Effect of Panchgavya along with Different Levels of Fertilizer and FYM on Soil Properties in Kharif Clusterbean (Cyamopsis tetragonoloba)

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ABSTRACT

A field was conducted at Agronomy Instructional Farm, S.D. Agricultural University, Sardarkrushinagar during kharif 2016 to find out a effect of panchgavya along with different levels of fertilizer and fym on soil properties in kharif clusterbean (cyamopsis tetragonoloba). The experiment comprised of fourteen treatment combinations comprising of two organic manure levels viz., no FYM (M1) and 5 t FYM per hectare (M2) and seven fertilizer levels and panchgavya spray viz., 50 % RDF + panchgavya spray @ 3 % at branching + flowering (N1), 50 % RDF + panchgavya spray @ 6 % at branching + flowering (N2), 75 % RDF + panchgavya spray @ 3 % at branching + flowering (N3), 75 % RDF + panchgavya spray @ 6 % at branching + flowering (N4), 100 % RDF + panchgavya spray @ 3 % at branching + flowering (N5), 100 % RDF + panchgavya spray @ 6 % at branching + flowering (N6) and RDF (N7) were evaluated. The results revealed that higher seed yield, net realization and benefit: cost ratio can be achieved by fertilizing kharif clusterbean crop (var. GG 2) with the application of 5 tones FYM/ha and 100 % RDF (25: 50: 00 NPK kg/ha) along with panchgavya spray @ 3 % at branching and flowering stages.

Keywords
Panchgavya, FYM, RDF, Clusterbean

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Introduction

Clusterbean (Cyamopsis tetragonoloba) is popularly known as guar and has been recognised as one of the most important commercial crop of arid and semi-arid regions. It is a good source of carbohydrates, protein, fiber and minerals like calcium, phosphorus and iron and contains appreciable amount of vitamin 'C.' In India, clusterbean is cultivated in 56.03 lakh hectares with production and productivity of 27.15 lakh tonnes and 485 kg/ha respectively during 2013-14 (Annual Report, 2014). In Gujarat, it is cultivated in 2.79 lakh hectares with a production of 1.68 lakh tonnes and productivity of 604 kg/ha, respectively during 2014-15 (DOA, 2015). Conventional agriculture has made an adverse impact on soil and plant health. This eventually, leads to high demand for organic farming to protect soil and plant health. Organic farming in recent years is gaining importance due to realization of inherent advantages. It confers in sustaining crop production and also maintaining dynamic soil nutrient status and safe environment.
Sufficient and balanced application of organic and inorganic fertilizers is a major component of INM. Sustainable agricultural production incorporates the idea that natural resources should be used to generate increased output and incomes, especially for low-income groups, without depleting the natural resource base. INM’s goal is to integrate the use of all natural and man-made sources of plant nutrients, so that crop productivity increases in an efficient and environmentally benign manner, without sacrificing soil productivity of future generations.

**Materials and Methods**

A experiment was conducted during kharif 2016 at Agronomy Instructional Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar, Gujarat to study the “effect of panchgavya along with different levels of fertilizer and fym on soil properties in kharif clusterbean (cyamopsis tetragonoloba).” The soil of the experimental plot was loamy sand in texture, slightly alkaline in reaction get free from any kind of salinity hazard. The soil was loamy sand in texture, low in organic carbon (0.17 %) and available N (161 kg/ha), medium in available P (39 kg/ha) and K (159 kg/ha) with pH 7.20.

The field was laid out in randomized block design with factorial concept and replicated three times. Clusterbean variety Gujarat Guar 2 was sown by keeping 45 cm distance between two row in all the treatments.

A uniform basal dose of N and P₂O₅ (25 & 50 kg/ha) was applied at the time of sowing. Panchgavya sprayed @ 3 % and 6 % at branching and flowering stages as per treatments. All the recommended package of practices was followed for the crop. The growth parameters were recorded at appropriate time during experiment. Yield parameters were also recorded at harvest.

Quality parameters and available N and P₂O₅ in soil were analysed.

**Results and Discussion**

**Effect of organic manure levels**

Data on seed yield presented in Table 1 showed that the effect of organic manure levels on seed yield of kharif clusterbean was found significant. Significantly the higher seed yield and stover yield of 808 and 1636 kg/ha was recorded by the application of 5 t FYM per hectare (M₂) over no FYM (M₁) (691 kg/ha). The percentage increased in seed yield by the application of 5 t FYM per hectare was to the tune of 16.93 and 10.91 per cent higher than that of no FYM. The marked increase in various yield components with addition of FYM seems to be not only due to adequate supply of assimilates per nutrients, but also to its pivotal role in enhancing physicochemical and biological properties of the soil. In the recent years, with increasing evidences on potential role of growth hormones in yield formation, it has been advocated that balanced hormonal pattern in plant system exert profound influence on proper development of growth and reproductive structures ultimately leads to productivity of the crop. Results of present study corroborate with the findings of Singh et al., (2010), Sharma and Verma (2011), Vairavan (2011) and Datt et al., (2013).

**Effect on soil properties**

The nitrogen and phosphorus content in seed and stover recorded by the application of 5 t FYM per hectare was higher than that of no FYM, respectively. It could be attributed to the fact that after decomposition and mineralization, the FYM supplied available nutrients directly to the plants and also had...
solubilizing effect on fixed form of nutrients. Similar results were also reported by Sharma and Verma (2011) and Meena (2013).

Significantly the higher nitrogen uptake (38.63, 26.35 and 64.98 kg/ha) was noted under the treatment of 5 t FYM per hectare (M2) in seed, stover and total by the crop over no FYM (M1), respectively. No FYM (M1) noted significantly the lower nitrogen uptake (31.98, 22.01 and 53.99 kg/ha) in seed and stover and total by the crop, respectively.

Significantly the higher phosphorus uptake was noted under the treatment of 5 t FYM per hectare (M2) in seed, stover and total by the crop (3.31, 3.74 and 7.05 kg/ha), respectively over no FYM (M1). No FYM (M1) noted significantly the lower phosphorus uptake (2.64, 3.15 and 5.79 kg/ha) in seed and stover and total by the crop, respectively.

Significantly higher in available nitrogen and phosphorus was recorded under 5 t FYM per hectare was to the tune of 5.74 and 7.55 per cent higher than that of no FYM, respectively. The beneficial effect of FYM on growth and yield attributes might be due to additional supply of plant nutrients as well as improvement in physical and biological properties of soil. Similar results were also reported by Sharma and Verma (2011), Jat et al. (2012) and Datt et al. (2013).

**Effect of fertilizer levels and panchgavya spray**

**Effect on seed and stover yield**

The data embodied in Table 1 revealed that significantly the higher seed yield and stover yield of kharif clusterbean was produced with application of 100 % RDF + panchgavya spray @ 3 % at branching + flowering (N3) as compared to all other treatments, but it was remained at par with 100 % RDF + panchgavya spray @ 6 % at branching + flowering (N6). The per cent increase in seed yield by 100 % RDF + panchgavya spray @ 3 % at branching + flowering (N3) and 100 % RDF + panchgavya spray @ 6 % at branching + flowering (N6) was to the tune of 33.38 and 29.14 per cent over 50 % RDF + panchgavya spray @ 6 % at branching + flowering (N2), respectively. Crop yield is the complex function of physiological processes and biochemical activities, which modify plant anatomy and morphology of the growing plants. This might be due to favourable effect on vegetative i.e., plant height and number of branches per plant and reproductive growth viz., pods per plant and test weight which were the important yield attributes having significant positive correlation with seed yield. Natarajan (2002) reported that foliar spray 3 % concentration of panchgavya was effective in majority of crops. The increase in seed yield was observed by Kumar et al., (2011), Patel et al., (2013) showed that seed yield was significantly increased by 3 % foliar spray of panchgavya.

**Effect on soil properties**

A perusal of data revealed that application of 100 % RDF + panchgavya spray @ 3 % at branching + flowering (N3) found significantly the higher nitrogen content and phosphorus in seed and stover. In addition to bio-regulator Panchgavya foliar spray which contains lot of macro-nutrient, micro-nutrient and growth regulators like auxins, GA helped in producing higher biomass and also in better recovery of N and P content in plant. The cow urine rich in uric acid, a source of nitrogen was readily soluble in liquid form, one of the important compounds in Panchgavya and was readily available to the plants directly influencing the nitrogen content of leaves. Similar findings have been reported by Choudhary et al., (2014) (Table 2–5).
Table.1 Yield and economics of kharif cluster bean as influenced by different treatments

| Treatments | Yield (kg/ha) | Gross return (₹/ha) | Total cost (₹/ha) | Net return (₹/ha) | BCR |
|------------|--------------|---------------------|-------------------|-------------------|-----|
| Seed       | Stover       |                     |                   |                   |     |
| [A] Levels of organic manure (M) : | | | | | |
| M₁: No FYM | 691          | 1475                | 27135             | 3194              | 1.13|
| M₂: With FYM (5 t/ha) | 808          | 1636                | 31552             | 27201             | 1.16|
| S.Em. ± | 16.63        | 39.85               |                   |                   |     |
| C. D. (P = 0.05) | 48.35       | 115.85              |                   |                   |     |

[B] Levels of fertilizer application and panchgavya spray (N):

| N₁: 50% RDF + panchgavya spray @ 3% at branching + flowering | 698<sup>cd</sup> | 1481<sup>ab</sup> | 27392 | 24260 | 3132 | 1.13 |
| N₂: 50% RDF + panchgavya spray @ 6% at branching + flowering | 659<sup>a</sup>  | 1439<sup>b</sup>  | 25943 | 25010 | 933  | 1.04 |
| N₃: 75% RDF + panchgavya spray @ 3% at branching + flowering | 768<sup>bc</sup> | 1580<sup>ab</sup> | 30040 | 25220 | 4820 | 1.19 |
| N₄: 75% RDF + panchgavya spray @ 6% at branching + flowering | 727<sup>cd</sup> | 1527<sup>ab</sup> | 28499 | 25970 | 2529 | 1.10 |
| N₅: 100% RDF + panchgavya spray @ 3% at branching + flowering | 879<sup>a</sup>  | 1699<sup>a</sup>  | 34163 | 26180 | 7983 | 1.30 |
| N₆: 100% RDF + panchgavya spray @ 6% at branching + flowering | 851<sup>ab</sup> | 1699<sup>a</sup>  | 33183 | 26930 | 6253 | 1.23 |
| N₇: RDF (25:50:00 NPK kg/ha) | 664<sup>d</sup> | 1464<sup>ab</sup> | 26168 | 25430 | 738  | 1.03 |

S.Em. ± | 31.12        | 74.56               |                   |                   |     |

Interaction (M x N) : S.Em. ± 44.00 105.44

C. V. % 10.17 11.74

Selling price of produce : Seed : `35/kg and Stover : `2/kg.

Table.2 Interaction effect of levels of organic manure and fertilizer levels and panchgavya spray on seed yield of kharif clusterbean

| Treatments combinations | Seed yield (kg/ha) | Levels of fertilizer application and panchgavya spray (N) |
|-------------------------|-------------------|--------------------------------------------------------|
|                         | N₁ | N₂ | N₃ | N₄ | N₅ | N₆ | N₇ |
| Levels of Organic Manure (M) |     |     |     |     |     |     |     |
| M₁                      | 636<sup>de</sup> | 605<sup>f</sup> | 711<sup>cde</sup> | 672<sup>det</sup> | 815<sup>abcde</sup> | 788<sup>bcd</sup> | 611<sup>f</sup> |
| M₂                      | 761<sup>cde</sup> | 712<sup>cde</sup> | 825<sup>abc</sup> | 782<sup>bde</sup> | 942<sup>a</sup> | 914<sup>ab</sup> | 717<sup>cde</sup> |

Table.3 Interaction effect of levels of organic manure and fertilizer levels and panchgavya spray on stover yield of kharif clusterbean

| Treatments combinations | Stover yield (kg/ha) | Levels of fertilizer application and panchgavya spray (N) |
|-------------------------|----------------------|--------------------------------------------------------|
|                         | N₁ | N₂ | N₃ | N₄ | N₅ | N₆ | N₇ |
| Levels of Organic Manure (M) |     |     |     |     |     |     |     |
| M₁                      | 1402<sup>b</sup> | 1350<sup>b</sup> | 1507<sup>ab</sup> | 1457<sup>ab</sup> | 1597<sup>ab</sup> | 1605<sup>ab</sup> | 1407<sup>b</sup> |
| M₂                      | 1560<sup>ab</sup> | 1528<sup>ab</sup> | 1654<sup>ab</sup> | 1597<sup>ab</sup> | 1801<sup>a</sup> | 1792<sup>a</sup> | 1520<sup>ab</sup> |
Table 4 Nitrogen and phosphorus content in seed and stover and N uptake of *kharif* clusterbean as influenced by different treatments

| Treatments | N content (%) | P content (%) | N uptake (kg/ha) |
|------------|---------------|---------------|-----------------|
|            | Seed | Stover | Seed | Stover | Seed | Stover | Total |
| [A] Levels of organic manure (M) : | | | | | | | |
| M₁ | 4.61 | 1.49 | 0.380 | 0.213 | 31.98 | 22.01 | 53.99 |
| M₂ | 4.77 | 1.60 | 0.407 | 0.228 | 38.63 | 26.35 | 64.98 |
| S. Em. ± | 0.04 | 0.01 | 0.003 | 0.002 | 0.77 | 0.71 | 1.09 |
| C. D. (P = 0.05) | 0.11 | 0.04 | 0.009 | 0.007 | 2.24 | 2.06 | 3.17 |
| [B] Levels of fertilizer application and panchgavya spray (N) : | | | | | | | |
| N₁ | 4.57 | 1.46 | 0.375 | 0.217 | 32.08 | 21.63 | 53.71 |
| N₂ | 4.49 | 1.39 | 0.365 | 0.205 | 29.46 | 19.59 | 49.05 |
| N₃ | 4.73 | 1.66 | 0.408 | 0.228 | 36.34 | 26.24 | 62.58 |
| N₄ | 4.62 | 1.56 | 0.393 | 0.217 | 33.59 | 23.93 | 57.52 |
| N₅ | 5.02 | 1.71 | 0.433 | 0.243 | 44.08 | 29.13 | 73.21 |
| N₆ | 4.90 | 1.69 | 0.417 | 0.235 | 41.73 | 28.71 | 70.44 |
| S. Em. ± | 0.07 | 0.03 | 0.006 | 0.004 | 1.44 | 1.33 | 2.04 |
| C. D. (P = 0.05) | 0.20 | 0.08 | 0.375 | 0.217 | 4.19 | 3.86 | 5.93 |
| Interaction (M x N) : | | | | | | | |
| S. Em. ± | 0.10 | 0.04 | 0.008 | 0.006 | 2.04 | 1.88 | 2.89 |
| C. D. (P = 0.05) | NS | NS | NS | NS | NS | NS |
| C. V. % | 3.64 | 4.19 | 3.47 | 4.96 | 10.01 | 13.44 | 8.39 |

Table 5 Phosphorus uptake in seed and stover and available status of nitrogen and phosphorus in soil after harvesting of *kharif* clusterbean as influenced by different treatments

| Treatments | P uptake (kg/ha) | Available N (kg/ha) | Available P₂O₅ (kg/ha) |
|------------|-----------------|---------------------|---------------------|
|            | Seed | Stover | Total | Seed | Stover | Total | Seed | Stover | Total |
| [A] Levels of organic manure (M) : | | | | | | | |
| M₁ | 2.64 | 3.15 | 5.79 | 165.90 | | 35.22 |
| M₂ | 3.31 | 3.74 | 7.05 | 175.43 | | 37.88 |
| S. Em. ± | 0.06 | 0.09 | 0.12 | 1.32 | | 0.32 |
| C. D. (P = 0.05) | 0.19 | 0.26 | 0.33 | 3.84 | | 0.94 |
| [B] Levels of fertilizer application and panchgavya spray (N) : | | | | | | | |
| N₁ | 2.62 | 3.20 | 5.82 | 169.33 | | 35.25 |
| N₂ | 2.40 | 2.96 | 5.36 | 162.62 | | 32.74 |
| N₃ | 3.15 | 3.62 | 6.77 | 175.73 | | 37.48 |
| N₄ | 2.87 | 3.32 | 6.19 | 169.65 | | 36.08 |
| N₅ | 3.82 | 4.14 | 7.96 | 179.66 | | 41.76 |
| N₆ | 3.55 | 4.00 | 7.55 | 176.81 | | 40.17 |
| S. Em. ± | 0.12 | 0.17 | 0.21 | 2.47 | | 0.60 |
| C. D. (P = 0.05) | 0.35 | 0.49 | 0.62 | 7.19 | | 1.76 |
| Interaction (M x N) : | | | | | | | |
| S. Em. ± | 0.17 | 0.24 | 0.30 | 3.50 | | 0.85 |
| C. D. (P = 0.05) | NS | NS | NS | NS | NS | NS |
| C. V. % | 9.89 | 11.92 | 8.18 | 3.55 | | 4.05 |
Significantly the higher nitrogen uptake by seed and total by crop (44.08 and 73.21 kg/ha) was found under the application of 100 % RDF + panchgavya spray @ 3 % at branching + flowering (N$_5$), respectively, but it was remained at par with 100 % RDF + panchgavya spray @ 6 % at branching + flowering (N$_6$). Whereas, N uptake by stover under treatment N$_5$ was at par with treatments N$_6$ and N$_3$. Significantly the lower uptake of nitrogen by seed, stover and total by crop (29.46, 19.59 and 49.05 kg/ha) was noted under 50 % RDF + panchgavya spray @ 6 % at branching + flowering (N$_2$), respectively. However, it was at par with treatments N$_7$ and N$_1$.

Significantly the higher phosphorus uptake by seed, stover and total (3.82, 4.14 and 7.96 kg/ha) was found under the application of 100 % RDF + panchgavya spray @ 3 % at branching + flowering (N$_5$), respectively, but it was remained at par with 100 % RDF + panchgavya spray @ 6 % at branching + flowering (N$_6$). Significantly the lower uptake of phosphorus by seed by stover and total by the crop (2.89 and 5.31 kg/ha) was found under RDF (N$_7$), respectively. However, it was at par with treatments N$_2$ and N$_1$.

Available nitrogen and phosphorus of the soil was recorded by the application of 100 % RDF + panchgavya spray @ 3 % at branching + flowering was to the tune of 11.71 and 28.93 per cent higher than that of RDF (N$_7$), respectively. Effective micro-organisms (EMO) are the mixed culture of naturally occurring beneficial microbes predominately lactic acid bacteria (Lactobacillus), yeast (Saccharomyces), actinomycetes (Streptomyces), photosynthetic bacteria (Rhodo pseudomonas) certain fungi (Aspergillus) which were found to be present in panchgavya improve the soil quality.

**Interaction effect**

The data outlined showed that application of 5 t FYM per hectare and 100 % RDF along with panchgavya spray @ 3 % at branching and flowering stage (M$_2$N$_5$) gave significantly the higher seed yield, but it was remained at par with 5 t FYM per hectare and 100 % RDF along with panchgavya spray @ 6 % at branching and flowering stage (M$_2$N$_6$), 5 t FYM per hectare and 75 % RDF along with panchgavya spray @ 3 % at branching and flowering stage (M$_1$N$_3$) over other treatment combinations. The data outlined showed that application 5 t FYM per hectare and 100 % RDF along with panchgavya spray @ 3 % at branching and flowering stage (M$_2$N$_5$) gave significantly the higher stover yield (1801 kg/ha) followed by 5 t FYM per hectare and 100 % RDF along with panchgavya spray @ 6 % at branching and flowering stage (M$_2$N$_6$) gave stover yield (1792 kg/ha), but it was remained statistically at par with M$_2$N$_3$, M$_1$N$_6$, M$_2$N$_4$, M$_1$N$_5$, M$_2$N$_1$, M$_2$N$_2$, M$_2$N$_7$, M$_1$N$_3$ and M$_1$N$_4$.

Interaction due to organic manure levels and fertilizer levels and panchgavya spray on nitrogen and phosphorus content in seed and stover, nitrogen and phosphorus uptake by seed, stover and total by the crop and available N and P$_2$O$_5$ status of soil after harvest of kharif clusterbean was found non-significant.

It is concluded that higher seed yield from kharif clusterbean can be obtained with the application of 5 tonnes FYM/ha and 100 % RDF (25:50:00 NPK kg/ha) along with panchgavya spray @ 3 per cent at branching.
and flowering stages in North Gujarat Agro-climatic Zone.

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