Short communication

STATUS OF ZINC AVAILABILITY IN JHUM FIELDS UNDER RAINFED CONDITION IN ZUNHEBOTO DISTRICT OF NAGALAND.

Abstract

Zinc is an essential micronutrient element required for plants. It is also an important dietary nutrient for the wellbeing of human beings and animals. The zinc deficiency in the soil is spreading worldwide which can lead to decrease in crop yield. In Nagaland, its deficiency is slowly increasing and several factors such as shifting cultivation, forest fire, leaching and run off and nutrient exhaustion in the soil by the crop may be attributing to its deficiency in the soil. As zinc deficiency is rapidly increasing all over, a soil survey on zinc availability was conducted in 682 jhum fields under rainfed condition covering 7 villages of Zunheboto district of Nagaland during 2016-17. The soil samples were collected from the field and analysed using standard procedure. It was observed that the zinc deficiency ranged from 83.60% to 97.35% which indicated that it deficiency is found in this part of the region. Almost all the crops respond well to zinc application. Thus zinc fertilization is essential for improving soil health and crop yield.

Key words: Jhum field, zinc, soil health, yield.

Introduction

Zinc is an important micronutrient for plant growth and nutrition. Its deficiency is about 36.5% in Indian soil. This micronutrient is required in small amount but in inadequate condition, it will cause physiological stress in plants (Alloway B. J., 2008). The available zinc in plant is also low in about 30% of the cultivated soils in the world (FAO). It is considered the fourth most yield limiting nutrient for crops in India. It plays an important role for various enzymatic actions required for protein synthesis, nitrogen metabolism and energy transfer in animals as well as human beings too. There are about 3 billion people around the world suffering from zinc deficiency. This condition is prevalent in areas where people are constantly depending on a particular cereal diet. The recommended daily intake of 15 mg Zn per day is required for overall growth and immune systems in humans. Deficiency of zinc leads to memory loss, hair and skin problems, weakness in body muscles, infertility, stunted brain development of the fetus and congenital diseases. Zinc deficiency in plants causes stunted growth, chlorosis, spikelet sterility, water uptake and transport in plants. Zinc deficiency in soil is also found all over the world. Zn deficiency is likely to increase from 49 to 63% in Indian soils by 2025 (Arunachalam *et al*., 2013). In zinc deficiency plants, protein, carbohydrate and chlorophyll formation is significantly reduced. It plays a key role in the production of growth hormone auxin. The yield decline in an intensified cropping systems is mainly due to micronutrient deficiencies (Katyal and Rattan, 2003). The zinc deficiency problem has been rapidly increasing due to lack of knowledge on zinc responsiveness and use of highly zinc susceptible crop variety.

The deficiency of zinc in Nagaland is increased by 4.62 % (Shukla, 2018). There are several factors causing zinc deficiency in this areas such as shifting cultivation, leaching and run off and forest fire that leads to decline in fertility of top soil(FAO) which may attribute to the zinc deficiency in this region. The continuous removal of the nutrient by the crop without replenishing it also leads to zinc deficiency.

Keeping the limitation of zinc availability in mind, this soil survey was conducted in jhum fields under zunheboto district of Nagaland.

Materials and methods

The soil survey was conducted in 7 villages covering 682 jhum fields under zunheboto district. The soils ranged from red sandy loam to clay loam soils, pH from 5.0 to 6.8, low organic carbon and available phosphorus, medium in available nitrogen and potassium. Altogether 682 soil samples were analysed. The soil samples were collected from 15cm depth during the year 2016-17. The available zinc in the soil was determined using the standard procedure given by Lindsay and Norvell (1978).

Results and discussion

Zinc deficiency was found in all the 7 villages. Its deficiency ranges from 83.60% to 97.35% in the jhum fields (table 1). The highest zinc deficiency was seen in Aotsakili village followed by sumi settsu village. Eventhough the rate of deficiency of zinc differs from one location to another but from the soil samples that were analysed, it showed that zinc deficiency is spread over a large area.

The traditional practice of jhumming has lead to gradual decrease in the soil bases and further decline in soil fertility. The heavy rainfall in this region is also another

factor that leads to loss of nutrients due to leaching and runoff causing micronutrient deficiency . The total zinc status is low in sandy, highly leached and weathered acidic soil (Alloway B. J., 2008). Zinc availability may also be decreased due to low soil organic carbon content in the rainfed region (Srinivasarao *et al*, 2009). The DTPA-extractable Zn was also found to be increased as the soil organic carbon increases (Sharma *et al*., 2004). When the amount of micronutrients applied to the soil is less as compared to its removal by the crop, it creates deficiency of micronutrient and in turn decrease the yield of

crop. Continuous cropping with zinc requiring crop also leads to depletion of soil available zinc if the nutrient source is not applied in the soil. In India, the loss of yield due to lack of zinc fertilizer application is about 10% as reported by Shukla *et al* (2009). The major productivity constraints faced in the rainfed farming is due to micronutrient deficiency (srinivasarao *et al.*, 2012a, 2012b).

Zinc being an important micro nutrient for growth and yield of crops, timely nutrient management through balanced fertilization will enhanced soil fertility and crop productivity. Zinc deficiency can be diagnosed through soil test, field observation and plant analysis.

Table 1: Status of Zinc availability in jhum fields areas under Zunheboto district.

Location	No. of fields sample	Zn (mg kg^{-1})		Deficiency %
		Lowest	Highest	
Sumi Settsu	130	0.08	3.26	96.27
Zaphumi	84	0.12	2.93	92.13
Lumami	100	0.24	3.11	85.67
Alaphumi	26	0.17	2.73	88.28
Aotsakili	72	0.04	2.98	97.35
Lumithsami	150	0.20	2.24	83.60
Litta New	120	0.14	3.36	92.00

Conclusion

From the survey conducted, it was observed that Zn is an essential micro nutrient for a varied range of crops. Its deficiency is widely found all over in all types of soils. Zinc deficiency is expected to increase 63% by 2025 (Srinivasarao *et al*., 2013). Therefore correcting this nutrient deficiency is essential for enhancing the soil health and fertility and crop productivity.

References

Alloway BJ. Zinc in soils and crop nutrition. 2008. Brussels, Belgium: IZA; and Paris, France: IFA.

Arunachalam P, Kannan P, Prabukumar G and Govindaraj M . Zinc deficiency in Indian soils with special focus to enrich zinc in peanut. *African Journal of Agricultural Research*. 2013. Vol 8(50), 6681-6688.

Bandyopadhyay S, Ray P, Padua S, Ramachandran S, Jena RK, Roy PD, Dutta DP, Singh, SK, and Ray, SK. Priority Zoning of Available Micronutrients in the Soils of Agroecological Sub-regions of North-East India Using Geo-spatial Techniques. *Agric Res*. 2018. 7(2).

Ganeshamurthy AN, Raghupathi HB, Rupa TR, Rajendiran S and Kalaivanan D. Micronutrient Management in Horticultural Crops. *Indian Journal of Fertilisers*, 2018. Vol. 14 (4), pp.68-85.

Hafeez B. , Khanif YM. and Saleem M. Role of Zinc in Plant Nutrition- A Review. *American Journal of Experimental Agriculture*. 2013. 3(2): 374-391.

Global hunger index. The challenge of hunger: taming price spikes and excessive food price volatility. Washington, DC: International Food Policy Research Institute; 2011. p. 59.

Katyal JC. Micronutrients in Indian Agriculture. *Indian Journal of Fertilisers*, (2018). Vol. 14(4), 12-26.

Lindsay WL. and Norwell WA. Development of DTPA test zinc, iron, manganese and copper. *Soil Sci. Soc. American J*., 1978. 42: 421-428.

Sharma BD, Arora H, Kumar R and Nayyar VK. Relationships between soil characteristics and total DTPA-extractable micronutrients in inceptisols of Punjab. *Communications in Soil Science and plant analysis*. 2004. 35:799-818.

Shukla AK, Behera SK., Pakhre A and Chaudhari SK. Micronutrients in Soils, Plants, Animals and Humans. *Indian Journal of Fertilisers*, 2018. Vol. 14 (4), pp.30-54.

Shukla AK, Dwivedi BS, Singh VK and Gill MS. Macro role of micro nutrients. *Indian Journal of Fertilisers*. 2009. 5(5):11–30

Srinivasarao Ch and Rani YS. Zinc deficiency: A productivity constraint in rainfed crop production systems of India. *SAT eJournal*. 2013. vol(11).

Srinivasarao Ch, Venkateswarlu B, Lal R, Singh AK, Vittal KPR, Sumantha Kundu, Gajanan GN and Ramachandrappa B. Long-term effects of crop residues and fertility management on carbon sequestration and agronomic productivity of groundnutfingermillet rotation on an alfisol in southern India. *International Journal of Agricultural Sustainability*. 2012a. 10(3):1–15.

Srinivasarao Ch, Venkateswarlu B, Lal R, Singh AK, Vittal KPR, Sumantha Kundu, Gajanan GN, Ramachandrappa B and Chary GR. Critical carbon inputs to maintain soil organic carbon stocks under long-term finger-millet (Eleusine coracana [L.] Gaertn.) cropping on Alfisols in semiarid tropical India. *Journal of Plant Nutrition and Soil Science*. 2012b. 175:681– 688.

Srinivasarao Ch, Vittal KPR, Venkateswarlu B, Wani SP, Sahrawat KL, Marimuthu S and Kundu S. Carbon stocks in different solis under diverse rainfed systems in tropical india. *Communications in soil science and plant analysis*. 2009. 40: 2338-2356.

Sutradhar AK. Research Associate, College of Food, Agriculture and Natural Resources; Kaiser, D.E and Rosen, C. J, Extension nutrient management specialists.

World Bank (2009).