Effect of application of iron and zinc on growth and yield of Cluster bean (*Cyamopsis tetragonoloba* L.)

Abstract:

A field experiment was conducted during *Zaid* 2022 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36 %), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice on the basis of one year experimentation. The application of Iron at 15000 ppm + Zinc 20 kg/ha, recorded significantly higher Plant height (102.80 cm), number of nodules per plant (47.57) Plant dry weight (55.04 g/plant). Significantly maximum pods/plant (44.50), Seeds/pod (14.31) were recorded with the treatment of Iron at 15000 ppm + Zinc 20 kg/ha.

Key words: Sulphur, Iron, Zinc, cluster Bean.

Introduction:

Cluster bean [*Cyamopsis tetragonoloba* (L.)Taub] popularly known by its vernacular name ‗Guar' is an important legume crop mainly grown under rainfed condition in arid and semi-arid regions of Rajasthan during kharif season. It is very hardy and drought tolerant crop. Its deep penetrating roots enable the plant to utilize available moisture more efficiently and thus offer better scope for rainfed cropping. The crop also survives even at moderate salinity and alkalinity conditions. There is no other legume crop so hardy and drought tolerant as cluster bean, which is especially suited for soil and climate of Rajasthan. Among dry land crops guar occupies an important place in the national economy because of its industrial importance mainly due to the presence of gum in its endosperm (35 to 40%). Cluster bean is grown for different purposes from very ancient time viz., vegetable, green fodder, green manure and production of seeds. Besides, all these, it provides nutritional concentrate and fodder for cattle and adds to the fertility of soil by fixing considerable amount of atmospheric nitrogen. Cluster bean seed is also used as a concentrate for animal and for extraction of gum‖. Seed of cluster bean contain 28 to 33 per cent gum. Guar gum has its use in several industries viz., textiles, paper, petroleum, pharmaceuticals, food processing cosmetics, mining explosives, oil drilling etc. Cluster bean is leguminous crop and can fix 37-196 kg N/ha/ year.

Zinc deficiency has been reported to be the most widespread micronutritional disorder of the food crops in India as well as the world over. The magnitude of zinc deficiency varied widely among soil types and within the various states. Coarse textured, calcareous, alkaline or sodic soils having sandy texture, high pH and low in organic matter are generally low in available zinc. Calcareous soils of Bihar, vertisols and Inceptisols of Andhra Pradesh, Tamil Nadu and Madhya Pradesh and Aridisols of Haryana showed extensive deficiency of zinc resulting low crop yields. Zinc is a crucial component of the package of the practices recommended sodic soils reclamation. Deficiencies of Fe, Mn and Cu are much less extensive than that to zinc. Though marked response of crops to Zn application has been noticed, Zn deficiency is a major nutritional constraint for successful crop production in Tamil Nadu. The available Zn content of Indian soils varied from traces to 22 mg kg-1 and 47 per cent of Indian soils were found to be deficient in Zn. (Mishra *et al*. 2009).

The iron is a structural component of porphyrin molecules, cytochromes, heme, non heme, ferrichrome and leghaemoglobin. These substances are involved in oxidation- reduction reactions in respiration and photosynthesis. It is also an important part of the enzyme nitrogenease. Which is essential for nitrogen-fixation by nitrogen fixing microorganisms. Iron in chloroplasts reflects the presence of cytochromes for performing various photosynthetic reduction processes and ferrodoxin as an electron acceptor. The ferrodoxins are Fe-S proteins and are the first stable redox compound of the photosynthetic electron transfer. The chemical fertilizers, no doubt, are important source which can meet the nutrient requirement but their imbalance and continuous use has led to environmental pollution and deterioration of soil health. Furthermore, availability of fertilizer at economic prices is another problem for the farmers. In last few years, price of cluster bean remained quite high and farmers realized high profit by producing cluster bean seed because the guar gum demand has increased substantially in abroad. Despite the maximum area of cluster bean in Rajasthan the average productivity is only 0.48 t/ha compared 1.27and 0.84 t/ha in Haryana and Gujarat (Anonymous 2016-17).

Material and Methods:

The experiment conducted to know the Effect of foliar application of iron and zinc on growth and yield of Cluster bean (Cyamopsis tetragonoloba L.) was carried out at Crop Research Farm of Sam Higginbottom University, Prayagraj, Uttar Pradesh in 2022. The experiment was laid out in an RBD (Randomized Block Design) consisting of Ten treatments including Control with 3 replications, with the treatment combinations The treatments which are T_1: Iron at 5000 ppm + Zinc 10 kg/ha, T_2: Iron at 5000 ppm + Zinc 20 kg/ha, T_3: Iron at 5000 ppm + Zinc 30 kg/ha, T_4: Iron at 10000 ppm + Zinc 10 kg/ha, T_5: Iron at 10000 ppm + Zinc 20 kg/ha, T_6: Iron at 10000 ppm + Zinc 30 kg/ha, T_7: Iron at 15000 ppm + Zinc 10 kg/ha, T_8: Iron at 15000 ppm + Zinc 20 kg/ha, T_9: Iron at 15000 ppm + Zinc 30 kg/ha, T_{10}: Control (RDF) 20:40:20 kg NPK/ha are used.

Results

At 80 DAS, there was significant difference among the treatments. However, highest number of nodules per plant (47.57) was recorded with the application of Iron at 15000 ppm + Zinc 20 kg/ha, whereas minimum number of nodules per plant (36.81) was recorded with the treatment Control (RDF) 20:40:20 kg NPK/ha and Iron at 15000 ppm + Zinc 10 kg/ha (47.39) which was statistically at par with T8.

there was significant difference among the treatments. However, highest plant dry weight (55.04 g) was recorded with the application of Iron at 15000 ppm + Zinc 20 kg/ha, whereas minimum plant dry weight (52.47 g) was recorded with the treatment Control (RDF) 20:40:20 kg NPK/ha and Iron at 15000 ppm + Zinc 10 kg/ha (54.14 g), Iron at 15000 ppm + Zinc 30 kg/ha (54.00 g) which was statistically at par with T8.

Number of Pods/plants: Significantly Maximum Number of Pods/plant (44.50) was recorded with the treatment of application of Iron at 15000 ppm + Zinc 20 kg/ha over all the treatments, and minimum was recorded in Control (RDF) 20:40:20 kg NPK/ha (35.12). However, the treatments Iron at 15000 ppm + Zinc 10 kg/ha (43.81), which was found to be statistically at par with T8.

Number of Seeds/Pod:

The perusal of the data of number of seeds/pods was recorded at harvest, is presented in Table 1. The data reveals that there was significant effect among different treatments on number of seeds/pods. Maximum number of seeds per pod (14.31) was recorded with the treatment of application of Iron at 15000 ppm + Zinc 20 kg/ha over all the treatments. However, the treatments Iron at 15000 ppm + Zinc 10 kg/ha (14.00), which was found to be statistically at par with T8, minimum was recorded in Control (RDF) 20:40:20 kg NPK/ha (10.00).

Seed index (g): Seed index (34.36 g) was recorded higher with the treatment application of Iron at 15000 ppm + Zinc 20 kg/ha over all the treatments, and minimum was recorded in Control (RDF) 20:40:20 kg NPK/ha (32.45 g) and there was no significant change in between the treatments.

Discussions:

the application of mineral nutrient significantly increased the available content of Zn and Fe nutrient in soil at harvest of the crop. The increase in available content of Zn and Fe may also be due to direct addition of these nutrients in the experimental soil. Synergism between nitrogen and iron, phosphorus and molybdenum and Mo and Zn may also be responsible for increase in available content of these nutrients. Similar results were also reported by Mishra *et al*. (2011) and Sharma and Jain (2012).

The application of micronutrient fertilizers alone might supply one nutrient only but conjoint use of micro nutrient fertilizers would provide two nutrients in proper ratio to plant and soil and also reduces the possibilities of multiple micronutrients deficiencies in particular. The responses of some of the micronutrients viz, Fe and Zn have also been found promising in increasing the productivity of the soils (Masood Ali and Mishra, 2000). Significant response of pulses to micro nutrients have also been reported by several workers (Teotia *et al*., 2000; Chavan *et al*. (2012) and Gupta and Ganagwar (2012). The stimulating effect of Zn and Fe on total and effective nodules might be due to increased availability of these nutrients to the crop and the microorganisms responsible for enhanced nodulation. The balanced supply of Zn and Fe might have improved over all development of crop plant and total and effective nodules of the crop. Similar finding were also reported by Gupta and Gangwar (2012) and Singh *et al*. (2008).

Conclusion:

It is concluded that application of Iron at 15000 ppm + Zinc 20 kg/ha was recorded significantly higher growth and yield attributes, as compared to other treatments. Since, the finding based on the research done in one season.

Table 1: Response of iron and zinc on growth and yield attributes of Cluster bean.

Treatments	Plant height	Dry weight	Pods/plant (No)	Seeds/pod (No)	Seed index (g)
T1	95.50	38.78	37.00	10.30	32.50
T2	95.70	40.45	37.24	10.50	32.55
T3	96.70	37.54	36.57	10.00	32.45
T4	97.40	40.68	38.64	12.00	32.91
T5	100.00	42.09	39.40	12.47	33.45
T6	100.20	40.12	38.32	11.00	32.60
T7	101.70	47.39	43.81	14.00	33.79
T8	102.80	47.57	44.50	14.31	34.36
T9	102.50	44.32	41.20	13.00	33.65
T10	94.70	36.81	35.12	10.00	32.45
Sem(±)	0.71	0.62	0.53	0.24	0.50
CD (p=0.05)	2.11	1.86	1.59	0.72	-

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