

Original Research Article

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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

Effect on seed and stover yield

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 (N₅) 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 (N₅) 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 (N₅) 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) :						
M ₁ : No FYM	691	1475	27135	23941	3194	1.13
M ₂ : With FYM (5 t/ha)	808	1636	31552	27201	4351	1.16
S.Em. ±	16.63	39.85				
C. D. (P = 0.05)	48.35	115.85				
[B] Levels of fertilizer application and <i>panchgavya</i> spray (N) :						
N ₁ : 50% RDF + <i>panchgavya</i> spray @ 3% at branching + flowering	698 ^{cd}	1481 ^{ab}	27392	24260	3132	1.13
N ₂ : 50% RDF + <i>panchgavya</i> spray @ 6% at branching + flowering	659 ^d	1439 ^b	25943	25010	933	1.04
N ₃ : 75% RDF + <i>panchgavya</i> spray @ 3% at branching + flowering	768 ^{bc}	1580 ^{ab}	30040	25220	4820	1.19
N ₄ : 75% RDF + <i>panchgavya</i> spray @ 6% at branching + flowering	727 ^{cd}	1527 ^{ab}	28499	25970	2529	1.10
N ₅ : 100% RDF + <i>panchgavya</i> spray @ 3% at branching + flowering	879 ^a	1699 ^a	34163	26180	7983	1.30
N ₆ : 100% RDF + <i>panchgavya</i> spray @ 6% at branching + flowering	851 ^{ab}	1699 ^a	33183	26930	6253	1.23
N ₇ : RDF (25:50:00 NPK kg/ha)	664 ^d	1464 ^{ab}	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 <i>panchgavya</i> spray (N)						
Levels of Organic Manure (M)	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇
M ₁	636 ^{ef}	605 ^f	711 ^{cdef}	672 ^{def}	815 ^{abcd}	788 ^{bcd}	611 ^f
M ₂	761 ^{cde}	712 ^{cdef}	825 ^{abc}	782 ^{bcde}	942 ^a	914 ^{ab}	717 ^{cdef}

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 <i>panchgavya</i> spray (N)						
Levels of Organic Manure (M)	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆	N ₇
M ₁	1402 ^b	1350 ^b	1507 ^{ab}	1457 ^{ab}	1597 ^{ab}	1605 ^{ab}	1407 ^b
M ₂	1560 ^{ab}	1528 ^{ab}	1654 ^{ab}	1597 ^{ab}	1801 ^a	1792 ^a	1520 ^{ab}

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) :							
M ₁	4.61	1.49	0.380	0.213	31.98	22.01	53.99
M ₂	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 <i>panchgavya</i> spray (N) :							
N ₁	4.57	1.46	0.375	0.217	32.08	21.63	53.71
N ₂	4.49	1.39	0.365	0.205	29.46	19.59	49.05
N ₃	4.73	1.66	0.408	0.228	36.34	26.24	62.58
N ₄	4.62	1.56	0.393	0.217	33.59	23.93	57.52
N ₅	5.02	1.71	0.433	0.243	44.08	29.13	73.21
N ₆	4.90	1.69	0.417	0.235	41.73	28.71	70.44
N ₇	4.50	1.37	0.363	0.197	29.86	20.05	49.91
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	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 inn soil after harvesting of *kharif* clusterbean as influenced by different treatments

Treatments	P uptake (kg/ha)			Available N (kg/ha)	Available P ₂ O ₅ (kg/ha)
	Seed	Stover	Total		
[A] Levels of organic manure (M) :					
M ₁	2.64	3.15	5.79	165.90	35.22
M ₂	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 <i>panchgavya</i> spray (N) :					
N ₁	2.62	3.20	5.82	169.33	35.25
N ₂	2.40	2.96	5.36	162.62	32.74
N ₃	3.15	3.62	6.77	175.73	37.48
N ₄	2.87	3.32	6.19	169.65	36.08
N ₅	3.82	4.14	7.96	179.66	41.76
N ₆	3.55	4.00	7.55	176.81	40.17
N ₇	2.42	2.89	5.31	160.83	32.39
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
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 (N₅), respectively, but it was remained at par with 100 % RDF + *panchgavya* spray @ 6 % at branching + flowering (N₆). Whereas, N uptake by stover under treatment N₅ was at par with treatments N₆ and N₃. 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 (N₂), respectively. However, it was at par with treatments N₇ and N₁.

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 (N₅), respectively, but it was remained at par with 100 % RDF + *panchgavya* spray @ 6 % at branching + flowering (N₆). Significantly the lower uptake of phosphorus by seed (2.40 kg/ha) was noted under 50 % RDF + *panchgavya* spray @ 6 % at branching + flowering (N₂). However, it was at par with treatments N₇ and N₁. Whereas, significantly the lower uptake of phosphorus by stover and total by the crop (2.89 and 5.31 kg/ha) was found under RDF (N₇), respectively. However, it was at par with treatments N₂ and N₁.

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 (N₇), 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 (M₂N₅) 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 (M₂N₆), 5 t FYM per hectare and 75 % RDF along with *panchgavya* spray @ 3 % at branching and flowering stage (M₂N₃) and No FYM and 100 % RDF along with *panchgavya* spray @ 3 % at branching and flowering stage (M₁N₅) 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 (M₂N₅) 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 (M₂N₆) gave stover yield (1792 kg/ha), but it was remained statistically at par with M₂N₃, M₁N₆, M₂N₄, M₁N₅, M₂N₁, M₂N₂, M₂N₇, M₁N₃ and M₁N₄.

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 P₂O₅ 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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