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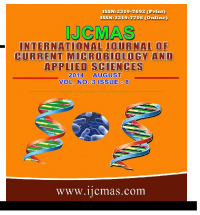

Original Research Article

Effect of fertility and sulphur levels on quality parameter of summer clusterbean (*Cyamopsis tetragonoloba* L.) under south saurastra region

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K e y w o r d s

Clusterbean, Nitrogen, Phosphorus, Protein, Quality, Sulphur

A B S T R A C T

A field experiment was conducted on medium black soil at the Department of Agronomy, Junagadh Agricultural University, Junagadh (Gujarat) during the summer season of 2012 (21.5^0 N, 70.5^0 E, altitude of 60 m above the mean sea level). The twelve treatment combinations consisted of four levels of fertility *viz*., without fertility (F_1), 20:40 kg N and P ha^{-1} (F_2), 30:60 kg N and P ha^{-1} (F_3) and 40:80 kg N and P ha^{-1} (F_4) and three levels of sulphur *viz*., without sulphur (S_1), 20 kg S ha^{-1} (S_2) and 40 kg S ha^{-1} (S_3), were laid out in factorial randomized block design and replicated three times. The whole quantity of N, P and S fertilizers was applied as basal in all the plots as per the treatments. Nitrogen, phosphorous and sulphur were applied through of urea, di-ammonium phosphate (DAP) and bentonite, respectively. Significantly higher protein content (28.30 %) and protein yield (385 kg ha^{-1}) were recorded under F_4 fertility level (40:80 kg N and P ha^{-1}). Application of 40 kg S ha^{-1} significantly increased in protein content (27.27 %) and protein yield (97 %) of clusterbean over control. Interaction between fertility and sulphur levels was found to be significant in respect of protein yield. Through, application of 40:80 kg N and P ha^{-1} with 40 kg S ha^{-1}, enhanced the protein (462 kg ha^{-1}) yields, were fetched due to application of 40:80 kg N and P ha^{-1} with 20 kg S ha^{-1}.

Introduction

Clusterbean or guar (*Cyamopsis tetragonoloba* L.) is a widely grown crop but not on commercial basis on large scale at farmer's field. In the recent years, this crop has assumed great significance due to the presence of a good quality of gum in the endosperm of its seed. Due to diversified uses of clusterbean gum in textile, paper, explosive and mining industries, pharmaceuticals, cosmetic goods and food stuffs, it has ever increasing demand in the international market. It is principally used as a feed for livestock and poultry. India leads among the major guar producing countries of the world, contributing around 75 to 80% to the world's total production (7.5 to 10 lakhs tonnes). (Agril. Statistics at a glance, 2012). According to Aykroyd (1963) the composition of clusterbean is 81.0 g moisture, 10.8 g carbohydrate, 23% protein,

1.4 g of fat, 1.4 g of minerals, 0.09 mg thiamine, 0.03 mg riboflavin, 47 I.U. vitamin C, 316 I.U, vitamin A (per 100 g of edible portion). Among different nutrients, nitrogen is one of the most expensive and important nutrients. Phosphorus content of soils is either low or medium.

This is alarming because P is the backbone of balanced fertilizer use and it occupies a key place in intensive agriculture. Sulphur as secondary plant nutrient is becoming increasingly important in agriculture as it is the "Master Nutrient" for all oilseeds and pulses, and is rightly being called the "Fourth Major Plant Nutrient", along with nitrogen, phosphorus and potassium. Keeping above facts in view, the present investigation was taken to study the effect of fertility and sulphur levels on quality of summer clusterbean.

Materials and Methods

The experiment was carried out in College of Agriculture, Junagadh Agricultural University, Junagadh during summer 2012 (21.5^0 N, 70.5^0 E, altitude of 60 m above the mean sea level). The soil of the experimental plot was clayey in texture and slightly alkaline in reaction with pH 7.8 and EC 0.33 dS/m. The soil was low in available nitrogen (237 kg ha^{-1}), medium in available phosphorus (32.5 kg ha^{-1}), medium in potash (269 kg ha^{-1}) and medium in S (19.85 kg ha^{1}).

'Pusa Navbahar' variety was selected for the present investigation, as it is more popular in this region. The experiment comprising of twelve treatment combination were laid out in factorial randomized block design with three replication. The data collected from experiment were subjected to statistical analysis for Factorial Ranadomised Block Desigen as prescribed by Panse and Sukhatme, (1985).

Treatment details

(a) Factor A: N: P fertility levels (kg ha^{-1})

F_1 = 0:0, F_2 = 20:40, F_3 = 30:60, F_4 = 40:80

(b) Factor B: levels of Sulphur (kg ha^{-1})

S_1 = 0, S_2 = 20, S_3 = 40

In order to evaluate effect of treatments on quality protein content (%) in seed was calculated by multiplying the nitrogen concentration (%) in seed by the factor 6.25 as reported by Angelo and Mann (1973). Protein yield kg ha^{-1} for each treatment was calculated by using following formula

$$\text{Protien yield } (kg/ha) = \frac{\text{Seed protien content } (\%) \times \text{Seed yield } (kg/ha)}{100}$$

Results and Discussion

Effect of fertility level on quality parameters

A profound and augmenting effect on quality parameters *viz.,* protein content and protein yield of seed (Table 1) was appreciably influenced by fertility level. In respect of protein content remarkably the highest values were observed with application of 40:80 kg N and P ha^{-1} (F_4), which remained statistically equivalent to that of 30:60 kg N and P ha^{-1} (F_3) while, remarkably the lowest values were observed under without application of nitrogen and phosphorus (F_1). The higher protein content of seed under 40:80 or 30:60 kg N and P ha^{-1} as compared to 20:40 kg N and P ha^{-1} was due to its dependence on nitrogen content. This could also be explained on the basis of better availability of desired and required nutrients in crop root zone and enhanced photosynthetic and metabolic activity resulting in better partitioning of photosynthates to sinks, which reflected in quality enhancement in terms of ascorbic acid and protein content.

Table.1 Effect of different fertility and sulphur levels on protein content and yield in seed of summer clusterbean

Treatment	Protein content (%)	Protein yield(kg ha^{-1})
Fertility levels (N : P kg ha^{-1})		
F_1 – Control	24.31	160
F_2 – 20 : 40	25.55	318
F_3 – 30 : 60	27.11	367
F_4 – 40 : 80	28.30	385
S.Em±	0.78	14
C.D. at 5%	2.28	40
Sulphur levels (kg S ha^{-1})		
S_1 – Control	24.54	190
S_2 – 20	27.14	358
S_3 – 40	27.27	375
S.Em±	0.67	12
C.D. at 5%	1.98	35
Interaction (FXS)		
C.D. at 5%	NS	70
C.V.%	8.86	13

Table.2 Interaction of different fertility and sulphur levels on protein yield (kg ha^{-1})

Treatment	Level of sulphur(kg ha^{-1})			Mean
Fertility (kg ha^{-1})	**S_1:Control**	**S_2:20**	**S_3:40**	
F_1 -Control	105	176	199	160
F_2 – 20 : 40	190	356	408	318
F_3 – 30 : 60	225	437	439	367
F_4 – 40 : 80	242	462	453	385
Mean	190	358	375	
S.Em. ±	24			
C.D. at 5 %	70			
C.V.%	13			

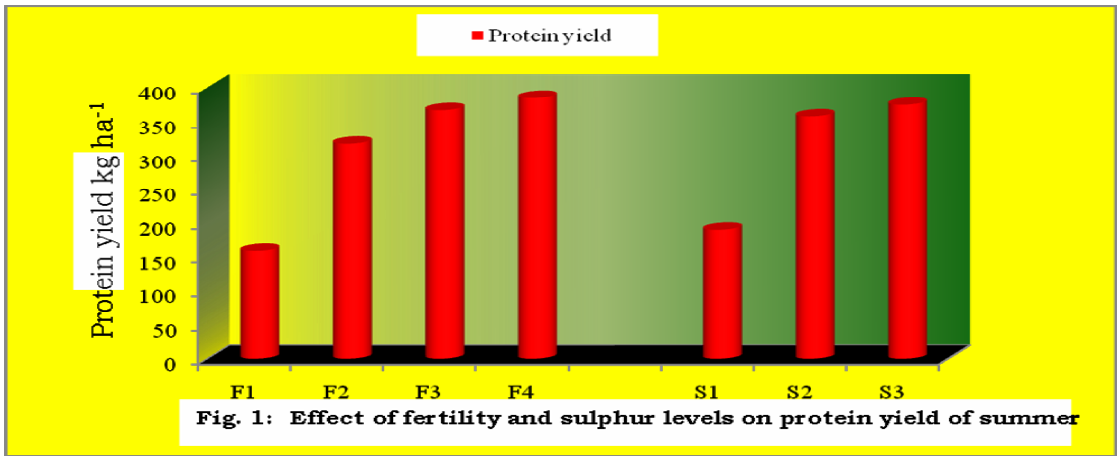

Fig. 1: Effect of fertility and sulphur levels on protein yield of summer

This finding closely associated with those of Sunder *et al.,* (2003), Rathod *et al.,* (2006) and Shinde *et al.,* (2007). A perusal of data (Table 1) revealed that different levels of fertility exerted their significant influence on protein yield in seed (Fig. 1). The application of fertility at 40:80 kg N and P ha^{-1} (F_4) gave significantly the highest protein yield in seed (385 kg ha^{-1}), which was found at par with treatment F_3. The treatment F_1 recorded the lowest protein yield in seed (160 kg ha^{-1}). Application of 40 kg S ha^{-1} gave significantly the maximum protein yield (375 kg ha^{-1}). Whereas, the treatment S_1 (control) recorded significantly the lowest protein yield (190 kg ha^{-1}).

Nitrogen and phosphorus provides the mechanism for energy storage in the form of ATP and the transfer of that energy source to fuel vital plant functions. Quality of a crop depends upon the protein content of seed, which is the major constituent of seed in legumes. Due to improvement in the nutritive quality of the clusterbean seed, protein yields from clusterbean seeds would be increased. These findings are more or less conformity with those reported by Rathod *et al.,* (2006) for nitrogen and Chavan *et al.,* (2008) for phosphorus.

Effect of sulphur on quality parameters

Data presented in Table 1 showed that application of sulphur to clusterbean enhanced the protein content and protein yield. The highest protein content of clusterbean was appreciably observed with application of 40 kg S ha^{-1}. However, application of 20 kg S ha^{-1} statistically at par in case of protein content in clusterbean seed. This might be due to sulphur play an important role in synthesis of essential amino acids like Cysteine, Cystine, Methionine and certain vitamins like Biotin, Thiamine, Vitamin B_1 as well as formation of ferodoxin an iron-containing plant protein that acts as an electron carrier in the photosynthetic process and chlorophyll which required for the production of protien. Similar results were also obtained by Gandhi and Shakhela (2005), Kumar *et al.* (2012), and Yadav *et al.* (2012).

Interaction effect of fertility levels and sulphur protein yield

The interaction of different levels of fertility and sulphur on protein content in seed was found appreciable (Table 2). The perusal data indicate that the highest protein yield (461.80 kg ha^{-1}) was recorded under combination application of fertility at 40:80 kg N and P ha^{-1} + 20 kg S ha^{-1} (F_4S_2) over rest of treatment combination. However, it was statistically at par with treatment F_2S_2, F_2S_3, F_3S_3 and F_4S_3. The lowest protein yield (104.66 kg ha^{-1}) was recorded with interaction of treatment no application of fertility and sulphur (F_0S_0).

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