EFFECT OF DIFFERENT NUTRIENT SOURCES ON YIELD, NUTRIENT CONTENT AND UPTAKE OF BLACK GRAM (*Vigna mungo* L. HEPPER) IN ORGANIC AGRICULTURE

ABSTRACT

The field investigation was conductedto study the influence of different organic nutrient sources on black gram *cv*. GU 3 at Organic Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat during summer season ofthe year 2021. The experiment was laid out in Randomized Block Design with Factorial concept, consisting of two levels *viz*., soil application and foliar application each having three factors. Total of nine treatments *i. e*., S_1 :100 % RDN through NADEP compost, S_2 : Ghan-jivamrut @ 500 kg/ha and S_3 : Ghan-jivamrut @ 500 kg/ha + Jivamrut @ 500 l/ha and that of foliar application were, F_0 : Control, F_1 : Novel organic liquid nutrient @ 1 % and F_2 : *Moringa* leaf extract @ 3 %. The application of foliar spray was done thrice at 15, 30 and 45 days after sowing. werereplicated thrice. The result revealed that the mean data of nutrient content in black gram seed and stover did not significantly change due to soil and foliar application of different organic nutrient sources. The total NPK uptake was recorded significantly the highest with S_1 treatment, whereas total K uptake was found statistically similar with the treatment S_3. The foliar application of treatment F_2 recorded significantly the highest total NPK uptake by crop.So, it can be concluded that providing 100 percent RDN through NADEP compost in the soil and giving 3 percent Moringa leaf extract or 1 percent Novel organic liquid nutrients on days 15, 30 and 45 after planting on leaves gave significantly higher seed yield, stover yield and total N, P and K nutrient uptake compared to the Ghan-jivamrut @ 500 kg/ha and Ghan-jivamrut @ 500 kg/ha + Jivamrut @ 500 l/ha treatments on soil and control.

Keywords:Biofertilizer, Black gram, Ghan-jivamrut, Jivamrut, NADEP compost, Novel organic liquid nutrient,*Moringa* leaf extract, Organic Farming.

1. INTRODUCTION

The overgrowing population of our country has increased the demand of food grain which has led Indian agriculture toward the adoption of green revolution technology. The greed to increase the food grain production gave rise to the overuse of chemical fertilizers. These chemical fertilizers has degraded the soil health. To overcome these problem, Organic farming a system which avoids or largely excludes the use of synthetic inputs and to the maximum extent feasible rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection can be used. Due to growing awareness of health and environment related issues in agriculture the organic farming is gaining a gradual momentum across the world. While trends of rising the consumer demand for organics are becoming discernible, sustainability of the crops has become the prime concern in agricultural development (Reddy, 2019).

Pulses play a vital role in ensuring nutritional security, particularly in densely populated countries. They are grain legumes like beans, lentils, and peas, providing essential proteins, energy, minerals, and vitamins. India, the largest global producer of pulses, faces challenges in per capita availability despite its significant contribution to global production (Anon., 2018).Black gram (*Vignamungo* L. Hepper) is a crucial pulse crop in India, rich in protein and various nutrients. It aids soil fertility through nitrogen fixation, making it a sustainable choice.Pulses are also called as “Marvel of Nature” (Makwana *et al*., 2020). Despite its nutritional benefits and versatility, there's a need to address the declining per capita availability.In organic farming, composting, especially the NADEP method, offers an eco-friendly solution. Cow-based organic manures like jivamrut, bijamrut, panchgavya are being used as good alternative of chemical fertilizer by playing very important role in organic farming (Kaur, 2020). Biofertilizers containing nitrogen-fixing and phosphate-solubilizing microorganisms, contribute to soil healthby accelerating certain microbial processes to augment the availability of nutrients in a form that plants can assimilate readily (Anon., 2016).*Moringa* leaf extract, acting as a bio-stimulant with zeatin, enhances crop growth efficiently, reducing dependence on chemical fertilizers (Fuglie, 2000).Enriched banana pseudo-stem sap emerges as a remedy for inorganic farming's harmful effects. This value-added product contains major and micronutrients, plant growth regulators, and beneficial microbes, promoting crop growth and protecting against pests. It is the patent product "NOVEL- Liquid Organic Nutrient" has been developed by the Banana Pseudo-stem Processing Unit, Navsari Agricultural University, Navsari, Gujarat (Salunke, 2010).Addressing the environmental and economic burdens of chemical fertilizers, these organic practices align with the growing global trend towards sustainable agriculture. As awareness increases, incorporating these methods can ensure a healthier and eco-friendly future for pulse cultivation, contributing to both food security and sustainable agriculture. Owing to the importance and increasing future demand of quality food this study will be useful to solve these problems.

2. MATERIALS AND METHOD

The field experiment was conducted at Organic Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari during summer season of 2021 on black gram *cv.* GU 3. The experiment was laid out in a Randomized Block Design with Factorial concept (FRBD), with two factors *viz.*, soil application and foliar application each having three levels and was replicated thrice. The three level of soil application were namely, S_1 :100 % RDN through NADEP compost, S_2 : Ghan-jivamrut @ 500 kg/ha and S_3 : Ghan-jivamrut @ 500 kg/ha + Jivamrut @ 500 l/ha and that of foliar application were, F_0 : Control, F_1 : Novel organic liquid nutrient @ 1 % and F_2 : *Moringa* leaf extract @ 3 %. The application of foliar spray was done thrice at 15, 30 and 45 days after sowing. Before sowing the seed treatment of *Rhizobium* and PSB was given. The soil of the experimental field was clayey in texture with high range of organic carbon content (0.81 %) and the available K_2O (497.52 kg/ha) while, the available N (258.6 kg/ha) as well as available P_2O_5 (56.80 kg/ha) was in medium range. The weather conditions were favourable for the proper growth and development of the crop throughout the cropping period. The nutrient content in different organic source used during the experiment has been displayed below in the Table 1.

Table 1 : The chemical composition of different organic source

Sr. No.	Parameters	Liquid/ Solid organic sources				
		NADEP compost (%)	Ghan-jivamrut (%)	Jivamrut (%)	Novel organic liquid nutrient (%)	*Moringa*leaf extract (%)
1.	N	1.35	0.95	0.091	0.062	0.97
2.	P	0.90	0.46	0.024	0.018	0.23
3.	K	1.23	1.12	0.118	0.180	0.92

2.1 CHEMICAL ANALYSIS OF PLANT SAMPLE

The plant samples collected from the representative treatment plots were oven dried at 60±5°C for 24 hours till the constant weight was recorded. Then the samples were grinded into powder form using themixture grinder with stainless steel blade and were sieved using 2 mm sieve. Later,these samples were used for the analysis of N, P and K content using the standard methods of analysis shown in Table 2. While the nutrient uptake was calculated using the formula.

2.1.1 Nutrient Content (%)

The analysis of nutrient content from the seed and stover was found out using these samples by following the different standard methods of analysis as shown in the Table 2. The plant samples were digested using concentrated H_2SO_4 for nitrogen analysis and with diacid for analysis of phosphorus and potassium content.

Table 2 : Different methods adopted for analysis of plant samples

Sr. No.	Parameters	Method of analysis	Reference
1.	Nitrogen (N)	Kjeldahl's Method	Jackson, 1973
2.	Phosphorus (P)	Spectrophotometry	Jackson, 1973
3.	Potassium (K)	Flame Photometric Method	Jackson, 1973

2.1.2Nutrient Uptake (kg/ha)

The uptake of N, P and K nutrients by seed and stover was calculated using the individual nutrient concentration and dry matter yield of seed and stover.

The nutrient uptake by plant was calculated using the formula :

$$\text{Nutrient Uptake (kg/ha)} = \frac{\text{Nutrient content (\%)} \times \text{Dry matter yield of (seed/stover) (kg/ha)}}{100}$$

3. RESULT AND DISCUSSION

3.1 EFFECT OF DIFFERENT TREATMENT ON YIELD AND HARVEST INDEX OF BLACK GRAM

3.1.1 Seed yield

The seed yield was calculated on the basis of seed yield obtained from the net plot (kg/plot) and was subjected to statistical analysis. The results obtained have been highlighted in Table 3.Looking at theanalyzed data, significant result was obtained for the seed yield as the effect of soil application of organic nutrient sources showed positive impact on it. The result revealed that the application of 100 per cent RDN through NADEP compostsignificantly recordedthe highest seed yield *i. e.* 1041 kg/ha. While the S_2treatment where 500 kg/ha Ghan-jivamrutwas applied recorded the lowest seed yield of 836 kg/ha.An appraisal of seed yield data indicated that foliar spray of liquid organic sources significantly influenced the seed yield as much variation was observed. The foliar spray of 3 per cent*Moringa*leaf extract (F_2 treatment) resulted in significantly higher seed yield (1051 kg/ha) and was statistically similar with foliar spray of 1 per centNovel organic liquid nutrient(F_1 treatment) which recorded 937 kg/ha seed yield. While the F_0 treatment as control where no foliar application was given recorded the lowest seed yield *i. e.* 805 kg/ha.The reason for the higher seed yield due to *Moringa*leaf extract may be that it increases the loading and unloading of assimilates across membrane boundaries of the vascular tissues leading to increase in yield. Cytokinins present in MLE also promote carbohydrate metabolism and create new source-sink relationships leading to increased yield of crop.The influence of interaction effect of soil and foliar application on the seed yield was found to be statistically non-significant. No variation in seed yield was observed due interaction effect.The previous experiment results noted by Chaudhari (2013) in green gram andRathva (2013) in pigeon pea, Abohassan and Abusuwar (2017) in green gram, Gunasekar*et al.* (2018), Nivethadevi*et al.* (2021) in black gram and Irshad *et al.* (2022) in chickpea were found to be closely related with the findings of present research work.

3.1.2 Stover yield

The stover yield of net plot was noted at the time of harvest which was converted to obtain stover yield on hectare basis. The details regarding the stover yield of black gram have been tabulated in Table 3. From the result obtained it was concluded that the stover yield was significantly influenced by the soil application of the organic nutrient sources. The S_1(100 % RDN through NADEP compost) treatment recorded significantly higher stover yield of 2696 kg/ha and it remained at par with S_3(Ghan-jivamrut @ 500 kg/ha + Jivamrut @500 l/ha) treatment which recorded 2536 kg/ha stover yield.The result revealed that the foliar application of *Moringa*leaf extract @ 3per cent*viz.*, F_2 treatment recorded significantly higher stover yield of 2725 kg/ha butwas statistically similar with F_1 treatment where, Novel organic liquid nutrient @ 1 per cent was sprayed and it recorded 2446 kg/ha stover yield. The F_0 treatment, control where no spray was given recorded the lowest 2228 kg/ha stover yield.The statistically non-significant result was obtained for the stover yield due to the interaction effect between the soil and foliar application of various nutrient organic sources.The results of present study are in conformity with the previously reported findings of Chaudhari (2013) in green gram andRathva (2013) in pigeon pea, Gunasekar*et al.* (2018) in black gram, Nivethadevi*et al.* (2021) in black gram and Irshad *et al*. (2022) in chickpea.

3.1.3 Harvest index

Theharvest index was calculated on the basis of the seed yield and biological yield which was subjected to statistical analysis. The prevailing result have been presented in Table 3. The resultindicated that the harvest index did not significantly differ due to the influence of soil application of the various organic nutrient sources. Numerically, the S_1 treatment recorded the highest harvest index followed by S_2 and S_3 treatment *i.e.* 28.24 %, 27.82 % and 26.49 %, respectively.The foliar application of different treatment did not show significant difference in the resulting harvest index. The F_1 treatment (Novel organic liquid nutrient @ 1 %)recorded numerically the highest harvest index of 27.98 per cent in comparison to F_2 treatment and F_0 treatment which recorded 27.83 per cent and 26.75 per cent harvest index, respectively.The harvest index was not significantly inferred due to the interaction between the soil and foliar application of the various organic nutrient sources and the result obtained was statistically non-significant.

Table 3 :Effect of different treatments on seed yield, stover yield and harvest index of black gram

Treatments	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)
Factor I : Soil application (S)			
S_1 - 100 % RDN through NADEP compost	1041	2696	28.24
S_2 - Ghan-jivamrut @ 500 kg/ha	836	2166	27.82
S_3 - Ghan-jivamrut @ 500 kg/ha + Jivamrut @ 500 l/ha	917	2536	26.49
SEm ±	40	123	1.17
CD at 5 %	120	379	NS
Factor II : Foliar application (F)			
F_0 - Control	805	2228	26.75
F_1 - Novel organic liquid nutrient @ 1 %	937	2446	27.98
F_2–*Moringa*leaf extract @ 3%	1051	2725	27.83
SEm ±	40	126	1.17
CD at 5 %	120	379	NS
Interaction			
S×F	NS	NS	NS
CV %	12.89	15.36	12.74

3.2 EFFECT OF DIFFERENT TREATMENTS ON NUTRIENT CONTENT IN SEED AND STOVER OF BLACK GRAM

3.2.1 Nutrient Content in Seed

The nutrient content *i. e.* N, P and K percentage in black gram seed was analyzed using different methods and the result obtained have been tabulated in Table 4.Thesoil application and foliar application of different organic nutrient sources sprayed thrice at 15, 30 and 45 DAS failed to effect, the NPK content of black gram seed and resultant data were statistically non-significant.The nitrogen content in seed was numerically recorded the highest for the S_3 treatment **(**Ghan-jivamrut @ 500 kg/ha + Jivamrut @500 l/ha) followed by S_1(100 % RDN through NADEP compost) treatment and S_2 **(**Ghan-jivamrut @ 500 kg/ha**)** containing3.18, 3.16 and 3.14 per cent nitrogen content in seed, respectively.The mean data obtained for the phosphorus content in seed indicated that there was no variation observed as the result was statistically non-significant and numerically the highest 0.393 per cent phosphorus content in seed was recorded for S_2 treatment while, the S_3 treatment recorded the lowest 0.385 per cent phosphorus content.The potassium content in seed did not differ significantly due to the impact of soil application of organic sources. The result concluded that the potassium content in seed ranged from 1.20 – 1.22 per cent in black gram seed.

The nitrogen content in black gram seed on statistical analysis gave non-significant result and numerically the highest value of nitrogen content *i. e.* 3.20 per cent was recorded for the F_2 treatment. While the F_1 treatment recorded the lowest value 3.12 per cent nitrogen content.With respect to phosphorus content in seed the obtained result was non-significant. It can be concluded that numerically the F_1 treatment where 1 per cent Novel organic liquid nutrient was sprayed recorded the highest 0.393 per cent phosphorus content followed by F_2 treatment with 0.389 per cent P content where 3 per cent *Moringa*leaf extract was sprayed. While the F_0 control treatment recorded lowest 0.383 per cent P content.From the estimated potassium content, it was observed that no variation was found due to foliar application of various organic nutrient sources. Numerically the highest potassium content of 1.23 per cent was recorded for the F_1 treatment while, the F_0 treatment recorded the least 1.20 per cent potassium content in seeds of black gram.Looking at the analyzed data it was revealed that the interaction effect between the soil and foliar application of the various organic nutrient sources resulted in non-significant result for the major nutrient *viz*., nitrogen, phosphorus and potassium content in black gram seeds.

3.2.2 Nutrient Content stover

The nutrient content in stover of black gram estimated through various methods have been recorded and presented in Table 4.Theprevailing data regarding the estimated nutrient content in stover of black gram revealed that soil application of organic nutrient sources could not influence the major nutrient content as no variation was observed in them.Numerically the obtained mean data for the nitrogen content in stover, concluded that the application of 100 per cent RDN through NADEP compost (S_1 treatment) recorded the highest 0.664 per cent N content in stover. The application of Ghan-jivamrut @500 kg/ha (S_2 treatment) resulted in the lowest 0.646 per cent nitrogen content in stover of black gram however, the combine application of Ghan-jivamrut @ 500 kg/ha and Jivamrut 500l/ha (S_3) recorded better results, 0.657 per cent nitrogen content in comparison toS_2 treatment.The numerically the highest phosphorus content in stover of black gram was obtained in S_1 treatment followed by the S_2 and S_3 treatment *i. e.* 0.224 %, 0.218 % and 0.216 %, respectively.The potassium content in stover did not should any variation due to soil application of nutrient sources. The 0.832 per cent potassium content was found numerically the highest in the S_3 treatment. While the S_1 treatment recorded the lowest potassium content of 0.798 per cent in stover of black gram.The foliar spray of nutrient sources applied at 15, 30 and 45 DAS did not significantly interfere the NPK content in stover of black gram.Numerically the highest value of nitrogen content in stover 0.677 per cent was obtained in F_2 treatment where 3 per cent *Moringa*leaf extract was applied while, the F_0 treatment where no spray was given recorded the lowest 0.638 per cent nitrogen content in stover. The data evaluated for the phosphorus content in stover did not show much variation in them and was statistically found to be non-significant. However, numerically the F_2 treatment noted the highest 0.227 per cent P content and the F_1 treatment recorded the lowest 0.214 per cent P content in stover of black gram.The perusal of dataregarding the potassium content in stover of black gram indicated that foliar spray did not influence the K content. The potassium content was numerically higher for F_0 treatment 0.823 per cent followed by F_1 treatment with 0.822 per cent K and then at last F_2 treatment with 0.804 per cent K content in stover.On the statistical assessment of data regarding the major nutrient content in stover, it was observed that the interaction effect of soil and foliar application of organic sources could not differ the NPK content in stover of black gram as the result obtained were statistically non-significant. During the experiment only one variety was used so the results obtained for the nutrient content were found to be statistically non-significant because the application of nutrient sources cannot influence its's quality parameters but can improve its performance.

Table 4 :Effect of different treatment on N, P and K content in seed and stover of black gram

Treatments	NPK content in seed (%)			NPK content in stover(%)		
	N	P	K	N	P	K
Factor I : Soil application (S)						
S_1 - 100 % RDN through NADEP compost	3.16	0.387	1.22	0.664	0.224	0.80
S_2 - Ghan-jivamrut @ 500 kg/ha	3.14	0.393	1.20	0.646	0.218	0.82
S_3 - Ghan-jivamrut @ 500 kg/ha + Jivamrut @ 500 l/ha	3.18	0.385	1.21	0.657	0.216	0.83
SEm±	0.03	0.008	0.02	0.013	0.005	0.01
CD at 5%	NS	NS	NS	NS	NS	NS
Factor II : Foliar application (F)						
F_0 – Control	3.16	0.383	1.20	0.638	0.217	0.82
F_1 - Novel organic liquid nutrient @ 1 %	3.12	0.393	1.23	0.652	0.214	0.80
F_2 – *Moringa* leaf extract @ 3%	3.20	0.389	1.21	0.677	0.227	0.82
SEm±	0.03	0.008	0.02	0.013	0.005	0.01
CD at 5%	NS	NS	NS	NS	NS	NS
Interaction						
S×F	NS	NS	NS	NS	NS	NS
CV %	2.87	5.90	3.80	5.74	6.35	3.80

3.2 EFFECT OF DIFFERENT TREATMENTS ON SEED, STOVER AND TOTAL NUTRIENT UPTAKE BY BLACK GRAM PLANT

3.3.1 Nutrient Uptake by Seed

The details regarding the N uptake, P uptake and K uptake have been tabulated in Table 5. A significant difference was noticed due to the effect of soil application of different treatment on the nitrogen uptake by the seeds, but it could not influence the phosphorus and potassium uptake by the seed as they did not differ significantly.The data pertaining with regard to nitrogen uptake by the seed was found to be statistically significant. The S_1 treatment where 100 per cent RDN was applied through NADEP compost recorded significantly higher 23.18 kg/ha nitrogen uptake and it remained at par with the S_3 treatment where combined application of Ghan-jivamrut @ 500 kg/ha + Jivamrut @500 l/ha was given recorded 20.68 kg/ha nitrogen uptake. While the S_2 treatment where only Ghan-jivamrut @ 500 kg/ha was used resulted in the lowest 19.56 kg/ha nitrogen uptake by seeds. The phosphorus uptake by the seed did not show any variation due to soil application of different organic sources. Numerically the highest 2.86 kg/ha P uptake was noted for the S_1 treatment followed by S_3 treatment with2.50 kg/ha P uptake by seeds and then S_2 treatment with 2.46 kg/ha phosphorus uptake by seeds of black gram.The results obtained for the potassium uptake by seeds revealed that no variation was observed in it and the maximum potassium uptake 8.91 kg/ha was recorded for theS_1 treatment while minimum 7.51 kg/ha potassium uptake was observed in S_2 treatment.On the assessment of NPK uptake by seed it was noticed that the foliar spray of liquid organic nutrient given at 15, 30 and 45 DAS significantly influenced the nutrient uptake.The result obtained for the nitrogen uptake by seed indicated that the F_2 treatment recorded significantly higher 23.67 kg/ha N uptake and it was found statistically similar with the F_1 treatment which recorded 21.09 kg/ha N uptake by seeds of black gram. While the F_0 treatment recorded the least 18.65 kg/ha N uptake by seeds.The mean data of phosphorus uptake by seed revealed that the significantly higher 2.89 kg/ha P uptake was noted in the F_2 treatment (*Moringa*leaf extract @ 3%)and it remained at par with F_1 treatment (Novel organic liquid nutrient @ 1 %) which recorded 2.67 kg/ha P uptake by the seeds. While the control treatment recorded the lowest 2.27 kg/ha P uptake by seeds.The prevailing data regarding the influence of foliar spray on potassium uptake by seeds concluded that the F_2 treatment recorded significantly higher K uptake of 8.94 kg/ha which remained statistically similar with F_1 treatment which recorded 8.31 kg/ha K uptake by seeds. The lowest 7.06 kg/ha K uptake was noted for the F_0 treatment *i. e.* no spray. The reason behind higher nutrient uptake by plant treated with 3 per cent *Moringa*leaf extract is that MLE works as a plant bio stimulant which contain essential macronutrients and micronutrients.It is also rich in phytohormones such as Indole-3-Acetic Acid (IAA), gibberellins (GAs) and zeatin as a cytokinin.Theinteraction between the soil and foliar application of organic sources did not show significant difference on the NPK uptake by the seeds of black gram.The findings of present research work were found to be closely related with the results reported by Chaudhari (2013) in green gram and Rathva (2013) in pigeon pea.

3.3.2 Nutrient Uptake by Stover

The prevailing data regarding the major nutrient uptake by the stover of black gram have been depicted in Table 5. The major nutrient uptake showed significant variation due to the influence of the soil application of organic manure and on statistical analysis the result obtained was statistically significant.The mean data regarding nitrogen uptake by the stover indicated that the S_1(100 % RDN through NADEP compost) treatment recorded significantly higher (10.68 kg/ha) N uptake and was statistically similar with S_3(Ghan-jivamrut @ 500 kg/ha + Jivamrut @500 l/ha) treatment which recorded 9.80 kg/ha N uptake. While the S_2(Ghan-jivamrut @ 500 kg/ha) treatment recorded the least N uptake of 8.42 kg/ha by the stover.The examined data of phosphorus uptake by stover revealed that the soil application of 100 per cent RDN through NADEP compost (S_1 treatment) recorded significantly higher P uptake (3.60 kg/ha) which was found at par with S_3 treatment which recorded P uptake of 3.24 kg/ha. And the S_2 treatment recorded the lowest 2.83 kg/ha P uptake by stover.The soil application of the different organic nutrient sources significantly influenced the potassium uptake by the stover and it was noted that the S_1 treatment recorded significantly higher (12.85 kg/ha) K uptake and it remained at par with S_3 treatment recording 12.42 kg/ha K uptake by stover. Looking at the analyzed results, the nutrient uptake by stover was significantly influenced by the foliar spray of different liquid organic sources applied at 15, 30 and45 days after sowing.An appraisal of nitrogen uptake data achieved was significantly the highest11.06 kg/ha N uptake by stover was observed in F_2treatment in which 3 per cent *Moringa*leaf extract was sprayed. In comparison to the F_0treatment(control) which recorded the lowest 8.41 kg/ha N uptake, the F_1 treatment (Novel organic liquid nutrient @ 1 %) recorded better 9.42 kg/ha N uptake by stover. The F_2treatment recorded significantly the highest 3.71 kg/ha phosphorus uptake by stover. The F_1treatment recorded 3.10 kg/ha phosphorus uptake. While the lowest 2.86 kg/ha P uptake was observed in the F_0treatment.On the assessment of potassium uptake by the stover, it was noticed that the significantly the highest 13.42 kg/ha K uptake was noted for the F_2 (*Moringa*leaf extract @ 3 %) treatment. The F_1(Novel organic liquid nutrient @ 1 %) treatment recorded 11.63 kg/ha K uptake which was better than control.The interaction between soil and foliar application of the various nutrient organic sources did not significantly influence the major nutrient uptake by stover. The effect of foliar feeding of bio-stimulants like *Moringa*leaf extract is a complementary technique that can enhance growth, increase the yield ofthe crop and reduce the negative effects of abiotic stress during crop development. Foliar feeding is nothing but spraying liquid fertilizer directly to the leaves as opposed to in the soil (Puglisi *et al*., 2022). Their epidermis and stomata work cleverly to absorb thenutrients (potassium, phosphorous, and nitrogen) from liquid fertilizer for the growth of plants (Karthiga*et al.*, 2022).Chaudhari (2013) in green gram and Rathva (2013) in pigeon peaobtained results were similar to the findings of present research work.

Table 5 :Effect of different treatments on N, Pand Kuptake by seed, stover and total uptake by black gram

Treatments	NPK uptake by seed (kg/ha)			NPK uptake by stover (kg/ha)			Total NPK uptake (kg/ha)		
	N	P	K	N	P	K	N	P	K
Factor I : Soil application (S)									
S_1 - 100 % RDN through NADEP compost	23.18	2.86	8.91	10.68	3.60	12.85	33.86	6.46	21.76

S_2 - Ghan-jivamrut @ 500 kg/ha	19.56	2.46	7.51	8.42	2.83	10.61	27.98	5.29	18.12
S_3 - Ghan-jivamrut @ 500 kg/ha + Jivamrut @500 l/ha	20.68	2.50	7.89	9.80	3.24	12.42	30.47	5.74	20.13
SEm ±	0.92	0.15	0.38	0.44	0.16	0.53	1.07	0.24	0.71
CD at 5 %	2.75	NS	NS	1.32	0.48	1.60	3.20	0.71	2.14
Factor II : Foliar application (F)									
F_0 – Control	18.65	2.27	7.06	8.41	2.86	10.83	27.07	5.13	17.90
F_1 - Novel organic liquid nutrient@ 1 %	21.09	2.67	8.31	9.42	3.10	11.63	30.50	5.77	19.93
F_2–*Moringa*leaf extract @ 3%	23.67	2.89	8.94	11.06	3.71	13.42	34.73	6.60	22.36
SEm ±	0.92	0.15	0.38	0.44	0.16	0.53	1.07	0.24	0.71
CD at 5 %	2.75	0.44	1.15	1.32	0.48	1.60	3.20	0.71	2.14
Interaction									
S × F	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	13.03	16.72	14.22	13.69	14.83	13.36	10.42	12.24	10.65

3.3.3 Total NPK Uptake by Plants of Black Gram

The total nutrient uptake calculated based on the nutrient uptake by seed and stover have been presented in Table 5. The soil application of the organic nutrient sources significantly influenced the total nutrient uptake so, much variation was observed in them. The mean data of total nitrogen uptake concluded that the S_1 treatment recorded significantly the highest 33.86 kg/ha total N uptake. The S_2 treatment recorded the lowest total N uptake of 27.98 kg/ha. The S_1 treatment in which 100 per cent RDN was applied through NADEP compost recorded the significantly the highest total phosphorus uptake of 6.46 kg/ha. However, the lowest total P uptake (5.29 kg/ha) was recorded for the S_2 treatment. The perusal data to total potassium uptake indicated that significantly higher total K uptake *i. e.* 21.76 kg/ha was observed for the S_1treatment and it remained statistically similar with the S_3 treatment which noted total K uptake of 20.13 kg/ha. While the S_2 treatment recorded the lowest 18.12 kg/ha total K uptake by black gram. The prevailing data of total nutrient uptake by black gram was significantly influenced by the foliar spray of different liquid nutrient sources applied thrice *i. e.* at 15 DAS, 30 DAS and 45 DAS. TheF_2(*Moringa*leaf extract @ 3%) treatment recorded significantly the highest total N uptake, total P uptake and total K uptake *i. e.* 34.73 kg/ha, 6.60 kg/ha and 22.36 kg/ha, respectively. While the lowest total nutrient uptake by black gram *i. e.* total N uptake (27.07 kg/ha), total P uptake (5.13 kg/ha) and total K uptake (17.09 kg/ha) was recorded for the F_0 (control) treatment where no spray was given. The F_1 treatment where 1 per cent Novel organic liquid nutrient was sprayed recorded better result in comparison to control *i. e.* total N uptake (30.50 kg/ha), total P uptake (5.77 kg/ha) and total K uptake (19.93 kg/ha). The statistically non-significant results were obtained for the total nutrient uptake by black gram as it was not influenced by the interaction effect of the soil and foliar application of different organic nutrient sources. The reason behind the significant result for the NPK uptake by seed and stover could be that these parameters were calculated based on their respective yield and nutrient content. The findings of present research work are in accordance with the results of previous experiment reported by Chaudhari (2013) in green gram and Rathva (2013) in pigeon pea.

4. CONCLUSION

From the experiment carried out, it can be concluded that providing 100 percent RDN through NADEP compost in the soil and giving 3 percent Moringa leaf extract or 1 percent Novel organic liquid nutrients on days 15, 30 and 45 after planting on leaves gave significantly higher seed yield, stover yield and total N, P and K nutrient uptake compared to the Ghan-jivamrut @ 500 kg/ha and Ghan-jivamrut @ 500 kg/ha + Jivamrut @ 500 l/ha treatments on soil and control.

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