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RESEARCH PAPER

Influence of nutrient management on yield attributes, yield and economics of summer green gram (*Vigna radiata* L.)

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Abstract : Green gram (*Vigna radiata* L.) is one of the most extensively grown pulse crop. It is the basically *Kharif* season crop but now days it has also good summer season crop. The field investigation was carried out during summer season of 2020 to study the effect of nutrient management of summer green gram (*Vigna radiata* L.) at RCSM College of Agriculture, Kolhapur (MH),India.The field experiment was laid out in randomized block design with eight treatments of nutrient management and three replications. A spacing of 30 cm between rows and 10cm between plants was adopted in seed sowing.The soil of the experimental field was sandy clay loam in texture, slightly alkaline in reaction (pH 7.43), having electrical conductivity 0.22 dS m^{-1}, bulk density 1.34 mg m^{-3} and organic carbon content was (0.39%), low in available nitrogen (238.29 kg ha^{-1}), high in available phosphorus (30.61 kg ha^{-1}) and medium in available potassium (251.29 kg ha^{-1}). Phule Vaibhav variety of green gram was used for sowing.The different nutrient management treatments included in the field experimental study were T_1-Control (unmanured), T_2-100% RDF (20:40:00 NPK kg ha^{-1}),T_3-100% RDF + Vermicompost 2.5 t ha-1,T_4-100% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST),T_5-75% RDF (15:30:00 NPK kg ha^{-1}),T_6-75% RDF + Vermicompost 2.5 t ha^{-1}, T_7-75% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST), T_8-Vermicompost 5 t ha^{-1}+ Biofertilizer (ST). The result reveled that, the yield contributing characters like number of pods $plant^{-1}$(21.93), length of pod (8.79 cm), weight of pod $plant^{-1}$ (14.70 g), number of grains pod^{-1}(11.13), grain yield $plant^{-1}$ (5.97 g), grain yield (15.70 q ha^{-1}), stover yield (33.97 q ha^{-1}) and biological yield (49.67q ha^{-1}), were more with the integrated application of 100% RDF + Vermicompost 2.5 t ha^{-1} as well as seed treatment with biofertilizer.The application of 100% RDF + Vermicompost 2.5 t ha^{-1} + biofertilizer (ST) had significantly maximum gross monetary returns (Rs. 123169.20 ha^{-1}). However, higher net monetary returns (Rs. 71137.97 ha^{-1}) and highest B:C ratio (3.25) recorded under application of 100% RDF (20:40:00 NPK kg ha^{-1}) due to lower cost of chemical fertilizers.

Key Words : Green gram, Yield attributes, Yield, Returns, Vermicompost, Biofertilizer

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INTRODUCTION

Pulses are one of the important food crops globally due to higher protein content.Pulses are the edible seeds of plants in the legume family.Summer pulses are very important for improving soil health, providing additional income to farmers and crop diversification in northern

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states of India. Growing crops like summer green gram can certainly lead to increase in house-hold income of farmers and help in combating malnutrition and sustaining agricultural production.

Green gram or mung bean (*Vigna radiata* L.) is one of the most ancient and extensively grown leguminous crops of India. It is primarily rainy season crop but with development of early maturing varieties, it has also proved to be an ideal crop for spring and summer seasons. Pulses as a candidate crop, contributes immensely towards doubling farmers' income through diminishing cost of production, scaling per unit productivity, efficient marketing networks and successful technology delivery mechanisms by giving emphasis sustainable intensification and crop diversification, climate resilient production technologies backed with strong research outputs in pulses can contribute towards doubling the farmers' income (Singh, 2018). The humble mung bean is a powerhouse of nutrition. It is valued for the protein enriched seed as an important dietary ingredient to overcome protein malnutrition of human beings. India is the highest producer as well asconsumer of pulses in the world. Pulses play a vital role in Indian Agriculture. Green gram is a protein rich staple food. It contains about 25 per cent protein, which is almost three times that of cereals.

Integrated use of inorganic sources of nutrient with organic sources of nutrient helps to not only in maintaining higher productivity but also in providing greater stability in crop production. Application of organic amendments may increase supply of macro and micronutrients to plants and could mobilize unavailable nutrients to available forms and as a cumulative effect, nutrient uptake is higher than synthetic fertilizers (Sharma *et al*., 2008). In spite of being widely adapted crop in India, its productivity is very low. Maximum productivity of crop could be achieved with the maximum use of agrochemicals. The impressive gains in food production achieved due to green revolution but due to intensive use of agro-chemicals soil health is being affected. There is now tremendous scope on growers to use integrated nutrient management approach to increase productivity and sustain soil health. Organic amendment offers an alternative or supplementing control tactic to increase production (Meena, 2015).

Organic sources of nutrients like vermicompost are extensively used in various crops. These organic additives can be used to promote the development of beneficial organisms in the soil. Several workers used organic sources of additives to enhance the growth, yield and quality of crops (Meena, 2013; Mujahid and Gupta, 2010).

Keeping all these views in front, a field experiment entitled "Effect of nutrient management on summer green gram", was planned and conducted at the Post Graduate Research Farm, Agronomy Section of Rajarshee Chhatrapati Shahu Maharaj College of Agriculture, Kolhapur (M.S.), India, during summer, 2020.

Material and Methods

The field experiment was conducted during summer season of 2020 at Agronomy Research Farm, Agronomy Section, RCSM College of Agriculture, Kolhapur (MH).Agro-climatically Kolhapur comes under Sub Mountain Zone of Maharashtra and geographically it is situated on an elevation of 548 meters above the mean sea level on 16^0 42' North latitude and 74^0 14' East longitude.The soil of the experimental field was sandy clay loam in texture, slightly alkaline in reaction (pH 7.43), having electrical conductivity 0.22dS m^{-1} and organic carbon content was (0.39%), low in available nitrogen (238.29 kg ha^{-1}), high in available phosphorus (30.61 kg ha^{-1}) and medium in available potassium (251.29 kg ha^{-1}). The field experiment was laid out in Randomized Block Design, consisting eight treatments which was replicated three times. The different nutrient management treatments included in the field experimental study were T_1-Control (un manured), T_2-100% RDF (20:40:00 NPK kg ha^{-1}), T_3-100% RDF + Vermicompost 2.5 t ha^{-}1, T_4-100% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST), T_5-75% RDF (15:30:00 NPK kg ha^{-1}), T_6-75% RDF + Vermicompost 2.5 t ha^{-1} , T_7-75% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST), T_8-Vermicompost 5 t ha^{-1}+ Biofertilizer (ST). Experimental green gram crop Phule Vaibhav variety sowed at the space of 30 x 10 cm by using 16 kg ha^{-1} seed rate. The observations on yield parameters and yield *viz.,*number of pods $plant^{-1}$, length of pod(cm), weight of pod $plant^{-1}$(g), number of grains pod^{-1}, grain yield $plant^{-1}$ (g), 1000 grains weight (g), grain yield (q ha^{-1}), stover yield (q ha^{-1}), biological yield (q ha^{-1}), harvest index (%) were recorded.On the basis of result obtained from the field experiment, the economics of various treatments was worked out. The gross income ha^{-1} was calculated on the basis of grain and stover yield from each respective treatment. The minimum support price for grain yield and prevailing market prices for stover yield were considered. Net monetary return and B: C ratio also worked out.The experimental data was statistically analyzed by using a standard method of "analysis of variance" as reported by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Yield attributes:

The data presented on yield attributes in Table 1 shows that yield contributing characters like number of pods plant^{-1}(21.93), length of pod (8.79 cm), weight of pod plant^{-1} (14.70 g), number of grains pod^{-1} (11.13), grain yield plant^{-1} (5.97 g), were significantly more with the integrated application of 100% RDF + Vermicompost 2.5 t ha^{-1} as well as seed treatment with biofertilizer and which was remained on par with application of T_7-75% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST),T_3-100% RDF + Vermicompost 2.5 t ha^{-1}, T_6-75% RDF + Vermicompost 2.5 t ha^{-1} and significantly superior over T_2-100% RDF (20:40:00 NPK kg ha^{-1}),T_8-Vermicompost 5 t ha^{-1}+ Biofertilizer (ST).,T_5-75% RDF (15:30:00 NPK kg ha^{-1}) and T_1-Control (unmanured). Increase in values of yield attributes is observed due to higher amount of available nutrient and adequate irrigation application. However, 1000 grains weight (47.49 g) failed to reach the level of significanceunder different treatments of nutrient management because of generally less influence of biotic and abiotic factors on summer green gram.Arsalan *et al*. (2016) on green gram, Chaudhary *et al*. (2016) on black gram, Verma *et al*. (2017) and

Table 1 :Yield attributing characters of summer green gram as influenced by different nutrient management treatments at harvest

Treatments	Number of pods plant^{-1}	Weight of pods plant^{-1} (g)	Length of pod (cm)	Number of grains pod^{-1}	Grain yield plant^{-1} (g)	Test weight (g)
T_1 - Control (un manured)	14.80	10.23	6.81	7.60	3.20	42.63
T_2 - 100% RDF (20:40:00 NPK kg ha^{-1})	18.93	12.84	7.87	9.40	4.83	44.89
T_3 - 100% RDF + Vermicompost 2.5 t ha^{-1}	20.27	13.71	8.33	10.27	5.57	46.19
T_4 - 100% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST)	21.93	14.70	8.79	11.13	5.97	47.49
T_5 -75% RDF (15:30:00 NPK kg ha^{-1})	17.73	12.21	7.31	9.20	4.33	43.68
T_6 -75% RDF + Vermicompost 2.5 t ha^{-1}	19.33	13.38	8.17	10.07	5.13	45.37
T_7 -75% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST)	21.07	14.09	8.58	10.53	5.80	47.06
T_8 - Vermicompost 5 t ha^{-1} + Biofertilizer (ST)	18.27	12.45	7.54	9.33	4.63	44.14
S. Em±	0.86	0.58	0.29	0.46	0.27	1.87
C. D. at 5%	2.61	1.78	0.91	1.40	0.84	NS
General mean	19.04	12.95	7.92	9.69	4.93	45.18

Table 2 : Grain, straw, biological yield and harvest index of summer green gram as influenced by different nutrient management treatments

Treatments	Grain yield (q ha^{-1})	Stover yield (q ha^{-1})	Biological yield (q ha^{-1})	Harvest index (%)
T_1 - Control (un manured)	8.73	24.67	33.40	26.14
T_2 - 100% RDF (20:40:00 NPK kg ha^{-1})	13.06	29.43	42.49	30.80
T_3 - 100% RDF + Vermicompost 2.5 t ha^{-1}	14.76	32.66	47.41	31.12
T_4 - 100% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST)	15.70	33.97	49.67	31.61
T_5 -75% RDF (15:30:00 NPK kg ha^{-1})	11.95	28.09	40.04	29.88
T_6 -75% RDF + Vermicompost 2.5 t ha^{-1}	13.89	31.48	45.37	30.60
T_7 -75% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST)	15.20	33.24	48.44	31.46
T_8 - Vermicompost 5 t ha^{-1} + Biofertilizer (ST)	12.71	28.52	41.24	30.82
S. Em±	0.77	1.47	1.49	1.89
C. D. at 5%	2.35	4.49	4.54	NS
General mean	13.25	30.25	43.50	30.30

Konthoujam *et al*. (2013) on soyabean.

Yield:

The yield data on grain yield, straw yield, biological yield and harvest index ha^{-1} are furnished in Table 2 clearly shows that grain yield (15.70 q ha^{-1}), stover yield (33.97 q ha^{-1}), biological yield (49.67q ha^{-1}), were significantly more with the integrated application of 100% RDF + Vermicompost 2.5 t ha^{-1} as well as seed treatment with biofertilizer and which was remained on par with application of T_7-75% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST),T_3-100% RDF + Vermicompost 2.5 t ha^{-1}, T_6-75% RDF + Vermicompost 2.5 t ha^{-1} and significantly superior over T_2-100% RDF (20:40:00 NPK kg ha^{-1}),T_8-Vermicompost 5 t ha^{-1}+ Biofertilizer (ST).,T_5-75% RDF (15:30:00 NPK kg ha^{-1}) and T_1-Control (unmanured). Adequate availability of balanced nutrients such as RDF, Vermicompost and biofertilizer with irrigation supplement at proper time resulted in higher yield of summer green gram. However harvest index (31.61%) was failed to reach the level of significance. Singh *et al*. (2019), Pandey *et al*. (2019) and Tyagiand Singh (2019). Higher availability of both macro and micro nutrient improved root growth which leads to adequate amount of absorption from deeper layer of soil.

Economics:

Mean gross monetary returns, cost of cultivation, net monetary returns and B:C ratio are presented in Table 3.The higher gross monetary returns was observed with the the treatment T_4-100% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (Rs. 123169.20 ha^{-1}) due to higher yield.In general, the average cost of cultivation was Rs. 46731.03 ha^{-1}. The higher cost of cultivation (Rs. 71724.9) recorded by treatment T_8 - Vermicompost 5 t ha^{-1} + Biofertilizer and followed by also vermicompost included treatment *viz*., $T_{4,}$ $T_{7,}$ T_3 and T_6 occured higher values of cost of cultivation as compare to other nutrient management treatments due to higher cost of Vermicompost. Lower cost of cultivation (Rs. 29324.9 ha^{-1}) recorded under controlled plot.

Similar findings on gross monetary returns and cost of cultivation recorded by Farhad*et al*. (2017), Gohil *et al*. (2017). Among the different nutrient management treatments the T_4-100% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer recorded the higher net monetary returns (Rs. 70300.60 ha^{-1}) and it was found on par with all treatments except treatment T_1 – control and T_8 - Vermicompost 5 t ha^{-1} + Biofertilizer (ST), which was found significantly inferior over it. Similar results were reported earlier by Meena*et al*. (2015), Verma *et al*. (2017), Farhad*et al*. (2017), Gohil *et al*. (2017) and Kalkute *et al*. (2019). The higher benefit: cost ratio of 3.25 was recorded with the treatment T_2-100% RDF and lowest (1.31) with the treatment T_8 [Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST)]. This trend was occurred due to higher cost of Vermicompost and lower cost of chemical fertilizer.Similar results on B: C ratio were reported earlier by Meena *et al*. (2015), Verma *et al*. (2017) and Gohil *et al*. (2017).

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Table 3 : Economics of summer green gram as influenced by different treatments

Treatments	Cost of cultivation (Rs. ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	Benefit : Cost ratio
T_1 - Control (un manured)	29325	70245	40920	2.3
T_2 - 100% RDF (20:40:00 NPK kg ha^{-1})	31605	102743	71138	3.25
T_3 - 100% RDF + Vermicompost 2.5 t ha^{-1}	52805	115986	63181	2.19
T_4 - 100% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST)	52869	123169	70301	2.32
T_5 -75% RDF (15:30:00 NPK kg ha^{-1})	31019	94443	63424	3.04
T_6 -75% RDF + Vermicompost 2.5 t ha^{-1}	52219	109372	57153	2.09
T_7 -75% RDF + Vermicompost 2.5 t ha^{-1} + Biofertilizer (ST)	52283	119352	67070	2.28
T_8 - Vermicompost 5 t ha^{-1} + Biofertilizer (ST)	71725	100042	28317	1.39
S. Em±	-	5483.84	5483.84	-
C. D. at 5%	-	16633.52	16633.52	-
General mean	46731.03	104419.11	57688	2.38

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