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Effect of INM on chemical properties of soil, nutrient uptake and yield of greengram in sodic soil

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Abstract

A field experiment was conducted during Kharif 2018 at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli, to study the effect of integrated nutrient management on chemical property of soil, nutrient uptake and yield of greengram. The experiment was laid out in randomized block design with eleven treatments having three replications. The results revealed that significantly higher number of pods plant⁻¹ (32.73), number of seeds per pod⁻¹ (11.07), seed yield (866 kg ha⁻¹) and stover yield (1976 kg ha⁻¹) and maximum uptake of nitrogen, phosphorus and potassium (51.2, 11.15, and 38.13 kg ha⁻¹ respectively) were recorded due to application of 75% RDF + Vermicompost @2t ha⁻¹ + Bio-fertilizer. Application of 75% RDF and bio-fertilizers with vermicompost and castor cake markedly increased the available nutrient content in soil. Hence it can be concluded that the application of 75% RDF + Vermicompost @2t ha⁻¹ + Bio-fertilizer would be useful to increase the yield of green gram and available nutrient status in sodic soil.

Keywords: Greengram, vermicompost, castor cake, bio-fertilizer and uptake

Introduction

Green gram is the third important pulse crop after chickpea and red gram. It accounts for 10-12% of total pulse production in the country. In Tamil nadu, the area under greengram is 1.8 L ha, with the production of 1.2 L t, and productivity of 642 kg ha⁻¹. It is mostly cultivated under marginal and sub-marginal lands of low soil fertility (Saravanan *et al.*, 2013) [10] with improper use of inorganic fertilizer (Bairwa *et al.*, 2009) [11].

Problem soils are the major constraints in our country. In India 6.74 m ha and in Tamil Nadu 3.68 m ha are salt affected soil. Productivity of most of the crops in salt affected soil is low due to salt stress. Greengram is important pulse crop that is grown in sodic soil. However, the productivity of greengram in sodic soil is very low, because of less availability and uptake of nutrients and poor aeration (Fageria *et al.*, 2011) [3]. Use of soil amendments and application of farm yard manure and green manure reduces the effects of salt stress.

Improper use of inorganic fertilizer depletes the soil fertility and productivity besides the depletion of nutritional quality of pulses (Bairwa *et al.*, 2009) [11]. Thus the integration of inorganic fertilizer and organic manures resulted in better growth, yield and nutrient uptake (Kumpawat, 2010) [7]. Being a leguminous crop, greengram has ability to fix atmospheric nitrogen in soil but it is adversely affected in salt affected soils. Therefore application of bio-fertilizer is needed to ensure nodulation and nitrogen fixation. In cognizance of the above, a study was undertaken to find out the appropriate nutrient management practices for increasing the productivity of greengram in sodic soils of Trichy district.

Materials and methods

A field experiment was conducted during Kharif 2018 at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli. The soil of the experimental field was sandy clay loam texture with low in available nitrogen (168 kg ha⁻¹), medium in available phosphorus (17.4 kg ha⁻¹) and high in available potassium (235 kg ha⁻¹). Treatments comprised of 100 % recommended dose of fertilizers (RDF), Vermicompost @2 t ha⁻¹ + Bio-fertilizer, Castor cake @500 kg ha⁻¹ + Bio-fertilizer, 75% RDF + Vermicompost @2 t ha⁻¹, 75% RDF + Castor cake @500 kg ha⁻¹, 75% RDF + Vermicompost @2 t ha⁻¹ + Bio-fertilizer, 75% RDF + Castor cake @500 kg ha⁻¹ + Bio-fertilizer, 50% RDF + Vermicompost @2 t ha⁻¹, 50% RDF + Castor cake @500 kg ha⁻¹, 50% RDF + Vermicompost @2 t ha⁻¹ + Bio-fertilizer, 50% RDF + Castor cake @500 kg ha⁻¹ + Bio-fertilizer. As per the treatment vermicompost and castor cake

were applied as basal and fertilizers were applied in the form of di-ammonium phosphate (DAP), Urea and muriate of potash (MOP) and incorporated manually in the furrow before sowing. The treatments were laid out in randomised block design with three replications. The greengram variety VBN 3 was sown at a spacing of 30 x 10cm on 11 July, 2018. Before sowing, the seeds were inoculated with Rhizobium and PSB each @20 g/ kg of seed and shade dried as per the treatment. All other agronomic practices were carried out as per TNAU crop production guide. After harvest, the plant and soil samples were collected for analysis. The collected data for various parameters were analysed using AGRESS software.

Result and discussion

Yield attributes and yield

The results given in table 1 revealed that yield attributes and

yield of greengram were significantly influenced by different integrated nutrient management practices (INM). Among the treatments, application of 75% RDF + Vermicompost @2 t ha⁻¹ + Bio-fertilizer increased the number of pods plant⁻¹ (32.73), number of seeds per pod⁻¹ (11.07), seed yield (866 kg ha⁻¹) and stover yield (1976.10 kg ha⁻¹) of greengram in sodic soil which was closely followed by the application of 75% RDF + Castor cake @500 kg ha⁻¹ + Bio-fertilizer. With regard to stover yield both the above mentioned treatments were on par. It might be due to increased availability of nutrients to plant which enhanced early root growth and cell multiplication leading to maximum absorption of nutrients by crop ultimately results in increased yield attributes and yield. Maximum absorption and translocation of nutrients resulted in higher stover yield. Similar results were also reported by Yadav *et al.* (2007)^[12] and Yubaraj Dhakal *et al.* (2016)^[13].

Table 1: Effect of treatments on yield attributes and yield of greengram

Treatments	No. of pods plant ⁻¹	No. of seeds pod ⁻¹	Seed yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)
T1- 100% RDF	29.29	10.13	703	1646.9
T2- VC + Rh + PSB	28.87	9.20	601	1563.2
T3- CC + Rh + PSB	28.25	9.47	594	1451.5
T4- 75% RDF + VC	28.40	9.62	636	1692.8
T5- 75% RDF + CC	29.87	9.61	623	1566.3
T6- 75% RDF + VC+ Rh + PSB	32.70	11.07	866	1976.1
T7- 75% RDF + CC+ Rh + PSB	30.90	10.35	758	1908.3
T8- 50% RDF + VC	28.93	9.61	639	1701.3
T9- 50% RDF + CC	28.43	9.54	611	1729.9
T10- 50% RDF + VC+ Rh+ PSB	29.20	10.27	748	1936.1
T11- 50% RDF + CC+ Rh +PSB	30.90	9.53	632	1851.8
S.Ed (±)	0.70	0.30	28.92	42.51
CD (P = 0.05)	1.46	0.63	60.34	88.67

RDF- Recommended dose of fertilizer, VC- vermicompost, CC- castor cake, Rh- Rhizobium, PSB- phosphobacteria

Nutrient uptake and nutrient status

Amongst combinations, the maximum uptake of N, P and K (Table 2) by greengram (51.2, 11.15, and 38.13 kg ha⁻¹ respectively) was recorded under the treatment 75% RDF + Vermicompost @ 2 t ha⁻¹ + Bio-fertilizer, which was significantly on par with 75% RDF + Castor cake @500 kg ha⁻¹ + Bio-fertilizer and 50% RDF + Vermicompost @ 2 t ha⁻¹ + Bio-fertilizer. The lowest uptake of nutrients was observed under 100% RDF. Addition of manures and bio-fertilizers ensures the maximum absorption and translocation of nutrients, which resulted in higher uptake of nutrients by the crop. Combined application of organic manures with bio-fertilizer increased the nutrient uptake by plant (Ipsita Das and Singh, 2014)^[5]. The higher removal of nutrients might be due to better development of root and shoot (Karnavat Rekha *et al.*, 2018)^[6]. Similar findings were reported by Gorade *et al.* (2014)^[4] and Bhavya *et al.* (2018)^[2].

The results given in table 2 revealed that the treatment of 75% RDF + Vermicompost @ 2 t ha⁻¹ + Bio-fertilizer inoculations

increased nitrogen (228.4kg ha⁻¹), phosphorus (24.66 kg ha⁻¹) and potassium (316.4 kg ha⁻¹) content in sodic soil recorded after harvest of the greengram but it was found to be at par with the treatment 75% RDF + Castor cake @500 kg ha⁻¹ + Bio-fertilizer. Hence it is clear that application of manures and bio-fertilizers increased the soil nutrient status after harvest of the crop. It might be due to the mineralisation of nutrients from manure during decomposition and also fixation and solubilisation of N and P by the bio-fertilizers. Vermicompost with or without chemical fertilizer increased the soil NPK in clay loam and sandy loam soil (Manivannan *et al.*, 2007). Application of farm yard manure along with zinc improved the chemical properties of soil (Parshottam Sinha *et al.*, 2017)^[9]. Similar studies were reported by Tyagi *et al.* (2014)^[11].

From this study, it is concluded that the integration of 75% RDF + Vermicompost @ 2 t ha⁻¹ + Bio-fertilizer gives higher yield in greengram and also increasing the nutrient availability in sodic soils of Trichy district.

Table 2: Effect of treatments on nutrient uptake and available nutrients in soil after harvest of greengram

Treatments	Nutrient uptake (kg ha ⁻¹)			Available nutrients in soil (kg ha ⁻¹)		
	N	P	K	N	P	K
T1- 100% RDF	49.8	10.55	37.21	192.4	21.76	297.2
T2- VC + Rh + PSB	49	10.66	37.44	182.9	22.30	302.1
T3- CC + Rh + PSB	48.8	10.59	37.41	182.3	22.13	303.8
T4- 75% RDF + VC	49.5	10.81	37.67	215.6	23.86	310.3
T5- 75% RDF + CC	49.4	10.78	37.64	214.7	23.75	307.5
T6- 75% RDF + VC+ Rh + PSB	51.2	11.15	38.13	228.4	24.66	316.4
T7- 75% RDF + CC+ Rh + PSB	51.0	11.12	38.07	219.2	24.23	314.6

T8- 50% RDF + VC	49.3	10.75	37.54	194.2	22.96	297.1
T9- 50% RDF + CC	49.2	10.73	37.50	193.3	22.63	298.0
T10- 50% RDF + VC+ Rh+ PSB	50.5	10.91	37.75	217.5	24.10	312.6
T11- 50% RDF + CC+ Rh +PSB	50.1	10.89	37.73	213.7	23.92	310.2
S.Ed (\pm)	0.47	0.13	0.10	3.64	0.64	4.18
CD ($P = 0.05$)	0.99	0.28	0.22	7.60	1.34	8.72

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