RESEARCH ARTICLE

Residual Effect of Integrated Nutrient Management in Little Millet on Growth and Yield Parameters of Rabi-green Gram under Little Millet-green Gram Cropping Sequence

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Abstract

A field experiment was conducted to study the residual effect of integrated nutrient management in little millet on production potential of succeeding green gram crop under little millet-green gram cropping system. The residual effect of 50% RDN through chemical fertilizer + 50% RDN through vermicompost to *Kharif* little millet reported the significant effect on growth, yield attributes, seed and stover yields of succeeding green gram followed by 50% RDN through chemical fertilizer + 50% RDN through biocompost. Application of 50% RDN through chemical fertilizer + 50% RDN through vermicompost recorded maximum plant height at 60 DAS (52.08 cm) and at harvest (75.07 cm), maximum number of branches per plant at harvest (5.00), dry matter accumulation per plant (26.56 g), seed index (3.39 g) seed yield (991 kg/ha) and stover yield (2513 kg/ha). Thus, application of 50% RDN through chemical fertilizer + 50% RDN through vermicompost along with a recommended dose of 40 kg P_2O_5 reported the promising residual effect on growth, yield and yield attributing characters of succeeding green gram in little millet-green gram cropping sequence.

Keywords: Biocompost, Cropping sequence, Green gram, Seed yield, Vermicompost.

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Introduction

Millets are very high in their nutrition content. Each millet is three to five times nutritionally superior to rice and wheat in terms of proteins, minerals and vitamins so now Millet Network of India promotes millets as "nutri-cereals" instead of Coarse Cereals. Millets are rich in vitamin B, calcium, iron, potassium, magnesium, zinc, also gluten-free and have low-GI (Glycemic index); thus, millets are suitable for people allergies/intolerance of wheat. Also for diabetic, weight loss millets are excellent. Little millet is a humble grain with nutritional and health benefits. It contains 1.2% fat, 7.7% protein, and 68.8% carbohydrate. Wide adaptation, easy cultivation, free from major pest and diseases and drought tolerance has made this crop an indispensable component of the dry farming system.

Green gram is an important pulse crop of India. Due to their short duration, they can be grown as main, intercrop, catch and green manure crop. Pulses are known to improve soil fertility as they fix atmospheric nitrogen through symbiotic nitrogen fixation with the help of bacterium called *Rhizobia*. Thus every pulse plant is a mini-fertilizer factory itself.

Integrated nutrient management (INM) is the system of rationalization of the plant nutrition management to upgrade the efficiency of plant nutrient supply through the adequate association of local and external nutrient sources accessible and affordable to the farmers (Blaise 2004). Combined application of organic manures and chemical fertilizers generally produces higher crop yields than their sole application. This increase in crop productivity may be due to the combined effect of nutrient supply, synergism and improvement in soil physical and biological properties (Sarwad *et al*. 2005). Locally available various organic sources like biocompost, vermicompost, and FYM can be judiciously used to enhance the yield and profitability of crops.

The information available on the residual effect of growth and yield parameters on cereal-pulse cropping sequence is meager. In South Gujarat, limited research work has been carried out on the residual effect of different cropping sequence and hence present investigation was taken up to study the residual effect of integrated nutrient management in little millet on growth and yield parameters of green gram under little millet-green gram copping sequence.

Materials and Methods

The investigation was conducted at the Rajendrapur Farm, Krishi Vigyan Kendra, Navsari Agricultural University, Waghai (Dist-Dangs) during the years 2016-17 and 2017-18. The soil of the experimental field was clayey in texture, medium

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in organic carbon (0.70%), available nitrogen (282.73 kg/ha) and available phosphorus (46.83 kg/ha) whereas high in available potassium (373.28 kg/ha). The soil was slightly acidic in reaction (pH 6.8). The treatment consisted of integrated nutrient management *viz*. T_1–100% RDF (40:20:00 kg/ha), T_2–50% RDN through chemical fertilizer + 50% RDN through biocompost, T_3–50% RDN through chemical fertilizer + 50% RDN through vermicompost, T_4 – 75% RDN through chemical fertilizer + 25% RDN through biocompost and T_5–75% RDN through chemical fertilizer + 25% RDN through vermicompost to little millet in *Kharif* season as main plot treatments replicated four times in randomized block design. Organic manures (biocompost and vermicompost) were applied to little millet as per treatments and evenly spread and mixed in that particular bed. The little millet was fertilized as per treatments. The nitrogen was applied through urea (46% N) whereas; phosphorus was applied through single superphosphate (16% P_2O_5). The 50% dose of nitrogen and a full dose of phosphorus were applied at the time of transplanting and the remaining 50 % dose of nitrogen was applied 30 days after transplanting. In case of phosphorus fertilizer, the quantity of phosphorus from bio-compost and vermicompost was counted and deducted from the quantity of recommended dose of phosphorus and remaining phosphorus was applied in the form of single superphosphate. After the harvesting of little millet, the green gram was grown as succeeding crop on 19th November 2016 and 16th November 2017. During *Rabi* season each main plot treatment was split into four sub-plot treatments with four levels of recommended dose of fertilizer *viz.*, S_1 -control, S_2 50% RDF (10:15:00 NPK kg/ha), S_3 -75% RDF(15:30:00 NPK kg/ha) and S_4 100% RDF (20:40:00 NPK kg/ha) to green gram resulting in twenty treatment combinations replicated four times in split-plot design. The experiment was conducted on the same site without changing the randomization of the treatment for the successive year to assess the residual effects. The data recorded were statistically analyzed using MSTATC software. The purpose of analysis of variance was to determine the significant effect of treatments on little millet. LSD test at 5 percent probability level was applied when analysis of variance showed a significant effect for treatments.

Results and Discussion

Growth

It is clear from the result presented in Table 1 that all growth attributes in pooled *viz*., the height of the plant, number of branches/plant and dry matter accumulation/plant of green

Table 1: Residual effect of integrated nutrient management in littlem millet on growth parameters of rabigreen gram (2 year Pooled data)

	Plant height (cm)			*Number of branches/plant*			*Dry matter accumulation/plant (g)*		
Treatments	*30 DAS*	*60 DAS*	*At harvest*	*30 DAS*	*60 DAS*	*At harvest*	*30 DAS*	*60 DAS*	*At harvest*
(I). *Main plot treatment (khariflittle millet)*									
T_1: 100% RDF	22.00	41.06	63.92	2.05	3.93	4.27	3.33	17.59	23.74
T_2: 50% RDN through chemical fertilizer + 50 % RDN through biocompost	22.60	50.81	73.43	2.14	4.40	4.85	3.65	19.59	25.93
T_3: 50% RDN through chemical fertilizer + 50% RDN through vermicompost	22.78	52.08	75.07	2.18	4.61	5.00	3.69	20.27	26.56
T_4: 75% RDN through chemical fertilizer + 25% RDN through biocompost	22.33	44.16	67.10	2.09	4.04	4.39	3.47	18.32	24.85
T_5: 75% RDN through chemical fertilizer + 25% RDN through vermicompost	22.57	45.78	68.93	2.13	4.15	4.49	3.49	18.68	25.12
SEm+	0.58	0.79	0.81	0.03	0.08	0.08	0.07	0.36	0.32
CD (P=0.05)	NS	2.31	2.36	NS	0.23	0.24	0.19	1.04	0.93
CV (%)	10.28	9.55	6.56	10.61	11.05	10.11	10.38	10.66	7.17
(II) *Sub plot treatment (rabi green gram)*									
S_1: Control	21.58	36.36	59.48	2.04	3.51	3.88	3.07	16.47	22.93
S_2: 50% RDF	22.19	43.33	65.68	2.10	3.98	4.28	3.32	17.80	24.27
S_3: 75% RDF	22.65	53.04	76.24	2.14	4.66	5.04	3.82	20.32	26.59
S_4: 100% RDF	23.41	54.39	77.37	2.21	4.76	5.20	3.89	20.98	27.17
SEm+	0.34	0.61	0.61	0.03	0.06	0.07	0.05	0.26	0.26
CD (p = 0.05)	0.94	1.72	1.71	0.08	0.17	0.18	0.15	0.72	0.72
CV (%)	9.60	8.24	5.51	9.32	9.45	8.94	9.28	8.53	6.40
General mean	22.46	46.78	69.69	2.12	4.23	4.60	3.53	18.89	25.24

gram was significantly influenced due to INM to preceding *Kharif* little millet from 30 DAS onwards.

At 30 DAS, 60 DAS and at harvest, significantly maximum plant height was recorded under application of 50% RDN through chemical fertilizer + 50% RDN through vermicompost, which was found to be at par with 50% RDN through chemical fertilizer +50% RDN through biocompost. The results are in direct line with the observations of Singh *et al*. (2001).

In case of a number of branches per plant at 60 DAS and at harvest, application of 50% RDN through chemical fertilizer + 50% RDN through vermicompost found a significantly higher number of branches, which was statistically at par with 50% RDN through chemical fertilizer + 50% RDN through biocompost. The results are in conformity with the earlier observations of Gawai and Pawar (2006).

Dry matter accumulation per plant was recorded at 60 DAS and harvest, significantly maximum dry matter accumulation per plant were recorded with the application of 50% RDN through chemical fertilizer + 50% RDN through vermicompost, which was statistically at par with 50% RDN through chemical fertilizer + 50% RDN through biocompost. Similarly, the beneficial residual effect of the addition of vermicompost or biocompost along with chemical fertilizers under cropping system on growth attributes reported by Patel *et al.* (2018).

It may be due to the fact that more nutrient availability under these treatments resulted into the increased conversion of carbohydrates into protein which in turn elaborated into protoplasm and cell wall material increased the size of the cell, which expressed morphologically in terms of plant height, a number of branches and ultimately dry matter accumulation.

The satisfactory growth of the green gram under combine application of chemical fertilizers and organic manures over control could be seen due to an adequate supply of all the essential plant nutrients, better soil properties due to the residual effect of combined application of chemical fertilizers and organic manures (vermicompost or biocompost) to preceding crop *Kharif* little millet. Vermicompost or biocompost have not been fully utilized by the little millet in first crop season and notably benefitted the succeeding green gram.

Yield and Yield Attributes

Yield contributing characters of green gram *viz*., a number of pods per plant, seed index and seed yield per plant (Table 2) were significantly influenced due to the residual effect of integrated nutrient management applied in *Kharif* little millet. Application of 50% RDN through chemical fertilizer + 50% RDN through vermicompost to preceding *Kharif* little

Table 2: Residual effect of integrated nutrient management in little millet on yield attributes and yield of rabi green gram (2 year Pooled data)

Treatments	*Number of pods/plant*	*Seed index (g)*	*Seed yield/ plant(g)*	*Seed yield (kg/ ha)*	*Stover yield (kg/ha)*
(I) *Main plot treatment (khariflittle millet)*					
T_1: 100% RDF	17.65	2.97	4.38	860	2102
T_2: 50% RDN through chemical fertilizer + 50 % RDN through biocompost	20.21	3.26	5.21	953	2404
T_3: 50% RDN through chemical fertilizer + 50% RDN through vermicompost	21.18	3.39	5.49	991	2513
T_4: 75% RDN through chemical fertilizer + 25% RDN through biocompost	18.55	3.05	4.81	909	2228
T_5: 75% RDN through chemical fertilizer + 25% RDN through vermicompost	19.16	3.13	4.95	921	2270
SEm+	0.35	0.06	0.11	14.66	41.11
CD (p = 0.05)	1.02	0.17	0.31	42.48	119.98
CV (%)	10.21	10.29	12.13	9.64	10.09
(II) *Sub plot treatment (rabi green gram)*					
S_1: Control	15.53	2.69	3.44	761	1834
S_2: 50% RDF	17.12	2.98	4.35	882	2165
S_3: 75% RDF	22.00	3.45	5.99	1019	2574
S_4: 100% RDF	22.76	3.53	6.10	1046	2639
SEm+	0.30	0.05	0.07	12.39	29.37
CD (p = 0.05)	0.85	0.13	0.21	34.86	82.66
CV (%)	9.83	9.14	9.48	8.59	8.06
General mean	19.35	3.16	4.97	927	2303

millet recorded a significantly higher number of pods, seed index and seed yield per plant which was remained at par with50% RDN through chemical fertilizer + 50% RDN through biocompost. Such effect may be owing to the increased availability of nutrient in soil from the native pool as well as their residual effect through mineralization and improvement of physicochemical properties of soil, which result into more growth of crop and resulted in adequate food supply to sink and ultimately reflected into better yield attributes. These results are in accordance with Nawle *et al.* (2009) in *Kharif* forage sorghum-*rabi* chickpea and Shanwad *et al.* (2010) in maize-Bengal gram.

The result regarding green gram seed yield and stover yield have been described in Table 2. The differences in seed yield and stover yield were reached up to the level of significance. Preceding *Kharif* little millet fertilized with 50% RDN through chemical fertilizer + 50% RDN through vermicompost recorded significantly higher seed (991 kg/ha) and stover (2513 kg/ha) yield of succeeding green gram being remained at par with 50% RDN through chemical fertilizer + 50% RDN through biocompost. The increased seed and stover yields of green gram due to INM to preceding *Kharif* little millet might be due to good crop growth (growth attributes) resulted in to maximum values of yield attributes, ultimately it influences positively on yield, as growth and yield parameters show positive and significant correlation with seed and stover yield of green gram. Similar results reported earlier by Imade (2014) in *Kharif* rice-*rabi* green gram and Mansuri (2016) in *Kharif* rice-*rabi* chickpea.

Conclusion

Based on experimental results, little millet crop should be nourished with 50% RDN through chemical fertilizer +50% RDN through vermicompost along with a recommended dose of 40 kg P_2O_5 reported the promising residual effect on growth, yield and yield attributing characters of succeeding green gram in little millet-green gram cropping sequence.

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