

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON PRODUCTION AND PROFITABILITY OF FODDER COWPEA SEED PRODUCTION

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SUMMARY

The experiment was conducted on fodder cowpea seed production during the summer seasons of 2020 to 2022 at Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat). The treatment consists of three levels of organics (Control, FYM 2.0 t/ha and Bio compost 2.0 t/ha) and three levels of fertilizer viz., 50 % RDF, 75 % RDF and 100 % RDF (RDF 20-40-00, N-P₂O₅-K₂O kg/ha) with the use of bio fertilizer *Rhizobium* + PSB as seed treatment @10 ml/ kg seed as a common application in Randomized Block Design with factorial concept. The result of three-year experimentation revealed that application of Bio compost 2.0 t/ha gave significantly superior plant height, number of pods per plant, number of seeds per pod, seed yield and fodder yield except number of pods per plant and fodder yield which were remained at par with application of FYM 2.0 t/ha. In case of fertilizer levels application of 100 % RDF resulted significantly higher plant height, number of pods per plant, number of seeds per pods, seed yield and fodder yield however, which were at par with treatment F₂ (75% RDF) except number of pods per plant. The interaction between organic and fertilizer levels was found significant in pooled data. The treatment combination O₂F₂ (Bio compost 2.0 t/ha and 75 % RDF) recorded significantly higher plant height, number of pods par plant, number of seeds per pod, seed and fodder yields. Gross return, net return and B:C ratio were found highest under treatment combination O₂F₂. Based on the results of three years' experimentation on seed production of fodder cowpea, it can be concluded that application of Bio compost 2.0 t/ha along with 75 % RDF produced higher seed and fodder yield with maximum net return.

Key words: Bio compost, FYM, fodder cowpea, *Rhizobium* and PSB

Green fodder and grazing resources in the country has made the livestock to undergo consistently with malnourishment resulting in their production potentiality at sub optimal level as compared to many developed nations. India is having the affluent livestock population of 520 million heads, which is about 20 per cent of the world's livestock population. But, the country has only 4.4 per cent of the cultivated area under fodder crops. There is currently a net deficiency of 35.6% green fodder, 10.95% dry fodder and 44% concentrate feed materials in the country (IGFRI vision, 2050). The demand for green and dry feed will be 1012 and 631 million tones, respectively by 2050.

Cowpea (*Vigna unguiculata* L.) is a multipurpose *kharif* and warm season pulse crop, commonly cultivated all over India. Cowpea is cultivated as seed, green vegetable and fodder in diverse agriculture system in many countries. The crop is adaptable to a variety of soil types and climatic conditions in the humid tropics and subtropics. The crop has a great ability to fix atmospheric nitrogen

through root nodules to improve soil fertility, stop soil erosion through a deep tap root system, and supply a significant amount of organic matter that will likely be useful for the subsequent crop as well as soil health sustenance (Namakka *et al.*, 2017). It is typically adapted to various biotic and abiotic stresses like drought, high temperatures (Ankita *et al.*, 2024)). Among the various agronomic practices for increasing productivity of crop, nutrient management plays an important role. Excessive use of chemical fertilizers makes trouble on crop productivity, soil health and also for environment. On other side organic manures and bio fertilizers have positive effects on soil health with ecofriendly manner. So, judicious combination of organic and inorganic fertilizer maintains the soil fertility and productivity. This may ultimately cause a significant reduction in use of chemical fertilizers.

MATERIAL AND METHODS

An experiment on seed production of fodder cowpea was conducted at Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural

University, Navsari (Gujarat) during the summer seasons of the year 2020 to 2022. The soil of the experimental field was clayey in texture and showed medium in available nitrogen (235.00 kg/ha), moderately high phosphorus (50.40 kg/ha) and very high potassium (300.50 kg/ha), slightly alkaline in reaction with normal electrical conductivity. After the harvest of the previous crop, the experimental field was cultivated with tractor- drawn cultivator in cross wise direction. The treatment consists of three levels of organics (Control, FYM 2.0 t/ha and Bio compost 2.0 t/ha) and three levels of fertilizer viz., 50 % RDF, 75 % RDF and 100 % RDF (RDF 20-40-00, N-P₂O₅-K₂O kg/ha). The design of experiment was Randomized Block Design with factorial concept. The common application of biofertilizers, *Rhizobium* + PSB used as seed treatment @10 ml/kg seed each. Fodder cowpea variety GFC-4 was used in this experiment with 40 kg/ha seed rate and spacing was 45 cm X 10 cm. During the three years of the experimentation weather was normal. The organic manures and fertilizers were given as a basal dose. The first irrigation was given immediately after sowing. The subsequent irrigations were given as per the requirement of the crop. Hand weeding operations was carried out manually depending on field condition. The periodical observation was measured from the previously selected five plants from each net plot. The crop from the ring area of each plot was harvested first and collected. The gross realization was worked out on the basis of prevailing market prices. The net realization was worked out by deducting the total cost of cultivation

from gross realization per hectare for each treatment and recorded accordingly.

RESULTS AND DISCUSSION

Effect of organics

Results in Table 1 revealed that organics treatment O₂ (Bio compost 2.0 t/ha) recorded significantly higher plant height during all the years of studies, but this treatment was almost at par with treatment O₁ (FYM 2.0 t/ha) in 2020 and 2021, however, treatment O₂ was significantly superior in pooled result. Further, the results revealed that organics treatment O₂ (Bio compost 2.0 t/ha) recorded significantly higher numbers of pods per plant in individual years as well as in pooled, but it was almost at par with O₁ (FYM 2.0 t/ha). Numbers of seeds per pod was significantly higher in treatment O₂ (Bio compost 2.0 t/ha) during individual years but it was at par with O₁ (FYM 2.0 t/ha). However, treatment O₂ was significantly superior in pooled result. The data in Table 3 indicated that significantly higher seed (514.07, 970.22, 802.95 and 762.41 kg/ha) and fodder (175.31, 285.43, 284.44 and 248.40 q/ha) were recorded with treatment O₂ (Bio compost 2.0 t/ha) during all three years and pooled result respectively, but It was statistically almost at par with treatment O₁ (FYM 2.0 t/ha) during individual years. The pooled results indicated the highest seed yield obtained with bio compost 2.0 t/ha. In case of fodder yield, it was registered higher under treatment O₂ (Bio compost 2.0 t/ha), but it was at par with O₁ (FYM 2.0 t/ha). The

TABLE 1
Effect of INM on plant height, number of pods per plant and number of seeds per pod of fodder cowpea

Treatment	Plant height at harvest (cm)				Number of pods/plant				Number of seeds /pod			
	2020	2021	2022	Pooled	2020	2021	2022	Pooled	2020	2021	2022	Pooled
Organics												
O ₀ : Control	46.92	50.51	53.63	50.36	7.70	8.62	8.49	8.27	7.02	8.30	8.54	7.96
O ₁ : FYM 2.0 t/ha	49.89	62.72	59.05	57.22	9.30	10.49	9.34	9.71	7.47	10.31	9.27	9.02
O ₂ : Bio compost 2.0 t/ha	61.78	65.98	61.01	62.92	10.12	12.00	9.62	10.58	9.27	10.82	9.72	9.94
S. Em±	2.56	2.63	1.73	1.41	0.35	0.41	0.28	0.33	0.31	0.42	0.27	0.21
C. D. (P=0.05)	7.68	7.87	5.19	4.01	1.05	1.22	0.83	1.29	0.94	1.26	0.80	0.59
Fertilizer levels												
F ₁ : 50% RDF	45.37	49.25	49.93	48.18	7.77	9.06	7.90	8.24	6.79	8.14	7.94	7.63
F ₂ : 75% RDF	52.14	64.26	62.98	59.79	8.98	10.72	9.94	9.88	7.83	10.51	9.92	9.42
F ₃ : 100% RDF	61.07	65.70	60.79	62.52	10.38	11.33	9.61	10.44	9.14	10.78	9.68	9.87
S. Em±	2.56	2.63	1.73	1.41	0.35	0.41	0.28	0.33	0.31	0.42	0.27	0.21
C. D. (P=0.05)	7.68	7.87	5.19	4.01	1.05	1.22	0.83	1.29	0.94	1.26	0.80	0.59
Interaction (OXF)												
S. Em±	4.43	4.54	3.00	2.36	0.61	0.70	0.48	0.34	0.54	0.72	0.46	0.34
C. D. (P=0.05)	NS	NS	NS	6.70	NS	NS	NS	0.96	NS	NS	NS	0.98
Sig. Interactions with Y												
C.V%	14.54	13.19	8.97	12.36	11.70	11.75	9.07	11.01	11.90	12.86	8.71	11.37

probable reason might be positive effect of biocompost on growth and yield character due to improved soil physical, chemical and biological properties. The improvement in seed yield and fodder yield were mainly on account of increase in the growth and yield parameters. Same finding recorded by Meena and Roop Chand (2014) and Kinnari *et al.* (2020).

Effect of fertilizer levels

The data presented in Table-1 indicated that plant height influenced significantly by different levels of fertilizers. Significantly higher values of plant height recorded with treatment F₃ (100 % RDF) during all the individual years and in pooled results, but it was at par with F₂ (75% RDF). Number of pods per plant and number of seeds per pod significantly higher in treatment O₂ (Bio compost 2.0 t/ha) but it was at par with O₁ (FYM 2.0t/ha), however, number of seeds per pod was significantly superior only in O₂ (Bio compost 2.0 t/ha). Significantly higher seed yield (508.16, 966.31, 829.13 and 758.15 kg/ha) and fodder

yield (180.74, 281.48, 279.50 and 242.63 q/ha) were recorded with the highest fertilizer level F₃ (100 % RDF) during all the three year as well as in pooled except in 2022 where treatment F₂ (75% RDF) recorded higher seed yield, however it was at par with F₂(75% RDF). It might be positive response of nitrogen and phosphorus on growth characters due to augment of cell division and cell expansion of fodder cowpea. The improvement in seed yield and fodder yield were mainly on account of increase in the growth and yield parameters. Same finding recorded by Kinnari *et al.* (2020) and Nanda *et al.* (2023).

Interaction effect

Interaction effects were found significant in case of plant height, number of pods per plant and number of seeds per pods, seed yield and fodder yield in pooled results (Table 2 and Table 4). Significantly higher plant height was observed by O₂F₂ and which was at par with O₂F₃. Number of pods per plant significantly higher with O₂F₂ and it was at par with O₂F₃ and O₁F₃. Significantly

TABLE 2
Interaction effect of organics and fertilizer levels on plant height, number of pods/plant and seeds/pod of fodder cowpea (Pooled data)

Treatment	Plant height at harvest			Number of pods/plant			Number of seed /pod		
	F ₁	F ₂	F ₃	F ₁	F ₂	F ₃	F ₁	F ₂	F ₃
O ₀	41.49	51.09	58.49	6.73	8.42	9.66	6.56	8.08	9.23
O ₁	50.65	56.96	64.06	8.71	9.70	10.71	8.01	8.96	10.09
O ₂	52.41	71.33	65.02	9.29	11.51	10.94	8.31	11.22	10.28
S. Em±		2.37			0.34			0.35	
C. D. (P=0.05)		6.70			0.96			0.99	

TABLE 3
Effect of Integrated nutrient management on seed and fodder yields of fodder cowpea

Treatment	Seed yield (kg/ha)				Fodder yield (q/ha)			
	2020	2021	2022	Pooled	2020	2021	2022	Pooled
Organics								
O ₀ : Control	391.11	741.77	705.68	612.86	143.21	223.21	241.48	202.63
O ₁ : FYM 2.0 t/ha	415.83	922.95	777.28	705.36	163.46	277.53	264.20	235.06
O ₂ : Bio compost 2.0 t/ha	514.07	970.22	802.95	762.41	175.31	285.43	284.44	248.40
S. Em±	22.37	38.79	22.83	17.70	6.09	11.35	7.19	5.00
C. D. (P=0.05)	67.07	116.30	68.45	50.26	18.27	34.03	21.54	14.20
Fertilizer levels								
F ₁ : 50 % RDF	378.28	723.74	656.80	586.27	145.68	225.18	244.94	205.27
F ₂ : 75 % RDF	434.58	944.90	829.13	736.20	155.56	279.51	279.50	238.19
F ₃ : 100 % RDF	508.16	966.31	800.00	758.15	180.74	281.48	265.68	242.63
S. Em±	22.37	38.79	22.83	17.81	6.09	11.35	7.18	5.23
C. D. (P=0.05)	67.07	116.30	68.45	50.57	18.27	34.03	21.54	14.87
Interaction (OXF)								
S. Em±	38.75	38.79	39.54	29.86	10.55	19.66	12.44	8.41
C. D. (P=0.05)	NS	NS	NS	84.60	NS	NS	NS	23.82
Sig. Interactions with Y								
C.V%	15.24	13.25	8.99	12.55	11.38	12.99	8.19	11.17

TABLE 4
Interaction effect of organics and fertilizer levels on yields and economics of fodder cowpea (Pooled over 3 years)

Treatment combination	Seed yield (kg/ha)	Fodder yield (q/ha)	Gross Return (Rs./ha)	Cost of cultivation (Rs./ha)	Net Return (Rs./ha)	B:C ratio
O ₀ : Control x F1: 50 % RDF	507.58	180.24	99757	38249	61508	1.61
O ₀ : Control x F2: 75 % RDF	625.33	202.96	117169	40005	77164	1.93
O ₀ : Control x F3: 100 % RDF	705.65	224.69	130916	42324	88593	2.09
O ₁ : FYM 2.0 t/ha x F1: 50 % RDF	621.06	208.89	118563	43732	74831	1.71
O ₁ : FYM 2.0 t/ha x F2: 75 % RDF	702.22	236.05	134015	45384	88631	1.95
O ₁ : FYM 2.0 t/ha x F3: 100 % RDF	792.79	260.25	149425	47791	101635	2.13
O ₂ : Bio compost 2.0 t/ha x F1: 50 % RDF	630.17	226.67	124715	39868	84848	2.13
O ₂ : Bio compost 2.0 t/ha x F2: 75 % RDF	881.05	275.56	161962	42682	119280	2.79
O ₂ : Bio compost 2.0 t/ha x F3: 100 % RDF	776.02	242.96	142731	43241	99489	2.30
S.Em±	29.86	8.41	-	-	-	-
C. D. (P=0.05)	84.60	23.82	-	-	-	-
C.V%	12.55	11.17	-	-	-	-

Price: Seed: Rs. 90/kg, Green fodder- Rs. 3.00/kg, FYM: Rs. 2.0/kg, Bio compost: Rs. 0.65/kg, N: Rs. 5.91/kg and P: Rs. 10.80/kg.

higher seeds per pod were produced in O₂F₂ and which was at par with O₂F₃. Treatment combination O₂F₂ (Bio compost 2.0 t/ha and 75 % RDF) recorded significantly higher seed yield (881.05 kg/ha) and fodder yields (275.56 q/ha) These results are in agreement with findings of Kinnari *et al* (2020).

ECONOMICS

The data presented in Table 4 with respect to cost of cultivation, gross returns, net returns and benefit cost ratio was not analyzed statistically and inference are drawn on average values. The interaction effect of organics and fertilizer levels on seed yield and fodder yield were significant. So, the economics of treatment combination was considered. The data showed that treatment combination O₂F₂ recorded maximum gross return (Rs. 161962/ha), net returns (Rs. 119280/ha) and B: C ratio (2.79).

CONCLUSION

Based on the results of three-year experimentation on seed production of fodder cowpea, it can be concluded that application of Bio compost @ 2.0 t/ha along with 75 per cent RDF produced higher seed yield and fodder yield with maximum net returns.

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