Study on the effects of Sulphur, Zinc and FYM on growth, yield and economics of French bean (*Phaseolus vulgaris* L.) in Central Plain Zone of Uttar Pradesh

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Abstract

A field experiment was conducted during Rabi season of 2013-14 at the Students Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. The main objectives of this field study was to evaluate the effect of Sulphur, Zinc and FYM on growth attributes, yield attributes, yields and economics of french bean in Central Plain Zone of Uttar Pradesh. The treatment comprised 12 combinations of three sulphur level viz., control, 15 and 30 kg/ha, two zinc levels viz., 0 and 10 kg/ha and two FYM levels viz., 0 and 10 t/ha which was laidout in split plot design with three replications. The soil of the experimental field was alluvial in texture with pH of 7.3 and EC of 0.26 mm has/ cm at 25 °. French bean of PDR-14 variety was used in the study. Results showed that the growth attributes viz., Plant height of number of branches per plant, Fresh weight by 30kg/ha sulphur doses over control and 15 kg/ha sulphur, respectively. Individual application of Z@10 kg/ha was found significantly superior over control dose to increased all growth attributes except dry weight per plant of study field tail. The number of branches/plant and fresh weight/plant was significantly increased in respect 10 t/ha FYM compared to without FYM. Individually application of S@30 kg/ha, Z@10 kg/ha and FYM@10 t/ha were found significantly superior in all yield attributes over next doses, respectively except dry weight/plant in respect to FYM only. The highest grain yield (24.52 q/ha), straw yield (29.68 q/ha) harvest index (45.10%), gross income (Rs. 138192/ha), net income (Rs. 102847/ha) and return per rupee (2.90) were recorded significant upto 30 kg/ha sulphur over 0 and 15 kg/ha sulphur, doses, respectively. The increment evaluated in grain yield (41.08%) and (14.10%) and net return (57.76%) and (18.26%) compared to control and 15 kg/ha sulphur, respectively. Individual used of Z@10kg/ha and FYM@10t/ha were found significantly more produced than without Zinc and FYM in respect to yields and economics parameters, respectively expect return per rupee by FYM only. The increment percentage in grain yield (21.49% and 16.83%) and net return (29.02% and 15.81%) compared to without Zinc and without FYM doses, respectively.

I. INTRODUCTION

Pulses have been in the mainstay of agriculture and nutrition of the people in the developing world. Pulses on account of their vital role in nutritional security, soil productivity and elaborate properties, have been an integral part of sustainable agriculture since ages. They had been grown with cereals not only for meeting the diversified house hold need in the country but also for equilibrium in agriculture production system. The current Indian populations is 1.21 billion and is expected to go upto 1.27 billion in 2020 and 1.37 billion in 2030. At present of consumption, the demand for pulses would increase annually by 3.3%. It has been estimated that the requirement of pulses in likely to be around, 23mt in 2020 and 24-26 mt in 2030. This will require about 75 per cent increase in production by year 2030. Thus, the present productivity of 0.6 t/ha will have to be raised.
to 1 t/ha. India is the largest producer and consumer of pulses in the world (Anonymous, 2015). Among the pulses rajmash is one of the high potential pulse crop with a yielding potential of 18-20 q/ha. French bean, the most important species under Phaseolus, is originated in central and South America. The deficiency of micronutrient particularly zinc, iron and manganese is commonly reported in UP since zinc deficiency increase with increase in pH and calcium carbonate content. The response of zinc in flood plains and alkali soil is observed extensively. Zinc is an essential micro-nutrient for plant growth. Sulphur the secondary major nutrient, has got many important roles to play. Sulphur deficient plant witnesses greater decrease in chlorophyll content in leaves and carbohydrates metabolism etc. Sulphur plays a vital role in lipid synthesis. FYM have been traditionally used in agriculture for maintaining soil fertility due to nutrient content, higher organic matter, increased water holding capacity and increased uptake of nutrient and yield stability. FYM also improves physical (soil texture, soil structure), chemical (soil pH) and biological conditions of soil. The present study, therefore, undertaken to determine the effect of sulphur, Zinc and FYM on growth and yield attributes, yields and economics of french bean.

**II. MATERIALS AND METHODS**

A field experiment was conducted at Students Instructional Farm (SIF) at C.S. Azad University of Agriculture & Technology, Kanpur (UP) during Rabi season of 2013-14. The treatment comprised 12 combinations of three sulphur level viz., control, 15 and 30 kg/ha, two zinc levels viz., 0 and 10 kg/ha and two FYM levels viz., 0 and 10 t/ha which was laidout in Split Plot Design with three replications. The soil of the experimental field was alluvial in texture with pH of 7.3 and EC of 0.26 mmhos/cm at 25°C. French bean of PDR-14 variety was used in the study. Seed of Rajmash variety Uday (PDR-14) was sown at the seed @ 100 kg/ha, row- spacing of 30 cm and plant spacing of 10cm sowing of rajmash was done by country plough on November 21, 2013 at a row and plant spacing with a seed rate as per treatments. The crop was harvested on 26.03.2014. Recommended dose of fertilizer was used 80 kg N + 60 kg P2O5 + 40 kg K2O/ha with sulphur, zinc and FYM as per treatment. FYM applied 20 days before sowing for getting good result.

**III. RESULTS AND DISCUSSION**

**Growth and Yield Attributes**

The data pertaining to growth characters and yield attributes were summarized in Table-1. The plant height of french bean sown significant plant height 13.64, 13.56 and 13.37 cm observed by the application of sulphur 30 kg/ha, zinc (10 kg/ha) and FYM (10 t/ha), respectively. The number of branches/ plant recorded maximum (4.24) by sulphur@ 30 kg/ha and minimum 2.93 by without sulphure sown significant response. The application of zinc@10kg/ha recorded maximum number of branches (3.99) per plant and minimum (3.47) branches per plant without zinc. The FYM applied@ 10 t/ha recorded maximum number of branches (3.93) and minimum (3.53) recorded without FYM treatment. The fresh weight of plant shown significant response by the individual application of sulphure, zinc and FYM and recorded maximum fresh weight i.e. 96.25, 93.63 and 93.92g by the application of sulphure @ 30 kg/ha, zinc@10 kg/ha and FYM@10 t/ha, respectively. The dry weight of plant recorded maximum 16.77g by sulphur@ 30 kg/ha and minimum 13.59 kg by without sulphure differed significantly. The response of zinc and FYM found non-significant respective to its different doses. The interaction effects on all growth attributes viz., plant height, number of branches/plant, fresh and dry weight were found to be non-significant of study. It influences growth of plant as it involve diverse metabolic activities of hydrogenase and carboxylase. According to FYM helps in vegetative growth in French bean. Similar results were revealed by Band et al. (2007).

The numbers of pods/plant recorded minimum 4.68 and 4.99 in without sulphure and without Zinc treatments, respectively and it was increased significantly and registered maximum number of pods 5.94 and 5.75 with use of S @30 kg and Z @10 kg/ha, respectively. The response of FYM found non-significant in respect of number of pods/plant. Number of seeds/pod increased significantly by the used of sulphure, Zinc & FYM and recorded maximum number of seeds i.e.
6.71, 6.60 and 6.40 by the used of Sulphure@30 kg/ha, Zinc@10 kg/ha and FYM@10 t/ha, respectively. The interaction effect of S×Z found significant in respect to number of seeds/pod. The number pods/plant and the test weight of *Fassulus vulgaris* h. were increased none significantly by the application of different doses of S, Z and FYM. The minimum test weight 43.69, 44.62 and 45.19 g recorded in without S, Z and FYM treatments, while it was registered maximum 47.69, 47.21 and 46.63 g with the application of S@30 kg, Z@10 kg and FYM@10 t/ha, respectively.

Table-1: Growth and yield attributes as influenced by different doses of S, Z and FYM in french bean crops.

| Treatments | Plant height (cm) | No. of branches/ plant | Fresh wt./ per plant | Dried wt./ plant (g) | No. of Pods/plant | No. of seeds/pod | Test wt. (g) |
|------------|------------------|------------------------|----------------------|----------------------|------------------|-----------------|-------------|
| Sulphure (Kg/ha) |
| 0          | 12.26            | 2.93                   | 90.05                | 13.59                | 4.68             | 5.60           | 43.69       |
| 15         | 13.59            | 4.02                   | 92.75                | 15.58                | 5.49             | 6.38           | 46.36       |
| 30         | 13.64            | 4.24                   | 96.25                | 16.77                | 5.94             | 6.71           | 47.69       |
| SE (d)     | 0.27             | 0.14                   | 0.50                 | 0.47                 | 0.27             | 0.07           | 0.39        |
| CD at 5%   | 0.749            | 0.389                  | 1.384                | 1.296                | 0.749            | 0.199          | 1.077       |
| Zinc Kg/ha |
| 0          | 12.77            | 3.47                   | 92.40                | 15.12                | 4.99             | 5.86           | 44.62       |
| 10         | 13.56            | 3.99                   | 93.63                | 15.51                | 5.75             | 6.60           | 47.21       |
| SE (d)     | 0.21             | 0.08                   | 0.51                 | 0.18                 | 0.13             | 0.07           | 0.354       |
| CD at 5%   | 0.507            | 0.182                  | 1.251                | NS                   | 0.305            | 0.165          | 0.867       |
| FYM (t/ha) |
| 0          | 12.96            | 3.53                   | 92.11                | 14.93                | 5.21             | 6.06           | 45.19       |
| 10         | 13.37            | 3.93                   | 93.92                | 15.70                | 5.31             | 6.40           | 46.63       |
| SE (d)     | 0.19             | 0.14                   | 0.70                 | 0.42                 | 0.25             | 0.09           | 0.52        |
| CD at 5%   | NS               | 0.300                  | 1.533                | NS                   | NS               | 0.196          | 1.34        |

Yields and economics

The summary of data regarding yields and economics of French bean summarized in Table-2. The response of S, Z and FYM were found increasing significant in respect to grain yield of crop. The maximum grain yield 24.52, 23.18 and 22.77 q/ha recorded with the application of S@30 kg, Z@10 kg and FYM@10 t/ha, respectively while, it was found minimum 17.38q, 19.08q and 19.49q/ha in without S, Z and FYM treatment (Control), The yield increasement recorded 41.8%, 21.0% and 16.8% with the individual application of S@30kg, Z@10kg and FYM@10 t/ha, respectively. The straw yield increased by the individual application of S, Z and FYM in different treatments sown significant response similarly to that of grain yield. The harvest index recorded maximum 45.10% with the application of S@30 kg/ha and minimum 39.94% in without, sulphur treatment shown 5.16% increment. The application of Z@10 kg/ha recorded maximum harvest index 44.56% and minimum 41.01% in without zinc treatment shown 3.55% increment. The use of FYM@10 t/ha recorded 44.22% harvest index which was differed significantly to control treatment. The interaction effect of S×Z was found significant in respect to harvest index. Similar results was obtained by Ganie et. al. (2014).

The economic analysis revealed that applicat of S@30 kg/ha observed maximum grass income (Rs. 1, 38,192) and net income (Rs 10, 2847) and minimum grass income (Rs 99704) and net income (Rs. 65,192) computed in control i.e. without sulphur treatment. The application of zinc@10 kg/ha recorded maximum grass income (Rs 1, 30901) and net income (Rs. 95775) and minimum grass income (Rs. 1, 08950/-) and net income (Rs 74233) in without zinc treatment. The use of FYM@10 t/ha also computed maximum gross income (1, 28,659) and net income (91,232) which was significantly superior with control treatment. The interaction effect of sulphur×Zinc, S×FYM and Z×FYM in respect to grass income and net income found significant. The benefit cost ratio in respect to return per rupee found maximum (2.90) and minimum (1.87) with the use of S@30 kg and without sulphur treatment, respectively. The application of Z@10 kg/ha recorded maximum return.
(2.72) and minimum (2.11) in without zinc treat. The FYM applied @ 10 t/ha recorded maximum returns/ per rupee (2.42) which was found none significantly compared to control treatment. The interaction effect of S×Z, S×FY and Z×FYM found significant in terms of B: C ratio. The similar results were obtained by Pable et al. (2010).

**Table-2: Yields and economics as influenced by different doses of Sulphur, Zinc and FYM in French bean crops.**

| Treatments | Grain yield (q/ha) | Straw yield (q/ha) | Harvest index (%) | Gross income (Rs./ha) | Net income (Rs./ha) | Return per Rupees |
|------------|--------------------|--------------------|-------------------|------------------------|---------------------|-------------------|
| **Sulphur (kg/ha)** | | | | | | |
| 0          | 17.38              | 25.38              | 39.94             | 99,704                 | 65192               | 1.87              |
| 15         | 21.49              | 27.95              | 43.32             | 121894                 | 86967               | 2.48              |
| 30         | 24.52              | 29.68              | 45.10             | 138192                 | 102847              | 2.90              |
| SE (d)     | 0.64               | 0.71               | 0.66              | 730.07                 | 730.09              | 0.04              |
| CD at 5%   | 1.768              | 1.969              | 1.830             | 2015.571               | 2015.624            | 0.111             |
| **Zinc (kg/ha)** | | | | | | |
| 0          | 19.08              | 26.66              | 41.01             | 108960                 | 74233               | 2.11              |
| 10         | 23.18              | 28.68              | 44.56             | 13090                  | 95775               | 2.72              |
| SE (d)     | 0.61               | 0.34               | 0.61              | 374.45                 | 374.43              | 0.03              |
| CD at 5%   | 1.483              | 0.840              | 1.488             | 913.831                | 913.786             | 0.078             |
| **FYM (t/ha)** | | | | | | |
| 0          | 19.49              | 26.93              | 41.36             | 111222                 | 78776               | 2.41              |
| 10         | 22.77              | 28.41              | 44.22             | 128659                 | 91232               | 2.42              |
| SE (d)     | 0.85               | 0.67               | 0.84              | 502.99                 | 503.03              | 0.04              |
| CD at 5%   | 1.844              | 1.452              | 1.823             | 1095.719               | 1095.803            | NS                |

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