Original Research Article

Potential of integrated nutrient managements (INM) on Nutrient uptake (N, P and K) by chickpea

ABSTRACT

This work estimated the potential uses of NPK by chickpea under using of different combination of bio-fertilizer. The field experiment was conducted at Research Field, Department of Soil Science, JNKVV, Jabalpur (M.P.). The field is located in the south-eastern part of Madhya Pradesh at $23^0$13' North latitude, 79^0 57' East longitudes at an altitude of 393 meter above the mean sea level. The experimental field was well-drained with levelled topography. The experiment was carried out on chickpea (JG-14). The experiment was consists of three main-plot treatments of NPK and six sub-plot treatments of vermicompost and biofetilizers which were replicated three times in a split plot design (SPD) with treatments error was P>0.05 value during analysis. The results revealed that the INM influence directly on NPK(nitrogen, phosphorus and potassium) uptake. The treatment 100% NPK (65.08 and 26.39 $kgha^{-1}$) with combination vermicompost and *Rhizobium+ PSB+KSB+ Trichoderma* (biofetilizers)(61.77 and 27.45 $kgha^{-1}$) highest nitrogen uptake. Phosphorus uptake estimated maximum in treatment of 50% NPK (7.24 and 4.03 $kgha^{-1}$) with combination vermicompost and biofetilizers (10.03 and 4.92 $kgha^{-1}$) moreover potassium uptake found highest in 100% NPK (5.10 and 27.11 $kgha^{-1}$) with vermicompost and biofetilizers (4.92 and 27.80 $kgha^{-1}$) in seed and stover respectively.

Keyword:Nutrients uptake, Trichoderma, Pseudomonas, Vermicompost, Biofetilizers etc.

1. INTRODUCTION

Food security, food quality, soil health sustainability and climate resilience are the key areas of the integrated crop management concept (ICM). Integrated nutrient management (INM) in conventional agriculture is recognized as one of the strategies to address the above priorities under the ICM. At the same time, we rely sufficiently on organic sources to meet the nutritional needs of our crops, in addition to using chemical fertilizers to feed the vast world population in general and India in particular. Integrated nutrient management refers to maintaining soil fertility and plant nutrient supply at optimal levels to maintain desired productivity by optimizing the benefits of all possible sources of organic, inorganic and biological components in an integrated manner. Integrated Nutrient Management (INM) uses of chemical fertilizers along with organic fertilizers, crop residues, and cover crops, legumes in cultivation systems, the use of bio-fertilizers and other locally available nutrient sources to provide nutrients to plants at optimal levels to maintain crop productivity in an integrated manner(Choudhary*et al.* 2018)

2. METHODS AND MATERIALS

The field experiment was carried out at Research field of Department of Soil Science, JNKVV, Jabalpur during Rabi season 2021-22. The experiment was consists of three main-plot treatments of NPK and six sub-plot treatments of vermicompost and biofetilizers which were replicated three times in a split plot design (SPD). The NPK fertilizers were supplied through urea, single super phosphate, muriate of

potash were applied at recommended dose of 20:60:20 kg/h. The experimental data were tabulated and analyzed statistically by the method of analysis of variance as described by Gomez and Gomez (1984)

2.1 Nutrient Content estimation

The percentage nutrient content has been estimated in different ways, i.e. Nitrogen content in chickpea pods and stover were estimated based on dry weight using the micro-Kjeldahl method according to the method described by AOAC (1995). The phosphorus content in chickpea pods and stover were estimated on the basis of dry weight using the vanado-molybdate yellow color method published by Bhargava and Raghupathi (1984). Potassium content in chickpea pods and stover were estimated on a dry weight basis from acid digestions using a flame photometer following the method of Bhargava and Raghupathi (1984).

2.2 Nutrient uptake

The nitrogen, phosphorous, and potassium content of chickpea pods and stover were tested on a dry weight basis using standard procedures as described before. The uptake of nutrients by chickpea pods and stover was computed in terms of kg ha^{-1} by multiplying the respective content of nutrient and yield ha^{-1} using the following formula

$$\text{Nutrient uptake (kg ha}^{-1}\text{)} = \frac{\text{Nutrient content (\%)} \times \text{yield (kg ha}^{-1}\text{)}}{100}$$

3. RESULTS AND DISCUSSION

3.1 Nitrogen uptake by chickpea at harvest

The data on contents of N uptake in the seed and stover of chickpea are presented in Table 1.The N uptake in the seed of chickpea in kg/ha at harvest ranged from 53.68 to 69.80kg/ha with an average of 60.17 kg/ha. *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma+ pseudomonas* exhibited significantly maximum response with 69.80kg/hawhich was 14% more over that of control (60.17kg/ha). This was followed by the response of *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma* with 68.86kg/ha on the other hand, the response of the treatments *NPK100+ VC+ Rhizobium +PSB+KSB* were found statistically at par.

Table 1 nitrogen uptakeunder different treatments of fertilizer by seed and stover of check pea crop

Main treatments / Sub treatments	Seed				Straw			
	0% NPK	50% NPK	100% NPK	**Mean**	0% NPK	50% NPK	100% NPK	**Mean**
Vermicompost+Rhizobium +PSB	54.83	60.89	65.44	60.38	24	25.07	25	24.69
Vermicompost+Rhizobium +KSB	55.42	58.92	58.92	57.75	25.33	25.93	26.36	25.88
vermicompost+Rhizobium+ PSB+KSB	55.15	58.33	66.05	59.84	25.28	27	27.41	26.56

Vermicompost+Rhizobium +PSB+KSB+Trichoderma	62.67	56.98	68.86	61.77	26.29	26.67	27.57	27.45
Vermicompost+ Rhizobium+ Trichoderma+Pseudomonas	59.05	56.46	69.80	61.4	28.5	26.13	28.5	26.67
control	53.68	60.17	61.4	58.41	25	24.17	26.67	25.28
Mean	56.8	58.62	65.08		25.73	25.83	26.39	
	NPK(A)	VC+BF(B)	AxB		NPK(A)	VC+BF(B)	AxB	
SEm±	0.88	1.51	2.61		0.52	0.84	1.45	
CD(0.05)	3.45	4.36	7.66		2.04	2.42	4.19	

The N uptake in the stover of chickpea in kg/ha at harvest ranged from 24.00 to 28.50kg/ha with an average of 25.98 kg/ha. *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma+ pseudomonas* exhibited significantly maximum response with 28.50 kg/ha which was 14% more over that of control (24.00kg/ha). This was followed by the response of *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma* with 27.57q/ha. On the other hand, the response of the treatments *NPK100+ VC+ Rhizobium +PSB+KSB* were found statistically at par. Similarly finding denoted through Choudhary*et al*(2018)

3.2 Phosphorus uptake by chickpea at harvest

The data on contents of P uptake in the seed and stover of chickpea are presented in Table 2. The P uptake in the seed of chickpea in kg/ha at harvest ranged from 6.75 to 11.95kg/ha with an average of 8.74 kg/ha. *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma+ pseudomonas* exhibited significantlymaximum response with 11.95 kg/hawhich was 44% more over that of control (6.75 kg/ha). This was followed by the response of *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma* with 11.17 kg/ha.On the other hand, the response of the treatments *NPK100+ VC+ Rhizobium +PSB+KSB* were found statistically at par.

Table 2Phosphorus uptake under different treatments of fertilizer by seed and stover of check pea crop

Main treatments / Sub treatments	Seed				Straw			
	0% NPK	50% NPK	100% NPK	Mean	0% NPK	50% NPK	100% NPK	Mean
Vermicompost+Rhizobium +PSB	7.03	9.7	9.41	8.71	4.31	4.24	5.42	4.66
Vermicompost+Rhizobium +KSB	8.69	8.15	9.56	8.8	4.43	4.05	4.71	4.39
vermicompost+Rhizobium +PSB+KSB	7.2	7.15	10.97	8.44	4.49	4.76	5.22	4.82
Vermicompost+Rhizobium +PSB+KSB+Trichoderma	7.72	9.47	11.17	10.03	3.27	4.84	5.43	4.92
Vermicompost+ Rhizobium+ Trichoderma+Pseudomonas	7.98	10.14	11.95	6.94	3.88	4.99	5.89	3.92

control	6.75	7.24	6.94	6.98	3.8	4.03	3.92	3.92
Mean	7.56	8.64	10		4.03	4.49	5.1	
	NPK(A)	VC+BF(B)	AxB		NPK(A)	VC+BF(B)	AxB	
SEm±	1.07	0.69	1.2		0.27	0.19	0.34	
CD(0.05)	4.21	2	3.46		1.04	0.56	0.97	

The P uptake in the stover of chickpea in kg/ha at harvest ranged from 3.80 to 5.89kg/ha with an average of 3.92 kg/ha. *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma+ pseudomonas* exhibited significantlymaximum response with 5.89 kg/hawhich was 34% more over that of control (3.92kg/ha). This was followed by the response of *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma* with 5.43 kg/ha.On the other hand, the response of the treatments *NPK100+ VC+ Rhizobium +PSB+KSB* were found statistically at par. The data was correlated with Shah *et al.* (2022)

3.3 Potassium uptake by chickpea at harvest

The data on contents of K uptake in the seed and stover of chickpea are presented in Table 3.The K uptake in the seed of chickpea in kg/ha at harvest ranged from 3.80 to 5.89kg/ha with an average of 4.54 kg/ha. *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma+ pseudomonas* exhibited significantly maximum response with 5.89 kg/ha which was 48% more over that of control (3.80kg/ha). This was followed by the response of *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma* with 5.43 kg/ha.On the other hand, the response of the treatments *NPK100+ VC+ Rhizobium +PSB+KSB* were found statistically at par.

Table 3Potassium uptake under different treatments of fertilizer by seed and stover of check pea crop

Main treatments / Sub treatments	Seed				Straw			
	0% NPK	50% NPK	100% NPK	Mean	0% NPK	50% NPK	100% NPK	Mean
Vermicompost+Rhizobium+PSB	4.31	4.24	5.42	4.66	23.14	25.62	27.61	25.46
Vermicompost+Rhizobium+KSB	4.43	4.05	4.71	4.39	27.06	22.12	23.76	24.31
vermicompost+Rhizobium+PSB+ KSB	4.49	4.76	5.22	4.82	20.91	20.93	29.13	23.66
Vermicompost+Rhizobium+PSB+ KSB+Trichoderma	3.27	4.84	5.43	4.92	27.12	22.76	29.38	27.8
Vermicompost+ Rhizobium+ Trichoderma+Pseudomonas	3.88	4.99	5.89	3.92	28.97	23.95	30.46	22.28
control	3.8	4.03	3.92	3.92	20.11	21.87	22.28	21.42
Mean	4.03	4.49	5.1	0	24.55	22.88	27.11	0
	NPK(A)	VC+BF(B)	AxB		NPK(A)	VC+BF (B)	AxB	
SEm±	0.27	0.19	0.34		0.85	1.01	1.75	
CD(0.05)	1.04	0.56	0.97		3.33	2.92	5.06	

The K uptake in the stover of chickpea in kg/ha at harvest ranged from 20.11 to 30.46 kg/ha with an average of 24.84 kg/ha. *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma+ pseudomonas* exhibited significantly maximum response with 30.46 kg/hawhich was 21% more over that of control (20.11 kg/ha). This was followed by the response of *NPK100+ VC+ Rhizobium +PSB+ KSB+ Trichoderma* with 29.38 kg/ha.On the other hand, the response of the treatments *NPK100+ VC+ Rhizobium +PSB+KSB* were found statistically at par.Similar result have also been reported by Singh *et al*. (2017), Harikesh, *et al.,* (2018), Patel *et al*. (2020), Khan *et al*. (2021).

4. CONCLUSION

The INM was shows efficient use of nutrient uptake *i.e.* nitrogen, phosphorus and potassium through seed and stover of chickpea. the highest nitrogen uptake reflected in the treatment of INM100%NPK with *vermicompost* (*Rhizobium* + *Trichoderma* + *Pseudomonas*)nutrients by seed and stover.Phosphorus as well as potassium nutrients uptake estimated highest in the treatments of INM combination (100%NPK + *vermicompost* + *Rhizobium* + *Trichoderma* + *Pseudomonas*).

CONSENT AND ETHICAL APPROVAL (WHERE EVER APPLICABLE)

The plant materials (Chickpea) used for our research work was provided by the Department of soil science and agricultural chemistry, JNKVV, Jabalpur and All local, national, or international guidelines and legislation were followed on this study for the production of chickpea crop.

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