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EFFECT OF FOLIAR APPLICATION OF NPK AND ZINC SULPHATE ON PRODUCTIYITY AND ECONOMIC OF WHEAT (*TRITICUM AESTIVUM* L.) UNDER SANDY LOAM SOIL IN IRRIGATED CONDITION AT CHHINDWARA DISTRICT OF MADHYA PRADESH, INDIA

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Abstract

A study was conducted during *rabi* 20015 and 2016 at demonstration field of Krishi Vigyan Kendra, Chandangaon, Chhindwara district of Madhya Pradesh (India) to find out the "Effect of foliar application of N_2, P_2O_5, K_2O and zinc sulphate on productivity and economic of wheat (*Triticum aestivum* L.) under sandy loam soil in irrigated condition of chhindwara district of Madhya Pradesh". The study consist three treatments *i.e.* $\mathbf{T_1}$- Farmer practice (No use of foliar application), $\mathbf{T_2}$ - 50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg/ha at tillering and pre-flowering stage as foliar spray. $\mathbf{T_3}$ -50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg/ha and Zinc sulphate 10 kg/ha at per-flowering stage as foliar spray. The plant height is 97 cm during 2015, 2016 and mean value respectively in $\mathbf{T_3}$ after that $\mathbf{T_2}$ with 95.25, 97.25 and 96.25 cm and length of spike was significantly increased 9.47, 9.48 and 9.48 cm under $\mathbf{T_3}$ during the year 2015, 2016 and mean value as compared to farmers practices ($\mathbf{T_1}$) followed by $\mathbf{T_2}$ was recorded 9.01, 9.26 and 9.14, respectively. In respect number of grains/spike is significantly increased 57.88, 57.13 and 51.75/ spike in mean value data as compared to control treatment ($\mathbf{T_1}$). The weight of 1000 grains of wheat was significantly superior weight 42.45, 42.14 in mean data as compared to $\mathbf{T_2}$ was recorded 40.65g. The $\mathbf{T_3}$ was recorded significantly highest grain yield 58.38 q/ha (50% more) over farmers practices (39.94 qha) $\mathbf{T_1}$ also found significantly superior over rest of the $\mathbf{T_2}$ (53.88 q/ha) in mean value of two years data. Similarly, straw yield of wheat was also recorded significantly superior in the treatment $\mathbf{T_3}$ by the tune of 88.82 q/ha over $\mathbf{T_2}$ and $\mathbf{T_1}$ with 86.25 and 73.00 q/ha, respectively. However, during 2015 and 2016 being found statically superior with 83.63 and 94.00 q/ha in $\mathbf{T_3}$ as compared to $\mathbf{T_2}$ straw yield 80.50 and 92.00 q/ha also $\mathbf{T_1}$ straw yield 72.00 and 74.00 q/ha. The highest cost of cultivation was found Rs 24644/ha in $\mathbf{T_3}$ as compared to $\mathbf{T_2}$ Rs. 24230/ha and 21540/ha $\mathbf{T_1}$. The highest gross return monetary return was found Rs. 115603/ha in $\mathbf{T_3}$ followed by Rs. 107763/ha in $\mathbf{T_2}$ over Rs. 82152/ha in farmers practices $\mathbf{T_1}$ as per mean data. The mean value of net return of two year was recorded the highest Rs. 109442/ha in $\mathbf{T_1}$ followed by Rs. 101706/ha in $\mathbf{T_2}$ as compared with farmers practices ($\mathbf{T_1}$) Rs. 76767/ha. Same as highest B : C ratio was 4.69 $\mathbf{T_1}$ followed by 4.45 $\mathbf{T_2}$ as compared with farmers practices ($\mathbf{T_1}$) as per tow year mean data.

Key words : Wheat production, wheat economic, farmer practices, wheat (*Triticum aestivum* L.).

Introduction

Wheat (*Triticum aestivum* L.) is an important staple cereal in India both from the point of view of grass hectarage cultivated and grain production, after successful story of green revaluation the country has made an impressive progress in enhancing productivity of wheat in India during 1964-65, but wheat demands in India is increasing continuously due to ever increasing population day by day. To meet wheat demand there is an urgent need to increase the production and productivity of the wheat. Wheat yield can also be increased by high yielding variety, disease and lodging resistant variety; synchronized tillering, irrigation facility and use of need based amount of macro and micro nutrients either as soil or foliar application. The foliar application of the micro nutrients is more effective then soil application (Sahu and Singh, 1995 & Narang *et al*., 1977). Zinc is also involved in various metabolic activities of plant such as

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photosynthesis, respiration and assimilation of organic compound to sink. The efficacy of such type element is improved when, it is used in combination with other elements like N & K (Rajput *et al*., 1995 and Fathi *at al*., 1990).

With increasing population growth and diminishing water availability Indian agriculture facing servers challenge to produce more food per unit of land and water. Use of high yielding varieties and increasing cropping intensity with growing of wheat year after year has resulted in depletion of macro and micro nutrient like nitrogen, phosphorus, potash and zinc sulphate respectively, resulting declining or stagnation productivity of wheat due to unfavorable climate condition especially temperature during seedling to tillering. For sustainability agriculture, it is imperative to renewable inputs which can maximize the ecological benefits and minimizing the environmental hazards. One possible way of achieving this is to decreased dependence on use of macro nutrients by foliar application of NPK and Zinc sulphate which helps in better transportation mechanism in the plants phloem and increasing the yield potential of wheat. The mineral fertilizer application went so high that in has shown its ill effect like soil fertility degradation adverse effect on soil physical properties, over exploitation of natural resources ground water pollution and eutrophication. Soil have not only became hungry for major plant nutrient (nitrogen, phosphorus & potash), but are also showing deficiency symptoms of base elements like zinc, manganese and ferrous.

Materials and Methods

The study was conducted during *rabi* 2014-15 and 2015-16 at demonstration field of Krishi Vigyan Kendra, Chandangaon, Chhindwara district of Madhya Pradesh (India). Soils of the experimental sites were sandy to sandy loam in texture, neutral (pH 7.5) in reaction, low in nitrogen and phosphorus and medium in potassium status. The study consist three treatments *i.e*. $\mathbf{T_1}$- Farmer practice (No use of foliar application), $\mathbf{T_2}$- 50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg/ha at tillering and pre-flowering stage as foliar spray. $\mathbf{T_3}$ - 50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg/ha and Zinc sulphate 10 kg/ha at per-flowering stage as foliar spray. The above three treatment were replicated 4 times in the each year in Randomized Block Design. The variety GW-322 was grown in second week of November in both years, the crop was irrigated at critical growth stages during both the years of experiments. The crop was raised with the recommended dose fertilizer (RDF) of major nutrients and zinc sulphate in demonstrated plots *i.e* 100, 60 and 40, N_2, P_2O_5 and K_2O kg/ha, respectively. The supplied of 50 % dose nutrients as basal application. The weed control was done by 2,4-D spray at 25 days after sowing. The crop was harvested in the second week of April in both the years of investigation. The harvesting and threshing was done in treatment wise separately. The observation of yield attributing parameters, yield and economic assessment like ear length, number of grains/ ear, test weight, grain and straw yield were recorded treatment and replication wise at every plots and then statistical analysis for the test of significant were done. Observation of five competitive plants at maturity stage from each treatment and replication were randomly selected, average of these plants in respect of different like plant characters plant height, length spikes, number of grains/spike and test weight was taken. The length of spike excluding awns were recorded in centimeter, the spike of plants were threshed by hands and the number of grain/ear were counted, 1000 grains were counted and weighted for test weight and recorded. After separate threshing of different treatment the grain and straw yield was recorded and then converted into q/ha for further statistical analysis.

The economics was calculated by simple mathematical formula. The cost of cultivation included all the expenditure. Right from land preparation, cost of irrigation cost of inputs cost of treatments with spray cost and other experiments. Gross return was calculated by multiplying of produce to prevailing market price. B: C ratio was calculated as gross return divided by cost of cultivation additional cost was calculated as additional amounts spends to treatments given and additional return was calculated as different between net return of control & net return of treatments.

Results and Discussion

Yield attributes parameters

The experiment represented data of yield attributing parameters wheat in table 1, revealed that the plant height are increased at maturity stage by all two treatment as compared to control. Significantly the increased plant height (cm) was recorded in treatment $\mathbf{T_3}$ -50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg/ha and Zinc sulphate 10 kg/ha at per-flowering stage. The plant height is 97 cm during 2015, 2016 and mean value respectively in $\mathbf{T_3}$, after that $\mathbf{T_2}$ with 95.25, 97.25 and 96.25 cm and length of spike was significantly increased 9.47, 9.48 and 9.48 cm under $\mathbf{T_3}$ during the year 2015, 2016 and mean value as compared to farmers practices ($\mathbf{T_1}$) followed by $\mathbf{T_2}$ was recorded 9.01, 9.26 and 9.14, respectively. In respect number of grains/spike is significantly increased 57.88,

Table 1 : Effect of N_2, P_2O_5, K_2O and zinc sulphate foliar spray on yield attributing of wheat.

Treatments	Plant height (cm)			Length of spikes (cm)			No. of grain/spike			Test weight (g)		
	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean
T_1- Farmer practice (No use of foliar application)	88.75	85.75	**87.25**	7.87	7.88	**7.88**	51.75	51.75	**51.75**	41.01	40.22	**40.65**
T_2- 50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg /ha at tillering and pre-flowering stage as foliar spray.	95.25	97.25	**96.25**	9.01	9.26	**9.14**	56.00	58.25	**57.13**	42.45	41.84	**42.15**
T_3 -50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg /ha and Zinc sulphate 10 kg/ha at per-flowering stage as foliar spray	97.00	97.00	**97.00**	9.47	9.48	**9.48**	58.50	57.25	**57.88**	42.60	42.30	**42.45**
S. Em. ±	0.85	0.83	**0.84**	0.1	0.11	**0.105**	0.62	0.47	**0.55**	0.18	0.29	**0.24**
CD 5%	2.44	2.4	**2.42**	0.3	0.32	**0.31**	1.8	1.37	**1.59**	0.52	0.85	**0.68**

Table 2 : Effect of N_2, P_2O_5, K_2O and zinc sulphate foliar spray on yield of wheat.

Treatments	Grain Yield (q/ha)			Straw yield (q/ha)		
	2015	2016	Mean	2015	2016	Mean
T_1- Farmer practice (No use of foliar application)	40.13	39.75	**39.94**	72.00	74.00	**73.00**
T_2- 50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg/ha at tillering and pre-flowering stage as foliar spray.	50.75	57.00	**53.88**	80.50	92.00	**86.25**
T_3 -50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg/ha and Zinc sulphate 10 kg /ha at per-flowering stage as foliar spray	57.00	59.75	**58.38**	83.63	94.00	**88.82**
S. Em. ±	**0.80**	**1.32**	**1.06**	**1.96**	**1.32**	**1.64**
CD 5%	**2.31**	**3.83**	**3.07**	**5.65**	**3.82**	**4.735**

57.13 and 51.75/spike in mean value data as compared to control treatment (T_1). In respect number of grains/ spike is increased as compared to control treatment (T_1) 51.75 in each years and mean data. The significantly increased of number grains 57.88 and 57.13/spike in pooled data in (T_3) and (T_2), respectively. The number of grains was recorded 58.50 and 57.25/spike in T_3 and 56.00 and 58.25/spike in which T_2 during 2015 and 2016, respectively. The weight of 1000 grains of wheat during 2015, 2016 and mean was significantly superior weight 42.60, 42.30 and 42.45 g. in T_3 and 42.45, 41.84 and 42.15 in T_2 (50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg/ha at tillering and pre-flowering stage as foliar spray in the year 2015 and 2016 respectively, as compared to control plots T_1 was lower test weight 1000 grain 41.01, 40.22 and 40.65 during 2015, 2016 and mean value, respectively. The spray of N_2, P_2O_5 and K_2O and 0.5% Zinc sulphate at pre-flowering stage has a favourable impact on source and sink. Better translocation of assimilation from source to sink is one of the possible reasons for increasing the yield attributes of wheat crop resulting in increased plant height, length of spikes, number of grains/spike and test weight of wheat Similar resulted were also recorded by Sahu and Singh (1995) with the application of (2% N_2, P_2O_5, and K_2O and 0.5% Zinc sulphate at pre-flowering stage).

Dayanand *et al*. (2013) also recorded significantly higher yield attributing of wheat like plant height grains per spike and test weight with (2% N_2, P_2O_5, and K_2O and 0.5% Zinc sulphate at pre-flowering stage). Gul *et al*. (2011) recorded two time spray of 0.5% zinc solution on wheat was higher influenced in plant height, no of tillers and other yield attributing characters.

Table 3 : Effect of N_2, P_2O_5, K_2O and zinc sulphate foliar spray on Economics of wheat.

Treatments	Cost of cultivation			Gross monitory returns			Net the monitor year returns			B:C ratio		
	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean	2015	2016	Mean
T_1- Farmer practice (No use of foliar application)	21540	21540	**21540**	82204	82100	**82152**	76819	76715	**76767**	3.82	3.81	**3.815**
T_2- 50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg /ha at tillering and pre-flowering stage as foliar spray.	24230	24230	**24230**	101325	114200	**107763**	95268	108143	**101706**	4.18	4.72	**4.45**
T_3-50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg /ha and Zinc sulphate 10 kg/ha at per-flowering stage as foliar spray	24644	24644	**24644**	112106	119100	**115603**	105945	112939	**109442**	4.55	4.83	**4.69**
S Em±	NA	NA	**NA**	1424	1993	1708.5	3588	3175	3381.5	0.06	0.08	0.07
CD 5%	NA	NA	**NA**	4113	5756	4934.5	10364	9171	9767.5	0.17	0.24	0.205

Productivity

Yield

Date revealed that in table 2, despite that treatment T_3 was recorded significantly highest grain yield 58.38 q/ha (50% more) over farmers practices (39.94 qha) T_1 also found significantly superior over rest of the T_2 (53.88 q/ha) in mean value. During the year 2015 Treatment T_3 was found significantly superior with 57.00 q/ha over T_2 grain yield 50.75q/ha and farmer practices (T_1). In which during the year 2016 was found 59.75 q/ha significantly superior T_3 as compared T_2 grain yield 57.00 q/ha and 39.75 q/ha in T_1. Similarly straw yield of wheat was also recorded significantly superior in the treatment T_3 by the tune of 88.82 q/ha over T_2 and T_1 with 86.25 and 73.00 q/ha, respectively. However, during 2015 and 2016 being found statically superior with 83.63 and 94.00 q/ha in T_3 as compared to T_2 straw yield 80.50 and 92.00 q/ha also T_1 straw yield 72.00 and 74.00 q/ha.

Dayanand *et al*. (2013) also recorded 5.7, 10.4 and 12.7% higher grain yield over control with tow foliar spray of 500 ppm thiourea, 0.5% zinc sulphate and + 500 ppm, thiourea + 0.2 zinc sulphate (mixed solutioin) spray at tillering and grain initation stage. Sahu and Singh (1995) also found similar result that thiourea spray at both tillering and flowering increased the grain yield, biological yield and harvest index. Grain yield increased by 23.9% over control.

Economic

Data in table 3 revealed that highest cost of cultivation was found Rs. 24644/ha in T_3 as compared to Rs. 24230/ha T_2 and 21540/ha T_1. The highest gross return monetary return was found Rs. 115603/ha in T_3 followed by Rs. 107763/ha in T_2 over Rs 82152/ha in farmers practices T_1 as per mean data. The mean value of net return of two year was recorded the highest Rs. 109442/ha in T_1 followed by Rs. 101706/ha in T_2 as compared with farmers practices (T_1) Rs. 76767/ha. Same as highest B: C ratio was 4.69 T_1 followed by 4.45 T_2 as compared with farmers practices (T_1) as per two year mean data.

Conclusion

The present results on the productivity of wheat in different foliar spray of soluble fertilizer to be concluded that the treatment combination T_3 -50% of RDF, N 50, P_2O_5 30 and K_2O -20 kg/ha and Zinc sulphate 10 kg/ha at per-flowering stage as foliar spray was highest profitable combination interm of higher gross monetary returns Rs. 115603/ha, net monetary returns Rs. 109442/ha as well as higher B : C ratio 4.69 with significantly effect as compared to farmers practices.

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