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R Gurjar
Pulse Research Station, Model Farm, Anand Agricultural University, Vadodara Gujarat, India

KV Patel
Pulse Research Station, Model Farm, Anand Agricultural University, Vadodara Gujarat, India

CR Mistry
Pulse Research Station, Model Farm, Anand Agricultural University, Vadodara Gujarat, India

HP Patel
Pulse Research Station, Model Farm, Anand Agricultural University, Vadodara Gujarat, India

Correspondence
R Gurjar
Pulse Research Station, Model Farm, Anand Agricultural University, Vadodara Gujarat, India

Effect of integrated nutrient management on yield and quality of pigeonpea

R Gurjar, KV Patel, CR Mistry and HP Patel

Abstract
A field experiment was conducted during *kharif* seasons of 2008-09, 2009-10, 2010-11 and 2011-12 at pulse research station, Model farm, Vadodara Anand Agricultural University to study the effect on organic and inorganic nutrient effects on pigeon pea. Four treatment of T_1 (100% RDF), T_2 (100% RDN from FYM), T_3 (100% RDN from 50% FYM, 25% Vermicompost and 25% Poultry manure) and T_4 (100% RDN from 75% from fertilizer and 25% Vermicompost). The study revealed that yield attributing characters like plant height, pods per plant, green pod yield and quality parameter like protein, nitrogen and phosphorus content of pigeonpea were recorded highest with the application of 100% RDN from FYM whereas application of 100% RDN from 50% FYM, 25% Vermicompost and 25% Poultry manure showed maximum potassium content in grain of pigeonpea.

Keywords: FYM, Vermicompost, Poultry manure, Protein and Pigeonpea

Introduction
Pigeonpea is one of the important pulse crops of India and 91 per cent of the world's pigeonpea is produced in India. The productivity of pigeon pea in India (799 kg/ha) is far below the average productivity (848 kg/ha) of world. In India, it occupies an area of about 4.09 million hectares producing 3.27 million tones with an average productivity of 799 kg per hectare (Anon., 2010).

Pigeonpea is the fifth prominent grain legume crop in the world and holds second position in India after chickpea. It is mainly eaten in the form of split pulse as *dal*. Besides this, in the tribal areas of various status, the use of pigeonpea as green vegetable is very common (Saxena *et al*., 2010) [1]. The crushed dry seeds are feed of animals, while green leaves are used as a quality fodder. The dry stems of pigeonpea make an excellent fuel wood.

The low yield of pigeonpea is mainly attributed to their cultivation on poor soils with inadequate and imbalanced nutrient application, no application of organic manures and micronutrients like sulphur, zinc, iron etc. Since the soils are low in organic matter content, use of organic manures plays a vital role in improving soil physical condition, provides vital plant nutrients and maintains long term productivity of the soil. The use of inorganic fertilizers along with bulky organic manures was found more advantageous in enhancing crop yields.

Materials and Methods
A field experiment was conducted during the *kharif* season of 2008-09, 2009-10, 2010-11 and 2011-12 at the Pulse Research Station, Anand Agricultural University, Modal Farm, Vadodara, Gujarat. Soil was sandy loam with pH 7.97, organic carbon 0.57%, available P 139.15 kg P_2O_5/ha and available K 479.19 kg K_2O/ha. The treatment of T_1 -100% RDF (25:50:00 kg NPK/ha), T_2 - 100% RDN from FYM/compost, (i.e. @ 5 t/ha), T_3-100% RDN from (50% FYM, 25% Vermi compost and 25% Poultry manure and T_4- 100% RDN from (75% from fertilizer and 25% Vermi compost).

The experiment was laid out in a randomized block design with six replications. The treatments were continued throughout the study in the same plots during four years of experimentation. Recommended dose of fertilizer (25:50:00 kg NPK/ha) of pigeonpea was applied as per treatments. Gujarat Tur-1 (GT-1) variety of pigeonpea was used for experimental purpose. The inter-culturing as weeding done at 30 and 45 DAS to remove weeds. The thinning operation was carried out for maintaining plant spacing of 90 cm × 30 cm. Plant height, number of pods/plant and green pod yield *etc*. were recorded.

Results and Discussion

Effect on growth Plant height

Data presented in Table-2 indicated that significantly the highest plant height (152 cm) of pigeonpea was recorded with application of 100% RDN from FYM (T_2) during all the years as well as in pooled. Increasing plant height might be due to application of nitrogen with organic manures increased available status of nutrients, which probably provided favorable physical environment and must be ensured for plant to growth.

Yield and yield attributes

Number of pods per plant

Application of integrated nutrient management practices found significant effect on yield and yield attributing characters of pigeon pea. The influence of different treatments on number of pods per plant (145.79) was found significant during four years as well as in pooled analysis. According to the pooled analysis, treatment T_2 (100% RDN from FYM) being at par with T_1 (100% RDF), produced significantly more number of pods per plant as compared to rest of the treatments (Table 3). Integrated nutrient management treatment have resulted in higher number of pods/plant by attributing higher plant growth and development, which helped in augmenting the grain and Stover yields. Prolong availability of soil moisture due to organic manure increased uptake of nutrients, release of phyto-hormones and organic acids which provides foods for beneficial bacteria all might have contributed to the yield

Green pod yield

The effect of different treatments on green pod yield was found significant during all the years as well as in pooled analysis. Among the different treatments, T_2 (100% RDN from FYM) produced significantly the highest green pod yield during all the three years with one exception, during 2011-12, wherein it was at par with T_1 (100% RDF). Pooled analysis also showed significant superiority of this treatment among all. The interaction effect between treatment × year was found significant (Table 1). Application of organic manure with inorganic fertilizers play important role on growth and development of plant by efficient utilization of resources by crops under recommended nutrient supply. Increasing yield might also be due to the increased availability of both the native and applied nutrients in soil and their uptake by plants through improved root system and these might also be due to the decomposition and humiliation of organic manures which produces humus and helps in improving the physical, chemical and biological properties of soil which favorably improved yield attributes and ultimately the yield of crops,

Protein content (%) in grain

Composite sample of green seeds of pigeon pea was analyzed for protein content during last three years. The result revealed that during first year T_4, during second year T_3 and during third year T_1 showed the highest value of protein content but on an average T_2 recorded the highest value of protein content among all (Table 4). Application of organic matter with inorganic fertilizer had also shown its significant effect on protein content Enhancement in the protein content this might be due to the significant role of organic matter in root enlargement, better microbial activities resulted in more availability and uptake of nitrogen and thereby increased protein content in seed.

NPK content (%) in grain

Treatment wise composite seed sample were analyzed for N, P and K content during all the years and the data are presented in table 5. On an average treatment T_2 (100% RDN from FYM) recorded maximum N and P content whereas T_3 (100% RDN from 50% FYM, 25% Vermicompost and 25% Poultry manure) showed maximum potassium content in grain of pigeonpea.

Table 1: Grain pod yield (q/ha) as influenced by different treatments

Treatments	Years				Pooled Mean
	2008-09	2009-10	2010-11	2011-12	
T_1	56.95	52.69	41.74	61.88	53.32
T_2	64.58	64.17	48.10	67.25	61.03
T_3	55.11	55.97	39.80	50.15	50.26
T_4	58.68	56.43	41.31	54.78	52.80
S.Em. ±	1.82	2.57	1.40	2.00	1.44
C.D. (0.05)	5.48	7.74	4.21	6.03	4.59
C.V.%	7.58	10.97	8.00	8.38	8.97
Interaction Y × T					Sig.
S.Em.±					1.99
C.D. (0.05)					5.63

Table 2: Plant height (cm) of pigeonpea as influenced by different treatments

Treatments	Years				Pooled Mean
	2008-09	2009-10	2010-11	2011-12	
T_1	141.83	139.50	117.00	152.67	139.33
T_2	166.00	150.83	134.33	156.83	152.00
T_3	161.83	119.33	108.00	132.00	130.29
T_4	137.67	123.33	114.67	130.17	126.46
S.Em. ±	7.01	7.37	5.94	7.43	3.48
C.D. (0.05)	21.12	22.21	17.91	22.39	9.85
C.V.%	11.19	13.55	12.28	12.73	12.79

Table 3: Number of pods /plant of pigeonpea as influenced by different treatments

Treatments	Years				Pooled Mean
	2008-09	2009-10	2010-11	2011-12	
T_1	134.83	136.50	134.33	162.00	141.92
T_2	140.17	139.50	139.50	164.00	145.79
T_3	115.83	107.67	111.17	139.50	118.54
T_4	117.00	126.67	109.67	134.50	121.96
S. Em. ±	6.47	7.83	7.87	7.79	3.61
C.D. (0.05)	19.50	23.62	23.73	23.48	10.20
C.V.%	12.48	15.04	15.59	12.72	13.94

Table 4: Protein content (%) in pigeonpea grain as influenced by different treatments

Treatments	Years			Pooled Mean
	2008-09	2009-10	2010-11	
T_1	9.58	11.00	11.82	11.00
T_2	14.61	12.84	11.34	12.84
T_3	12.22	11.99	11.05	11.99
T_4	14.85	12.35	11.27	12.35

Table 5: Nitrogen, Phosphorus and Potassium content (%) in grain of pigeonpea as influenced by different treatments (Four year mean)

Treatments	Nitrogen	Phosphorus	Potassium
T_1	3.17	0.21	2.69
T_2	3.28	0.25	2.99
T_3	3.24	0.24	3.12
T_4	3.21	0.24	2.95

Conclusion

It can be concluded from the pooled results of the four years that, treatment T_2 (100% RDN from FYM) found significantly superior among all with respect to green pod yield. It also recorded the highest plant height as well as number of pods per plant on pooled basis. This treatment also showed the highest value of Protein, Nitrogen and Phosphorus content in grain.

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