

ZINC ENRICHMENT IN MAIZE GROWN IN SOIL DRESSED WITH NEEM FERTILIZER

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Abstract: A large part of reclaimed wetland in the Eastern fringe of Kolkata is being used for maize farming. Fertilizers are frequently being added to the soil by maize growers in order to obtain better yield as well as to improve the soil quality in many cases. In this study, effect of supplementation of urea and neem fertilizer in wetland soil on zinc uptake by maize leaves and grains were investigated, as maize is one of the staple crops consumed by all irrespective of economic standards in our country and also throughout the world.

Key words: Maize, Neem fertilizer, Urea, Wetland, Zinc, Immunity, Anti-Oxidant.

I. INTRODUCTION:-

India is an agro-based country. As until 2018, agriculture employed more than 50% of the Indian work force and contributed 17–18% to country's GDP. Across seasons, varieties of crops are grown throughout the country going in accordance with the quality of the soil, fertilizers and other allied factors. Quality of the soil, where a particular crop is grown plays a very crucial role in deciding not only the yield but also the nutritional index of the crop itself. This depends on a number of factors like the ability of the soil to make essential nutrients available to the crops, aeration, percentage of heavy metals in the soil etc. The number of heavy metals found in any soil plays a pivotal role in estimating the quality of the soil. Heavy metals like copper, zinc and arsenic can prove to be decisive weather a particular soil can be used for farming or not. The use of fertilizers for better yield of crops are a must nowadays given the demand and supply ratio throughout the country and even in the export relations abroad.

The wetland located in the Eastern fringe of Kolkata is famous for dumping wastes. At the same time, these wetlands are also being used for agricultural purposes. Maize is a very important crop due to its nutritional values (Nuss and Tanumihardjo, 2010) and also because it acts as an important raw material in several industrial applications. Maize farming is a popular practice in these wetland areas. Maize farmers supply different fertilizers in their field regularly for better yield. Urea is frequently being used by maize growers as it is an inexpensive form of nitrogen fertilizer. In addition to it, farmers are now using organic fertilizers in their field also.

Several studies have confirmed the presence of different heavy metals in wetland soil (Chattopadhyay et al., 2002; Khatun et al., 2016; Dutta et al., 2016). Zinc, a heavy metal, also found to be present in the wetland soil (Das et al., 2014), proves to be a very important one for human body as it has anti-oxidant properties and acts both as a co-factor for enzymes like carbonic anhydrase and inhibitor for enzymes like NADPH Oxidase. At the same time, excessive concentrations of zinc can lead to unwanted toxicity in the body. Maize plant is a significant accumulator of zinc (Lu et al., 2015). During the present investigation, a field experiment was conducted to study the effect of supplementation of urea and neem fertilizer in wetland soil on zinc uptake by maize leaves and grains. Our study is based on the effect of some fertilizers in supplementing the uptake of heavy metal (in our case, zinc). The study was carried forward with the following objectives:-

- To improve the yield of maize, an inexpensive staple crop available to all irrespective of socio-economic standards in an eco-friendly manner
- To test whether the incorporation of organic fertilizers increase the zinc uptake in maize plants, which is a natural accumulator of zinc.
- To exploit the anti-oxidant property of zinc at a non-toxic concentration which helps us to reduce oxidative stress and boost our immunity, which is the need of the hour.

II. Materials and Methods:

2.1. Growing plants in the field:

Three plots (33 sq. m each) were selected in reclaimed wetland in the eastern fringe of Kolkata (Latitude - 22.572645, Longitude - 88.363892). One plot was used as control while the other two were used for urea and neem fertilizer treatment separately. Maize seeds (Cv. MSF 56) were disinfected with 0.1% HgCl₂ solution for 5 minutes, washed thoroughly with sterile distilled water, soaked in water for overnight and then sown in rows (60- 75 cm apart) in the field (wetland soil).

2.2. Supplementation of urea and neem fertilizer in the soil:

Maize seeds (Cv. MSF 56) sown in wetland soil was supplemented with urea and neem fertilizer at the rate of 150 and 500kg / ha respectively. Leaves and cobs of 88 old day plants were collected and the amount of zinc was estimated.

2.3. Estimation of zinc:

Zinc content in the sample was estimated using Atomic Absorption Spectrophotometer (Perkin Elmer 2380).

III. Results:-

3.1. Effect of supplementation of urea and neem fertilizer (Neem shield) on zinc uptake by maize leaves

The results of Zinc uptake by leaves of maize plants (Cv. MSF 56) are given in Table 1.

Table 1. Effect of supplementation of urea and neem fertilizer (Neem shield) on zinc uptake by maize leaves

Treatment		Average zinc content ($\mu\text{g/g}$ dry wt.) in leaves
Untreated (control)		13.93 ± 0.467
Treated (fertilizer)	Urea	12.97 ± 0.467
	Neem fertilizer	34.50 ± 0.467

Results show that addition of neem fertilizer to wetland soil increased zinc uptake significantly by maize leaves when it is compared to untreated set and urea treatment too. In case of neem fertilizer treatment, 147.66 % enhancement in zinc uptake was noticed in relation to control. A decrease (6.89 %) in zinc uptake has been noted in case of urea treatment when it is compared to untreated control set.

3.2. Effect of supplementation of urea and neem fertilizer (Neem shield) on zinc uptake by maize grains

The results of zinc uptake by cobs of treated maize plants (Cv. MSF 56) are given in Table 2.

Table 2. Effect of supplementation of urea and neem fertilizer on zinc uptake by maize grains

Treatment		Average zinc content ($\mu\text{g/g}$ dry wt.) in grains
Untreated (control)		10.13 ± 0.467
Treated (fertilizer)	Urea	26.50 ± 0.467
	Neem fertilizer	27.30 ± 0.467

Results reveal that addition of fertilizer to wetland soil enhanced zinc uptake by maize grains. Urea and neem fertilizer treatment showed 161.6 % and 169.49 % increase in zinc uptake respectively. Supplementation of neem fertilizer showed a slight increase in zinc uptake in comparison to urea.

IV. Discussions:-

Maize plant is responsive to zinc sources (Ruffo et al. 2016). Lu et al., 2015 also proved that presence of heavy metal in the soil resulted in the accumulation of heavy metal content specially zinc in maize plant. A great effect of nitrogen fertilizer on zinc absorption by winter wheat has been established by Zhao et al, 2016. They showed that nitrogen application increased total Zn accumulations and Zn concentrations of each plant part of winter wheat. Furthermore, it was also noted that appropriate N application increased Zn content in grains. The results obtained from our study shows the increase in the amount of zinc uptake via supplementation with fertilizers as nitrogen sources which automatically uplifts the nutritional value of these cobs as the anti-oxidant property of zinc allows reduction of oxidative stress in our body and builds up immunity which is the need of the hour amidst the deadly pandemic situation the world is stuck in today. These advantages acquired from zinc can be extracted from the maize grown in fertilized soil and owing to the fact that maize is an inexpensive staple crop consumed all around the world irrespective of the socio-economic status of people employed in varied sectors, this study can be our key to boost immunity in such a handy way amidst the COVID-19 crisis. The concentration of zinc accumulated in both the maize leaves and cobs, are well below the toxicity level but provides us with the added advantage that can be accumulated from zinc uptake whose mechanism is well explained by Gupta et al., 2016.

V. Conclusion:

Present experiment indicates that supplementation of fertilizer (urea and neem fertilizer) in wetland soil plays an important role in zinc uptake by maize plants. Addition of neem fertilizer showed higher increase in zinc uptake in both maize leaves and grains (cobs) when it was compared to untreated control set which boosted the nutritional index of the maize and hence may lead to the improvement of the socio-economic status of the maize farmers.

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VII. References:

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