Effect of sulphur and foliar application of thiourea on growth and yield of Clusterbean (*Cyamopsis tetragonoloba* L.)

Abstract:

The field experiment was conducted during *Zaid*2023 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.3). The experiment was laid out in Randomized Block Design with nine treatments each replicated thricebased on one year of experimentation. The application of Sulphur at 45 kg/ha + Thiourea at 1500 ppm, recorded Significant maximum pods/plant (41.00), Seeds/pod (14.00), Seed index (31.80 g), Seed yield (1.84 t/ha), stover yield (3.66 t/ha), Harvest index (33.45 %) were recorded with the treatment of Sulphur at 45 kg/ha + Thiourea at 1500 ppm.

Keywords: Foliar application, Sulphur, cluster bean, Thiourea.

Introduction:

In India, vegetable cluster bean is extensively cultivated over the country in both the season of *Zaid* and *Kharif*. It is broadly cultivated in urban regions, rural regions and also in kitchen gardens. In the rural region, tender pods of vegetable cluster beansare used for vegetable purposes and adequate pods are also used for dehydration and then they were used in off-season vegetable forming. India is the highest producerof guar in the world contributing about 80% of global production. Vegetable cluster beansare largely grown in Rajasthan, Punjab, Haryana, Madhya Pradesh and Uttar Pradesh. Rajasthan ranks first position in India both in area and production. It accounts for almost 82.1% area and 70% production of India. Haryana and Gujarat have second and third positions respectively. In Rajasthan, guar is generally grown in Churu, Barmer, Nagaur, Sriganganagar, Sikar, Jalore, Jaisalmer, Jaipur, Bikaner, Jhunjhunu and Alwar districts. Cluster beans attained a significant place at the national level as well as the state level (Jyani *et al*., 2018). In India, during 2018-19 Total beans were cultivated in a 229 ha with a production of 2324 MT (Anonymous, 2018-19).

It is a well-established fact that the growth and yield of plants are highly influenced by extensive ranges of nutrients. Micro and macronutrients are very much needed by plants among them. Sulphur is now recommended as the fourth major plant nutrient (Tandon and Messick, 2007). In India, extensive spread sulphur deficiency, itis reported as one of the major elementsrequired for the yield of plants or even decline. At present sulphur deficiency in the soil of various states is ranging from 5 to 83% with an overall mean of 41% (Singh, 2001). In Udaipur, Dungarpur and Bundi districts of Rajasthan, 66% of 179 soil samples were found deficient in sulphur (Rego *et al*., 2007). Due to the regular use of high-analysis fertilizers,high-yieldingplantvarieties, sulphur deficiency has been noted as hidden hunger in various crops, especially oilseed and pulses.

Sulphur (S) is a crucial mineral nutrient required by plants for growth, development and productivity [Shah 2022]. Generally, the deficiency of nutrients, especially S, in agricultural soil causes serious defects in plant growth and development, such as stunted growth, poor branching, premature leaf fall, reduced plant biomass, lower photosynthetic pigment synthesis, inhibition of protein synthesis and enzyme activities and decreased the productivity of crops. However, due to the regular cultivation of crops, nutrient depletion occurred in the soil. For example, the concentration of S decreases due to the use of S-free fertilizers and the reduction in the use of traditional organic manure in cultivated land [Siddiqui 2012]. Consequently, in the last few decades, the requirement of S in agriculture has been widely concerned due to its deficiency in agricultural soil producing a decrease in crop productivity.

Thiourea is a sulphydryl compound whichhelps to improve soil productivity due to its role as a drought tolerant mediatorwhich is well established in the arid and semi-arid regions (Sahu *et al*., 1993).Thiourea has 42% sulphur and 36 % of nitrogen. Thus, in the physiology of plants both it behaves as both a sulphydryl compound and an amino compound, responsewhich is similar to the urea (Garg *et al*., 2006). The stimulatory action of thiourea acts in various physiological processes of plants. It is mainly used for enhancing its dormancy-breaking and germination-stimulating effects. Several researchers working on many crops had reported that the use of growth substances is one of the effective means for delaying the senescence of leaves. The beneficial effects of thiourea were attributed to its role in significantly increasing the net photosynthetic rates and the concentrations of total chlorophyll and starch in the leaves (Burman *et al*., 2004).

The information on the different doses of sulphur and foliar application of thiourea in vegetable cluster beans is scarce. At a physiological level, this is directly associated with enhanced photosynthesis, increased metabolite translocation and coordinated regulation of plant’s source-to-sink relationships (Pandey *et al*., 2013). Hence, keeping in view the above

facts, an investigation entitled Effect of sulphur and foliar application of thiourea on growth and yield of Clusterbean (*Cyamopsis tetragonoloba* L.) was conducted at Crop research farm of SHUATS, Naini Agricultural University.

Material and Methods:

The experiment conducted to know the Effect of sulphur and foliar application of thiourea on the growth and yield of Clusterbean (*Cyamopsistetragonoloba* L.) was carried out at Crop Research Farm of Sam Higginbottom University, Prayagraj, Uttar Pradeshin 2023. The experiment was laid out in anRandomized Block Design (RBD) consisting of nine treatments plus a Control, all with 3 replications, combinations named as T1=Sulphur at 15 kg/ha + Thiourea at 500 ppm, T_2= Sulphur at 15 kg/ha + Thiourea at 1000 ppm, (T_3) Sulphur at 15 kg/ha + Thiourea at 1500 ppm, (T_4) Sulphur at 30 kg/ha + Thiourea at 500 ppm, (T_5) Sulphur at 30 kg/ha + Thiourea at 1000 ppm, (T_6) Sulphur at 30 kg/ha + Thiourea at 1500 ppm, (T_7) Sulphur at 45 kg/ha + Thiourea at 500 ppm, (T_8) Sulphur at 45 kg/ha + Thiourea at 1000 ppm, (T_9) Sulphur at 45 kg/ha + Thiourea at 1500 ppm, (T_{10}) Control (RDF) 20:40:20 kg NPK/ha.

Results

In Table 1 are presented the data of all treatments (T1-T10), in the next paragraphs it will be discussed each parameter:

The number of Pods/plants: Significantly Maximum Number of Pods/plant (41.00) was recorded with the treatment of the application of Sulphur at 45 kg/ha + Thiourea at 1500 ppm over all the treatments, and the minimum was recorded in Control (RDF) 20:40:20 kg NPK/ha (30.00). However, the treatments Sulphur at 45 kg/ha + Thiourea at 1000 ppm (39.50), which was found to be statistically at par with T9.

The number of Seeds/Pod: Maximum number of seeds per pod (14.00) was recorded with the treatment of the application of Sulphur at 45 kg/ha + Thiourea at 1500 ppm over all the treatments, and the minimum was recorded in Control (RDF) 20:40:20 kg NPK/ha (9.00). However, the treatments Sulphur at 45 kg/ha + Thiourea at 1000 ppm (13.50), which was found to be statistically at par with T9.

Seed index (g): Seed index (31.80 g) was recorded with the treatment of the application of Sulphur at 45 kg/ha + Thiourea at 1500 ppm over all the treatments, and the minimum was recorded in Control (RDF) 20:40:20 kg NPK/ha (27.06 g). However, the treatments Sulphur at 45 kg/ha + Thiourea at 1000 ppm (31.34) and Sulphur at 45 kg/ha + Thiourea at 500 ppm (30.80 g) which were found to be statistically at par with T9.

Seed yield (t/ha): Maximum seed yield (1.84 t/ha) was recorded with the treatment of the application of Sulphur at 45 kg/ha + Thiourea at 1500 ppm over all the treatments, and the minimum was recorded in Control (RDF) 20:40:20 kg NPK/ha (1.46 t/ha). However, the

treatments Sulphur at 45 kg/ha + Thiourea at 1000 ppm (1.83 t/ha) and Sulphur at 45 kg/ha + Thiourea at 500 ppm (1.77 t/ha) were found to be statistically at par with T9.

Stover yield (t/ha): Maximum straw yield (3.66 t/ha) was recorded with the treatment of the application of Sulphur at 45 kg/ha + Thiourea at 1500 ppm over all the treatments, and the minimum was recorded in Control (RDF) 20:40:20 kg NPK/ha (3.28 t/ha). However, the treatments Sulphur at 45 kg/ha + Thiourea at 1000 ppm (3.65 t/ha) and Sulphur at 45 kg/ha + Thiourea at 500 ppm (3.59 t/ha), Sulphur at 30 kg/ha + Thiourea at 1500 ppm (3.57 t/ha) which were found to be statistically at par with T9.

Harvest index (%): Maximum Harvest index (33.45 %) was recorded with the treatment of the application of Sulphur at 45 kg/ha + Thiourea at 1500 ppm over all the treatments, and the minimum was recorded in Control (RDF) 20:40:20 kg NPK/ha (30.81 %). However, the treatments Sulphur at 45 kg/ha + Thiourea at 1000 ppm (33.39 %) and Sulphur at 45 kg/ha + Thiourea at 500 ppm (33.02 %) were found to be statistically at par with T9.

Discussions:

Thiourea is an important compound having thiol and amino groups, fact which make it biologically important, specially because its action onto soil remarkably differs over urea application, as its applicability proved beingsignificant in the modulation of gene expression, induction and activation of antioxidative defence system which results in improvised photosynthetic capacity and leaf gas exchange properties of crops growing under stressful environments. Foliar application of thiourea @1000pm at pre-flowering plus pod initiation stages and pod initiation alone, and @500ppm at pre-flowering and pod initiation stages significantly improved the growth and the yield of lentil at hilly conditions of NEH region, through better root growth and adaptability with better nutrient uptake which consequently resulted in higher net returns and increased benefit-cost ratio. Improved agronomic technologies like cost-effective foliar application techniques could help in utilizing the untapped potential of rice fallow through the expansion of pulses in this NEH region (Premaradhya 2018). This might be due to greater seed yield and fodder with the application and use of thiourea which serve as a viable alternative to overcome the soil barrier in nutrient and water deficiency. This simple, easy and promising production technique may lead to on-farm adaptation of such as sulfhydryl compound (Rehman *et al*., 2013) by resource-poor hill farmers of the NEH region.

Conclusion:

Sulphur is essential for many growth functions in plants including nitrogen metabolism, enzyme activity and protein and oil synthesis..It is concluded that the application of Sulphur at 45 kg/ha + Thiourea at 1500 ppm recorded significantly higher yield parameters growth as compared to other treatments. Since, the finding based on the research done in one season.

Table 1:Response of sulphur and foliar application of thiourea on Yield attributes and Yield of Clusterbean.

Treatments	Pods /plant (No)	Seeds/pod (No)	Seed index (g)	Seed yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
T1 - Sulphur at 15 kg/ha + Thiourea at 500 ppm	32.00	9.00	27.33	1.64	3.46	32.17
T2 - Sulphur at 15 kg/ha + Thiourea at 1000 ppm	33.00	9.60	27.61	1.66	3.48	32.30
T3 - Sulphur at 15 kg/ha + Thiourea at 1500 ppm	34.00	10.00	29.33	1.68	3.50	32.43
T4 - Sulphur at 30 kg/ha + Thiourea at 500 ppm	36.00	10.30	29.49	1.70	3.52	32.59
T5 - Sulphur at 30 kg/ha + Thiourea at 1000 ppm	34.00	11.00	29.57	1.74	3.56	32.85
T6 - Sulphur at 30 kg/ha + Thiourea at 1500 ppm	38.00	12.40	30.00	1.75	3.57	32.91
T7 - Sulphur at 45 kg/ha + Thiourea at 500 ppm	37.00	13.00	30.80	1.77	3.59	33.02
T8- Sulphur at 45 kg/ha + Thiourea at 1000 ppm	39.50	13.50	31.34	1.83	3.65	33.39
T9 - Sulphur at 45 kg/ha + Thiourea at 1500 ppm	41.00	14.00	31.80	1.84	3.66	33.45
T10 - Control (RDF) 20:40:20 kg NPK/ha	30.00	9.00	27.06	1.46	3.28	30.81
Sem(±)	0.61	0.21	0.40	0.02	0.05	0.37
CD(p=0.05)	1.82	0.64	1.18	0.07	0.14	1.11

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