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AR Katara
Ph.D. Scholar, Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

DD Patel
Principal, College of Agriculture, Navsari Agricultural University, Bharuch Campus, Gujarat, India

SV Gosavi
Ph.D. Scholar, Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

PM Patel
Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

RS Patel
Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

Corresponding Author:
AR Katara
Ph.D. Scholar, Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India

Effect of nutrient management on nutrient content and uptake by Indian bean in Indian bean-summer sorghum cropping sequence

AR Katara, DD Patel, SV Gosavi, PM Patel and RS Patel

Abstract
A field experiment entitled, "Effect of nutrient management on nutrient content and uptake by Indian bean in Indian bean-summer sorghum cropping sequence" was conducted at College farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) during kharif and rabi season of 2019-20 and 2020-21. The field experiment consisted of nutrient management treatments viz., T_1:- RDF (25 N - 50 P_2O_5 - 00 K_2O kg/ha), T_2:- 75% RDF, T_3:- 75% RDF + Vermicompost @ 2 t/ha, T_4:- 75% RDF + FYM @ 5 t/ha, T_5:- 75% RDF + Biocompost @ 5 t/ha, T_6:- 75% RDF + Vermicompost @ 2 t/ha + NPK consortia @ 1 litre/ha soil treatment, T_7:- 75% RDF + FYM @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment and T_8:- 75% RDF + Biocompost @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment to Indian bean in rabi season and all these treatments replicated three times in randomized block design. On the basis of two-year pooled results, it was observed that treatment receiving 75% RDF + Biocompost @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment (T_8) recorded significantly higher nutrient content (N and P_2O_5) and uptake (N, P_2O_5 and K_2O) as well as its total uptake and which was remained almost at par with application of 75% RDF + Vermicompost @ 2 t/ha + NPK consortia @ 1 litre/ha soil treatment (T_6) and 75% RDF + FYM @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment (T_7). While, the lower nutrient content (N and P_2O_5) and uptake (N, P_2O_5 and K_2O) were found with treatment receiving RDF (T_1) by seed and stover of Indian bean as well as its total uptake also. However, K_2O content in seed and stover of Indian bean was not significantly influenced by various nutrient management treatments.

Keywords: Indian bean, nutrient management, nutrient content and uptake

1. Introduction
Pulses are the cheapest source of dietary protein; valuable animal feed, also plays a key role in improving and sustaining soil productivity on account of biological nitrogen fixation and addition of huge amounts of organic matter. Pulses are integral part of the cropping system because these crops fit well in the crop rotation and crop mixture and are most suited diversifying crops in cropping systems. In India pulses are grown in an area of 29.15 million hectares with total production of 25.41 million tonnes with productivity of 853 kg/ha during the year 2017-18 (Anonymous, 2018a) [2]. While, in Gujarat these are grown over an area of 6.6 lakh hectares with an annual production of 6.81 million tonnes with the productivity of 1029 kg/ha during the year 2018-19 (Anonymous, 2019) [3].

Among the pulses, Indian bean (*Dolichos Lablab* L.) or dolichus bean or lablab bean or hyacinth bean is a native of India. It is commonly grown in almost all the states *viz.*, Madhya Pradesh, Uttar Pradesh, Maharashtra, Arunachal Pradesh, Tamil Nadu and Gujarat. Besides India, it also grown throughout the tropical regions of Asia, Africa and America. It is commercially grown for pods used as vegetable and for dry seeds used as pulses, however, regional preferences are existed in the cultivation of Indian bean. For instance, green shelled seeds are mostly preferred in south India, whereas white pods are liked in eastern India. In north India plains people like green pods has its own importance as tender immature green pods, cooked as vegetable alone or with potatoes. Dry seeds are used for pulse purpose. The foliage of Indian bean is used as hay, silage and green manure.

In Gujarat, Indian bean is the most important crop particularly grown in Navsari, Surat and Valsad districts. In South Gujarat, it is highly grown during *rabi* season in field vacated by *kharif* crops like rice, maize and millets. In Gujarat, Indian bean was cultivated in an area of 8.1 lakh ha with production of 15.6 lakh MT and productivity of 871 kg/ha during the year2014-15 (Anonymous, 2016) [1]. To increase the production of any crops, a proper management practice has very much importance.

Among the various practices, nutrient management has prime important as under absence of nutrients, plant growth is affected and ultimately resulted in poor yield.

Nutrient management is an age-old practice but its importance was not very much realized in pre green revolution era due to low nutrient demands of the contemporary subsistence agriculture. This approach of nutrient management aims at judicious use of all the major sources of plant nutrients in an integrated manner, so as to get maximum economic yield without any deleterious effect on physical, chemical and biological properties of the soil. Thus, the basic concept underlying the principles of nutrient management is the maintenance and possible improvement in soil fertility for sustained crop productivity on long term basis (Harisudan *et al*., 2009) [7].

2. Material and Methods

The investigation was conducted during *rabi* and *kharif* season of 2019-20 and 2020-21 at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) to study the "Effect of nutrient management on nutrient content and uptake by Indian bean in Indian bean-summer sorghum cropping sequence". The soil of the experimental field was clayey in texture, low in organic carbon (0.41%) and available nitrogen (198.40 kg/ha), medium in available P_2O_5 (37.98 kg/ha) and very high in available K_2O (313.83 kg/ha). The soil was slightly alkaline in reaction (pH 8.2) with normal electrical conductivity (0.30 d/Sm). The field experiment consisted of nutrient management treatments *viz*., T_1:- RDF (25 N - 50 P_2O_5 - 00 K_2O kg/ha), T_2:- 75% RDF, T_3:- 75% RDF + Vermicompost @ 2 t/ha, T_4:- 75% RDF + FYM @ 5 t/ha, T_5:- 75% RDF + Biocompost @ 5 t/ha, T_6:- 75% RDF + Vermicompost @ 2 t/ha + NPK consortia @ 1 litre/ha soil treatment, T_7:- 75% RDF + FYM @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment and T_8:- 75% RDF + Biocompost @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment to Indian bean in *rabi* season and all these treatments replicated three times in randomized block design.

The Indian bean *cv*. Gujarat Wal- 2 was sown with spacing 60 × 30 cm in the month of October and harvested in the month of February during both the years. The recommended dose of fertilizers for Indian bean was 25 N + 50 P_2O_5 + 00 K_2O kg/ha. The Indian bean was fertilized as per treatments. The inorganic source of nitrogen was applied through urea whereas phosphorus was applied through DAP. The full dose of nitrogen and phosphorus were applied at the time of sowing as per the treatment. While the organic manure such as FYM, biocompost and vermicompost were applied to respective plot before the sowing of Indian bean as per the treatment. The remaining amount of the NPK consortia as soil treatment was mixed thoroughly with the organic manure and applied in the field as per treatment during both the years.

The observations on N, P_2O_5 and K_2O content (%) and uptake (kg/ha) by seed and stover of Indian bean as well as total uptake (kg/ha) were recorded. Plant samples of seed and stover of Indian bean were collected at harvest from each plot during both the years and were grind in willey mill to pass through 40 mesh sieve. The grind material was collected in butter paper bags and later used for chemical analysis. Nitrogen, phosphorus and potassium content from seed and stover were estimated using standard procedures given by Jackson (1973) [8].

The nutrient (NPK) uptake by seed and stover of Indian bean was worked out by using following formula:

$$\text{Nutrient uptake (kg/ha)} = \frac{\text{Nutrient content (\%)}}{100} \times \text{Yield (kg/ha)}$$

3. Results and Discussion

That data pertaining to nutrient (N, P_2O_5 and K_2O) content and uptake by seed and stover of Indian bean as well as its total uptake is presented in Tables 1 and 2.

The results revealed that N and P_2O_5 content in seed and stover of Indian bean was found significantly higher with treatment receiving 75% RDF + Biocompost @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment (T_8) and which was remained at par with treatment 75% RDF + Vermicompost @ 2 t/ha + NPK consortia @ 1 litre/ha soil treatment (T_6) and 75% RDF + FYM @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment (T_7) on the basis of two years pooled analysis. However, significantly the lower N and P_2O_5 content in seed and stover of Indian bean were noted with application of RDF (T_1). While, K_2O content was found to be non-significant during both the years and in pooled analysis but the higher values of K_2O content in seed and stover of Indian bean was noted with treatment receiving 75% RDF + Biocompost @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment (T_8) and lower with treatment T_2 (75% RDF). This might be due to the addition of nitrogen through both organic and inorganic sources as well as biofertilizer. Incorporating organic sources along with chemical fertilizers and biofertilizer resulted in the formation of clay-humus complexes in the soil which promotes lower and prolonged availability of nitrogen to the crop. Similar effect of nutrient management was also observed on phosphorus availability which was further aided by the application of NPK consortia. As a result of better growth of crop plants and higher availability and content, potassium content may also have improved under these treatments. The results are in close conformity with the findings of Baldaniya (2017) [4], Sodavadiya *et al*. (2017) [13] and Desai *et al*. (2020) [6] in Indian bean crop; Patra and Sinha (2012) [11] and Patel *et al*. (2016) [10] in greengram crop; Sepehya *et al*. (2012) [12] with regard to garden pea; Desai *et al*. (2014) [5] in cowpea crop and Kumar and Singh (2014) [9] with respect to French bean.

Similarly, N, P_2O_5 and K_2O uptake by seed and stover of Indian bean as well as its total uptake were recorded significantly higher with application of 75% RDF + Biocompost @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment (T_8) and which was found to be at par with application of 75% RDF + Vermicompost @ 2 t/ha + NPK consortia @ 1 litre/ha soil treatment (T_6) and 75% RDF + FYM @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment (T_7) in majority of the cases. While, the lower N, P_2O_5 and K_2O uptake by seed and stover of Indian bean and also its total uptake were noted with application of RDF (T_1). The uptake of nutrients by the crop is a function of nutrient content and yield/biomass produced. When organic manures are applied in combination with chemical chemical and bio fertilizers, its nutrient releasing pattern is changed. Normally they initially release nutrients at a slower rate but on applying fertilizers like urea, the C: N ratio is lowered which results in faster mineralization of nutrients from organic manure. Hence, greater amount of nutrients are available for uptake by the crop in the year of application itself and nutrient use

efficiency is enhanced. Thus, due to higher yield values and improved nutrient content and uptake of N, P_2O5 and K_2O were also higher with these treatments. The results are in close conformity with the findings of Baldaniya (2017) [4], Sodavadiya *et al*. (2017) [13] and Desai *et al*. (2020) [6] in Indian bean crop; Patra and Sinha (2012) [11] and Patel *et al*. (2016) in greengram crop; Sepehya *et al*. (2012) [12] with regard to garden pea; Desai *et al*. (2014) [5] in cowpea crop and Kumar and Singh (2014) [9] with respect to French bean.

Table 1: Nutrient content in seed and stover of Indian bean as affected by different treatments (Two years pooled results)

Treatments		Nutrient content (%)					
		Seed			Stover		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O
T_1:	RDF (25 N - 50 P_2O_5 - 00 K_2O kg/ha)	3.410	0.297	1.452	1.089	0.198	2.244
T_2:	75% RDF	3.181	0.276	1.412	0.890	0.186	2.219
T_3:	75% RDF + Vermicompost @ 2 t/ha	3.451	0.300	1.471	1.103	0.200	2.250
T_4:	75% RDF + FYM @ 5 t/ha	3.304	0.288	1.427	0.981	0.192	2.233
T_5:	75% RDF + Biocompost @ 5 t/ha	3.523	0.306	1.491	1.110	0.206	2.256
T_6:	75% RDF + Vermicompost @ 2 t/ha + NPK consortia @ 1 litre/ha soil treatment	3.726	0.318	1.534	1.173	0.217	2.291
T_7:	75% RDF + FYM @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment	3.624	0.311	1.516	1.163	0.211	2.285
T_8:	75% RDF + Biocompost @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment	3.782	0.327	1.557	1.182	0.220	2.299
SEm±		0.088	0.007	0.034	0.025	0.005	0.047
CD (P=0.05)		0.256	0.020	NS	0.072	0.013	NS
CV (%)		6.176	5.668	5.558	5.605	5.433	5.065

Table 2: Nutrient uptake by seed and stover and its total uptake by Indian bean as affected by different treatments (Two years pooled results)

Treatments		Nutrient uptake (kg/ha)						Total nutrient uptake (kg/ha)		
		Seed			Stover					
		N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
T_1:	RDF (25 N - 50 P_2O_5 - 00 K_2O kg/ha)	46.72	4.07	19.93	28.37	5.14	58.43	75.09	9.21	78.35
T_2:	75% RDF	37.06	3.22	16.48	20.75	4.33	51.70	57.81	7.55	68.17
T_3:	75% RDF + Vermicompost @ 2 t/ha	48.83	4.24	20.81	29.30	5.32	59.69	78.13	9.56	80.50
T_4:	75% RDF + FYM @ 5 t/ha	43.39	3.77	18.66	24.64	4.82	56.05	68.03	8.59	74.71
T_5:	75% RDF + Biocompost @ 5 t/ha	51.25	4.44	21.67	30.31	5.62	61.63	81.56	10.06	83.30
T_6:	75% RDF + Vermicompost @ 2 t/ha + NPK consortia @ 1 litre/ha soil treatment	58.56	4.99	23.90	34.25	6.34	66.96	92.81	11.34	90.86
T_7:	75% RDF + FYM @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment	54.36	4.67	22.94	32.77	5.95	64.21	87.13	10.62	87.15
T_8:	75% RDF + Biocompost @ 5 t/ha + NPK consortia @ 1 litre/ha soil treatment	61.63	5.36	25.37	35.37	6.58	68.91	96.99	11.94	94.28
SEm±		2.75	0.26	1.00	1.29	0.22	2.34	2.87	0.34	2.34
CD (P=0.05)		7.98	0.76	2.90	3.74	0.65	6.79	8.30	0.99	6.78
CV (%)		13.43	14.69	11.54	10.74	9.90	9.42	8.81	8.51	6.98

4. Conclusions

On the basis of experimental results, it can be concluded that Indian bean crop should be fertilized with 75% RDF (17.5 N - 37.5 P_2O_5 - 00 K_2O) + Biocompost @ 5 t/ha + NPK consortia @ 1 litre/ha as soil application for getting higher nutrient content and uptake in Indian bean- summer sorghum sequence under south Gujarat condition.

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