International Journal of Plant & Soil Science

Volume 36, Issue 6, Page 99-107, 2024; Article no.IJPSS.116036
ISSN: 2320-7035

Evaluation of Different Organic Manure on Nutrient Content, Uptake and Yield of Mustard (*Brassica juncea* L) Crop

Pardeep Kumar [a++], Robin Kumar [b#], Ajay Kumar [c++*], Vikas Yadav [b++], Sidra Qidwai [d++], Praveen Kumar [c++] and Shivam Kaushik [d++]

[a] Department of Soil Science and Agricultural Chemistry, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India.
[b] Department of Soil Science and Agricultural Chemistry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India.
[c] Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India.
[d] Department of Agronomy, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2024/v36i64610

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/116036

Original Research Article

Received: 15/02/2024
Accepted: 19/04/2024
Published: 24/04/2024

ABSTRACT

A field experiment was conducted during 2020-21 at Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) during *Rabi* season to evaluate the "effect of different organic manure on nutrient content, uptake and yield of mustard *(Brassica juncea L)*

[++] *Research Scholar;*
[#] *Assistant Professor;*
**Corresponding author: E-mail: ajaykatariyaji@gmail.com;*

crop.". The experiment was laid out in randomized block design with Eight treatments and three replications. Eight treatments viz. Control, 100% VC (8 tonnes per hectare), 100% FYM (10 tonnes per hectare),100% PM (10 tonnes per hectare),50% FYM + 50% VC + Natural liquid manure (Jeevamrit), 50% FYM + 50% PM + Natural liquid manure (Jeevamrit), 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM along with different management practices were implemented. The result revealed that the highest nutrient content (%) by seed (3.15 N, 0.511 P, 0.560 K) and Stover (0.601 N, 0.180 P, 1.48 K) and the highest nutrient uptake (kg ha^{-1}) of all the three nutrients by seed (56.54 N, 9.17 P, 10.05 K) and stover (28.80 N, 8.63 P, 70.92 K) were recorded with combined effect of FYM, VC with application of Jeevamrit viz., and 50% NPKS through FYM+ 50% N through VC which was statistically at par toT6. Reduction in nutrient supply resulted significantly lower uptake of N, P and K in the treatment which received only 100% FYM. Similarly, the maximum seed (17.95 q ha^{-1}) and Stover (47.92 q ha^{-1}) yield of mustard was recorded in the T5 treatment (50% FYM + 50% VC + Natural liquid manure Jeevamrit) treatment received 50% recommended doses of NPKS through FYM and 50% N through VC which was at par to T6 in which 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) was applied. However, the lowest value found in control treatment (T6).

Keywords: Organic manure; Jeevamrit; natural liquid manure.

1. INTRODUCTION

Mustard (*Brassica juncea* L.) is also known as rai, raya, laha and raiya, whereas, rapeseed is called sarson, toria and yellow toria. The green tender Part of the plant is used for preparing "Sarson Ka Saag. The mustard oil is used for human consumption throughout Northern India in cooking. The oil content in mustard seeds ranges from 37-49 % [1].

Total area, production and yield of rapeseed-mustard in world during 2018-19 was 36.59 million hectares (mha), 72.37 million tonnes (mt) and 1980 kg/ha, respectively. There has been a considerable increase in production and productivity from 2013-14 to 2018-19. However, there was slight decrease in production and productivity from 2017-18 onward. The rapeseed-mustard acreage increased from 5.98 m ha (2017-18) to 6.12 mha (2018-19) and production got increased from 8.43 mt (2017-18) to 9.26 mt (2018-19). Globally, India continues to be at rank 4th after Canada, China and European Union in acreage (17.19%) and after European Union, Canada and China in production (8.54%). In India Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana, West Bengal, and Assam states accounted for 86.29% of area and 88.46% of production in the country. Rajasthan alone contributed 40.74% to the total area (Fig. 1) and 44.97% to the production [2].

In Indian mustard nutrient management is among the most important agronomic factors that affects the growth and yield of crop, but application of all the needed fertilizer through chemical fertilizers had hazardous effect of soil fertility & unsustainable yields. Chemical fertilizers are important input in order to get higher crop productivity, but total dependency on chemical fertilizers are associated with declines in some soil properties and crop yields over time and causes some serious land problems, like soil degradation (Hepperly *et al.,* 2009). Therefore, integration of organic manures and bio–fertilizers would be able to maintain soil fertility and sustain crop productivity efficiently. The addition of organic materials such as crop residues, animal manures, green manures to soils have a direct effect on soil organic matter content and can improve soil fertility, soil physical characteristics, and can augment microbial activities, ameliorate metal toxicity, and by complication [3].

Soil organic matter upon mineralization releases substantial quantities of Nitrogen, Phosphorus, Sulphur and smaller amount of micronutrients (Rahman et al. 2013). Animal manure is considered to be a valuable nutrient source when applied to soil at rates commensurate with good agronomic practices [4] Organic manures like FYM, Vermicompost and Poultry manure are excellent source of nutrients required by plants for quality produce. It contains table organic matter of up to 60%. Combined application of FYM, Vermicompost produces higher yield along with improving soil health [5].

Vermicompost helps in improving plant health & acts preventively against fungal diseases. Scientific research conducted on the effects of Vermicompost has found 30-50% increase in nitrogen uptake, increase in root length, root

numbers and shoot length. Organic manures enhance the activity of soil, improve the physical and nutritional system of soil and also enhance the activity of soil micro flora [6]. Poultry manure contains nutrient element that can support crop production and enhance the physical & chemical properties of soil and improves lateral water movement. It contains high amount of Nitrogen and Phosphorous than other bulky organic manures and is a good source of production of elements rich fertilizer.

2. MATERIALS AND METHODS

The field experiment was conducted during Rabi season 2020-2021 at Students Instructional Farm of A.N.D. University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) situated on Ayodhya-Raibarelly Road about 42 km. away from Ayodhya Head quarter at 26˚47′ N latitude and 82˚12′ E longitude and at an attitude of about 113 meter above the mean sea level. The field was well levelled having assured irrigation and drainage facilities. The soil was partially reclaimed sodic soil with silt loam texture, slightly alkaline in reaction (pH 8.10) with low in organic carbon (0.51%), low available nitrogen (154.00 kg ha^{-1}), medium in available phosphorus (20.40 kg ha^{-1}), available potassium (218 kg ha^{-1}) and available Sulphur (8.78 kg ha^{-1}). The experiment was comprised of eight treatments *viz.* Control, 100% VC (8 tonnes per hectare), 100% FYM (10 tonnes per hectare),100% PM (10 tonnes per hectare),50% FYM + 50% VC + Natural liquid manure (Jeevamrit), 50% FYM + 50% PM + Natural liquid manure (Jeevamrit), 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM along with different management practices were implemented. All the treatments were randomly allocated and replicated three times in a randomized block design. The mustard variety Varuna was grown and growth & yield, nutrient uptake, soil properties as influenced by different treatments were assessed.

Plant samples (Stover and seed) were collected randomly from each experimental unit at the time of harvest for the evaluation of nutrient content and uptake. The samples were dried in oven at 60 0C for 8 hrs. Oven dried plant samples (Stover and seed) were ground in stainless steel grinder for analysis of nitrogen, phosphorus and potassium. The processed Stover and seed samples were digested with conc. H_2SO_4 and H_2O_2 in presence of catalyst mixture. Modified Kjeldahl's method was adopted for determination of nitrogen content in stover and seed as described by Jackson (1973). The percentage of nitrogen content was multiplied with grain and straw yield to obtain nitrogen uptake by seed and straw, respectively.

The ground seed and Stover samples were digested with ternary acid mixture, having nitric, perchloric and sulphuric acid in 10:4:1 ratio and was determined by vanadomolybdo phosphoric yellow colour method (Jackson, 1973). The percentage of phosphorus content was multiplied with seed and Stover yield to obtain phosphorus uptake by seed and Stover, respectively. Potassium content in digested seed and Stover samples with ternary acid were determined separately by using flame photometer (Jackson, 1973). The percentage of 30 potassium content was multiplied with seed and Stover yield to obtain potassium uptake by seed and Stover, respectively. After harvesting, the yield per plot were recorded in kg separately and converted into t ha^{-1}.

3. RESULTS AND DISCUSSION

3.1 Nutrient Content and Uptake by Seed

The data regarding to the N, P&K content (%) and uptake (kg/ha) in seed of mustard were tabulated and analyzed statistically and the results have been presented in result table. It is realistic from the result Table 1, the application of various organic manure significantly influence the N-content (%) in mustard seeds and with the submission of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest N-content (%) in mustard seeds followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in that order. The untreated plot (control plot) plot with organic manure created significantly lowest N-content (%) in seed of mustard. It is practical from the results Table 1, the application of various organic manure significantly influence the P-content (%) in mustard seeds and with the giving in of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest P-content (%) in mustard seeds followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per

hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in that order. The untreated plot (control plot) plot with organic manure created significantly lowest p-content (%) in seed of mustard. It is realistic from the results Table 1, the application of various organic manure significantly influence the K-content (%) in mustard seeds and with the giving in of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest K-content (%) in mustard seeds followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in that order. The untreated plot (control plot) plot with organic manure created significantly lowest K-content (%) in seed of mustard. The N, P, K content in seed of mustard significantly increased with plot treated with T5 treatment (50% FYM + 50% VC + Natural liquid manure (Jeevamrit) over rest treatments. T5 treatment increased 8.89% over untreated plot. The N, P, K increased 8.89%, 8.81% and 24.11% respectively. It is certified that the organic manure increased the availability of N.P.K to mustard plant so that the NPK content increased in seed. The same findings also reported by Chung et al [7], Laxminarayana and Patiram [8], Singh et al [9], Kumar et al [10], Datta etal [11] and Singh et al [12].

The data regarding to the N, P&K uptake (kg ha^{-1}) by seed of mustard were tabulated and analyzed statistically and the results have been presented in result table . It is realistic from the result Table 1, the purpose of various organic manure significantly influence the N-uptake by seed of mustard and with the submission of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest N-uptake by mustard seeds followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in that order. The untreated plot (control plot) plot with organic manure created significantly lowest N-uptake by seed of mustard. It is practical from the results Table 1, the request of various organic manure significantly influence the P-uptake (kg/ha) by mustard seeds and with the generous in of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest P-content (%) in mustard seeds followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in with the aim of order. The untreated plot (control plot) plot with organic manure created significantly lowest p-uptake (kg ha^{-1}) by seed of mustard. It is reasonable from the results Table 1, the claim of various organic manure significantly pressure the K-uptake (kg/ha) by mustard seeds and with the charitable in of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest K-uptake by mustard seeds followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in that order. The untreated plot (control plot) plot with organic manure twisted significantly lowest K-uptake by seed of mustard. The N,P,K uptake kg/ha by the seed of mustard significantly noted highest with application of T5 treatment (50% FYM + 50% VC + Natural liquid manure (Jeevamrit) and the Nitrogen uptake 31.22%, Phosphorus 31.19% and Potash 42.68% over control correspondingly. It is attributed due to the N.P.K content and yield of seed of mustard found higher the said treatment. The same conclusion also report by Chung et al [8], Laxminarayana and Patiram [8], Singh et al [9], Kumar et al [10], Datta et al [11] and Singh et al [12].

3.2 Nutrient Content and Uptake by Stover

The data regarding to the N.P. and K. content (%) and uptake (kg ha^{-1}) in Stover of mustard were tabulated and analyzed statistically and the results have been presented in result table. It is apparent from the result Table 2, the reason of various organic manure significantly pressure the N-content (%) in Stover of mustard and with the giving in of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest N-content (%) in Stover of mustard followed by 50% FYM + 50% PM +

Table 1. Effect of different organic manure on N.P.K. content (%), uptake (kg/ha) and seed yield of mustard

Treatments	N-content in seed (%)	P-content in seed (%)	K-content in seed (%)	N- uptake by Seed (kg/ha)	P- uptake by seed(kg/ha)	K- uptake by seed(kg/ha)	Seed Yield (q/ha)
T1	2.87	0.466	0.425	38.89	6.31	5.76	13.55
T2	2.99	0.485	0.443	48.68	7.89	7.21	16.28
T3	2.97	0.482	0.440	43.56	7.06	6.45	15.40
T4	2.95	0.479	0.437	44.55	7.23	6.60	15.10
T5	3.15	0.511	0.560	56.54	9.17	10.05	17.95
T6	3.05	0.495	0.452	52.92	8.59	7.84	17.35
T7	2.91	0.472	0.431	45.74	7.42	6.78	14.97
T8	2.95	0.479	0.437	44.69	7.26	6.62	15.15
SE (m)	**0.05**	**0.007**	**0.005**	**1.51**	**0.43**	**0.36**	**0.67**
CD (p=0.05)	**0.14**	**0.019**	**0.012**	**4.58**	**1.30**	**1.09**	**2.04**

Table 2. Effect of different organic manure on N.P.K. content (%) and uptake (kg/ha) of mustard Stover

Treatments	N-content (%) in Stover	P-content (%) in Stover	K-content (%) in Stover	N-uptake (kg/ha) by Stover	P-uptake (kg/ha) by Stover	K-uptake (kg/ha) by Stover	Stover Yield (q/ha)
T1	0.548	0.164	1.35	20.80	6.22	51.23	37.95
T2	0.570	0.171	1.40	25.80	7.74	63.38	26.45
T3	0.567	0.170	1.40	24.36	7.30	60.14	42.96
T4	0.563	0.169	1.39	23.76	7.13	58.67	42.21
T5	0.601	0.180	1.48	28.80	8.63	70.92	47.92
T6	0.582	0.174	1.43	27.27	8.15	67.01	46.86
T7	0.555	0.166	1.37	24.44	6.97	57.53	41.99
T8	0.568	0.169	1.38	23.78	7.14	56.29	42.24
SE (m)	**0.008**	**0.002**	**0.02**	**0.82**	**0.36**	**2.21**	**1.43**
CD (p=0.05)	**0.025**	**0.006**	**0.06**	**2.48**	**1.10**	**6.63**	**4.33**

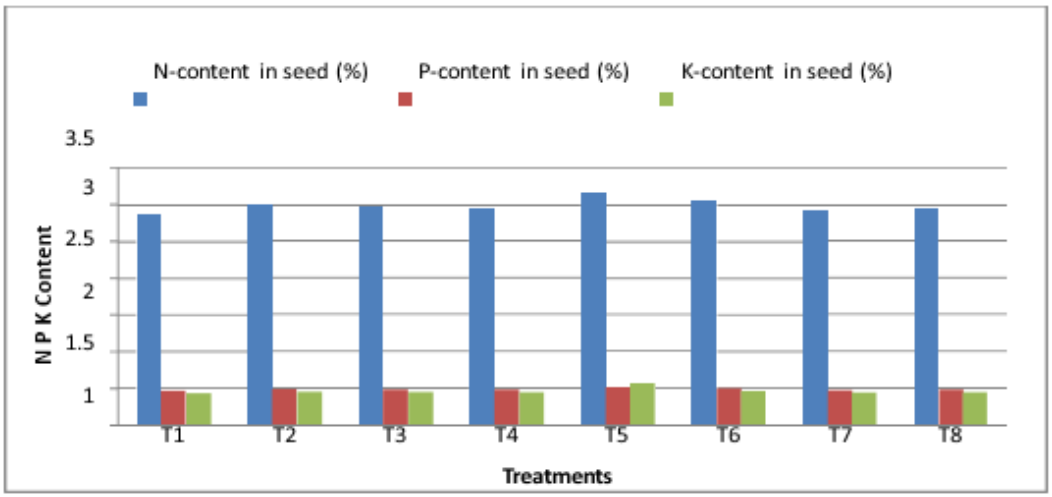

Fig. 1. Effect of different organic manure on N P K content in seed of mustard

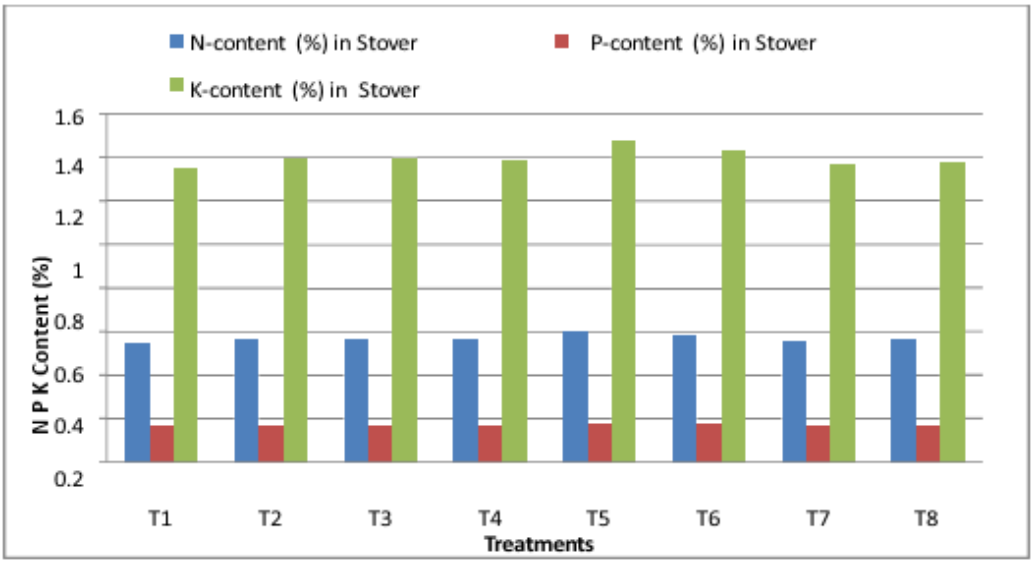

Fig. 2. Of different organic manure on N P K content (%) in Stover of mustard

Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in that order. The untreated plot (control plot) with organic manure created significantly lowest N-content (%) Stover of mustard. It is matter-of-fact from the results Table 2, the request of various organic manure significantly weight the P-content (%) in Stover of mustard and with the giving of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest P-content (%) in mustard Stover followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in with the aim of order. The untreated plot (control plot) plot with organic manure created significantly lowest p-content (%) in Stover of mustard. It is obvious from the results Table 2, the aver of various organic manure significantly pressure the K-content (%) in Stover of mustard and with the giving in of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest K-content in Stover of mustard followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per

hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in that order. The untreated plot (control plot) with organic manure twisted significantly lowest K-content in Stover of mustard.

The data regarding to the N, P, & K uptake by Stover of mustard were tabulated and analyzed statistically and the results have been presented in result table. It is plain from the result Table 2, the basis of various organic manure significantly force the N-uptake (kg/ha) by Stover of mustard and with the openhanded in of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest N-uptake (kg/ha) by Stover of mustard followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in that order. The untreated plot (control plot) with organic manure created significantly lowest N-uptake by Stover of mustard. It is matter-of-fact from the results Table 2, the request of various organic manure significantly weight the P-uptake by Stover of mustard and with the giving of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest P-uptake (kg/ha) by mustard Stover followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in with the aim of order. The untreated plot (control plot) with organic manure created significantly lowest p-uptake by Stover of mustard. It is apparent from the results Table 2, the aver of various organic manure significantly force the K-uptake (kg/ha) by Stover of mustard and with the giving in of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest K-uptake (kg/ha) by Stover of mustard followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in that order. The untreated plot (control plot) with organic manure abnormal significantly lowest K-uptake (kg/ha) by Stover of mustard. The same findings also reported by Ramesh et al [13,14], Chung et al [7], Singh et al [9] Datta et al [11], Rathod et al [15], Kaushik et al [16], Bellakki and Badanur [17], Singh et al (1982).

It is reasonable from the result Table 1, the application of various organic manure significantly influence the seed yield (q/ha) of mustards of mustard crop and with the submission of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 found significantly highest seed yield (q/ha) of mustard followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in that order. The untreated plot (control plot) plot with organic manure created significantly lowest seed yield (q/ha) of mustard crop. It is clear from the result Table 2, the application of various organic manure significantly force the Stover yield (q/ha) of mustard crop and with the agreement of 50% FYM + 50% VC + Natural liquid manure (Jeevamrit) T5 establish significantly advanced of mustard followed by 50% FYM + 50% PM + Natural liquid manure (Jeevamrit) T6 over 100% VC (8 tonnes per hectare) T2, 100% FYM (10 tonnes per hectare) T3, 100% PM (10 tonnes per hectare) T4, 50% FYM + 25% VC + 25% PM, 25% FYM + 50% VC + 25% PM T8 and over control in that order. The untreated (control plot) plot with organic manure originates significantly lowest Stover yield (q/ha) of mustard crop. The same findings also reported by Laxminarayana et al [8], Arya et al [18], Nagdive et al [19], Dongarwae et al [20], Nanwal et al [21,22].

4. CONCLUSION

On the basis of one year field experiment made during rabi 2020-2021, it may be concluded that the N.P. and K content along with uptake (kg/ha) in seed and Stover were recorded more in the T5. The grain yield and Stover yield recorded highest in the application of T5 (50% FYM + 50% VC + Natural liquid manure Jeevamrit) treatment received 50% recommended doses of NPKS through FYM and 50% N through VC.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Bhowmik B, Mitra B, Bhadra K. Diversity of insect pollinators and their effect on the crop yield of Brassica juncea L., NPJ-93, from Southern West Bengal. International Journal of Recent Scientist Research. 2014;5(6):1207-1213.
2. India. Directorate of Rapeseed-Mustard Research. Project Coordinator's Report. Bharatpur, Rajasthan; 2020.
3. Escobar MEO, Hue NV. temporal changes of selected chemical properties in three manure amended soils of Hawaii. Bioresource Tech. 2008;99:8649-8654.
4. Duffera M, Robarge WP, Mikkelsen RL. Estimating the Availability of Nutrients from Processed SwineLagoon Solids through Incubation Studies. Bioresource Tech. 1999;70:261-268.
5. Babalad HB, Poojar S, Vidyavathi, GY. Influence of ghanajeevamrutha and liquid organic manures on soil fertility and productivity of chickpea in vertisol; 2022.
6. Hadiyal JG, Kachhadiya SP, Ichchhuda PK, Kalsaria RN. Response of Indian mustard (Brassica juncea L.) to different levels of organic manures and bio-fertilizers. Journal of Pharmacognosy and Phytochemistry. 2017;6(4):873-875.
7. Chung RS, Wang CH, Wang CW, Wang YP. Influence of organic matter and inorganic fertilizer on the growth and nitrogen accumulation of corn plants. J. Plant Nutr. 2000;23(3):297-311.
8. Laxminarayana K, Patiram Effect of integrated use of inorganic, biological and organic manure on rice productivity and soil fertility in Ultisols of Mizoram. J. Indian Soc. Soil Sci. 2006;45(20):213-220.
9. Singh PK, Imnuksungba Kanajuia, SP. Effect of integrated nutrient management on growth, yield, its attributes and nutrients uptake of mustard crop in acidic soils of Nagaland. Environment and Ecology. 2009;27(3):1036-1039.
10. Kumar M, Singh AK. A study on nutrient uptake by paddy in integrated use of fertilizers and vermicompost. Asian J. Soil Sci. 2008;3(1):40-41
11. Datta AB, Mondal JK, Chanda NK. Influence of integrated nutrient management on soil properties of old alluvial soil under mustard cropping system. Communications in Soil Science and Plant Analysis. 2011;42(20):2473-2492.
12. Singh RP, Pal Y, Singh H. Effect of organic and inorganic sources of nutrients on growth, yield and quality of Indian mustard (Brassica juncea L.) under late sown condition. Pantnagar J. Res. 2011;9(2): 308-310.
13. Ramesh P, Panwar NP, Singh AB, Ramana S. Production potential, nutrient uptake, soil fertility and economics of soybeen (Glycine max) based cropping system under organic, chemical and integrated nutrient management practices. Indian J. Agron. 2009a;54(3):278-283.
14. Ramesh P, Panwar NR, Singh AB, Ramana S. Effect of organic nutrient management practices on the production potential, nutrient uptake, soil quality, input-use efficiency and economics of mustard (Brassica juncea). Indian J. Agric. Sci. 2009b;79(1):40-44.
15. Rathod VE, Sagare BN, Ravankar HN, Sarazp PA, Hadole SS. Efficiency of amendments for improvement in soil properties and yield of cotton grown in sodic vertisols of Vidarbha Using alkali water. J. Soils and Crops. 2003;13(1):176-178.
16. Kaushik RD, Verma KS, Dang YP, Sharma AP, Verma SI, Pannu BS. Effect of nitrogen and farm yard manure on yield of crops, nutrients uptake and soil fertility in paddy wheat rotation. Indian J. Agril. Res. 1984; 18:73-78.
17. Bellakki MA, Badanur VP, Setty RA. Long-term effect of integrated nutrient management on properties of vertisol under dryland agriculture. J. Indian Soc. Soil Sci. 1997;45:438-442.
18. Arya RL, Varshney JG, Kumar L. Effect of integrated nutrient application in chickpea + mustard intercropping system in the semi-arid topics of North India. Communications in Soil Science and Plant Analysis. 2007;38(1/2):229-240.
19. Nagdive SJ, Bhalerao PD, Dongarwar UR. Effect of irrigation and integrated nutrient management on growth and yield of Indian mustard. Annals of Plant Physiology. 2007; 21(2):182-185.
20. Dongarwar UR, Bhalerao PD, Negduie SJ. Effect of irrigation and INM on growth and yield of Indian mustard. Annals Physiol. 2007;21(2):182-185.
21. Nanwal S, Yadav RK. Productivity and quality of Indian mustard (Brassica juncea) as influenced by integrated nutrient management treatments in semi-arid

environment. Environment and Ecology. 2007;25(4):956-958.

22. Singh AK, Amgain LP, Singh SS. Integrated nutrient management in rice-wheat system under midland situation. In Extended Summaries of 21st International Congress on Agronomy, held at New Delhi, during November 23rd. 1998;450-451.

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