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Assessment of Applying Zinc to Improve the Quality of Sugarcane

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KEYWORDS

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ABSTRACT

Sugarcane is one of the cultivated crops in Bangladesh for centuries. In addition to running one of the most important agro-based industries, it runs the sugar industry as well. In order for sugarcane to be healthy, potassium (K) and zinc (Zn) must be present in its diet. According to estimates, no other material is as abundant as potassium (K) in the plant's cell sap. The potassium content of a sound sugarcane crop is generally between 180 and 240 kg per hector. Potassium (K) is one of the primary elements that provides sucrose which comes from the leaves to the storage tissues. The hydration and osmotic concentration within the stomata guard cells is done by Potassium (K). Zinc (Zn) performs different functions in plants, such as, taking part in different kinds of biological oxidation-reduction, activates metal in enzymes, metabolism of carbohydrate, synthesis of RNA, integrity of biological membranes, and stalk maturation, provides active counter action to infection by pathogens and ultimately increase crop yield and quality. The aim of the work is to evaluate the effect of utilizing zinc in sugarcane cultivation. Positive results are obtained. Zinc incorporation also increased the CCS%. 8 kg/ha zinc with recommended dose of NPK fertilizer is good from economical perspective.

1. INTRODUCTION

Sugarcane (Akh/Ekkhu/Gendari) is a long-tropical long-lived plant of the genus Saccharum, a member of the grass family. Among the three different genera, for trade purposes of sugar, S. officinarum is the most widely used species and has been cultivated in Asia since prehistoric times [1, 2]. In the Indian sub-continent and also in American parts, sugarcane has been grown since the 18th century and is now cultivated in most warm moist climate riched areas. S. robustum, one of the wild species, grows large in the tropical region.

At present, sugarcane is cultivated in around 100 countries and among them India, Argentina, Australia, Brazil, Barbados, China, Cuba, Mexico, Egypt, Jamaica, Peru, South Africa, and Hawaii, Florida, and Louisiana of the United States of America are the chief ones [3]. 0.38 million acres of land are currently used to grow sugarcane in Bangladesh. The annual sugarcane production is on average 5.7 million m tons. It is the second-highest cash crop for Bangladesh after jute [4].

A sugarcane plant is clearly attached with barks, each bearing bamboo-like shapes but juicy barks inside, and some of the varieties of barks are 5-7.5 meters long. The diameter is very variable that are from different varieties [5, 6]. Sugarcane that is grown in North Bengal has confined and strong stems. It grows around 2.5

cm in diameter. In the southern and western parts of Bangladesh, the cane that is cultivated usually stalks up to 3-5 cm in diameter and is light in nature. The soil where it grows must be moist in nature and the climate should be tropical. Strong sunlight, identical high temperature, and frequent rain during the growing season are desirable to get the highest production. Water irrigation isn't necessary if near about 1500 mm of rainfall is met in a year. The pH of the soil should hover around 6.5-7.5. In Bangladesh, it grows in the rainy season and comes to the marketplace or gets ready for production in winter.

In the past, sugarcane of different varieties was widely cultivated in Bangladesh. Up until now, The Sugarcane Research and Training Institute, Ishwardi has invented 30 odd sugarcane varieties. Amongst them Ishwardi 1/53, Ishwardi 1/54, Ishwardi 16, Ishwardi 17, Ishwardi 18, Ishwardi 19, Ishwardi 20, Ishwardi 25, Ishwardi 28 etc. In a factor, different varieties of sugarcane produce an average of 120 m tons of sugarcane.

It is the soft part of the sugarcane that is cultivated which is commonly known as "sett". The leftover part of the sugarcane after cutting from paddy is also been used for different purposes, such as seed and natural compost fertilizer [7].

Sugarcane is produced by planting cut pieces of sugarcane. After harvesting the plant cane, (during the period July-November in Bangladesh), the reproduction emerges to the first crop which is in turn similarly crop 12 months later. This process follows repeatedly until the soil decline to reproduce. The floor bed needs 80 to 110 days to establish covering full ground. Most of the K and Zn are needed by the sugarcane during their development. The sequence of outgrowth, progress rate, amount of leaves per mother shoots, and the area described earlier have reportedly been found to be little influenced by K and Zn elements [8].

In Bangladesh, it is quite evident that the deficiency of Potassium (K) and Zinc (Zn) has taken its full effect. It is due to the lack of effective pH and excessive abundance of $CaCO_3$ [9]. Again, flooding, repeated crop production, salty soil, and sedimentation of low organic material containing humus also cause the downfall of sugarcane production. Deficiency of essential plant nutrients in our soils is as nitrogen (100%), phosphorus (80-90%), potassium (40%), boron (30-40%), iron (20-30%), and zinc (60-70%).

The aim of the work is to evaluate the effect of utilizing zinc in sugarcane cultivation. In the next section (Section 2) we have discussed about the materials and method. In Section 3, we have presented the results of our study and the remaining section outlines the conclusions of our work (Section 4).

2. MATERIALS AND METHODS

The experiment has been done with three different places under randomized crop field with three replications. Sugarcane varieties Ishwardi 1/53, Ishwardi 1/54, Ishwardi 16, Ishwardi 17, Ishwardi 18 were planted at Mymensingh, Faridpur, Jessore and Rajshahi respectively with following treatments.

T 1 = 0 kg Zn per Hector (control)
T 2 = 2 kg Zn per Hector
T 3 = 4 kg Zn per Hector
T 4 = 6 kg Zn per Hector
T 5 = 8 kg Zn per Hector

The experimental dose was used as recommended K and Zn fertilizer applied equally on every single trial. The data was taken when the cane yielded after harvesting.

3. RESULTS AND DISCUSSION

It was observed that zinc nutrition in sugarcane improved cane yield and percentage of yield of Commercial Cane Sugar, CCS% of sugarcane in all experiments at each location as compared to control where only NPK fertilizer was applied (Fig-1, 2, 3, 4, 5, 6 and 8).

3.1. From Mymensingh

Following outcomes (Figure 1, 2) are observed.

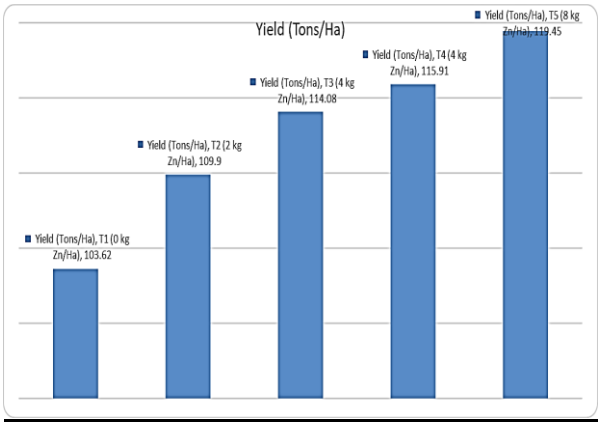

Fig. 1: Sugarcane yield vs different consumption of Zn in fertilizer.

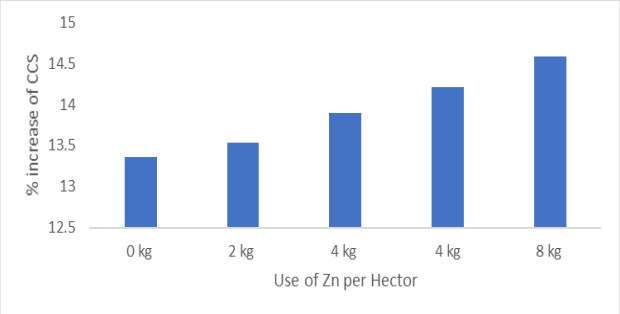

Fig. 2: Sugarcane percentage vs different consumption of Zn in fertilizer.

3.2. From Faridpur

Following outcomes (Figure 3, 4) are observed.

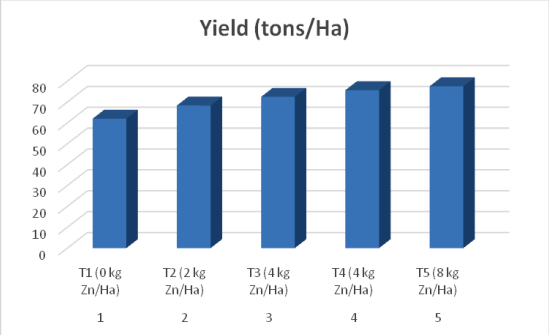

Fig. 3: Sugarcane yield vs different consumption of Zn in fertilizer.

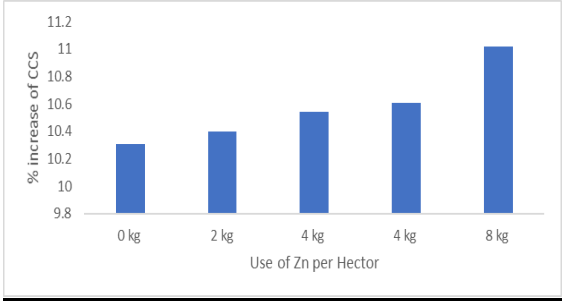

Fig. 4: Sugarcane percentage vs different consumption of Zn in fertilizer

3.3. From Jessore

Following outcomes (Figure 5, 6) are observed.

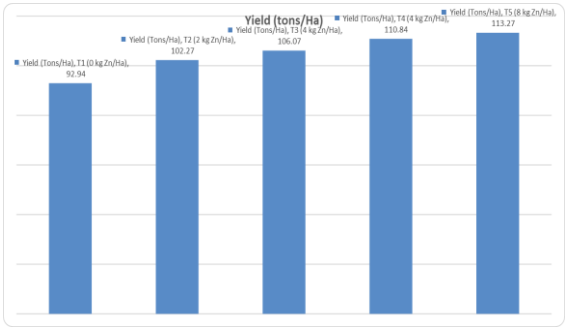

Fig. 5: Sugarcane yield vs different consumption of Zn in fertilizer.

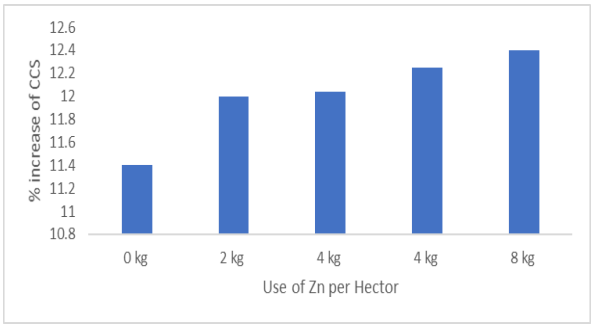

Fig. 6: Sugarcane percentage vs different consumption of Zn in fertilizer

3.4. From Rajshahi

Following outcomes (Figure 7, 8) are observed.

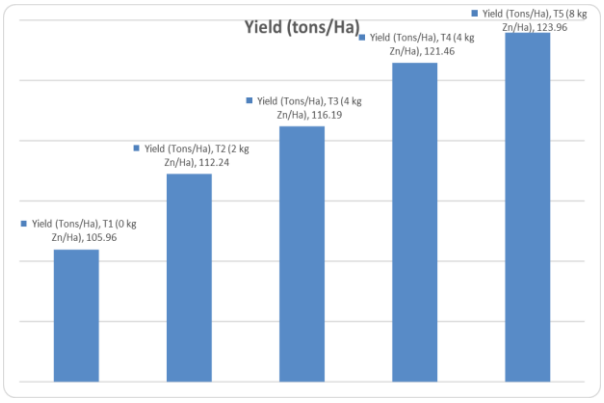

Fig. 7: Sugarcane yield vs different consumption of Zn in fertilizer.

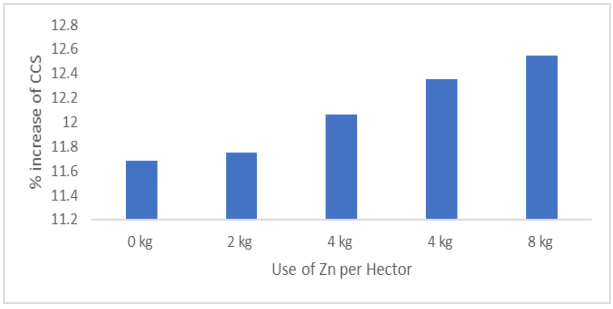

Fig. 8: Sugarcane percentage vs different consumption of Zn in fertilizer

Economics returns of sugarcane due to fertilizer application were worked out according to prices of fertilizer and sugarcane during 2019-20. It is evident from data in Table-1 that maximum cost benefit ratio (1:5.36) was obtained from T-5 followed by 1:5.25, 1:5.08 and 1:4.88 cost benefit ratio obtained from T-4, T-3 and T-2, respectively, as compared to control treatment.

Table-1. Economic Returns of Sugarcane due to Zinc Fertilizer Application

Fertilizers levels	Gross income in Taka	Values of increased yield in Taka	Cost of fertilizer in Taka	Net return due to fertilizer in Taka	Cost benefit ratio
0 kg Zn/Ha (T1)	1,84,538.25/-	--	33,535.00/-	1,51,003.25/-	1:4.50
2 kg Zn/Ha (T2)	1,98,814.50/-	14,276.25/-	33,788.00/-	1,65,026.50/-	1:4.88
4 kg Zn/Ha (T3)	2,06,955.00/-	22,416.75/-	34,042.00/-	1,72,913.00/-	1:5.08
6 kg Zn/Ha (T4)	2,14,569.00/-	30,030.75/-	34,295.00/-	1,80,274.00/-	1:5.25
8 kg Zn/Ha (T5)	2,19,793.00/-	35,255.25/-	34,548.00/-	1,85,245.50/-	1:5.35

4. CONCLUSION

It is factual to narrate that the economy of Bangladesh is widely dependent on agriculture. Agriculture is till now the largest employment sector in Bangladesh. Sugarcane is one of the most important cash crops in Bangladesh that can help to raise the border of income and employment of sugarcane producers and people who earn their livelihood through it. However, farmers are disinterested to produce sugarcane because it is less profitable compared to other cash crops and long-duration features. This study aimed at performing the economic analysis of sugarcane production focusing on profitability, factors productivity and resource use efficiency of sugarcane growers in the study area. Additional Zn intake to sugarcane enhance cane yield and this has been shown in the figure (1-8). Zinc incorporation also increased the CCS%. 8 kg/ha zinc with recommended dose of NPK fertilizer is good from economical perspective.

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CONFLICT OF INTEREST

The authors have confirmed that there is conflict of interest with this work.

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