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Organic and Conventional Nutrient Management on Soil Nutrient Status of Broad Leaf Mustard *(Brassica juncea* var. *rugosa)*

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Abstract

Experiment was conducted in field at Dakshinkali municipality -2, Kathmandu, Nepal during the year 2016-2018. The treatment combination were 13 including control viz. T_1(24t/ha FYM), T_2(6t/ha. vermicompost), T_3(4t/ha poultry manure), T_4(12t/ha compost), T_5(½NPK+3t/ha vermicompost), T_6(¾NPK+1.5t/ha vermicompost), T_7(½NPK+12t/ha FYM), T_8(¾ NPK+6t/ha FYM), T_9(½NPK+2t/ha poultry manure), T_{10}(¾NPK+1t/ha poultry manure), T_{11}(½NPK+6t/ha compost), T_{12}(¾ NPK+3t/ha compost) and T_{13}(Control). Randomized Complete Block Design was applied. The maximum total nitrogen (0.187%) and available phosphorous (49.42ppm) in soil were observed in T_2 (6t.ha^{-1} vermicompost) whereas, maximum available potassium (199.65ppm) was found in T_5 (½NPK+3t/ha vermicompost). In case of micronutrients, the maximum soil Ca, Mg and Fe (1903.33ppm, 218.25ppm and 1248.33ppm) were observed in T_5 (½NPK+3t/ha vermicompost) of Broad Leaf Mustard field.

Keywords: Broad leaf mustard**,** organic manures, conventional, nutrients management and soil.

Introduction

Broad Leaf Mustard is known as Mustard green also in some countries. Broad Leaf Mustard (BLM), *Brassica juncea var. rugosa*., belonging to family Cruciferae, is one the most popular, highly commercial and most widely grown leafy vegetables in Nepal. It can be found in Central to Eastern Asia. It is commonly known as 'Rayo' in Nepal. It is one of the rich sources of several vitamins and minerals. Cooler climatic condition is most suitable for its cultivation. Mainly in Nepal this crop grown as winter season crop in terai whereas it is mainly grown as summer season crop in the higher hills. In cooler conditions the quality of the leaves become better as compared to warmer conditions[1].

In Nepal, *BLM* is mainly produced for local consumption and local markets. Specially, it is highly popular in urban and pari urban areas of Nepal. Broad Leaf Mustard is also consumed in the form of fermented product locally known as Gundruk which is most popular and favorite Nepali dish[2].

The Nepalese productivity of the leafy vegetable crops is very low as compared to the world's productivity. Fertilizer is the most important factor to increase the yield and productivity of crops. Long term sustainability of crop production and its quality, injudicious use of increased level of chemical fertilizers indiscriminately, there has been destruction in the physical properties of soil along with drastic decline in inherent fertilizing capacity of the soil there by posing a serious threat. Organic manures, although poor source of nutrients, improves physical properties of soil and increases organic and humus content of soil promote to increases the water holding. For example, it has been reported that the use of vermi- compost increased growth, yield and quality in several crops[3].

Materials and methods

Experimental *field* was carried out in field at Dakshinkali municipality-2, Kathmandu, Nepal during the year 2016 - 2018. There were 13 treatments combination (Table-1). There are 13 treatments with three replications was applied. Marpha Broad Leaf Mustard variety was selected for experiment. Area of experimental plots size was 2X2.5m$^{2.}$ Total number of plants per plot was 36.

Soil Nutrient Status Determination: Soil Samples Collection and Preparation: Soil samples were collected just after harvesting the crop of crop that is the month of January. Soil samples were representing from 0 to 30cm deep. Collected sample were dried in shade, crushed and then sieved through a 2 mm bronze sieve and stored in cloth bags for laboratory analysis.

Nutrient determination: Alkaline permanganate method as modified[5] was used for total N estimated. 0.5N $NaHCo_3$ adjusted at pH 8.5 [6] and determined by phosphomolybdo blue method[7] was used for available P.

Ammonium acetate method[8] was used for determination of available K in soil. The estimated Ca and Mg was done by Complexometic titration method[9] and results of which were expressed in ppm. 10g soil was taken then added 20ml diethylene-triaminopenta acetate, shaken for two hours and filtered[10]. In the DTPA extract Fe was determined by atomic absorption spectrophotometer.

Results and discussion

Organic and conventional nutrient management on NPK Status in Soil of Broad Leaf Mustard: *Total Nitrogen:* The maximum (0.187%) total nitrogen content was observed in treatment 6 t/ha vermicompost (T_2) whereas minimum (0.114%) was observed in T_{13} (control) (Table-2). Nitrogen, phosphorus and potash of soil might have increased due to enhanced mineralization of organic nitrogen and Phosphorus on application of organic manures[11]. With the application of vermicompost these is less production of NO_3^{--} -N and availability of NH_4^+-N continue to be higher for longer period which will prevent pollution problems by NO_3. Thus mixing of N-fertilizer with vermicompost reduces the nitrogen losses in addition to increasing the availability of N. 5t ha^{-1} vermicompost plus chemical fertilizer increases the N, P and K in soil[12].

Available phosphorous: Available phosphorous was found maximum (49.42ppm) in T_2 (6ton/ha vermicompost) and minimum (30.21ppm) was observed in T_{13} (control) (Table-2). The increase in phosphorus with the application of vermicompost might be due to the fact that phosphatase activity in the gut of earthworm convert bound 'P' to soluble form thus making more phosphorus in plant[13]. Similar results have also been recorded in walnut[14] and in bean[15].

Available potassium: The maximum potassium (199.65ppm) was found in T_5 (½NPK+ 3ton/ha vermicompost) whereas the minimum (63.18ppm) were found in T_{13} (Control) (Table 2). This might be due to that vermicompost help to improve the soil health of field. Similarly it helps to good pore space, reduced pH and electrical conductivity, increased organic carbon content, available nitrogen, phosphorous, potassium and microbial population and activity in all types of soil. Similar results have also been recorded[16].

Organic and conventional nutrient management on Ca, Mg and Fe Status in Soil of Broad Leaf Mustard: ***Soil Calcium, Magnesium and Iron:*** The maximum soil calcium (1903.33 ppm), soil magnesium (218.25ppm) and soil iron (129.57ppm) were found in T_5 (½NPK+3ton/ha vermicompost) and the minimum (1248.33ppm), (175.60ppm) and (83.30ppm) were found in T_{13} (Control) (Table-3). This might be due to attributed to release of organically bound micronutrients present in vernicompost. Similar results were reported[17]. The macro as well as micro nutrient content has higher in vermicompost its play a major role to increase the nutrient in soil[18]. Similar results have also been recorded in Arecanut (*Areca catechu* L.)[19].

Table-1: Treatments combination**.**

Treatments	Sources of Nutrients
T_1	24 ton/ha FYM
T_2	6 t/ha vermicompost
T_3	4 t/ha poultry manure
T_4	12 t/ha compost
T_5	½ NPK+ 3 t/ha Vermicompost
T_6	¾ NPK + 1.5 t/ha Vermicompost
T_7	½ NPK + 12 t/ha FYM
T_8	¾ NPK +6 t/ha FYM
T_9	½ NPK + 2 t/ha poultry manure
T_{10}	¾ NPK + 1 t/ha poultry manure
T_{11}	½ NPK + 6 t/ha compost
T_{12}	¾ NPK + 3 t/ha compost
T_{13}	Control

Note: Recommended dose of Broad Leaf Mustard: 120: 80: 60 N: P_2O_5: K_2O kg ha^{-1}[14].

Table-2: Organic and conventional nutrient management on NPK Status in Soil of Broad Leaf Mustard.

Treatments		Soil Nitrogen (%)	Soil Phosphorus (ppm)	Soil Potassium (ppm)
T_1	24 ton/ha FYM	0.171	33.27	151.33
T_2	6 ton/ha vermicompost	0.187	49.42	141.03
T_3	4 ton/ha poultry manure	0.185	43.77	163.92
T_4	12 ton/ha compost	0.151	42.50	154.45
T_5	½ NPK+ 3 ton/ha Vermicompost	0.161	45.62	199.65
T_6	¾ NPK + 1.5 ton/ha vermicompost	0.160	46.34	153.02
T_7	½ NPK + 12 ton/ha FYM	0.161	45.24	116.46
T_8	¾ NPK + 6 ton/ha FYM	0.140	44.19	75.82
T_9	½ NPK + 2 ton/ha poultry manure	0.168	46.29	190.41
T_{10}	¾ NPK + 1 ton/ha poultry manure	0.158	46.88	167.19
T_{11}	½ NPK + 6 ton/ha compost	0.162	43.33	111.11
T_{12}	¾ NPK + 3 ton/ha compost	0.156	45.74	94.50
T_{13}	Control (No nutrient application)	0.114	30.21	63.18
LSD (0.05)		0.01810	3.540	31.94
P-Value		<.001	<.001	<.001
CV% (between treatments)		6.7	4.9	13.8
SEM		0.006	1.213	10.94

Table-3: Organic and conventional nutrient management on Ca, Mg and Fe Status in Soil of Broad Leaf Mustard.

Treatments		Soil Calcium (ppm)	Soil Magnesium (ppm)	Soil Iron (ppm)
T_1	24 ton/ha FYM	1320.00	211.80	102.17
T_2	6 ton/ha vermicompost	1770.00	228.45	93.54
T_3	4 ton/ha poultry manure	1546.67	203.10	118.07
T_4	12 ton/ha compost	1468.33	217.50	89.97
T_5	½ NPK+ 3 ton/ha Vermicompost	1903.33	218.25	129.57
T_6	¾ NPK + 1.5 ton/ha vermicompost	1766.67	216.60	118.47
T_7	½ NPK + 12 ton/ha FYM	1565.00	208.05	88.07
T_8	¾ NPK + 6 ton/ha FYM	1630.00	201.00	116.97
T_9	½ NPK + 2 ton/ha poultry manure	1675.00	203.70	92.63
T_{10}	¾ NPK + 1 ton/ha poultry manure	1740.00	208.95	101.87
T_{11}	½ NPK + 6 ton/ha compost	1638.33	206.70	94.93
T_{12}	¾ NPK + 3 ton/ha compost	1616.67	202.76	102.37
T_{13}	Control (No nutrient application)	1248.33	175.60	83.30
	LSD (0.05)	127.6	2.204	10.281
	P-Value	<.001	<.001	<.001
	CV% (between treatments)	4.7	1.9	6.0
	SEM	43.7	0.755	3.522

Conclusion

It is concluded that treatment 6 ton/ha vermicompost (T_2) was effective of total nitrogen whereas available phosphorous in soil whereas available potassium was effective in T_5 (½NPK + 3 ton/ha vermicompost). In micronutrients, used of T_5 (½NPK + 3 ton/ha vermicompost) were effective for improving the soil Ca, Mg and Fe Status in Soil of Broad Leaf Mustard field.

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