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Effect of organic and inorganic fertilizers on soil chemical properties of summer green gram

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Abstract
The present investigation was undertaken to study the "Effect of organic and inorganic fertilizers on soil chemical properties of summer green gram" was carried out during *summer* season of the year 2011-12, at College Agronomy farm, B. A. College of agriculture, Agricultural University, Anand. EC and pH of soil were not significantly influenced by application of organic manures and inorganic fertilizers at harvest & available K_2O of soil were not significantly influenced by application of inorganic fertilizers. Organic carbon and available P_2O_5, electrical conductivity and pH of soil were not significantly influenced by application of organic manures at harvest. Organic carbon and available P_2O_5 of soil analyzed at harvest were significantly higher recorded with the application of vermicompost @ 1 t ha^{-1} which was at par with incorporation of FYM @ 4 t ha^{-1}. Available N_2O and available K_2O of soil were significantly higher recorded with the incorporation of FYM @ 4 t ha^{-1} which was at par with incorporation of vermicompost @ 1 t ha^{-1}. No other soil properties were significantly affected by incorporation of organic manures. Organic carbon, available N_2O and available P_2O_5 of soil analyzed at harvest were significantly higher recorded with the application of 100% RDF (20 kg N + 40 kg P_2O_5 ha^{-1}) and was at par with 75% RDF (15 kg N + 30 kg P_2O_5 ha^{-1}). The interactive effect of organic manures and inorganic fertilizers on physico-chemical properties of soil were found to be non-significant at harvest.

Keywords: Green gram, FYM, vermicompost, EC, pH, OC, N_2O, P_2O_5, K_2O

Introduction
Green gram (*Vigna radiata* L.) is one of the important pulse crops in India. Green gram commonly known as "mung bean" has been cultivated in India since ancient times. It belongs to *Fabaceae* family. Green gram is originated from India and central Asia. It is the third most popular pulse crop cultivated throughout in India. Green gram is a protein rich staple food. It has enormous potential for the future needs to be capitalized. It has an edge over other pulses because of its high nutritive value, digestibility and non-flatulent behavior. It is grown principally for protein rich edible seeds which contain 24% crude protein, 56.7% carbohydrates, 1.3% fats, 3.5% minerals, 0.43% lysine, 0.1% methionine and 0.04% tryptophan (Kachroo, 1970) [6]. In Gujarat, green gram is grown in the districts of Kutch, Banaskantha, Mehsana and Panchmahals in kharif season under inadequate and erratic rainfall. However, it is grown in very large area in summer season in Kheda, Vadodara and Panchmahals districts. Green gram is grown about 65500 ha in summer with the production of 33000 MT with the productivity of 504 kg ha-1 during 2011-12 (Anon., 2012) [1].
Organic materials hold great promise as a source of multiple nutrients and ability to improve soil characteristics (Moller, 2009) [10]. According to Sanchez (1976) [13], 60 to 80% of soil phosphorus is of organic origin. Thus, inadequate amount of organic matter in soil will show nutrient deficiencies. These deficiencies can be warded off by regular application of manures. Soil fertility management plays a pivotal role in increasing green gram production. This involves adequate and balanced nutrient supply. Therefore, soil quality is determined by the efficient use of plant nutrients through judicially balanced and integrated use of all possible organic resources in conjunction with minimum chemical fertilizers. Even application of recommended dose of NPK fails to sustain soil quality and crop production (Tiwari, 2008) [16].
The need for accelerating fertilizer response though site specific balanced and adequate nutrient application is an essential pre-requisite. Optimum fertilizer application in the form of organic and inorganic fertilizers or bio-fertilizers is one of the well-established techniques for increasing crop production. Farm yard manure and vermicompost are the sources of primary, secondary and micro nutrients to the plant growth. They are the constant sources of energy for heterotrophic microorganisms, help in increasing the availability of nutrients, quality and quantity of crop produce. Integrated nutrient management involving organic manures, chemical and bio fertilizers all are used together to achieve sustained crop production and maintain soil health.

Material Method

The field experiment was carried out at College Agronomy Farm, B.A. College of Agriculture, Anand Agricultural University, Anand on the "Effect of organic and inorganic fertilizers on soil chemical properties of summer green gram" during summer season of the year 2011- 12. The experimental plot was prepared as per the method described by Kharadi *et al.* (2020). The experiment was laid out Randomized Block Design (Factorial) with no. of treatments 12 & four replication. The green gram variety Meha released from IARI, New Delhi having indeterminate growth habit was used in present experiment. Among Organic manure, treatments of M_3: Vermicompost @ 1 t ha^{-1} and M_2: FYM @ 4 t ha^{-1} compared with M_1: Control. In the inorganic fertilizer's treatments F1: Control, F2: 50% RDF, F3: 75% RDF, F4: 100% RDF. Recommended dose of fertilizers 20 kg N: 40 kg P_2O_5: 0 K_2O ha^{-1}. Soil samples was collected at harvest from the surface soil (0-15) using pipe auger and collected in polyethylene bags. Samples of vermicompost and farm yard manure (FYM) used in the field experiment were collected and analyzed for chemical parameters (Jackson, 1973) [5]

Result and Discussion

Effect of organic manures & inorganic fertilizers on EC (dsm^{-1}) of soil

Results revealed that soil electrical conductivity analyzed at harvest was not significantly influenced by application of FYM or vermicompost. This result is in agreement with the finding of Damor (2014) who reported non-significant changing in soil EC in same soil with the application of FYM @ 10 t ha^{-1} and application of vermicompost @ 3 t ha^{-1} (Table 1).

A perusal of data given in Table 1 revealed that the difference in electrical conductivity of the soil at harvest was statistically found to be non-significant. These results are in conformity with the findings of Sutaria *et al.* (2010) [14]. The interactive effect of organic manures and inorganic fertilizers on electrical conductivity of soil analyzed at harvest was found to be non-significant (Table 1).

Effect of organic manures & inorganic fertilizers on pH of soil

The differences in soil pH due to application of FYM or vermicompost determinate from soil at harvest were observed to be non-significant (Table 1). However, slightly less soil pH was estimated with the application of 1 t vermicompost ha^{-1}. This might be due to release of carbonic acid during decomposition of organic matter. The maintenance of soil pH nearer to neutral condition in plots receiving vermicompost may be attributed to enhanced buffering capacity of soil due to addition of organic matter. In the present investigation addition of vermicompost helped in restoring soil pH nearer to neutral range under alkaline soil condition, Similarly, Patel *et al*. (2010) [11] did not find change in soil pH due to application of FYM or vermicompost.

The results (Table 1) revealed that there was little higher soil pH was recorded with application of inorganic fertilizers at harvest. The results are in conformity with the findings of Srikanth *et al.* (2002) who did not show significant changing in soil pH due to application of fertilizers to cowpea crop. Data presented in Table 1 revealed that interaction effect of organic manures and inorganic fertilizers was found to be non-significant with respect to soil pH.

Effect of organic manures & inorganic fertilizers on organic carbon (%) of soil

As evident from Table 1, incorporation of FYM @ 4 t ha^{-1} and vermicompost @ 1 t ha^{-1} increased the organic carbon of soil. Organic carbon of soil analyzed at harvest was significantly higher found with the incorporation of vermicompost @ 1 t ha^{-1} in soil which was at par with the incorporation of FYM @ 4 t ha^{-1} under green gram crop. It has been well documented that the organic matter is converted to their basic organic components by the extra cellular enzymes produced by heterotrophs and these simple compounds are used by other microbes for their body building process. The decomposition of microbial bodies thus, enriches the soil with organic carbon. Organic carbon was increased hence a difference in organic carbon is found significant at harvest. These results of increment in organic carbon status are in agreement with the finding of Patel *et al*. (2010) [11] who also reported that the addition of FYM or vermicompost helped in improvement of organic carbon of soil.

The average organic carbon of soil increased with the application of inorganic fertilizers at harvest. The data presented in Table 1 showed that the differences in organic carbon of soil among the treatments of inorganic fertilizers at harvest were seemed to be significant. Organic carbon of soil analyzed at harvest was significantly higher with the application of chemical fertilizers @ 100% RDF and was at par with chemical fertilizers applied @ 75% RDF. These results are in conformity with the findings of Manjaiah and Singh (2000) who also reported increased organic carbon content of soil with the application of inorganic fertilizers in maize-wheat-cowpea cropping system in a *Typic ustrocherpt* soil.

The interactive effect of organic manures and inorganic fertilizers on organic carbon of soil analyzed at harvest was found to be non-significant (Table 1).

Effect of organic manures & inorganic fertilizers on available N_2O (kg ha^{-1}) of soil

The results furnished in Table 1 revealed that available nitrogen status significantly affected due to incorporation of farm yard manure and vermicompost. Significantly higher available nitrogen of soil was recorded with the application of FYM @ 4 t ha^{-1} which was at par with application of vermicompost applied @ 1 t ha^{-1} in soil at harvest. This result is in agreement with the findings of Gaikwad *et al*. (2011) [4] and Rajkhowa *et al*. (2003) [12] who reported higher available nitrogen in soil under the application of organic manures.

The results furnished in Table 1 revealed that available nitrogen of soil was significantly affected due to application of different inorganic fertilizer treatments. Available nitrogen of soil analyzed at harvest was significantly higher with the application of recommended dose of fertilizers (100% RDF) which was at par with application of 75% RDF. Increasing trend of available nitrogen in soil was noticed with increasing levels of RDF. This result is conformity with the finding of Menaria and Singh (2004) [9] who reported significantly higher available nitrogen in soil with recommended dose of fertilizers (20 kg N: 40 kg P_2O_5 ha^{-1}) over control in soil under chickpea crop.

The interactive effect of organic manures and inorganic fertilizers on available nitrogen of soil was found to be non-significant at harvest (Table 1).

Effect of organic manures & inorganic fertilizers on available P_2O_5 (kg ha^{-1}) of soil

The results furnished in Table 1 revealed that available soil phosphorus status significantly affected due to incorporation of farm yard manure and vermicompost. Significantly higher available P_2O_5 was recorded with the addition of vermicompost @ 1 t ha^{-1} which was at par with incorporation of FYM @ 4 t ha^{-1} in soil at harvest increased in soil available nutrients also improve the growth of green gram crop. Gaikwad *et al.* (2011) [4] found higher available P_2O_5 in sandy loam soil with the application of FYM or vermicompost over control in same soil at Anand under different crops.

It is seen from the data given in Table 1 that the available phosphorus from soil collected at harvest was numerically increased with increasing levels of inorganic fertilizers as compared to control at harvest. Available P_2O_5 of soil analyzed at harvest was significantly higher recorded with the application of 100% RDF which was at par with 75% RDF applied in green gram. This result is in agreement with the finding of Menarian and Singh (2004) [9].

Available soil phosphorus at harvest was not remarkably affected due to organic manures and inorganic fertilizers (Table 1).

Effect of organic manures & inorganic fertilizers on available K_2O (kg ha^{-1}) of soil

The results furnished in Table 1 revealed that available K_2O of soil significantly affected due to incorporation of farm yard manure and vermicompost. Significantly higher available K_2O of soil was recorded with incorporation of FYM @ 4 t ha^{-1} which was at par with addition of vermicompost @ 1 t ha^{-1} at harvest. This result is in closely agreement with the findings of Rajkhowa *et al.* (2003) [12].

The results presented in Table 1 revealed that the application of inorganic fertilizers did not exert any significant influence on available K_2O of the soil. Available K_2O was increased in soil with increasing levels of recommended dose of fertilizers at harvest. This result is in closely agreement with the findings of Chesti *et al*. (2007) [2] who reported built up of available potassium in soil in integrated nutrient management treatment in green gram.

The interaction effect of organic manures and inorganic fertilizers with respect to available K_2O of soil at harvest was found to be non-significant (Table 1).

Table 1: Effect of organic manures & inorganic fertilizers on chemical properties of soil

Treatments	EC (dsm^{-1})	pH	OC (%)	Avail. N_2O (kg ha^{-1})	Avail. P_2O_5 (kg ha^{-1})	Avail. K_2O (kg ha^{-1})
Organic Manures (M)						
M_1: control (No manure)	0.19	8.21	0.353	155.82	39.61	280.12
M_2: FYM @ 4 t ha^{-1}	0.20	8.20	0.366	159.99	39.81	291.37
M_3: Vermicompost @ 1 ha^{-1}	0.19	8.18	0.371	157.11	40.63	290.28
S.Em. ±	0.003	0.08	0.002	1.59	0.30	3.17
C.D. at 5%	NS	NS	0.007	4.77	1.01	9.48
Inorganic Fertilizers (F)						
F_1: Control (No Fertilizers)	0.19	8.21	0.351	154.18	39.54	284.60
F_2: 50% RDF	0.19	8.23	0.351	155.57	39.84	287.88
F_3: 75% RDF	0.20	8.22	0.363	157.75	40.96	294.11
F_4: 100% RDF	0.19	8.22	0.370	160.38	41.72	294.43
S.Em. ±	0.003	0.08	0.003	1.62	0.35	3.66
C.D. at 5%	NS	NS	0.009	4.45	1.03	NS
Interaction (M x F)	NS	NS	NS	NS	NS	NS
C V%	6.61	3.63	3.00	3.23	3.07	4.37

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