www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(7): 526-529

www.thepharmajournal.com
Received: 02-05-2021
Accepted: 07-06-2021

Raj Singh Choudhary
M.Sc., Department of Soil Science, Agricultural and Chemistry, SKN Agricultural University, Jobner, Jaipur, Rajasthan, India

BL Yadav
Professor, Department of Soil Science, Agricultural and Chemistry, SKN Agricultural University, Jobner, Jaipur, Rajasthan, India

Ramswaroop Jat
M.Sc., Department of Soil Science, Agricultural and Chemistry, SKN Agricultural University, Jobner, Jaipur, Rajasthan, India

Shyopal Jat
M.Sc., Department of Soil Science, Agricultural and Chemistry, SKN Agricultural University, Jobner, Jaipur, Rajasthan, India

Corresponding Author:
BL Yadav
Professor, Department of Soil Science, Agricultural and Chemistry, SKN Agricultural University, Jobner, Jaipur, Rajasthan, India

Effect of organic manures and mineral nutrients on growth, yield attributes and yield of Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub.]

Raj Singh Choudhary, BL Yadav, Ramswaroop Jat and Shyopal Jat

Abstract
A field experiment was conducted at Agronomy Farm, S.K.N. College of Agriculture, Jobner, (Rajasthan) during *kharif*, 2013 on loamy sand soil to study the effect of organic manures and mineral nutrients on soil properties and yield of Cluster bean [*Cyamposis tetragonoloba* (L.) Taub.]. The treatments consisted of four levels of organic manures (Control, FYM @ 10 t/ha, vermicompost @ 3 t/ha and poultry manure @ 4 t/ha) and five levels of mineral nutrients (Control, elemental sulphur @ 40 kg/ha, elemental sulphur @x 40 kg/ha + zinc sulphate @ 25 kg/ha, elemental sulphur @ 40 kg/ha + zinc sulphate @ 25 kg/ha + ferrous sulphate @ 50 kg/ha, elemental sulphur @ 40 kg/ha + zinc sulphate @ 25 kg/ha + ferrous sulphate @ 50 kg/ha + ammonium molybdate @ 1 kg/ha) were applied to the Cluster bean var. RGC-1003. The experiment was laid out in randomised block design and replicated three.

Keywords: Organic manures, mineral nutrients, growth, yield attributes and yield

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.

Cluster bean seed is used as a concentrate for animal and for extraction of "gum". Seed of Cluster bean contain 28 to 33 percent 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 per year.

In India, Cluster bean is mostly grown in Rajasthan, Haryana, Punjab, Uttar Pradesh and Madhya Pradesh. Total production of guar in India was achieved by 2.46 mt from an area of 5.15 m ha during 2012-13 with productivity of 478 kg/ha. A production of 2.0 mt ha was achieved in our state from an area of 4.5 m ha with productivity of 447 kg/ha. Nearly 90 percent of the area under guar crop in the country is being contributed almost consistently by Rajasthan state (Anonymous, 2012) [1]. Addition of organic material to the soil such as FYM, vermicompost, poultry manure etc. help in maintaining the soil fertility and productivity. These increases soil microbiological activities, plays key role in transformation recycling and availability of nutrients to the crop (Collins *et al.* 1992) [5]. These also improve the physical properties like soil structure, porosity, reduce compaction and crusting, increases water holding capacity of soil. The availability of major and micronutrients from native source also increases with incorporation of organic matter which might be due to release of organic acid (Stevensons, 1982) [15].

Zinc plays an outstanding role in synthesis of chlorophyll, protein and also regulates water absorption. Moreover, it also plays role in carbohydrates metabolism and activation of various enzymes which help in inducing alkalinity tolerance in crops by enhancing Na/K and Na/Ca ratio.

The iron is a structural component of porphyrin molecules, cytochromes, heams, hematin, 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 in 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 transport chain.

The molybdenum is an essential component of the enzyme nitrate reductase and structural component of nitrogenase, which is actively involved in nitgoen fixation by root- nodules bacteria of leguminous crops. Despite the maximum area of Cluster bean in Rajasthan, the average productivity is only 0.45 t/ha compared 1.35 and 0.89 t/ha in Haryana and Gujarat (Anonymous, 2012) [1].

Materials and Methods

A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif* season of 2013. The details of procedure adopted for raising the crop and criteria adopted for evaluation of treatments during the course of present investigation are described in this chapter. The site is situated 45 km west of Jaipur at 26^0 5' North latitude and 75^0 28 East longitude at an altitude of 427 meters above mean sea level. The place falls under Agro-climatic zone-IIIa (Semi-Arid Eastern Plains), of Rajasthan. The climate of this zone is typically semi-arid characterized by extremes of temperature during both summers and winters. During summers, the temperature may go as high as 48 ^{0}C, while, in winters, it may fall as low as -1.0 ^{0}C. The rainfall of this tract varies form 450-500 mm, most of which is contributed by south-west monsoon during the months of July and August. In order to determine the physico-chemical properties of soil, soil samples (0-15 cm depth) were collected from different spots of the experimental field prior to sowing and fertilization. The experimental soil was loamy sand in texture with soil was low in organic carbon (2.30%), low available nitrogen (124.2 kg N ha^{-1}), medium in available phosphorus (16.50 kg P_2O_5 ha^{-1}) and in available potassium (161.90 kg K_2O ha^{-1}) while the soil was deficient in available sulphur (7.45 mg kg^{-1}), available Mo 0.12 (mg kg^{-1}), available DTPA Fe 5.34 (mg kg^{-1}) available DTPA Zn 0.42 (mg kg^{-1}). The soil was non saline with a reaction 8.2. Recommended dose of N and P was applied through urea and DAP as basal at the time of sowing. The FYM @ 10 t ha^{-1}, vermicompost @ 3 t ha^{-1} and poultry manure @ 4 t ha^{-1} were applied uniformly 20 days before sowing and incorporated in soil manually in allocated beds as per treatment. Sulphur was applied through elemental sulphur as per treatment 21 days before sowing through broadcasting. Sulphur received through iron sulphate and zinc sulphate was equated, in sulphur treatment. Mo, Fe and Zn were applied through ammonium molybdate, *ferrous sulphate and* zinc sulphate. The crop was raised with standard package of practices. The crop was harvested at maturity and plot wise fodder and grain yield recorded after sun dry as well as plant height, number of branches per plant, number of capsule per plant, number of seed per capsule, 1000 seed test weight and yield were also recorded.

Results and Discussion

The results obtained from the present investigation are presented in Table 1 and 2.

Effect of organic manures

A perusal of data in Table 1 revealed that application of different organic manures significantly increased the plant height at harvest of the crop. The application of poultry manure @ 4 t/ha noted significantly higher plant height, number of pods/plant, number of seeds/pod, test weight, straw yield, seed yield and harvest index over control and FYM but remained statistically at par with the application of vermicompost. Data presented in Table 1 showed that application of organic manures had significant effect in increasing the number of pods per plant, number of seed per pod, test weight, seed and straw yield and harvest index. The higher increase in these yield attributes and yield have been reported to be associated with the release of macro and micronutrients during the course of microbial decomposition (Singh and Ram 1992) [14]. Organic matter also functions as source of energy for soil micro flora which brings about the transformation of inorganic nutrients held in soil or applied in the form of fertilizers, in a form that is readily utilized by growing plants. The beneficial effects of FYM/Vermicompost /poultry manure addition are also related to improvement in soil physical properties (Kofoed, 1987) [8]. The beneficial response of poultry manure and vermicompost to yield attributes and yield might also be attributed to the availability of sufficient amounts of easily utilizable from of plant nutrients throughout the growth period and specially at critical growth periods of crop resulting in better uptake, plant vigour and superior yield attributes (Brar and Pasricha, 1998; Bansal *et al.*, 2000 and Surender Rao and Sitaramayya, 2000) [2, 3, 16]. These finding corroborates with the results of several other workers (Singh *et al*. 2008, Ghanshyam *et al.* 2010; Singh *et al.* 2010 and Ramawtar *et al*. 2013) [6, 11-13].

Mineral nutrients

The data related to plant height presented in Table 1 indicated that the application of mineral nutrients significantly increased the plant height over control. All the treatments differed significantly among them. Significantly highest plant height plant height, number of pods/plant, number of seeds/pod, test weight, straw yield, seed yield and harvest index was recorded with the treatment M_4. The application of multi nutrients combination significantly increased the yield attributes. The significant improvement in yield attributes and yield of Cluster bean was noticed under M_4 (S + Zn + Fe + Mo) treatment.

The application of mineral fertilizers alone might supply one or two nutrients only but conjoint use of macro and micro nutrient fertilizers would provide essential nutrients in proper ratio to plant and soil and also reduces the possibilities of multiple micronutrients deficiencies in particular. It is well established fact that pulse crops require 15-20 kg N, 40-60 kg P_2O_5 and 20 kg S ha^{-1} for successful production. The responses of some of the micronutrients *viz.*, Mo, Fe and Zn have also been found promising in increasing the productivity of the soils (Masood Ali and Mishra, 2000) [10]. Significant response of pulses to mineral nutrients have also been reported by several workers (Lourduray *et al*. 1997; Teotia *et al.*, 2000*;* Chavan *et al.* 2012 and Gupta and Ganagwar 2012) [4, 7, 9, 17].

Table 1: Effect of organic manures and mineral nutrients on number of pods/plant, seed/pod and test weight

Treatments	Number of pods/plant	Number of seeds/pod	Test weight (g)
Organic manures			
Control (T0)	28.58	8.25	25.68
FYM (T1)	30.63	8.96	27.46
Vermicompost (T2)	32.69	9.58	28.30
Poultry manure (T3)	34.44	10.07	29.10
S.Em +	0.64	0.19	0.56
CD at (P = 0.05)	1.82	0.53	1.59
Mineral nutrients			
Control (M0)	27.40	7.84	23.29
Elemental sulphur (M1)	29.48	8.52	26.01
S + Zn (M2)	31.57	9.21	27.82
S + Zn + Fe (M3)	33.69	9.91	29.64
S + Zn + Fe + Mo (M4)	35.79	10.59	31.43
S.Em +	0.71	0.21	0.62
CD at (P = 0.05)	2.04	0.60	1.78

Table 2: Effect of organic manures and mineral nutrients on seed yield, straw yield and harvest index of crop

Treatments	Seed yield (q/ha)	Straw yield (q/ha)	Harvest index
Organic manures			
Control (T0)	8.82	25.59	25.61
FYM (T1)	9.52	27.30	25.83
Vermicompost (T2)	10.20	27.82	26.81
Poultry manure (T3)	10.80	28.90	27.18
S.Em +	0.21	0.52	0.57
CD at (P = 0.05)	0.61	1.50	1.62
Mineral nutrients			
Control (M0)	8.44	24.00	25.98
Elemental sulphur (M1)	9.15	25.71	26.21
S + Zn (M2)	9.84	27.39	26.40
S + Zn + Fe (M3)	10.52	29.07	26.54
S + Zn + Fe + Mo (M4)	11.23	30.84	26.66
S.Em +	0.24	0.59	0.63
CD at (P = 0.05)	0.68	1.68	1.81

Conclusion

Use of poultry manure @ 4 t ha^{-1} or vermicompsot @ 3 t ha^{-1} or as combined application of S + Zn + Fe + Mo resulted in significantly higher growth, yield attributes and yield of plant without compromising on soil fertility maintenance. However, these results are only indicative and require further experimentation for confirmation before making final recommendation to the farmers.

Reference

1. Anonymous. Vital statistics, Government of Rajasthan 2012.
2. Bansal SK, Mazumdar K, Singh V, Imax P. Long Term effect of potassium nutrient on productivity and sustainability of a Sorghum-Wheat cropping system. Proceedings International Conference on Managing Natural Resources for Sustainable Agriculture Production in the 21st century, New Delhi 2000;3:871-872.
3. Brar BS, Pasricha MS. Long term studies on integrated use of organic and inorganic fertilizer in Maize-Wheat-cowpea cropping system on an alluvial soil of Punjab. In: Long Term soil fertility management through integrated plant nutrient supply system. Indian Institute of Soil Science, Bhopal 1998, 154-168.
4. Chavan AS, Khafi HR, Raj AD, Parmar RM, Shekh MA. Effect of potassium and zinc on growth and yield of cowpea [*Vigna unguiculata* (L.) Walp.]. Research on Crops 2012;6:432-434.
5. Collins HP, Rasmussen PE, Doughlas CL. Crop rotation and residue management effect on soil and microbial dynamics. Soil Science Society of America Journal 1992;56:783-788.
6. Ghanshyam Kumar R, Jat RK. Productivity and soil fertility as affected by organic manure and inorganic fertilizer in green gram (*Vigna radiata*) wheat (*Triticum aestivum*) system. Indian Journal of Agronomy 2010;55:16-21.
7. Gupta SC, Ganagwar S. Effect of molybdenum, iron and mineral inoculation on symbiotic strain, nutrient uptake and yield of chickpea. Journal of Food Legume 2012;25:45-49.
8. Kofoed AD. The significance of FYM. Kodemines Tidskrift 1987;19:37-63.
9. Lourduray Christopher A, Krishnam RK, Geethalakshmi V. Micronutrient fertilization in groundnut. Madras Journal of Agriculture Research 1997;43:362-363.
10. Masood Ali, Mishra JP. Nutrient management in pulses and pulses based cropping system. Fertilizer News 2000;45:59-69.
11. Ramawtar Shivran AC, Yadav BL. Effect of NP fertilizers, vermicompost and sulphur on growth yield and quality of Cluster bean [*Cymopsis tetragonaloba* (L.)] and their residual effect on grain yield of succeeding wheat [*Triticum aestivum* (L.)]. Legume Research 2013;36:74-78.
12. Singh Q, Sekhon HS, Ram H, Sharma P. Effect of farmyard manure, phosphorus and phosphate solubilizing bacteria on nodulation, growth and yield of kabuli

chickpea. Journal of Food Legume 2010;23(3$4):226-229.
13. Singh VK, Sharma BB, Sahu JP. Effect of organic and inorganic sources of nutrients on urdbean productivity. Journal of Food Legumes 2008;21:173-174.
14. Singh WB, Khandelwal RB, Singh B. Effect of manganese and molybdenum fertilization with *Rhizobium* inoculation on yield and protein content of Cowpea. Journal of the Indian Society of Soil Science 1992;40:738-741.
15. Stevensons FJ. Organic matter and nutrient availability in non-symbiotic nitrogen fixation and organic matter in the tropics. Symposia paper. 12th International Congress of Soil Science, held at New Delhi 1982;2.
16. Surender Rao S, Sitaramnayya M. Performance of alternate organic nitrogen sources in an Inceptisol under Rice. In. Proc. Intern. Conf. on Managing Natural Resources for Sustainable Agricultural Production in the 21th century, New Delhi 2000;3:1464-1465.
17. Teotia VS, Ghosh D, Shrivastava PC. Influence of sulphur on yield and S-uptake by Soybean in Soybean-Wheat cropping system in Mollisols of Nainital Tarai. Fertilizer News 2000;45:65-68.