Original Research Article

Zinc and Sulphur recommendations *over* farmer practices for bridging technological gap in paddy crop in Central India

Abstract

Front line demonstrations were conducted at farmer's fields of tribal villages of Jabalpur (7 No.) and Mandla (6 No.) districts during *kharif* 2012 and 2013, respectively. Results revealed that the application of 5 kg Zn+RD significantly increased the grain yield (4.53 and 4.70 t ha^{-1}) zinc content in grain (13.18 and 12.97 $mgkg^{-1}$) and total Zn uptake and post harvest available Zn over farmer's practices or RD during both the years. While, the S content in grain and straw of rice, their total S uptake and post harvest available S increased significantly with the application of 40 kg S+RD and 5 kg Zn+40 kg S ha^{-1}+RD over farmers practice/ RD/5 kg Zn ha^{-1}+ RD during both the years.

With the application of 5 kg Zn+40 kg S ha^{-1}+RD, the extension gap was maximum (0.93 and 1.12 t ha^{-1}) while, the lowest technology gap (0.47 and 0.30) and technology index (9.4 and 6.0%). The performance of technology emphasizing the need to organize *Kisan* school in deficient sites of study area for the acceptance of (5 kg Zn +RD) improved technologies to bridge the wide extension gap.

Keywords: **Yield, Zinc, Sulphur, Technological gaps, Extension gap, Technological index**

1.0 Introduction

Rice (*Oryza sativa* L.) plays an important role in the national economy as it is considered as the staple food for most of the people of our country. In India, it is cultivated in 44.6 million hectares with a total production of 96 million tonnes (Chowdhury et al., 2014). In Madhya Pradesh, rice is cultivated in an area of 1.93 million ha with production of 2.78 million tonnes and productivity of 1.44 tonnes ha^{-1} (Verma et al., 2015). Productivity of rice in the farmer's field is far lower than the potential yields of improved rice varieties due to lack of production technology adopted by the farmer's such as use of recommended dose of major and minor nutrients and irrigation etc. Optimum utilization of production factors increased the yield (Seema et al., 2014 and Mallikarjuna et al., 2014). The present production level needs to be increased up to 120 million tonnes by the year 2020 (Sujathamma et al., 2015). To increase the productivity level and quality of rice at farmer's field with the use of recommended dose of major and minor nutrients in improved rice variety to feed the burgeoning population by conducting frontline demonstrations at farmer's field with an objective to increase the productivity of rice through popularization of improved production technologies and to find out the extension gap, technology gap and technology index.

2.0 Material and methods

2.1 Location of experiment:

The seven front line demonstrations at Kundam block (4 Pipariya,1 Pitkuhi and 2 Tilsani village) of Jabalpur district on rice were conducted during 2012. Six demonstrations were conducted in 2013 in the farmers' fields of tribal villages (Bhaiswahi, Baja, Boriya, Barbaspur, Kudamali and Podi) of Mandla district. These 13 farmers were selected from group meeting of farmers and imparted specific skill training in different aspects of cultivation. For the frontline demonstration, an area of 0.5 ha was covered with plot size of 100 sqm. The necessary steps for selection of site, farmers and layout of demonstration etc were followed as suggested by Choudhary (1999).

2.2 Soil analysis

The initial soil samples were collected from all the 13 fields and determined pH and electrical conductivity (Black 1965), organic carbon (Walkley and Black 1934), available N (Subbiah and Asija 1956), P (Whatanble and Olsen 1965), K (Black, 1965),S (Williams and Steinbergs,1959) and zinc (Lindsay and Norvell 1978).

2.3 Soil characteristics:

Tribal villages of Kundam Jabalpur: The soil types in study area was loamy skeletal, hyperthermic kaolinitic lithic ustorthents-typic ustochrepts.

(i) Pipariya: The soil samples having pH 6.48, 6.81, 6.28 and 6.70; EC 0.06,0.10,0.07 and 0.14 dS m^{-1};OC 4.8,10.3,6.0 and 5.6 gkg^{-1};available N 289, 451, 302 and 213, available P of 13.82, 25.5, 17.71 and 9.93, the available K of 334,238,163 and 216; 0.15% $CaCl_2$ extractable S 15,18.32, 6.25 and 6.0 and available Zn 0.55,0.40,0.42 and 0.42 in the fields of Shri Vijay Ku Yadav,Shri Govind,Shri Jaganath and Shri Surendra Kumar Yadav, respectively.

(ii) Pitkuhi: The soil samples of village having the pH 7.57, EC 0.10 dS m^{-1}, OC 6.3 g kg^{-1}, available N 314 kg ha^{-1}, P 24.18 kg ha^{-1} and K 222 kg ha^{-1} , S (0.15% $CaCl_2$) 9.20 mg kg^{-1} available Zn 0.44 $mgkg^{-1}$ in field of Shri Madan Paraste.

(ii) Tilsani :The soil samples having pH 6.8 and 6.73, EC 0.11and 0.09 dS m^{-1}, OC 5.5 and 4.8 gkg^{-1}, available N 208 and 326 kg ha^{-1}, P 12.78 kg ha^{-1} and 12.96 kg ha^{-1} , K 302 and 127 kg ha^{-1} and S (0.15% $CaCl_2$) 10.30 and 15.60 $mgkg^{-1}$ and available Zn 0.30 and 0.56 $mgkg^{-1}$ in fields of Shri Patiram Bhavedi and Shri Rakesh Singh Bhavedi, respectively.

Tribal villages of Mandla district: The soil types of was loamy mixed hyperthermic, typic ustochrepts - lithic ustorthents. The soil samples having pH 7.6, 6.9, 6.8, 7.4, 7.5 and 7.7, EC 0.13,0.15,0.16,0.15,0.09 and 0.12 dSm^{-1};OC 5.0,4.8,5.8,6.1,5.0 and 4.7gkg^{-1}; available N 200, 220,240,258,239 and 226 kg ha^{-1} ; available P 11.08,10.33,15.8,18.06,13.0 and 12.96 kg ha^{-1} ; K 302,350,250, 290, 200and 227 kg ha^{-1} available S 8.65,10.12,6.52,12.30,15.46 and 7.52$mgkg^{-1}$; available Zn 0.53, 0.30,0.26, 0.52, 0.57 and 0.39 $mgkg^{-1}$ in the field of Shri Vimal kumar Yadav (Bhaiswahi) Shri Ramesh Dhurve (Baja) Shri Umakant Maravi (Boriya) Shri Jagjivanram (Barbaspur) Shri Puran Lal (Kudhamaili) and Shri Jaggu Lal (Podi), respectively.

2.4 Crop management

The paddy variety, IR-36 was transplanted during 1st to 10 July. The recommended dose of nutrients 50% N and full dose of (P, K, S and Zn) were applied at the time of sowing as per the treatment. Remaining 50% of N was applied at maximum tillering stage. Irrigations were applied at different growth stages. The crop was harvested at maturity. At maturity, the plant samples were collected from each treatment of all the 13 demonstrations.

2.5 Plant analysis

The plant samples were washed with 0.1 N HCl and then with demineralized water and dried in oven at 65 ˚C for 6 hours. The dried grain and straw samples were grounded with stainless steel blade and sieved. These plant samples were analyzed for S content by turbidimetric method (Chesnin and Yien 1951); Zn by digesting with HF and $HClO_4$ acid and analyzed on atomic absorption spectrophotometer(AAS).

2.6 Gaps calculation:

The extension gap, technology gap and technology index were estimated using the following formulae as suggested by Samui et al., 2000.

Technology gap = Potential yield-Demonstration yield;

Extension gap= Demonstration yield- Farmers yield and

Technology index =Potential yield-Demonstration yield/Potential yield X100.

2.7 Statistical analysis

The experimental data's were analyzed considering no of farmers as replication as per the procedure outlined by Gomez and Gomez (1984). The critical difference was worked out at five percent probability level for significant results.

3.0 Results and discussion

3.1 Yield response

Data presented in Table-1 showed that the application of recommended dose of fertilizer (RD i.e. 120 N, 60 P_2O_5 and 40 K_2O kg ha^{-1}), 5 kg Zn+RD, 40 kg S+ RD and combined application of 5kg Zn ha^{-1}+40 kg S ha^{-1}+RD significantly increased the grain and straw yield of rice over farmer practices (32 N,23 P_2O_5, 0 K_2O kg ha^{-1}) during both the years. However, the application of 5 kg Zn+RD, 40 kg S+RD and 5kg Zn ha^{-1}+40 kg S ha^{-1} +RD were found significantly superior to RD for grain and straw yield during both the years except 40 kg S ha^{-1}+RD for grain and straw yield and 5 kg Zn ha^{-1}+40 kg S ha^{-1}+RD for straw yield during 2012 but the difference between 5 kg Zn+ RD and 5 kg Zn ha^{-1}+40 kg S ha^{-1} +RD was found no significant for grain yield during both the years.

The grain and straw yield with 5 kg Zn ha^{-1}+RD was found significantly higher than 40 kg S +RD during 2012 but not during 2013. It might be due to higher response to Zn application than S as the 100% soils were deficient in Zn. Though the maximum grain yield of rice 4.53 t ha^{-1} and 4.7 t ha^{-1} were observed with 5kg Zn ha^{-1}+40 kg S ha^{-1} +RD during 2012 and 2013, respectively but it was on par with 5 kg Zn+RD. The highest grain yield with combined application of 5kg Zn ha^{-1}+40 kg S ha^{-1} +RD might be due to synergistic effect of Zn and S on grain yield. The grain and straw yield with 40 kg S ha^{-1} +RD was found non significant over RD for grain and straw yield during 2012. It might be due to only 43% soils were deficient in available S. However, the application of 5 kg Zn ha^{-1}+40 kg S ha^{-1} +RD was found significantly superior to 40 kg S ha^{-1} +RD for straw yield during 2012 but it was non significant with 5 kg Zn ha^{-1}+RD.

The results clearly indicated the application of Zn and S increased the rice yield over the RD due to beneficial effect of Zn and S on balanced nutrition in deficient condition enhanced the yield of rice. The optimum utilization of all the production factors accelerates photosynthesis resulting in better yield (Seema et al., 2014; Mallikarjuna et al., 2014). Significant increase of grain and straw yield of rice with Zn application also reported by Kulhare et al., 2014a, 2014b and 2016. The increase of rice yield with S application was reported by Singh 2008 and Tandon 2011.

3.2 Zinc content, uptake by rice and post harvest available Zn

The application of 5 kg Zn+RD and 5kg Zn ha^{-1}+40 kg S ha^{-1} +RD significantly increased the Zn content in rice grain and Zn uptake by grain, straw and total Zn uptake over farmer's practices or RD during both the years but the Zn uptake between the two treatments was found non-significant. However, the application of 5 kg Zn+RD and 5kg Zn ha^{-1}+ 40 kg

S ha^{-1} +RD were found significantly superior to 40 kg S ha^{-1} +RD for Zn content in grain and straw during both the years. The application of 40 kg S ha^{-1} + RD showed significantly higher Zn content in grain than RD during 2012 but it was found on par for Zn content in grain and straw during 2013. However, the Zn uptake by grain, straw and total Zn uptake by rice were found significant with application of 40 kg S ha^{-1}+RD over farmers practices during both the years except the Zn uptake by grain during 2013. The significant increase of Zn content in grain and straw of rice with the Zn application might be due to increase of Zn availability in soil resulted higher Zn uptake than farmers practice. The increase of Zn content and uptake by rice and post harvest available Zn with Zn application were reported by Kulhare et al., 2014a, 2014b and 2016 and Sharma et al., 2015.

The post harvest available Zn content significantly increased with the application of 5kg Zn ha^{-1} +RD and 5 kg Zn +40 kg S ha^{-1}+RD over farmers practices or RD or 40 kg S +RD during both the years. It might be due to increase of available Zn in soil due to application of Zn. The increase of post harvest available Zn with Zn application was reported by Kulhare et al., 2014a, 2014b and Sharma et al., 2015.

3.3 Sulphur content, uptake by rice and post harvest available S

Data given in Table 2 showed that the application of 40 kg S+RD and 5kg Zn ha^{-1} + 40 kg S+RD significantly increased the S content in grain and straw of rice over farmer practice/ RD/5 kg Zn ha^{-1}+ RD during both the years but the difference between the two treatment was found non-significant. The application of RD, 5 kg Zn+RD, 40 kg S ha^{-1} +RD and 5kg Zn ha^{-1}+40 kg S ha^{-1} +RD significantly increased the S uptake by grain, straw and total S uptake over farmer's practice during both the years but the difference between RD and 5kg Zn ha^{-1}+RD was found non significant for S uptake by straw during 2012 and S uptake by grain, straw and total S uptake during 2013. The S content in grain and straw and their uptake by rice with 40 kg S+RD and 5 kg Zn+40 kg S+RD were found significant over RD. The application of 40 kg S+RD and 5 kg Zn+40 kg S+RD significantly increased the sulphur content in grain and straw of rice and after harvest available S in post harvest soil over farmer's practice/RD/5 kg Zn+RD. The increase of S content in grain and straw of rice with S application might be due to beneficial effect of S in increasing S availability in S deficient soils. The increase of S content in grain and straw of rice with S application was reported by Singh et al., 2013, Kour et al., 2014 and Prasad, 2014. The increase of S uptake and post harvest available S with Zn application was also reported by Tandon 2011 and Sharma et al., 2015.

3.4 Performance of technology:

The data presented in Table 3 indicated that the application of RD, 5 kg Zn+RD, 40 kg S ha^{-1} +RD and 5kg Zn ha^{-1}+40 kg S ha^{-1}+RD showed the extension gap of 0.55, 0.91, 0.64 and 0.93 t ha^{-1} during 2012 and 0.57, 0.90, 0.84 and 1.12 t ha^{-1} during 2013, respectively. The trend of extension gap increased with the advancement of technology over farmer's practices at Jabalpur and Mandla districts, emphasizing the need to organize Kisan School for the adoption of improved agricultural production technologies to reverse the trend of wide extension gap. The technology gap of 1.40, 0.85,0.49,0.76, and 0.47 t ha^{-1} during *Kharif* 2012 and 1.42,0.85,0.52,0.58 and 0.30 t ha^{-1} during 2013 were found with farmers practice, RD, 5 kg Zn+RD, 40 kg S ha^{-1} +RD and 5kg Zn ha^{-1}+40 kg S ha^{-1}+RD, respectively. The trend of technology gap showed the need of farmer's cooperation to carry out such demonstrations with encouraging results in future. The technology gap observed may be attributed to the dissimilarity in soil fertility status. Similar findings were recorded by Mitra et al., 2010.

The technology index of 28.0, 17.0, 9.8, 15.20 and 9.4% during 2012 and 28.4, 17.0, 10.4, 11.6 and 6% during 2013 were observed with the farmers practice, RD, 5 kg Zn+ RD, 40 kg S ha^{-1} +RD and 5kg Zn ha^{-1}+40 kg S ha^{-1}+RD, respectively. The technology index showed the feasibility of the evolved technology in the farmer's fields. Lower the value of technology index means higher the feasibility of technology (Mitra et al., 2014).

4.0 Conclusions

From the above findings, it can be concluded that the balance nutrient application i.e. 5 kg Zn +RD gave the significantly higher grain yield, zinc content in grain and straw and their Zn uptake and post harvest available Zn in soil. The performance of technology emphasizing the need to organize *Kisan* school in deficient sites of Jabalpur and Mandla districts for the acceptance of improved technologies to bridge the wide extension gap.

References

1. Black C.A. 1965. Methods of soil analysis Part 1 Am. Soc. Agron. Inc. Publi. Madison Wisconsin USA.p.920 and 936.
2. Chesnin, L. and Yien, C.H. 1951. Turbidimetric determination of available sulphates. Soil Science Society of America Proceedings 15, 149-151.
3. Choudhary, B. N. 1999. Krishi Vigyan Kendra - A guide for KVK managers. Division of Agricultural Extension, ICAR, pp.73-78.
4. Chowdhury, Md. Riton, K., Vinod sattar, A. and Brahmachari, K. 2014. Studies on the water use efficiency and nutrient uptake by rice under system of intensification. The Bioscan, 9(1): 85-88

5. Gomez, K. A., & Gomez, A. A. 1984. *Statistical procedures for agricultural research*. 2nd Edn. John Wiley & Sons Inc., NewYork, p-680.
6. Jackson, M.L.1973. Soil chemical analysis. Prentice Hall of India. New Delhi, p.498.
7. Kour, Sarabdeep, Arora Sanjay, Jalali, V. K. Bali A. S. & Gupta M. 2014. Direct and residual effect of sulphur fertilization on yield, uptake and use efficiency in Indian mustard and succeeding rice crop. Journal of Plant Nutrition, 37:14:2291-2301.
8. Kulhare, P.S., Tagore G.S. and Sharma G.D. 2016. Effect of zinc fertilization on yield and zinc uptake efficiency of rice genotypes grown in central India. International J. of Agriculture Sciences, 8(2):964-967.
9. Kulhare, P.S. Sharma G.D., Sharma B.L. and Khamparia, R.S. 2014b. Direct and residual effect of FYM and Zn levels on yield, Zn uptake and available Zn in rice –wheat sequence on a Vertisol. Journal of the Indian Society of Soil Science, 62(4):391-396.
10. Kulhare, P.S.Sharma G.D. Sharma B.L. and Khamparia, R.S. 2014a. Direct and residual effect of zinc and organic manures on yield, Zn content and uptake in a rice (*Oryza sativa*)-wheat (*Triticum aestivum*) sequence in a Vertisol. Journal of the Indian Society of Soil Science, 62(3):274-279.
11. Lindsay, W.L and Norvell W.A. 1978. Development of a DTPA soil test for Zn, Fe, Mn and Cu. Soil Sci. Soc. Am. J., 42: 421-428.
12. Mallikarjuna, Channabasavanna A. S., SudheendraSaunshi and Sharinivas C. S. 2014. Effect of herbicides on weed control and yield of wet seeded rice (*Oryza sativa* L.). The Bioscan. 9(2): 581-583.
13. Mitra, B. and Samajar, T. 2010. Yield gap analysis of rapeseed-mustard through front line demonstration. Agric. Exten. Review, April-June, pp.16-17.
14. Mitra, B. Mookherjee, S. and Biswas, S. 2014. Promotion of short duration rice variety Gotra Bidhan-1(IET 17430) through frontline demonstrations in terai region of West Bengal. J. Crop and Weed 10(1): 111-114.
15. Muthukumararaja, T. M., and Sriramachandrasekharan, M. V. 2012. Effect of zinc on yield, zinc nutrition and zinc use efficiency of lowland rice. Journal of Agril. Tech., 8, 551-561.
16. Prasad, R 2014. Major sulphur compounds in plants and their role in human Nutrition and health – An Overview. Proc Indian Natn Sci Acad 80 No. 5 December 2014 pp. 1045-1054
17. Samui, S. K., Maitra, S., Roy, D. K., Mandal, A. K. and Saha, D. 2000. Evaluation of front line demonstration on groundnut. J. Indian Soc. Coastal Agric. Res., 18 (2): 180-183.
18. Seema, Maya Krishna and Thoi Thoi Devi, M. 2014. Effect of nitrogen and weed management on nutrient uptake by weeds under direct seeded aerobic rice. The Bioscan. 9(2): 535-537.
19. Sharma, G.D., Thakur R.K., Chauhan N., Sharma B.L. and Tiwari D.K. 2015. Effect of INM on yield, nutrient uptake, protein content and economic performance of rice (*Oryza sativa*) and soil fertility in a Vertisol. Green Farming, 6(1):50-54.
20. Singh, M.V. 2008. All India Coordinated Research Project on Micro and Secondary nutrients and pollutant Elements in Soils and Plants. Progress Report 2005-2007.Indian Indsitute of Soil Science Nabibagh, Berasiya Road Bhopal. pp 49.
21. Singh, A K, Meena, M K Bharati, R C and Gade R M 2013. Effect of sulphur and zinc management on yield, nutrient uptake, changes in soil fertility and economics in rice (*Oryza sativa*)–lentil (*Lens culinaris*) cropping system. The Indian Journal of Agricultural Sciences, 83 (3):344-348.
22. Subbiah, B. V. and Asija G. L. 1956. A rapid procedure for the determination of available nitrogen in soils. Curr. Sci., 25: 259-260.
23. Sujathamma, P., Reddy Dharma K. and Usha Rani G. 2015.Yield gap analysis of rice for technological intervention. The Ecoscan, 9(2): 235-237.
24. Tandon, H.L.S. 2011. Sulphur in soils crops and fertilizers. Fertilizers development and consultation organization, New Delhi, India. p 52 and 61.

25. Verma, P. 2015. Soil properties, yield and nutrients uptake by rice as influenced by Integrated Nutrient Management (INM) in a Vertisol. Thesis, JNKVV, Jabalpur pp-4.
26. Walkley, A. and Black, I. A., 1934. An examination of Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. Soil Sci., 37, 29–38.
27. Watanabe, F.S. and Olsen, S.R. 1965.Test of an ascorbic acid method for determining phosphorus in water and $NaHCO_3$ extracts from soil. Soil Science Society of America Proceedings, 29: 677 – 678.
28. Williams, C.H. and Steinberg, A. 1959. Soil sulphur fractions as chemical indices of available sulphur in some Australian soils. Australian Journal of Agricultural Research 10, 340 - 352.

Table 1 Effect of Zn and S on yield, Zn content and uptake by paddy and post Zn status in soils of Jabalpur and Mandla district

Treatment	Yield ($t\ ha^{-1}$)				Zinc content in rice ($mg\ kg^{-1}$)				Zn uptake ($g\ ha^{-1}$)						PH Zn ($mgkg^{-1}$)	
	Grain		Straw		Grain		Straw		Grain		Straw		Total			
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
T_1 -FP (32N-23 P_2O_5 -0 K_2O kg ha^{-1})	3.60	3.58	4.84	4.88	8.02	8.9	16.12	17.83	29.14	31.35	79.01	87.07	108.15	118.43	0.42	0.45
T_{2-} RD (120 N-60 P_2O_5 -40 K_2O kg ha^{-1})	4.15	4.15	5.31	5.53	8.31	9.14	17.53	18.56	34.71	38.31	94.13	103.46	128.83	141.78	0.42	0.39
T_3 RD+5 kg Zn ha^{-1}	4.51	4.48	5.52	5.9	13.18	12.49	23.45	21.79	59.81	55.84	130.5	128.95	190.31	184.79	0.73	0.71
T_4 RD+40 kg S ha^{-1}	4.24	4.42	5.24	5.94	10.18	8.2	18.61	18.19	43.4	36.29	98.9	108.13	142.29	144.41	0.42	0.38
T_5 RD+5 kg Zn ha^{-1}+40 kg S ha^{-1}	4.53	4.7	5.49	6.33	12.97	11.85	23.49	20.06	58.88	55.05	130.38	127.28	189.26	182.33	0.71	0.64
SEm ±	**0.063**	**0.091**	**0.07**	**0.133**	**0.443**	**0.382**	**0.465**	**0.46**	**2.274**	**1.895**	**2.686**	**3.908**	**3.656**	**4.536**	**0.024**	**0.019**
CD(p=0.05)	**0.177**	**0.256**	**0.198**	**0.375**	**1.252**	**1.08**	**1.316**	**1.301**	**6.432**	**5.361**	**7.598**	**11.052**	**10.339**	**12.831**	**0.069**	**0.055**

FP-Framer practices RD- Recommended dose

Table 2 Effect of Zn and S on S content and uptake by paddy and post S status in soils of Jabalpur and Mandla district

Treatment	Sulphur concentration (%)				Sulphur uptake(kg ha-1)						PH avail. S ($mgkg^{-1}$)	
	Grain		Straw		Grain		Straw		Total			
	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013	2012	2013
T_1 -FP (32N-23 P_2O_5 -0 K_2O kg ha^{-1})	0.103	0.098	0.121	0.123	3.71	3.53	5.885	6.03	9.59	9.57	9.04	8.99
T_{2-} RD (120 N-60 P_2O_5 -40 K_2O kg ha^{-1})	0.102	0.101	0.126	0.126	4.27	4.18	6.696	6.97	10.97	11.15	9.19	7.89
T_3 RD+5 kg Zn ha^{-1}	0.105	0.093	0.128	0.118	4.74	4.23	7.079	7.03	11.82	11.26	9.29	7.37
T_4 RD+40 kg S ha^{-1}	0.133	0.115	0.151	0.14	5.63	5.07	7.939	8.29	13.57	13.36	18.14	12.3
T_5 RD+5 kg Zn ha^{-1}+40 kg S ha^{-1}	0.13	0.116	0.145	0.141	5.89	5.42	7.976	8.9	13.87	14.32	16.67	11.48
SEm ±	**0.002**	**0.003**	**0.002**	**0.003**	**0.128**	**0.156**	**0.167**	**0.273**	**0.239**	**0.39**	**0.56**	**0.342**
CD(p=0.05)	**0.007**	**0.009**	**0.007**	**0.009**	**0.361**	**0.44**	**0.472**	**0.773**	**0.676**	**1.102**	**1.57**	**0.968**

Table 3 Performance of Technology

Treatment	Extension gap		Technology gap		Technology index (%)	
	2012	2013	2012	2013	2012	2013
T_1 -FP (32N-23 P_2O_5 -0 K_2O kg ha^{-1})			1.4	1.42	28	28.4
T_{2-} RD (120 N-60 P_2O_5 -40 K_2O kg ha^{-1})	0.55	0.57	0.85	0.85	17	17
T_3 RD+5 kg Zn ha^{-1}	0.91	0.9	0.49	0.52	9.8	10.4
T_4 RD+40 kg S ha^{-1}	0.64	0.84	0.76	0.58	15.2	11.6
T_5 RD+5 kg Zn ha^{-1}+40 kg S ha^{-1}	**0.93**	**1.12**	**0.47**	**0.30**	**9.40**	**6.0**