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Nutrient management through organic source in summer green gram (*Vigna Radiate* L.)

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Abstract
The field experiment experiment was conducted at Agricultural Research Station for Irrigated crops, Anand Agricultural University, Thasra, Dist.: Kheda, Gujarat to study the effect of Nutrient management through organic source in summer green gram (*Vigna Radiate* L.). The field trial was laid out in Random Block Design with ten treatments viz., No manure (Control) (T_1), FYM 4.0 t/ ha (T_2), Vermicompost 1.0 t /ha (T_3), Castor cake 0.5 t/ha (T_4), Bio NP (Rhizobium & PSB 1 L/ha) (T_5), FYM 2.0 t/ ha + (Rhizobium & PSB 1 L/ha) (T_6), Vermicompost 0.5 t /ha + Bio NP (Rhizobium & PSB 1 L/ha) (T_7), Castor cake 0.25 t/ha + Bio NP (Rhizobium & PSB 1 L/ha) (T_8), FYM 2.0 t/ ha + Vermicompost 0.5 t /ha (T_9) and FYM 2.0 t/ ha + Castor cake 0.25 t/ha (T_{10}). Treatment T_9 (FYM 2.0 t/ ha + Vermicompost 0.5 t /ha) recorded significantly higher grain yield (1632 kg/ha) but was at par with treatment T_6 (FYM 2.0 t/ ha + Bio NP (Rhizobium & PSB 1 L/ha) and treatment T_7 (Vermicompost @ 0.5 t /ha + Bio NP (Rhizobium & PSB 1 L/ha)) than rest of the treatments. However, grain quality parameter viz. Protein content (24.73 %) also higher in the **t**reatment T_9 (FYM 2.0 t/ ha + Vermicompost 0.5 t /ha). The economics of various treatments showed that treatment T_9 (FYM 2.0 t/ ha + Vermicompost 0.5 t /ha) gave the highest net return of Rs 90727 per hectare with CBR 3.92.

Keywords: Nutrient management, greengram

Introduction
Green gram is an important pulse crop of Indian as it is grown in area of 3.44 million hectares with total production of 1.4 million tons and productivity of 406.98 kg/ha. India, major green gram producing states are Odissa, Madhya Pradesh, Rajasthan, Maharashtra, Gujarat and Bihar. In Gujarat, it is cultivated in about 2.3 lakh hectares with an annual production of 1.21 lakh tonnes and average of 526.09 kg /ha (Anonymous, 2011) [1]. The unprecedented like in cost of chemical fertilizers in the recent past has adversely affected consumption of chemical fertilizers and has aggravated the problems.In this context use of organic sources of plant nutrients such as biofertilizers and organic manures are the need of the time. Among various bio-fertilizers, safest way of supplying nitrogen to green gram through well known symbiotic nitrogen fixation process. Phosphate solublizing bacteria (PSB) have the consistent capacity to increase the availability of phosphate to plant by mineralizing organic phosphorus compounds. Manures contribute to the fertility of the soil by adding organic matter and nutrients, such as nitrogen, that are trapped by bacteria in the soil.FYM and Bio-fertilizer helps for better crop yield by improving soil fertility and soil physical condition. Hence adoptions of appropriate nutrient management strategies hold a great potential in boosting the green gram yield. Therefore, integrated nutrient management is crucial not only for increasing the yield but also for the improvement of soil health. Keeping all these factors in view, the present research was carried out.

Materials and Methods
The field experiment was conducted at the at Agricultural Research Station for Irrigated crops, Anand Agricultural University, Thasra, Dist.: Kheda, Gujarat during three consecutive *summer* seasons of the year 2017-18, 2018-19 and 2019-20. The experiment was laid out in a randomized block design with three replications. The soil of the experimental field was sandy clay loam in texture having good drainage capacity. The soil has low organic carbon and nitrogen, medium available phosphorus and high available potassium. The experiment consisted of ten treatments viz. No manure (Control) (T_1), FYM 4.0 t/ ha (T_2), Vermicompost

1.0 t /ha (T_3), Castor cake 0.5 t/ha (T_4), Bio NP (Rhizobium & PSB 1 L/ha) (T_5), FYM 2.0 t/ ha + Bio NP (Rhizobium & PSB 1 L/ha) (T_6), Vermicompost 0.5 t /ha + Bio NP (Rhizobium & PSB 1 L/ha) (T_7), Castor cake 0.25 t/ha + Bio NP (Rhizobium & PSB 1 L/ha) (T_8), FYM 2.0 t/ ha + Vermicompost 0.5 t /ha (T_9) and FYM 2.0 t/ ha + Castor cake 0.25 t/ha (T_{10}). Organic source of nitrogen was applied 7 days before sowing as per treatment. The seeds of green gram G.A.M 5 were utilized for sowing. Five plants were randomly selected for difference observations.

Table 1: Effect of nutrient management through organic source on yield and yield attributes of green gram

Sr. No.	Treatments	Number of pods per plant	Harvest Index (%)	Protein content (%)	Grain yield (kg/ha)	Haulm yield (kg/ha)
T_1	No manure (Control)	42.17^{d}	38.22	22.74^{b}	1052^{f}	1755^{c}
T_2	FYM 4.0 t/ ha	51.58^{c}	38.53	24.30^{a}	1259de	2176^{b}
T_3	Vermicompost 1.0 t /ha	55.38^{abc}	39.64	24.65^{a}	1453^{bc}	2223^{b}
T_4	Castor cake 0.5 t/ha	53.50^{bc}	38.03	24.25^{a}	1206^{e}	2194^{b}
T_5	Bio NP (Rhizobium & PSB 1 L/ha)	57.13^{abc}	38.94	24.18^{a}	1379^{cd}	2379^{ab}
T_6	FYM 2.0 t/ ha + Bio NP (Rhizobium & PSB 1 L/ha)	58.74^{ab}	39.94	24.01^{a}	1540^{ab}	2422^{ab}
T_7	Vermicompost 0.5 t /ha + Bio NP (Rhizobium & PSB 1 L/ha)	58.23^{ab}	40.48	24.66^{a}	1498^{abc}	2401^{ab}
T_8	Castor cake 0.25 t/ha + Bio NP (Rhizobium & PSB 1 L/ha)	55.19^{abc}	38.91	24.30^{a}	1366^{cd}	2337^{ab}
T_9	FYM 2.0 t/ ha + Vermicompost 0.5 t /ha	60.59^{a}	40.74	24.73^{a}	1632^{a}	2531^{a}
T_{10}	FYM 2.0 t/ ha + Castor cake 0.25 t/ha	56.10^{abc}	39.65	24.30^{a}	1386^{bcd}	2289^{ab}
	S. Em ±	1.72	-	0.29	48	82
	F test	Sig.	-	Sig	Sig.	Sig.
	CV %	9.43	-	1.48	10.79	10.82
	Interaction YxT	NS	-	0.59	NS	NS

Note: Treatment means with the letter/letters in common are not significant by Duncan's New Multiple Range Test at 5% level of significance

Table 2: Economics

Sr. No.	Treatments	Grain yield (kg/ha)	Haulm yield (kg/ha)	Gross return (Rs./ha)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)	B:.C
T_1	No manure (Control)	1052	1755	78905	25106	53799	3.14
T_2	FYM 4.0 t/ ha	1259	2176	94658	31106	63552	3.04
T_3	Vermicompost 1.0 t /ha	1453	2223	108379	31106	77273	3.48
T_4	Castor cake 0.5 t/ha	1206	2194	91002	30906	60096	2.94
T_5	Bio NP (Rhizobium & PSB 1 L/ha)	1379	2379	103667	25306	78361	4.10
T_6	FYM 2.0 t/ ha + Bio NP (Rhizobium & PSB 1 L/ha)	1540	2422	115066	28306	86760	4.07
T_7	Vermicompost 0.5 t /ha + Bio NP (Rhizobium & PSB 1 L/ha)	1498	2401	112063	28306	83757	3.96
T_8	Castor cake 0.25 t/ha + Bio NP (Rhizobium & PSB 1 L/ha)	1366	2337	102631	28206	74425	3.64
T_9	FYM 2.0 t/ ha + Vermicompost 0.5 t /ha	1632	2531	121833	31106	90727	3.92
T_{10}	FYM 2.0 t/ ha + Castor cake 0.25 t/ha	1386	2289	103887	30806	73081	3.37

Results and Discussion

Significantly increase in yield attributes viz., no. of pods/plant, harvest index (Table 1) was recorded with the application of FYM 2.0 t/ ha + Vermicompost 0.5 t /ha over rest of the treatments. The beneficial effect of organic manures on yield attributes could be due to the fact that after proper decomposition and mineralization, the manure supplies available nutrients directly to the plant and also had solubilising effect on fixed forms of nutrient in soil (Singh, 1981) [3]. Addition of FYM in soil having medium status of nutrient might have increased availability of macro and micro nutrients by improving root rhizsophere which ultimately enhanced removal of N, P and K as well as crop yield. Similar results were also reported by Prajapati *et al*., (1997) [2] in pearlmillet. Application of FYM 2.0 t/ ha + Vermicompost 0.5 t /ha produced significantly higher grain (1632 kg/ha) and hualam (2531^{a} kg/ha) yield wich might be due to higher value of growth and yield attributes. This ultimately resulted in increase in grain and stover yield. The increase in grain and stover yield with the application of FYM 2.0 t/ ha + Vermicompost 0.5 t /ha might be due to adequate quantities and balanced proportion of plant nutrients supplied to crop during crop growth and development period reported by Thenmozhi and Paulraj (2010) [4]. However, grain quality parameter viz. Protein content (24.73 %) also higher in the **t**reatment T_9 (FYM 2.0 t/ ha + Vermicompost 0.5 t /ha). The economics of various treatments (Table 2) showed that treatment T_9 (FYM 2.0 t/ ha + Vermicompost 0.5 t /ha) gave the highest net return of Rs 90727 per hectare with CBR 3.92.

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