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Effect of Nitrogen and Zinc on Growth, Yield and Economics of Clusterbean [(*Cyamopsis tetragonoloba* (L.) Taub]

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ABSTRACT

A field experiment was conducted during *kharif*, 2008 at S.V. Agricultural College, Tirupati to study the effect of nitrogen and zinc on growth and seed yield of clusterbean. The experiment was laid out in split plot design, replicated thrice with three nitrogen levels *viz.,* 20, 30 and 40 kg N ha^{-1} assigned to main plots and four zinc management practices *viz.,* 0.5 % $ZnSO_4$ spray at 25 DAS, 0.5 % $ZnSO_4$ spray at 45 DAS, 0.5 % $ZnSO_4$ spray at 25 and 45 DAS and 20 kg $ZnSO_4$ ha^{-1} as basal were assigned to sub plots. The results showed that nitrogen level of 30 kg N ha^{-1} and 0.5 % $ZnSO_4$ spray at 25 and 45 DAS significantly influenced growth characters, yield attributes, seed yield and economics of clusterbean.

Key words : Clusterbean, Growth, Nitrogen, Yield, Zinc.

Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub] popularly known as guar is extremely drought tolerant and thrives well in semi-arid regions. In India, guar beans are used as a vegetable for human consumption and the crop is also grown for cattle feed and as a green manure crop. The endosperm of the guar contains significant amount of galactomannan, which is extracted as guar gum and it is gaining importance in recent years as one of the global marketable products. The cultivation of guar can be extended to arid areas of Andhra Pradesh, where the rain fall is low and erratic in distribution, coupled with high temperatures and low fertility status of soils. The agro climatic conditions that prevail in these areas are favourable for growth and development of guar crop for seed purpose with good quality of gum.

Like other legumes, clusterbean has the potential to fix atmospheric nitrogen through its root nodulation but it requires nitrogen as a starter in early phase of growth. Similarly, zinc deficiency is a common problem in India and zinc is said to activate several enzymes, play a role in auxin synthesis and increase meristematic activities. Most of the work done on nutrition of this crop has been related with major elements whereas research on micronutrients is scanty. Hence, the present investigation "Influence of Nitrogen and Zinc Nutrition on Growth, Yield and Economics of Clusterbean" was under taken.

MATERIAL AND METHODS

The experiment was conducted on sandy loam soil of dryland farm of S.V. Agricultural college, Tirupati campus of Acharya N.G. Ranga Agricultural University, during *kharif*, 2008 in a split plot design with three replications. The experiment comprises three nitrogen levels in main plots *viz.,*20, 30 and 40 kg N ha^{-1} and four zinc management practices in sub plots *viz.,*0.5 % $ZnSO_4$ spray at 25 DAS, 0.5 % $ZnSO_4$ spray at 45 DAS, 0.5 % $ZnSO_4$ spray at 25 and 45 DAS and 20 kg $ZnSO_4$ ha^{-1} as basal. The initial fertility status of the soil is 240 (low), 25 (medium) and 229.7(medium) kg ha^{-1} of N, P_2O_5 and K_2O respectively and Zn of 2 mg kg^{-1} of soil (high). The Nitrogen was applied as per the main plot treatments and zinc was applied as per the sub plot treatments. The data recorded on various parameters of crop was subjected to statistical scrutiny by the method of analysis of variance as outlined by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Application of 40 kg N ha^{-1} resulted in tallest plants, which were significantly taller than those observed at other nitrogen levels which might be attributed to the fact that nitrogen induces cell-division, cell-elongation and higher auxin levels, which might have resulted in better growth of plants, leading to higher plant height. Similar results of increase in plant height with nitrogen levels have been reported by Sharma and Nehara (2004). Among

Table 1. Effect of nitrogen and zinc on growth characters of clusterbean at harvest.

Treatments	Plant height (cm)		Leaf area index		DMP (kg ha^{-1})	
Nitrogen levels						
N_1 – 20 N kg ha^{-1}	52.2		0.24		10441	
N_2 – 30 N kg ha^{-1}	58.2		0.31		11171	
N_3 – 40 N kg ha^{-1}	58.7		0.38		12573	
Zinc management practices						
Z_1 – 0.5 % $ZnSO_4$ spray at 25 DAS	54.4		0.33		11916	
Z_2 – 0.5 % $ZnSO_4$ spray at 45 DAS	49.4		0.30		10015	
Z_3 – 0.5 % $ZnSO_4$ spray at 25 and 45 DAS	71.8		0.37		13811	
Z_4 – Application of $ZnSO_4$ @ 20 kg ha^{-1}	43.2		0.23		9839	
	SEm ±	CD (0.05)	SEm ±	CD (0.05)	SEm ±	CD (0.05)
N	0.89	3.5	0.005	0.02	175	689
Z	0.37	1.1	0.004	0.01	398	1182
N at Z	1.05	3.8	0.009	0.03	-	NS
Z at N	0.65	1.9	0.008	0.02	-	NS

the zinc management practices, the plant height recorded was maximum with 0.5 % $ZnSO_4$ at 20 and 45 DAS.

The highest leaf area index was recorded with 40 kg N ha^{-1} and with application of 0.5 % $ZnSO_4$ at 20 and 45 DAS. The interaction of 40 N kg ha^{-1} along with 0.5 % $ZnSO_4$ at 20 and 45 DAS resulted in highest leaf area index. Increase in leaf area index due to higher dose of nitrogen may be effect of nitrogen on cell enlargement, resulting in production of more number of larger leaves per plant as well as per unit area.

The highest drymatter production was observed with 40 N kg ha^{-1} and while among zinc management practices, highest drymatter production was resulted with 0.5 % $ZnSO_4$ at 20 and 45 DAS. Adequate supply of nitrogen might have helped the guar to increase their growth and plant height due to the favourable effect on cell-enlargement and production of larger leaves. This inturn might have eventually resulted in higher photosynthetic efficiency and there by accumulated higher quantity of dry matter. This corroborates the findings of Mohmoud *et al.,* (1996), Sanjeev Kumar *et al.,* (2007) and Uday Burman *et al.,* (2007). While the interaction effect was found to be non-significant in increasing the dry matter production.

Yield attributes and yield

Yield attributes viz., number of clusters plant^{-1}, number of pods cluster^{-1} and number of seeds pod^{-1}, thousand seed weight and stalk yield were highest with 30 kg N ha^{-1}. Higher drymatter production and the efficient translocation of accumulated assimilates to the reproductive parts under adequate nitrogen nutrition might be responsible for beneficial effect on elevating the stature of all the yield attributes and stalk yield. Among the zinc management practices, 0.5 % $ZnSO_4$ at 20 and 45 DAS resulted in the higher no. of all the yield attributes and stalk yield. The beneficial effects of zinc might be through the acceleration of metabolic activities especially of protein, carbohydrate and nitrogen fixation. Similar results have been reported by Nandwal *et al.,* (1990), Kavitha Sharma *et al.,* (2004) and Gupta *et al.,* (2007). The interaction effect of 30 kg N ha^{-1} along with 0.5 % $ZnSO_4$ at 20 and 45 DAS resulted in the highest yield attributes i.e number of clusters plant^{-1}, number of pods cluster^{-1} and stalk yield while, the number of seeds pod^{-1} and thousand seed weight were not influenced by their interaction. This might be due to optimum availability of nutrients for luxurious and vigorous crop growth leading to efficient partitioning of assimilates from source to sink.

The highest seed yield was produced with 30 kg N ha^{-1}. Higher seed yield obtained with higher level of nitrogen supply was mainly due to increase in yield attributes. Adequate nitrogen nutrition has promoted growth stature as well as the yield attributes of clusterbean resulting in higher seed yield. Among the zinc management practices, the highest seed yield was obtained with 0.5 % $ZnSO_4$ at 20 and 45 DAS. Higher seed yield might be

Table 2. Effect of nitrogen and zinc on yield attributes, yield and economics of clusterbean.

Treatments	No. of clusters plant^{-1}	No. of pods cluster^{-1}	No. of seeds pod^{-1}	1000 seed weight (g)	Seed yield (kg ha^{-1})	Stalk yield (kg ha^{-1})	Net returns (Rs.ha^{-1})	Benefit-cost ratio
N_1	19.0	3.0	7.6	34.3	623	825	3061	1.5
N_2	20.6	4.1	7.9	33.2	819	1045	5960	1.9
N_3	19.7	3.0	7.2	33.1	692	912	4017	1.6
Z_1	18.7	3.5	7.6	33.8	719	916	4520	1.7
Z_2	17.8	3.1	7.5	32.7	657	822	3580	1.6
Z_3	24.8	4.0	7.9	35.7	891	1286	6696	2.0
Z_4	17.8	2.8	7.3	32.0	577	685	2589	1.4

	No. of clusters plant^{-1}		No. of pods cluster^{-1}		No. of seeds pod^{-1}		1000 seed weight (g)		Seed yield (kg ha^{-1})		Stalk yield (kg ha^{-1})		Net returns (Rs.ha^{-1})		Benefit-cost ratio	
	SEm ±	CD (0.05)	SEm ±	CD (0.05)	SEm ±	CD (0.05)	SEm ±	CD (0.05)	SEm ±	CD (0.05)	SEm ±	CD (0.05)	SEm ±	CD (0.05)	SEm ±	CD (0.05)
N	0.23	0.9	0.051	0.2	0.08	0.3	0.02	NS	10.76	42	16.72	66	161.44	634	0.024	0.1
Z	0.34	1.0	0.054	0.2	0.04	0.1	0.02	0.1	14.36	43	13.77	41	215.43	640	0.033	0.1
N at Z	0.55	1.7	0.096	0.3	-	NS	-	NS	24.08	76	26.58	89	361.24	1142	0.055	0.2
Z at N	0.58	1.7	0.093	0.3	-	NS	-	NS	24.87	74	23.86	71	373.14	1109	0.057	0.2

attributed to beneficial influence of zinc on yield attributing characters and also due to enhanced synthesis of carbohydrates and proteins because Zn activates several enzymes.

The interaction effect influenced the seed yield significantly. Application of 30 kg N ha^{-1}along with 0.5 % $ZnSO_4$ spray at 20 and 45 DAS resulted in highest seed yield. This might be due to higher availability of nutrients that stimulated the crop growth parameters, besides favourably influencing the yield attributes, which ultimately reflected in higher seed yield.

Economics:

Highest net returns and benefit cost ratio were recorded with 30 kg ha^{-1}. Among the zinc management practices tried, the highest net returns and benefit-cost ratio were recorded with 0.5 % $ZnSO_4$ at 20 and 45 DAS. The interaction effect was found to be significant in case of net returns and benefit: cost ratio. This might be attributed to a marginal difference in yield levels among the treatments.

The present experiment concluded that application of 30 kg N ha^{-1} in basal followed by foliar sprays of 0.5 % $ZnSO_4$ at 20 and 45 DAS results in higher seed yield of clusterbean.

LITERATURE CITED

Mohmoud S M, Badawy F H, Gameh M A and Sadiek H S 1996 Effect of inoculation of pigeon pea, siratro and guar with *Bradirhizobium* strains, nitrogen and phosphorus fertilization on: II forage crop yield. *Assiut Journal of Agricultural Sciences*, 27 (1): 17-32.

Nandwal A S, Dabas S, Bhari S and Yadav B D 1990 Zinc effect on nitrogen fization and cluster bean yield. *Annals of Arid Zones*, 29 (2): 99-103.

Gupta P P, Yadav B D and Joshi U N 2007 Effect of micronutrient on major diseases of clusterbean. *Journal of Arid Legumes,* 4(1): 47-51.

Kavitha Sharma, Jain K K and Sharma S k 2004 Yield components of clusterbean as influenced by zinc and thiourea. *Annals of Agricultural Research,* 25 (1): 169-171.

Table 3. Effect of nitrogen and zinc on yield of clusterbean.

Treatments	Z_1	Z_2	Z_3	Z_4	Mean
N_1	613	559	808	513	623
N_2	830	727	1053	666	819
N_3	715	685	813	554	692
Mean	719	657	891	577	
		SEm ±		CD (0.05)	
N		10.76		42	
Z		14.36		43	
N at Z		24.08		76	
Z at N		24.87		74	

Sanjeev kumar, Baboo R and Kumar M 2007 Response of guar (*Cymopsis tetragonoloba* L.) to rhizobium inoculation, nitrogen and phosphorus. *Progressive Agriculture,* 7(1/2): 147-148.

Panse V G and Sukhatme P V 1985 *Statistical Methods for Agricultural Workers*. Indian Council of Agricultural Research, New Delhi. 100-174.

Sharma S K and Nehara K C 2004 Effect of different varieties and fertilizer levels on yield and yield attributing characters of guar (*Cymopsis tetragonoloba* (L) Taub.). *National Symposium on Arid Legumes for Sustainable Agriculture and Trade* pp:51.

Uday Burman, Balvinder Kumar Garg and Shyam Kathju 2007 Interactive effects of phosphorus, nitrogen, and thiourea on cluster bean (*Cymopsis tetragonoloba* L.) under rainfed conditions of the Indian arid zone. *Journal of Plant Nutrition and Soil Science*, 170 (6): 803-810.

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