

Impact of various level of NPKS and Vermicompost on fertility Status of soil in Mustard (*B.juncea L.*) Crop.

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Abstract

The present investigation entitled, “Effect of major nutrients and vermicompost Crop” involved field experimentation conducted during Rabi season of year 2015-16 followed by laboratory analysis of the plant and soil sample. All grass have been removed from the plot and on crop productivity of mustard (*B.juncea L.*) plots and soil samples have been taken from each plot at 30 DAS, 60 DAS and at harvesting. Khurpi and auger have been used as sampling tools. Sample were collected in plastic bag.

The experiment was conduct on research plot of Udai Pratap Autonomous College, Varanasi (U.P.) adjoining the department of Agricultural Chemistry and Soil Science. The soils of Varanasi formed on alluvial, deposited by river Ganga have predominance of Illite, quartz, feldspars and Illite minerals are partly inherited from micas which are predominant in the sand and silt fractions. Varanasi is found under sub-tropical climate and situated in eastern U.P, India. The precipitation in this region is normally spread over period of three and four months. i.e from the last week of June to the second week of October is rain season. The distribution of average annual rain fall is 96.65mm of which 80% from June to September, 5.7% from October to December, 3.3% from

January to February and 3.0% from march to May.

Treatments of this investigation consisted of integration of N, P, K, S and vermicompost are T₁ Control, T₂ 50% NPKS, T₃ 50% NPKS+10t, Vermicompost/ha, T₄ 100 % NPKS, T₅ 100% NPKS+10t Vermicompost/ha T₆, 150 % NPKS & T₇ 200 % NPKS. Result pertaining the effect of various treatment of different level of NPKS on different growth stages of mustard crop.

The effect of different doses of NPKS+vermicompost different growth stages of mustard crop was found in the order T₅>T₇>T₆>T₃>T₄>T₂>T₁ and values were 90 DAS,131.33,129.00,127.67,118.33,124.65,111.00 under the respective treatment. Similarly higher plant height was recorded with T₅ treatment as compared to other treatment at all growth stages. Plant height increased with increasing the levels of NPKS. Similarly higher plant height was recorded with the application of 100% NPKS+10t vermicompost/ha. The grain yield of mustard crop as influenced by various treatment could be arranged in order to T₅>T₇>T₆>T₃>T₄>T₂>T₁ and value were 18.12, 17.35, 15.00, 10.20, 12.10, 8 and 6q/ha under the respective treatment.

Keywords: *Mustard, Vermicompost, B.juncea L., Major Nutrients, NPKS, Amit Singh*

Introduction

Rapeseed and mustard are grown in 53 countries of the world on 26.09 mha area with a production of 46.84 m tones of this rapeseed accounting for 25.21mha area and 46.12 m tones. Production is thus more important than mustard (FAO Production year book 2004).

Rapeseed and mustard are the third most important oilseed crops of the world after soybean and oil palm. These crop are grown under a wide range of agro-climatic conditions, It accounting for more than 70% of the area under rapeseed mustard. The oil content varies from 37-49%. The seed and oil used as condiment in the preparation of pickles and for flavoring curries and vegetables (Ministry of agriculture).

Total area under RM seed and associated crop in India for the 2013-2014 is 71.30 lakh hectares Production 73.00 lakh tones & average yield 1023kg/hectares (Ministry of agriculture). Generally, these crop require heavy loam soils except taramira which is raised on lighter soils. Soils having pH 6.0-7.5 is ideal for their proper growth and development.

Rapeseed and mustard respond well both to organic and inorganic manures. It available apply 15-20 tonnes/ha of FYM or Compost at the timed field preparation. Nitrogenous fertilizer in the form of ammonium sulphate is beneficial for the crop.

Integrated use of organic manure such as FYM 10-15 tones/ha with 100% recommended NPK fertilizer does not only sustain higher productivity but also maintain the fertility. Improved the quality of food crops particularly of oil seed. More than 99% of S in rapeseed is bound in glucosinolates (Schung *et al.* 1990) there was buildup of available N in soil receiving 100% NPK along with FYM. a significant @10

t/ha over other treatment. The higher available N Content in the 100%. NPK+FYM.@10t/ha treatment may be due to optimal fertilizer input, three year conjoint used of 10t FYM/ha with 100% NPK significantly improved the organic carbon and available N, P & K Contents over the chemical fertilizer alone significantly higher grain yield of 5.36 t/ha & total N.P.K. uptake by rice with the application of 100% NPK & 10% FYM/ha as compared to grain yield of 4.46 t/ha (Chesti *et al.* 2015).

The information regarding the application of NPKS and vermi compost in Indian Mustard is very less and fragmentary, particularly for eastern region for Uttar Pradesh. Keeping the above fact in view, an attempt has been made to study the effect of NPKS on soil properties and performance of mustard.

Materials and Methods

The present study entitled, “Effect of major nutrients and vermicompost on crop productivity of mustard (*B.juncea L.*) Crop” Involved field experimentation conducted during Ravi season of year 2015 followed by laboratory analysis of the plant and soil samples in the department of agriculture chemistry and soil science, Udai Pratap Autonomous college, Varanasi (U. P). All grasses were removed from the experimental plots and soil samples have been taken from each replication plots at 30 DAT, 60 DAT and at harvesting. Khurpi and auger was used as sampling tools. Samples were collected in clean plastic bags. Soil samples were brought to the laboratory, air dried soil samples were crushed and passed through 2 mm sieve. The representative samples about 500 gm were collected in polythene bags. Samples were analyzed for important physico-chemical properties. Treatments of this investigation consisted of integration of N,P,K,S and vermicompost are T₁ Control, T₂ 50% NPKS, T₃ 50% NPKS+10t, Vermicompost/ha, T₄ 100 % NPKS, T₅ 100% NPKS+10t Vermicompost/ha

T₆, 150 % NPKS & T₇ 200 % NPKS. The experiment was laid out in a randomized block design (RBD) with three applications in 2015-16. Field was prepared by cross harrowing followed by planking in all plots. Full care has been taken to level the plots uniformly and grasses were removed from the plots. Around each plot bunds were made to control water in the plot main and sub irrigation channels were made with help of spade. Mustard seed Varuna was sowing at spacing of 45x15cm.

Nitrogen, phosphorus potassium and sulphur were applied as per treatment through urea, SSP, MOP and elemental sulphur respectively as per treatments. Half dose of nitrogen, full dose of P, K and S were applied at the time of sowing and rest dose of nitrogen in two equal split one at 45 days and second after 60 days after sowing. Vermicompost was applied before 15days after sowing.

Organic carbon was determined by the modified Walkley and Black method (1934) as described by (Jackson 1967). The available soil nitrogen was determined by the alkaline Permanganate method (Subbiah and Asija 1956). The available phosphorus in soil was determined by the Olsen's method (Olsen's *et al.* 1954). The available potassium was determined by ammonium acetate method (Honway and Heidel, 1952). The available sulphur in soil was determined by barium sulphate Turbidimetric method (Chesnin and Yien, 1951). The height of 5 marked plants in all the plots were recorded at different growth stages (30 DAS, 60 DAS and at maturity) from the base of plant to the tip of the upper most fully matured and stretched leaf before emergence of ear and after it emergence. The mustard was harvested at maturity and separate bundles were made for each plot and weight. After one week of harvesting crop were weighed and threshed by hand. After threshing the weight of grain was recorded. The data collected from field and laboratory were analyzed statistically using standard procedure of randomized block design (RBD), (Cochramand

cox, 1959). Critical difference (C.D.) and standard error of mean (S.E.M.) were calculated to determine the significance among treatment mean.

Result and Discussion

The present investigation was carried out on "Study on "Effect of major nutrients and vermicompost on crop productivity of mustard (*B.juncea L.*) Crop" during Rabi season of 2015-16 on research plot of Udai Pratap Autonomous College, Varanasi (U.P).

Table-1 Indicated that nutrients uptake by Mustard under different treatments over major nutrients and vermicompost, through which total nutrient uptake.

Plant height

Result pertaining the effect of various treatment of different level of NPKS on different growth stages of mustard crop. The effect of different doses of NPKS+vermicompost different growth stages of mustard crop was found in the order T₅>T₇>T₆>T₃>T₄>T₂>T₁ and values were 90 DAS 131.33,129.00,127.67, 118.33,124.65,111.00 under the respective treatment. Similarly higher plant height was recorded with T₅ treatment as compared to other treatment at all growth stages. Plant height increased with increasing the levels of NPKS. Similarly higher plant height was recorded with the application of 100%NPKS+10t vermicompost/ha. Vermicompost also balance nutrition under the favourable environment might have helped in increasing chlorophyll content at flowering stage. Further improve the physical and biological properties as a result of addition of vermicompost might have also root expansion and increase the availability of nutrient. The in agreement Reddy and Reddy (1998) and Dhaka *et al* (2001)

Table-1 Plant height (cm) as influenced by

Treatment	Days After Sowing		
	30	60	90
T ₁	11.00	51.6	96.67
T ₂	15.50	65.86	111.00
T ₃	21.50	79.6	124.67
T ₄	18.67	71.33	118.33
T ₅	26.00	95.33	127.67
T ₆	27.50	97.13	129.00
T ₇	29.03	99.26	131.33
SEm±	0.843	1.718	0.888
CD(5%)	2.599	5.295	2.736

application of various levels of NPKS and vermicompost under mustard crop.

Number of branch

Table-2 Revealed that number of branch/plant as mustard crop a influenced by NPKS and vermicompost addition. The data related to number of branch of mustard crop under various treatments. Data clearly indicated that number of branches per plant increased with day after sowing. It was also recorded that

integration of NPKs and vermicompost significantly increased the number of branch as compared to chemical fertilizer alone at all levels of NPK. The number of branch at time of harvesting 1.20, 1.50 ,2.10, 1.80, 2.70, 2.20, 2.40 were under T₁ , T₂ , T₃ , T₄ , T₅ , T₆ , T₇ treatments respectively. Application of 100% NPKS + 10t vermicompost/ha significantly increased to other treatments at all growth stage. Significantly higher number of branch was found with application of NPKs and vermicompost

Treatment	Days After Sowing	
	60	90
T ₁	1.20	2.40
T ₂	1.50	2.83
T ₃	2.10	3.96
T ₄	1.80	3.26
T ₅	2.20	4.46
T ₆	2.40	4.50
T ₇	2.70	4.53
SEm±	0.716	0.548
CD (5%)	2.206	1.688

might be attracted to higher and continuous supply of NPKS. Similar result were also reported by Singh *et al* (2009).

Table-2 Number of branch/plant as mustard crop a influenced by NPKS and vermicompost addition.

No of grain /siliqua

Table-3 indicated that Number of siliqua /plant and no of grain/siliqua mustard crop a influenced by NPKS and vermicompost addition. Result pertaining the effect of various treatment of different growth stage of mustard crop. The effect of different dose of NPKS on different treatment level of siluqua found in order $T_5 > T_7 > T_6 > T_3 > T_4 > T_2 > T_1$ and values are varied

between 15.00,14.13,13.86,12.6, 11.26, 10.2, 9.26. Similarly higher grain/siliqua recorded with T_5 treatment as compared to other under respective treatment of vermicompost Inorganic potassium fertilizer increase the no of seed/siliqua. Similarly results were reported by **Channaveerswami (2005)** similarly the hugher grain/siliqua was recorded with application of 100%NPKS+10t vermicompost/ha.

Number of siliqua

The data of the number siliqua of mustard crop under the various treatments has been presented in Significantly higher no of siliqua was recorded with the application of 100%NPKS+10t vermicompost/ha . The number of siliqua per meter row length of mustard under different increased with time and reached the maximum at 60 DAS. The effect of various treatment on number of siliqua could be arranged in the order of $T_5 > T_7 > T_6 > T_3 > T_4 > T_2 > T_1$ and value varies are 89.73, 87.4, 85.4, 56.6,69.20, 47.6and 40 under the respective treatment. The combination of vermicompost and inorganic potassic fertilizer increase the number of siluqua than use of inorganic fertilizer alone. This may be because combination of inorganic and organic fertilizers improves the soil physical properties, which provide health and favourable soil condition to enhance nutrient efficiency.

Table-3 Number of siliqua /plant and no of grain/siliqua mustard crop a influenced by NPKS and vermicompost addition.

Treatment	Days After Sowing	
	No of siliqua	No of grain /siliqua
T ₁	40	9.26
T ₂	47.6	10.2
T ₃	69.2	12.6
T ₄	56.6	11.26
T ₅	85.4	13.86
T ₆	87.4	14.13
T ₇	89.73	15.00
SEm±	0.731	0.764
CD (5%)	2.253	2.352

Grain yield

Table-4 Indicated that, the data related to grain yield, oil content and straw yield of mustard crop under various treatment of NPKS presented.

The grain yield of mustard crop as influenced by various treatment could be arranged in order to $T_5 > T_7 > T_6 > T_3 > T_4 > T_2 > T_1$ and value were 18.12, 17.35, 15.00, 10.20, 12.10, 8 and 6q/ha under the respective treatment. **Raj and Karwasra (1994)** reported that the grain yield of toria increased significantly with increased doses of S up to 45mg/kg . **Janzen and bettany (1981)** reported that the higher S application relative to N availability caused excessive accumulation of sulphur in plant tissue

of rapeseed. Vermicompost application coupled with transport of photosynthesis toward reproductive structure might have increased the yield attributes. These results are conformity with those of **Rjkhowa et al (2000) and Singh et al (2007)**. Integration of vermicompost and NPKS recorded significantly higher grain yield over chemical fertilizer alone at all level of at all level of NPKS might be attributed to increased fertility status of soil and more availability of nutrient to the plant **Kumar et al (2014)**.

Oil content

Result pertaining to effect of various treatment of NPKS and vermicompost on oil content of mustard was found in order $T_5 > T_7 > T_6 > T_3 > T_4 > T_2 > T_1$ and value were 38.60, 37.50, 35.36, 32.35, 33.10, 31.50, 30.20 percent under respective treatment. Application of 100%NPKS +10t vermicompost/ha significantly increase the oil content over the control. Whereas it was remain at par with T_5 (38.60%). Sulphur improves the quality of food crop, particularly of oil seed more than 99% sulphur in rapeseed is bound in glucosinolates (**Schung et al 1990**). Phosphatic fertilization increased the amount of oleic, linolenic and erucic acid with an appreciable decrease in undesirable erucic acid content (**singh 1993**). Vermocompost application, as it play important role in oil synthesis and protein metabolism similar result were also reported by **Aruna and Reddy (1999)**.

Straw yield

The result obtains in respect of the effect of levels of NPKS and vermicompost on straw yield of mustard. Straw yield of mustard increased with increasing the different level of NPKS and maximum yield were recorded under 100%NPKS +10t vermicompost/ha application in order to 70.00, 68.53, 67.12, 58.33, 60.25, 53.50, 45 q/ha. The increase the straw yield due to application of 30kg S/ha as SSP was 11.3, 10.1 and 45% over that of

elemental S at 30kg/ha 1%, 5.52 and 2% respectively. The results of present investigation agree with finding of **Mishra (2003)**. The straw yield significantly higher with application of SSP as compared to other source of S. Adding vermicompost favour the condition for root growth and increase the growth of areal organ and production of dry material and finally improvement in the biological function of plant **Cavendra et al (2003)**.

Table-4 Effect of NPKS and vermicompost on grain yield, straw yield and oil content of mustard crop.

Treatment	Days After Sowing		
	Grain yield q/ha	Straw yield q/ha	Oil content (%)
T ₁	6.00	45	30.20
T ₂	8.00	53.50	31.50
T ₃	12.10	60.25	33.10
T ₄	10.20	58.33	32.35
T ₅	15.00	67.12	35.36
T ₆	17.35	68.53	37.50
T ₇	18.12	70.00	38.60
SEm±	0.744	1.150	0.804
CD (5%)	2.293	3.542	2.479

Summary and conclusion

Present experiment was conducted at the research plots of department of agriculture chemistry and soil science, Udai Pratap Autonomous College Varanasi with mustard variety varuna-555 as test crop during rabi season (2015-16) to investigate the soil properties and performance of test crop as influence by addition of various levels of NPKS and vermicompost. The treatments were composed of NPKS and vermicompost. The treatment were T₁(control), T₂(50NPKS), T₃(50%NPKS+ 10t vermicompost/ha), T₄(100%NPKS) T₅ (100%NPKS+ 10t vermicompost/ha), T₆(150%NPKS), T₇(200%NPKS). The mustard experiment was laid out in randomized block design (RBD)with three replications. Analysis of various soil properties in term of organic carbon, available nitrogen, available phosphorus, available potassium, available Sulphur were made at different time interval 30, 60 and 90 DAS.

higher nutrient uptake (NPKS) by mustard crop was recorded with T₅ as compared to rest of the treatments. The effect of various treatment on nutrient uptake by crop was found in order T₅>T₇>T₆>T₃>T₄>T₂>T₁.

Higher plant height was recorded with T₅ (131.33 cm) treatment as compared to other treatment at all growth stages. The effect of different doses of NPKS+ vermicompost on different growth stages of mustard crop in the order T₅>T₇>T₆>T₃>T₄>T₂>T₁.

Higher number of branch (4.56/plant), siliqua (89.75/piant), oil content (38.68Q/ha), straw yield (70q/ha), and grain yield (18.12Q/ha) were recorded under 100%NPKS+10t vermicompost/ha (T₅) applied plots.

The present study thus conducted that the application of NPKS with vermicompost in mustard crop significantly affected the growth, yield N uptake and available NPKS status of soil. The application of 100%NPKS and 10t

vermicompost /ha was found to be best treatment regarding growth, yield NPKS uptake and NPKS status in soil.

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