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Cumulative and Residual Effects of Integrated Nutrient Management Practices of *Kharif* Rice Followed by *Rabi* Black gram on Soil Available Nutrients after Summer Brinjal

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ABSTRACT

A field experiment was conducted during 2014-15 with rice in Kharif, black gram in *Rabi*andbrinjal in summer seasons at farmer's field, Devaryamjal village, near Hakimpet, Rangareddy district, Telangana. The experiment was laid out in randomized block design (RBD) with 11 treatments, each replicated 3 times. The treatments consisted of control (T_1), 100% RDFN (T_2), 75% RDFN + 25% N through VC, PM and FYM (T_3, T_6, T_9), 50% RDFN + 50% N through VC, PM and FYM (T_4, T_7, T_{10}), 100% RDN through VC, PM and FYM (T_5, T_8, T_{11}). Rice (BPT 5204) was test crop grown during *Kharif* season with RDF applied as N : P_2O_5: K_2O @ 120 : 60 : 40 kg ha^{-1}. A uniform dose of 60 kg ha^{-1}P_2O_5 and 40 kg ha^{-1}K_2O was applied as basal to all the plots. In the *Rabi* season black gram (LBG-20) was taken up in same plots. Each treatmental plot of *Kharif* crop was divided into two equal halves. In one half recommended dose of fertilizers to black gram @ 30 : 60 : 40 kg ha^{-1}(N : P_2O_5 : K_2O) were applied to study the cumulative effects. In the other half no fertilizers were applied to study the residual effects. In summer season a vegetable crop brinjal (Pusa purple long) was cultivated to find out the cumulative and residual effects of applied INM treatments to *Kharif* rice crop followed by legume black gram in *Rabi*. Same treatmental plots of *Rabi* crop were used for cultivation of brinjal in summer season following the same pattern of fertilizer application i.e., cumulative plots were applied with recommended dose of fertilizer @ 100 : 50 : 50 kg ha^{-1}(N : P_2O_5 : K_2O) and no fertilizers were applied to residual plots. The results revealed that after the harvest of brinjal, maximum available N, P_2O_5 and K_2O contents were recorded with treatment T_5, the values being 245.8, 27.3 and 326.1 kg ha^{-1} under cumulative effects and 210.7, 18.4 and 256.4 kg ha^{-1} respectively under residual effects. While treatment T_1 (control) recorded lowest values of available N, P_2O_5 and K_2O contents i.e., 221.4, 16.4 and 275.4 kg ha^{-1} under cumulative effects and 190.0, 13.8 and 217.3 kg ha^{-1} under residual effects.

Keywords: Brinjal, INM, Available Nitrogen, Phosphorus, Potassium

INTRODUCTION

Brinjal belongs to the family Solanaceae is cultivated as one of the leading and second major vegetable crop next to tomato. It is also called as egg plant and is native to India (Kiran et al., 2010). Brinjal fruits have some medicinal properties (Rajan and Markose, 2002). Some include treatment of diabetes, asthma, bronchitis etc. Now-a-days demand for brinjal as a vegetable is increasing rapidly among vegetable consumers in view of its better fruit colour, size and taste. Average productivity of brinjal crop is quite low, which can be increased by using several techniques i.e., integrated nutrient management, good hybrid seeds and organic farming. In intensive vegetable cultivation neither the chemical fertilizer nor the organic manure alone can help achieve sustainable production (Khan et al., 2008). Application of chemical fertilizers, pesticides improve production but adversely effect human health, soil productivity and quality of environment (Sharma et al., 2010). In contrast application of organic manures improve soil physical, chemical and biological properties and has a direct impact on moisture retention, root growth and nutrient conservation etc., (Kumar et al., 2011). Hence integrated nutrient management may be adopted to support enhanced productivity and quality of vegetables (Kiran et al., 2010). Therefore the present investigation was taken up to study the cumulative and residual effects of integrated nutrient management practices of *Kharif*rice followed by *Rabi* black gram on soil available nutrients after summer brinjal.

MATERIALS & METHODS

A field experiment entitled "Cumulative and Residual Effects of Integrated Nutrient Management Practices of *Kharif* Rice Followed by *Rabi* Black gram on Soil Available Nutrients after Summer Brinjal" was conducted during 2014-15 with rice in Kharif, black gram in *Rabi* and brinjal in summer seasons at farmer's field, Devaryamjal village, near Hakimpet, Rangareddy district, Telangana.It is situated at an altitude of 536 m above mean sea level, $17^0 23^{`}$ N latitude and $78^0 28^{`}$ E longitude. It is classified as Southern Telangana agro-climatic zone of Telangana State.*Kharif* rice was laid out in randomized block design (RBD) with 11 treatments, each replicated 3 times. The treatments consisted of control (T_1), 100% RDFN (T_2), 75% RDFN + 25% N through VC, PM and FYM (T_3, T_6, T_9), 50% RDFN + 50% N through VC, PM and FYM (T_4, T_7, T_{10}), 100% RDN through VC, PM and FYM (T_5, T_8, T_{11}). Soil of the experimental field is a sandy clay loam (ultisol), slightly alkaline in reaction (pH : 7.60), non saline (EC : 0.39 dS m^{-1}), medium in organic carbon (0.51%), low in available N (235 kg ha^{-1}), medium in available P_2O_5 (23 kg ha^{-1}) and high in available K_2O (304 kg ha^{-1}). Rice (BPT 5204) was test crop grown during *Kharif* season with RDF applied as N : P_2O_5: K_2O @ 120 : 60 : 40 kg ha^{-1}. A uniform dose of 60 kg $ha^{-1}P_2O_5$ and 40 kg $ha^{-1}K_2O$ was applied as basal to all the plots. In the *Rabi* season black gram (LBG-20) was taken up in same plots. Each treatmental plot of *Kharif* crop was divided into two equal halves. In one half recommended dose of fertilizers to black gram @ 30 : 60 : 40 kg ha^{-1}(N : P_2O_5 : K_2O) were applied to study the cumulative effects. In the other half no fertilizers were applied to study the residual effects. In summer season a vegetable crop brinjal (Pusa purple long) was cultivated to find out the cumulative and residual effects of applied INM treatments to *Kharif* rice crop followed by legume black gram in *Rabi*. Same treatmental plots of *Rabi* crop were used for cultivation of brinjal in summer season following the same pattern of fertilizer application i.e., cumulative plots were applied with recommended dose of fertilizer @ 100 : 50 : 50 kg ha^{-1}(N : P_2O_5 : K_2O) and no fertilizers were applied to residual plots. The soil samples were collected from each plot treatment wise after harvest of brinjal. The soil samples were analysed by following standard procedures. Organic carbon (%) was analysed by wet digestion method (Walkley and Black, 1934), available nitrogen (kg N ha^{-1}) by alkaline potassium permanganate method (Subbiah and Asija, 1956), available phosphorus (kg $P_2O_5 ha^{-1}$) by Olsen's method (Olsen et al., 1954), available potassium (kg K_2O ha^{-1}) by Neutral normal Ammonium acetate method (Jackson, 1973)

RESULTS AND DISCUSSION

Soil Available Nutrients

The data on contents of available nitrogen, phosphorus and potassium after harvest of brinjal due to cumulative & residual effects of INM treatments of *Kharif* rice, followed by *Rabi* black gram are presented in Table 1.

Available nitrogen

All the cumulative treatments recorded higher available nitrogen contents than their corresponding residual treatments. The difference in mean available nitrogen contents between cumulative & residual effects was 36.3 kg ha^{-1}.Among the cumulative treatments the mean available nitrogen content after harvest of brinjal was 237.8kg ha^{-1}. The minimum and maximum contents of available nitrogen were recorded with treatments T_1 (221.4 kg ha^{-1}) and T_5 (245.8 kg ha^{-1}) respectively. The available nitrogen content recorded with treatment T_5 was on par with all the treatments except T_1, T_2.Among residual treatments, the available nitrogen contents ranged from 190.0 to 210.7 kg ha^{-1} with a mean value of 201.5 kg ha^{-1}. The treatment T_5 which received 100% RDN through VC during *Kharif* rice crop and no fertilizer during *Rabi*black gram and summer brinjal recorded maximum available nitrogen content of 210.7 kg ha^{-1} which was on par with treatments T_3, T_4, T_7, T_8, T_{10}&T_{11} and significantly superior to treatments T_1, T_2, T_6&T_9.

Available phosphorus

Irrespective of the treatments, the available phosphorus contents observed under the cumulative effects were higher than their corresponding residual treatments. The difference in mean available phosphorus contents between cumulative & residual effects was 7.5 kg ha^{-1}. Among the cumulative treatments the mean available phosphorus content after harvest of brinjal ranged from 16.4 to 27.3 kg $ha^{-1}$with a mean value of 24.2 kg ha^{-1}. The available phosphorus content recorded with treatment T_1 was significantly lower than the rest of all the treatments. The treatment T_5 which received 100% RDN through VC during *Kharif* rice crop and 100% RDF during *Rabi*black gram and 100% RDF during summer brinjal recorded maximum available phosphorus content of 27.3 kg ha^{-1} which was on par with the treatments T_4, T_8, T_{11} and superior to rest of all the treatments. Among residual treatments, the available phosphorus contents ranged from 13.8 to 18.4 kg ha^{-1} with a mean value of 16.7 kg ha^{-1}. The treatment T_5 which received 100% RDN through VC during *Kharif* rice crop and no fertilizer during *Rabi*black gram and summer brinjal recorded maximum available phosphorus content of 18.4 kg ha^{-1} which was on par with treatments T_4, T_8&T_{11} and significantly superior to rest of all the treatments.

Available potassium

All the cumulative treatments recorded higher available potassium contents than their corresponding residual treatments. The difference in mean available potassium contents between cumulative & residual effects was 65.0 kg ha^{-1}. Among the cumulative treatments the mean available potassium content after harvest of brinjal was 304.7kg ha^{-1}. The available potassium content recorded with treatments T_1 (275.4 kg ha^{-1}) was inferior when compared to rest of all the

treatments. The treatment T_5 which received 100% RDN through VC during *Kharif* rice crop and 100% RDF during *Rabi*black gram and 100% RDF during summer brinjal recorded maximum available potassium content of 326.1 kg ha^{-1} which was on par with treatments T_4, T_8&T_{11} and significantly superior to rest of all the treatments. Among residual treatments, the available potassium contents ranged from 217.3 to 256.4 kg ha^{-1} with a mean value of 239.7 kg ha^{-1}. The treatment T_5 which received 100% RDN through VC during *Kharif* rice crop and no fertilizer during *Rabi*black gram and summer brinjal recorded maximum available potassium content of 256.4 kg ha^{-1} which was on par with treatments T_4, T_8, T_{11} and significantly superior to rest of all the treatments.

Among residual treatments, the decrease in available N, P_2O_5&K_2O due to treatments T_2 (100% RDFN to rice) and T_5 (100% RDN-VC applied to rice) were by 16.4, 30.9, 24.1 and 10.3, 20.0, 15.7 percent respectively when compared to initial nutrient status before cultivation of rice. The percent reduction in treatment T_2 was more when compared to treatment T_5. The treatments T_5, T_8&T_{11} which received 100% N through VC, PM &FYM during *Kharif* rice maintained more available N, P_2O_5&K_2O than 50% & 25% organic N treatments. This is due to the fact that the treatments with higher level (100%) of organic N maintained more available N, P_2O_5&K_2O than treatments with lower level (50% & 25%) of organic N. This is because mineralization process of 25% and 50% of organic part would have been completed earlier in the *Kharif* &*Rabi* seasons while in 100% organic N treatments after mineralization in *Kharif & Rabi* seasons the left over part of N was mineralized in the summer season. The increase in available N, P_2O_5&K_2O after harvest of brinjal due to cumulative effects was 18.0, 44.9 and 27.1 percent over residual effects respectively. The cumulative effects of treatments (residual effects of treatments applied to first crop of rice, coupled with direct effects of 100% RDF to black gram& brinjal) on third crop of brinjal grown in sequence with rice-black gram indicated that it should be fertilized with recommended fertilizer dose to maintain the required nutrient status in the soil. These results may be well supported by the findings of (Anchaldass et al., 2008, Shellke et al., 2001, Rasool Azarmi et al., 2008, Santhy et al., 2002).

CONCLUSION

From the above discussion, it can be inferred that application of organic manures significantly increase the available N, P and K status of soil when compared to application of N solely through chemical fertilizer. Among the different manures used in the study vermicompost showed superiority over poultry manure and farm yard manure. This indicates that application of vermicompost improves the availability of nutrients though it could not increase the total amount of nutrients in the soil.

Table 1 Cumulative and residual effects of integrated nutrient management treatments of *Kharif* rice followed by *Rabi*blackgram on soil available nutrient status after Summerbrinjal.

Treatments given to *Kharif* rice		Nitrogen (kg ha^{-1})		Phosphorus (kg ha^{-1})		Potassium (kg ha^{-1})	
		CUM.	RES.	CUM.	RES.	CUM.	RES.
T_1	- Control (No RDFN)	221.4	190.0	16.4	13.8	275.4	217.3
T_2	- 100% RDFN	232.6	196.4	22.3	15.9	293.6	230.8
T_3	- 75% RDFN + 25% N-VC	237.2	199.8	24.2	16.5	300.8	236.5
T_4	- 50% RDFN + 50% N-VC	241.8	204.3	25.8	17.4	312.5	245.8
T_5	- 100% RDN-VC	245.8	210.7	27.3	18.4	326.1	256.4
T_6	- 75% RDFN + 25% N-PM	235.7	198.6	23.7	16.3	298.2	234.4
T_7	- 50% RDFN + 50% N-PM	240.4	202.8	25.2	17.0	308.1	242.2
T_8	- 100% RDN-PM	244.5	208.6	26.9	18.0	321.0	252.4
T_9	- 75% RDFN + 25% N-FYM	234.1	197.5	23.2	16.1	296.4	233.1
T_{10}	- 50% RDFN + 50% N-FYM	238.8	201.2	24.7	16.7	303.4	238.6
T_{11}	- 100% RDN-FYM	243.3	206.4	26.5	17.7	316.5	248.9
SEm±		4.36	3.68	0.61	0.39	5.06	4.23
CD (P=0.05)		**12.89**	**10.87**	**1.79**	**1.15**	**14.94**	**12.50**
CV (%)		3.18	3.17	4.35	4.06	2.88	3.06
Mean		**237.8**	**201.5**	**24.2**	**16.7**	**304.7**	**239.7**

CUM - Cumulative effects - 100% RDF (N,P_2O_5 and K_2O @ 100:50:50 kg ha^{-1}, respectively)

RES - Residual effects - 0 RDF

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