	38.1	35.0
K-8027	9.2	17.6	37.8	33.1
SE (diff)	1.3	1.7	0.1	7.6
CD	2.7	3.5	0.3	15.5
2. Factor B (nutrional booster) control	8.8	16.9	36.9	31.2
Z_nSO_4 (0.5%)	9.2	17.5	37.5	33.2
Urea (2%)	9.0	17.2	37.2	32.7
Thiourea (500 ppm)	9.9	18.1	38.7	33.7
Z_nSO_4 (0.5%) + urea (2%)	9.3	17.7	38.0	33.4
Z_nSO_4 (0.5%) + thiourea (500 ppm)	9.6	18.0	38.3	34.7
Urea (2%) + thiourea (500 ppm)	9.6	18.0	38.3	34.7
Z_nSO_4 (0.5%) + urea (2%)+ thiourea (500 ppm)	10.9	18.5	39.8	37.1
SE (Diff)	2.7	3.4	0.6	1.8
CD	5.5	7.0	1.2	3.0
Intraction effect Varities/nutrional booter	NS	NS	NS	NS

significantly influenced by foliar spray of these treatments in compression to water spray control. Variety K-9351 appeared superior as it showed higher grain yield quintal per hectare in comparison to verity K-8027. Interaction effect appeared non-significant. These results are also confirmatory by Sahuetal (1993). It is concluded that wheat variety K-9351 was more

productive with the treatment applied @Z_nSO_4 (0.5%) + urea (2.0%) + thiourea (500 ppm) grain yield.

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ISSN: 0976-0547 (Online), 0253-150X (Print), Naas Rating: 4.21