Effect of organic manure and *Gliricidia* leaf extract on soil properties after harvest of green gram under organic farming

ABSTRACT

A field experiment was conducted during the summer season of 2022 to find out the influence of organic manure and *Gliricidia* leaf extract on soil fertility under green gram at the organic farm, Navsari Agricultural University, Navsari, Gujrat. The experiment site was high in organic C content (0.73 %), medium in available nitrogen (257.96 kg/ha) and phosphorus (27.14 kg/ha) while high in available potash (579.13 kg/ha) with pH 7.50 and EC 0.28 dS/m. The result indicated that available N was observed to significantly maximise under the application of 100% RDN through Compost + GLE @500 l/ha at 20, 40 and 60 DAS while available K_2O and DTPA extractable Fe were significantly maximum under the application of 100% RDN through Compost + 2% GLE through the foliar spray. Soil pH, EC, organic C, available P_2O_5, DTPA extractable Mn, Zn, and Cu were not affected significantly due to different treatment comprising various organic sources.

Keywords: *Gliricidia* leaf extract, Green gram, Organic manure, Soil fertility

INTRODUCTION

"Pulse crops play an important role in Indian agriculture and India is the largest producer and consumer of pulses in the world. Pulses contain a high percentage of quality protein nearly three times as much as cereals" (Upadhayay *et al*. 1999). "Pulses are known to improve the physical characteristics of soil through a tap root system which opens the soil into deeper layers and their ability to use atmospheric nitrogen through biological nitrogen fixation which is economically sound and environmentally acceptable. India grows nearly 27.99 million hectares of pulses with an annual production of 23.03 million tonnes and average productivity of 823 kg/ha". (Anon., 2021). "India shares about 35-37 per cent and 27 per cent of the total area and production of pulses, respectively in the world" (Ranpariya *et al.,* 2017). "In Gujarat, it is cultivated in 1.3 million hectares with an annual production of 1.89 million tonnes and productivity of 1449.29 kg/ha" (Anon., 2023).

"The excessive utilization of chemical fertilizers has not only caused the exhaustion of soil of its reserved nutrients but also resulted in soil health problems. The high cost of inorganic fertilizers makes it uneconomical and out of reach to poor farmers and it is also

undesirable due to its hazardous environmental effects. Moreover, the imbalance and continuous use of chemical fertilizers have adverse effects on soil physical, chemical and biological properties thereby affecting the sustainability of crop production, besides causing environmental pollution" (Virmani, 1994). "The application of organic sources of nutrients may work as the 'driving force' in sustainable crop production while improving soil health and fertility" (Singh and Singh, 2012). "Organic manure acts not only as a source of organic matter and nutrients but also increases the size, biodiversity and activity of the microbial population in the soil, influences structure, nutrient turnover over and many other changes related to physical, chemical and biological parameters of the soil" (Albiach *et al*., 2000). Further, the liquid organic manures meet the nutrient requirement of crops with greater nutrient use efficiency and also correct the deficiency as and when noticed under the organic production system.

MATERIAL AND METHOD

The experiment was conducted during the summer of 2022 at organic farming, ASPEE College of Horticulture, Navsari Agricultural University, Navsari to study the "Effect of organic manure and *Gliricidia* leaf extract on soil properties in green gram under organic farming." The green gram variety GM 7 was sown with a spacing of 45 cm x 10 cm. The experiment was laid out in randomized block design (RBD) with three replications and eight treatments. The details of treatments are as T_1: No manures, T_2: 50% RDN through Compost, T_3: 100% RDN through Compost, T_4: 50% RDN through Compost + GLE @ 500 l/ha, T_5: 50% RDN through Compost +2% GLE (FS), T_6: 100% RDN through Compost + GLE @500l/ha, T_7: 100% RDN through Compost + 2% GLE (FS) and T_8: GLE @ 500 l/ha + 2% GLE (FS). *Gliricidia* leaf extract (GLE) as a foliar spray applied at 15, 30 and 45 DAS while drenching at 20, 40 and 60 DAS. The soil of the experimental unit was clayey in texture with good water-holding capacity. The experiment site was high in organic C content (0.73 %), medium in available nitrogen (257.96 kg/ha) and phosphorus (27.14 kg/ha) while high in available potash (579.13 kg/ha) with pH 7.50 and EC 0.28 dS/m.

RESULT AND DISCUSSION

pH, EC and Organic C

The result revealed that soil physiochemical properties (Table 1) were influenced by different treatments. Results indicated that the effect of different treatments on pH, EC and

organic C of soil after the harvest of green gram was found non-significant. While organic C content was numerically higher (0.89 %) in T_7 (100% RDN through Compost+ 2% GLE through foliar spray) followed by T_3, T_2, T_6, T_4, and T_8. The data further showed that the lowest organic C content (0.75 %) in soil was found in T_1.

Availability of major nutrients

Organic matter addition significantly enhanced the nutrient availability of the soil. Data present in Table 1 indicate that application of 100% RDN through Compost + GLE @500 l/ha at 20, 40 and 60 DAS recorded significantly higher available nitrogen content (284.84 kg/ha) in soil after harvest of green gram as compared to control but at par with T_7 (100% RDN through Compost + 2% GLE through foliar spray) and T_3 (100% RDN through Compost) with corresponding values 275.34 and 268.88 kg/ha. The result regarding available P_2O_5 did not affect significantly due to different treatments. But numerically the highest available P_2O_5 (47.57 kg/ha) in soil was obtained with treatment T_7 (100%RDN through Compost + 2% GLE through foliar spray) followed by T_6 (100% RDN through Compost + GLE @500l/ha) and T_3 (100% RDN through compost) with value of 47.39 and 46.87 kg/ha.

While available K_2O content in soil after harvest of green gram showed that significantly higher available K_2O (591.20 kg/ha) was found in treatment T_7 (100% RDN through Compost + 2% GLE through foliar spray) which was found statistically at par with T_6 (100% RDN through Compost + GLE @500 l/ha), T_3(100% RDN through Compost) and T_5 (50% RDN through Compost +2% GLE through foliar spray) with value 584.60, 581.04 and 547.11 kg/ha respectively. The result demonstrates that the use of organic manure compost with *Gliricidia* leaf extract could be used for maintaining soil fertility by providing available major nutrients with improvement in soil physical and biological fertility. Similar results were also reported by the findings of, Ranpariya *et al.* (2017)in green gram, Karnavat *et al.* (2018) in green gram and Bag *et al.* (2015) in chickpea; Yadav *et al.* (2022) in chickpea; Swami *et al.* (2021) in green gram.

DTPA extractable Fe, Mn, Zn and Cu

In the case of DTPA extractable Fe, Mn, Zn and Cu in the soil after the harvest of green gram (Table 2), Mn, Zn and Cu did not show a significant effect. While Fe content in the soil after the harvest of green gram was significantly higher (9.65 mg/kg) which was statistically at par with T_3 (9.24 mg/kg) and T_6 (8.79 mg/kg) and significantly lowest Fe content (7.96 mg/kg) in the soil after harvest of green gram was found in control treatment T_1 (No manure). The increment of available Fe in soil due to those applications of different organic sources like compost and liquid organic formulation GLE enhance microbial activity

which increases the availability of Fe status in soil through solubilizations. Similar results were also obtained by Ranpariya *et al.* (2017) in green gram; Karnavat *et al.* (2018) in green gram; Bag *et al.* (2015) in chickpeas and Yadav *et al.* (2022) in chick peas.

Table 1: Effect of different treatments on pH, EC, OC and available major nutrients of soil after harvest of green gram

Treatment	pH (1:2.5)	EC (1:2.5) (ds/m)	OC (%)	Available major nutrients (kg/ha)		
				N	P_2O_5	K_2O
T_1	7.47	0.43	0.75	240.99	37.29	513.95
T_2	7.30	0.48	0.86	248.97	39.35	518.76
T_3	7.33	0.41	0.88	268.88	46.87	581.04
T_4	7.41	0.49	0.82	252.60	44.25	538.05
T_5	7.37	0.42	0.80	253.32	41.34	547.11
T_6	7.46	0.43	0.84	284.84	47.39	584.60
T_7	7.42	0.48	0.89	275.34	47.57	591.20
T_8	7.56	0.47	0.76	245.61	40.45	529.39
SEm (±)	0.15	0.02	0.03	9.05	2.48	16.16
CD at 5%	N.S.	N.S.	N.S.	27.45	N.S.	49.01
CV (%)	3.42	7.68	6.92	6.06	9.97	5.08
Initial status	7.50	0.28	0.73	275.96	27.14	579.13

Table 2: Effect of various treatments on DTPA extractable Fe, Mn, Zn and Cu in soil after harvest of green gram

Treatment	DTPA extractable (mg/kg)			
	Fe	**Mn**	**Zn**	**Cu**
T_1	7.96	5.74	0.46	1.56
T_2	8.15	5.77	0.50	1.68
T_3	9.24	6.17	0.62	1.88
T_4	8.50	6.08	0.54	1.72
T_5	8.38	6.11	0.55	1.57
T_6	8.79	6.26	0.61	1.71
T_7	9.65	6.39	0.64	1.96
T_8	7.98	5.73	0.47	1.86
SEm (±)	0.36	0.24	0.04	0.12
CD at 5%	1.11	N.S.	N.S.	N.S.
CV (%)	7.36	7.00	12.89	11.49
Initial status	5.86	11.01	0.36	2.85

Conclusions

Based on the above finding, it can be concluded that application of 100% RDN through Compost alone or in combination with foliar spray @ 2% or drenching @ 500 l/ha of *Gliricidia* leaf extract increases the availability of major nutrients and DTPA extractable Fe content in soil after harvest of green gram as compared to control. However, Organic manure application and liquid organic manure spray could not bring any significant impact on Organic C, available P_2O_5 and DTPA extractable Mn, Zn and Cu in soil.

Reference

1. Albiach, R.; Canet, R.; Pomares, F.; Ingelmo, F. Microbialbiomass content and enzymatic activities after the application of organic amendments to a horticultural soil.*Biores. Tech*. 2000;75:43-48.
2. Anonymous (2021). *Agriculture Statistics at a glance* 2021. Agricultural Statistics at a Glance 2021 | Official website of Directorate of Economics and Statistics, Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India (desagri.gov.in)

3. Anonymous (2023). Third advanced estimates of area, production and yield of major *Kharif*/ *rabi*/ summer crops of Gujarat state for the year 2022-2023, Directorate of Agriculture, Government of Gujarat, Gandhinagar.
4. Bag, P. A.; Kaswala, A. R. and Patel, A. I. (2015). Effect of liquid organic manures on yield and soil properties in chickpea (*Cicer arietinum* L.). *Biosci. Trends.*,**8**(3): 695-698.
5. Karnavat, R.; Pavaya, R. P.; Malav, J. K.; Chaudhary, N.; Patel, I. M. and Patel, J. K. (2018). Effect of FYM, phosphorus and PSB on yield, nutrient content and uptake by green gram (*Vigna radiata* (L.) Wilckzek) on loamy sand. *Indian J. Chem. Stud.*,**6**(2): 1026-1029.
6. Ranpariya, V. S.; Polara, K. B.; Hirpara, D. V. and Bodar, K. H. (2017). Effect of potassium, zinc and FYM on content and uptake of nutrients in seed of summer green gram (*Vigna radiata* L.) and post-harvest soil fertility under medium black calcareous soil. *Int. J. Chem. Stud*., **5**(5): 1055-1058.
7. Singh, R. K.; Singh, R. P. (2012). Vermicompost: one of the keys forsustainable crop production. Agricultural Research and.Sustainable Development in India. (Singh, S. P., Shukla,R. P., Nath, Triyugi and Kumar, R. Eds.) BhartiPublication, New Delhi-110 093, 239-250.
8. Swami, A.; Moola, R.; Meena, R. C.; Meena, D. S. and Kumar, S. (2021). Jiwamrita: A low-cost organic nutrient source for growth, yield and economics of organic mung bean [*Vigna radiata* (L.) Wilczek] under changing agricultural environment. *Int. J. Environ. Clim. Chang.*, **11**(10): 120-129.
9. Upadhayay, R.G.; Sharma, S.; Drawal, N. S. (1999). Effect of Rhizobium inoculation and graded levels of P on the growth and yield of green gram. *Legume Research.* **22**:277-279.
10. Virmani, S. M. (1994) The twenty first – Dr. R.V. Tamhanememorial Lecture: UNCEED Agenda 21: The newchallenge for soil research. *Journal of the Indian Society of Soil Science.* **42**:516-523.
11. Yadav, J. K.; Sharma, M. and Meena, R. H. (2022). Influence of organic manures on soil Physico-chemical properties under chickpea (*Cicer arietinum* L.). *J. Pharm. Innov.,* **11**(4): 643-645.