ASSESSING THE GRAIN QUALITY OF $ZnSO_4$ BIOFORTIFIED MAIZE (ZEA MAYS)

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ABSTRACT

The agricultural challenge of present decade includes enhancing of profitability of the farmers through increasing their produce productivity using novel and appropriate green technologies for ensured sustainability and increased productivity of quality enriched cereals. This will help them to be empowered and also address the twin problem of food security and nutritional security especially the problem of hidden hunger. After paddy and wheat, maize is highly popular and extensively grown cereal crop of Begusarai (Bihar) in Indo-Gangetic Plain. Maize is grown in Bihar in almost all districts and in all seasons. It is traditionally grown in the state during 2018-2019. The state produced about 2.42 MT, which is about 12 percent of the total crop production. However keeping in view the rising demand of the crop for food, feed, fodder and fuel, the productivity enhancement, quality enrichment and ensuring sustainability is the agricultural challenges. A scientific and systematic research on bio fortification of maize with different levels of zinc as soil application on a popular variety Dekalb 9081 was carried out and the effect of bio fortification on various attributes of grain yield was assessed. The result indicated significant quality improvement in bio fortified maize over the control besides the better crop growth parameters.

KEYWORDS: Grain Quality of $ZnSO_4$ biofortified Maize

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INTRODUCTION

After introduction of high yielding variety and intensive cropping in large areas, micronutrient deficiency especially zinc has appeared in many maize growing zones. For any crop, zinc is a significant micronutrient which helps it in its growth and development and plays several physiological functions in plant for e.g. synthesis of auxin and catalysing the phytochemical reaction of chlorophyll. Foliar application of micronutrient is highly effective in increasing micronutrient concentration in grain of wheat and maize (Lungu et. al., 2011). Pulses and cereals are good sources of protein for human consumption; however, they normally contain low quality of protein and essential amino acids, micronutrients (Zinc, Iron) and vitamin (Shewry, 2007). In many developing countries, the micronutrient and vitamin deficiency have been reported which is affecting the health of large number of population. Stunted growth and development of body and mind, poor immune system due to micronutrient and vitamins deficiency is cause of concern. Besides, the crude method of processing of food also reduces the quality and quantity of available micronutrients. Earlier our focus was mainly to increase the production of major staple food crop especially wheat, rice and maize, but now, time has come to pay more attention towards quality aspect to remove the nutritional deficiency from developing world (Malik et al., 2009). As most maize varieties popularly grown contains poor Zn, bio fortification approach which includes selection, improvement and management can help in ensuring optimum Zn concentration in the corn. The present research aimed to assess the enhanced quality aspect of the harvest of maize crop of variety Dekalb 9081 in Begusarai district of Bihar state in Indo-Gangetic Plain.

MATERIALS AND METHODS

Suitable experimentation with Maize variety Dekalb 9081 was conducted. The experimental crop was raised in RBD in three replications. There were three levels of zinc with control taken as treatment. Zinc (ZnSO_4) dose of 3mg/kg of soil, 9mg/kg of soil and 27mg/kg of soil was applied in three treatments of T1, T2, and T3 besides keeping a control. Similarly, three levels of Fe were tried with control. Observations and harvested crop analysis for assessing the Grain quality in ZnSO_4 biofortified maize was done and compared with control. The data obtained was compiled, tabulated and analysed with the help of ANNOVA using MSTAT- C software.

RESULT AND DISCUSSION

Observations on important parameter of quality attribute e.g. cob weight, grain/ cob, grain rows/ cob. Cob length, test weight, cob girth, shelling percentage and harvest index of maize were taken from one square m area from each plot and finally converted into t/ha by using standard procedure and recommended method.

Yield Attributes: The application of different levels of zinc to study plant indicated non- significant effect on yield attributing character viz. weight of cob plant-1, grains cob-1, grain rows cob-1, cob length, test weight, shelling percentage and cob girth during both the year. Although, relatively higher weight of cob plant-1, grains cob-1, grain rows cob-1, length of cob, test weight, shelling percentage and girth of cob were observed in treatment T3 followed by treatment T2 and control in the study period (2017 – 2019).

Table 1: Effect of Zinc (ZnSO_4) on yield Parameters of Maize

Treatment	Yield Attributes (Kg/ha)		
Application of ZnSO_4	Cob wt(g)	Grains /cob	Grain Rows/ cob
T1	97.1	381.1	13
T2	97.3	381.2	13
T3	99.3	383.5	14
T7 (Control)	95.2	378.3	13
SEm $\pm$	3.1	9.1	0.65
CD (P=0.01)	NS	NS	NS

Shelling Percentage: Relatively higher Shelling percentage of maize was observed in treatment T3 over treatment T2 and control during both the year.

Table 2: Effect of Zinc Application on Cob length, Test weight, Cob Girth and Shelling % of Maize

Treatment	Cob length (cm)	Test weight (g)	Cob girth (cm)	Shelling (%)
Application of ZnSO_4				
T1	13.75	232.9	13.8	80
T2	13.78	234	14	81.7
T3	14.1	236.4	15.25	83.3
T7 (Control)	13.3	226.65	13.15	79
SEm $\pm$	0.5	2.75	0.6	2.15
CD(P=0.05)	NS	NS	NS	NS

Yield: Effect of zinc application on yield of maize was studied. Significant difference in grain, stover and biological yield of maize were observed during 2017-2018 due to application of different levels of zinc while

these yields did not differ significantly during 2018-2019. Harvest index of maize was not affected significantly due to Zn application during both the year.

Grain Yield: The higher grain yield was obtained in treatment T3 which was at par with treatment with T2 and significantly higher than control in 2017-2018. No significant differences in grain yield was recorded in treatment T2 and control in the year 2018-2019. During second year relatively more grain yield was obtained with the application of 27 kg ZnSO₄/ha followed by 9 kg ZnSO₄/ha and control.

Stover Yield: The maximum stover yield was obtained with application of treatment T3, which was significantly higher than treatment T2, treatment T1 and control. During year 2018-2019 the higher stover yield was recorded with treatment T3 closely followed by treatment T2 and control.

Table 3: Effect of Zinc (ZnSO₄) Treatment on Yield and Harvest Index of Maize

Treatment Application of ZnSO ₄	Grain Yield (t/ha)	Stover Yield (t/ha)	Biological Yield (t/ha)	Harvest Index (t/ha)
T1	3.09	6.87	9.96	30.3
T2	3.24	6.99	10.23	30.4
T3	3.38	7.49	10.88	30.5
T7 (Control)	3.12	6.36	9.36	30.3
SEm±	0.24	0.49	0.34	1.8
CD (P=0.05)	0.38	0.38	1.18	-

Result of the suitable experiment conducted for consecutive two years indicated the effect of zinc levels on grain yield, stover yield, biological yield and Harvest Index content in maize. Varying levels of zinc applied to maize plant did not give any significant effect on grain yield and harvest index. However, relatively higher biological yield and harvest index were observed with the application of treatment T3 followed by treatment T2 and control during both the year of study. The quality parameters of grain yield from experimental produce were also studied which emphasised higher protein content in T3. However, concentration of nitrogen and potassium obtained due to application of zinc did not differ significantly. Phosphorus concentration significantly affected during both the year. Relatively higher nitrogen concentration in grain recorded due to application of treatment T3 than treatment T2 during both the year. Significantly higher phosphorus concentration observed with the application of treatment T3 and control treatment. However, it was par with treatment T2 during first year. Application of treatment T3 during second year was statically superior over the treatment T2 and control. Control was statistically similar with respect to P concentration in grain. Relatively higher potassium concentration was recorded when treatment was applied in comparison to treatment T2 and control during both the year of study.

CONCLUSIONS

Bio fortification is an effective biotechnological tool which successfully enhances the micronutrient availability in crops. The present research output emphasized that 27kg Zn So₄ /ha as soil applications significantly affect the various yield attributes viz. cob weight, grain/ cob, grain rows/ cob. Cob length, test weight, cob girth, shelling percentage and harvest index of the Zea mays Variety Dekalb 9081 and also the quality yield attributes.

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