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SL Yadav
Department of Soil Science and Agricultural Chemistry, College of Agriculture, RajmataVijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

GK Sharma
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

SS Yadav
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

SK Trivedi
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

K Yadav
Department of Horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

RS Jat
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Corresponding Author:
SL Yadav
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India

Long term effect of organic and chemical sources of nutrients on yield and economics of mustard in incept sols of gird region of Madhya Pradesh

SL Yadav, GK Sharma, SS Yadav, SK Trivedi, K Yadav and R Jat

Abstract
The studies on long term effect of application of organic and chemical sources of nutrientsin mustard were conducted at research farm, Department of Soil Science and Agricultural Chemistry, College of Agriculture, Gwalior, (M.P.) during *Rabi* season of 2020-21 and 2021-22 with nine treatments replicated thrice in randomized block design. The results indicated that the integration of vermicompost @5 t ha^{-1} + 50% recommended dose of NPK fertilizers resulted in achieving significantly higher grain yield (2779 kg ha^{-1}), straw yield (6883 kg ha^{-1}), (112553₹ ha^{-1}) and net return (₹79953₹ ha^{-1}) of mustard pooled basis in comparison to absolute FYM @20t ha^{-1} or vermicompost @10t ha^{-1} or 100% recommended dose of NPK fertilizers alone or their graded combinations. The benefit: cost ration of mustard was recorded at par under the treatments with integration of FYM @ 5 t ha^{-1} with 75 RDF, FYM @ 10t ha^{-1} with 50% RDF, vermicompost @ 5 t ha^{-1} with 50 RDF, vermicompost @ 2.5 t ha^{-1} with 75% RDF and absolute chemical but they were found significantly higher than the treatments with absolute FYM or Vermicompost or their integration with 25% RDF. These findings revealed that the integration of sources of nutrients is better in terms of yield and economics of crop.

Keywords: Vermicompost, FYM, organic nutrients, chemical nutrients, NPK, productivity, mustard

Introduction
Mustard (*Brassica juncea* L.) is the second largest oilseed crop in India after soybean. It is a diverse type of plants. Which is grown as vegetables, spices, fodder for animal and source of oils and condiments, and take part in our agriculture economy by production. Indian mustard is particularly being deep rooted and is able to utilize the soil moisture and nutrients from lower layers of the soil.Mustard is the main oilseed crop for the *Rabi* season which is planted on more than 74% area covered under oilseeds. Rajasthan, Uttar Pradesh, Madhya Pradesh, Haryana and Gujarat are the highest sown states of mustard seed accounting for more than 70% of total mustard acreage in the country. In India, mustard is cultivated on about 6.69 MHA area with a production and productivity of about 10.11 MTs and 1511 kg ha^{-1} during 2020-21 (Economic Survey, 2021-2022), respectively. However, in Madhya Pradesh, it is grown on about 7.7 lakh ha area with production and productivity of about 13.1 lakh tones and 1713 kg ha^{1}, respectively (Economic Survey, 2021-2022). Vermicompost has also been advocated as good organic manure for use in integrated nutrient management practices in field crops (Shroff and Devesthali 1992) [15]. Inorganic fertilizers especially nitrogen, phosphorus and potassium, not only help to maintain soil fertility, but also directly or indirectly changes the soil chemical, physical and biological properties. On long-term basis, these changes in soil properties are believed to cause significant differences in soil health and quality which in turn influences productivity of soils (Saha*et al*., 2008) [12]. Integration of organic manure along with fertilizer further increased the crop productivity (Arya *et al*., 2022) [3], and improves the microbial population and diversity in soil rather than sole application (Krishnakumar*et al*., 2005; Meena*et al*., 2016) [5, 7].

Material and Methods
A field investigation was carried out during the *Rabi* 2020-21 to *Rabi* 2021-22 in continuation of a 14 year old long term experiment on mustard (from *Rabi* 2006) at the Research Farm, College of Agriculture, Gwalior situated in grid zone (latitude of 26° 13'N and longitude 76°10'E with an altitude 197 meters) of Madhya Pradesh. The climate of experimental site is semi-arid and sub-tropical with extreme weather condition having hot and dry summer and

cold winter, where maximum temperature goes up to 44.7°C during summer and minimum as low as 2.9 °C. The mean annual rainfall of area is 700-800 mm. The experiment treatments consisted of nine fertility management practices namely; FYM @20 t/ha (Absolute Organic with FYM), FYM @ 10 t/ha + 50% NPK, FYM @ 15 t/ha + 25% NPK, FYM @ 5 t/ha + 75% NPK, VC @10 t/ha (Absolute Organic with VC), VC @ 5 t/ha + 50% NPK, VC @7.5 t/ha + 25% NPK, VC @ 2.5 t/ha + 75% NPK and 100% NPK (Absolute Chemical). The recommended dose for mustard through chemical fertilizer was 80 kg N, 60 kg P_2O_5 and 20 kg K_2O ha ^{1}. Half of the nitrogen was applied in the form of urea as a basal dose and remaining was top dressed after 1st irrigation at 30 DAS. Full dose of phosphorus and potash applied as single supper phosphate and mutate of potash at the time of sowing; while, 100% N was applied through FYM @10t ha^{-1}(0.8% N, 0.30% P and 0.45% K) and 100% vermicompost @5 t ha^{-1} (1.56% N, 1.0% P and 0.8% K) as per treatments. Soil of the experimental site was alluvial, sandy clay loam in texture and classified as Typic Us ochrepts at great group level. Observations on the grain yield and straw yield was recorded in per plot and further converted into per hectare basis.

Results and Discussion

Grain and straw yield

The data illustrated in Table 1 and Figure 1 showed the effect of graded doses of organic and chemical sources of nutrients and their combinations on yield of mustard in *Rabi* 2020-21 and 2021-22. The grain and straw yield of mustard was found significantly higher under the treatment T_6, where vermicompost @ 5 t ha^{-1} + 50% recommended dose of NPK was used, as compared to all the other treatments under study in both the years except the grain yield in treatment T_2 (FYM @10 t/ha + 50% NPK) was found at par with T_6, T_4 and T_8 in *Rabi* 2020-21 as compared to all the other treatments.

Table 1: Effect of organic and chemical sources of nutrients and their combinations on grain yield (kg ha^{-1}) and straw yield (kg ha^{-1}) of mustard

Treatments		Grain yield			Straw yield		
		2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T_1	FYM @20 t/ha (Absolute Organic with FYM)	1617	1625	1621	3505	3551	3528
T_2	FYM @ 10 t/ha + 50% NPK	2125	2136	2130	3948	4000	3974
T_3	FYM @ 15 t/ha + 25% NPK	1970	1980	1975	4345	4402	4374
T_4	FYM @5 t/ha + 75% NPK	2067	2077	2072	5162	5229	5196
T_5	VC @10 t/ha (Absolute Organic with VC)	1785	1794	1790	4708	4769	4738
T_6	VC @ 5 t/ha + 50% NPK	2206	2217	2211	5298	5367	5332
T_7	VC @ 7.5 t/ha + 25% NPK	1855	1865	1860	4402	4459	4430
T_8	VC @ 2.5 t/ha + 75% NPK	2056	2067	2061	5048	5113	5081
T_9	100% NPK (Absolute Chemical)	1876	1886	1881	5071	5137	5104
Sem.		52.1	48.8	35.7	21.0	21.3	14.9
CD (0.5%)		156.3	146.2	102.8	62.9	63.7	43.0

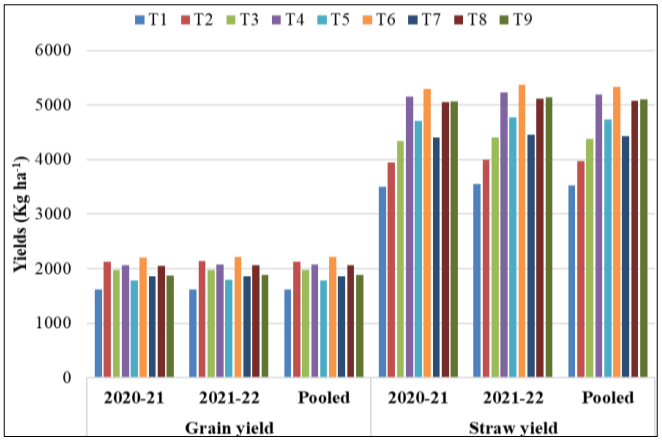

Fig 1: Effect of organic and chemical sources of nutrients and their combinations on grain yield and straw yield (kg ha ^{1}) of mustard

Economics of mustard

The data illustrated in Table 2 showed the effect of graded doses of organic and chemical sources of nutrients and their combinations on cost of cultivation, gross return, net return and benefit: cost ratio of mustard in *Rabi* 2020-21 and 2021-22. The cost of cultivation of mustard varies with the treatments. It was recorded highest under treatment T_5 and the lowest in the T_9. The gross and net return of mustard was found significantly higher under the treatment T_6, where vermicompost @ 5 t ha^{-1} + 50% recommended dose of NPK was used, as compared to all the other treatments under study in both the years. Whereas, the benefit: cost ration of mustard was recorded at par under T_2 (integration of FYM @ 10t ha^{-1} with 50 RDF), T_4 (integration of FYM @ 5 t ha^{-1} with 75% RDF), T_6 (integration of vermicompost @ 5 t ha^{-1} with 50 RDF), T_8 (integration of vermicompost @ 2.5 t ha^{-1} with 75% RDF) and T_9 (absolute chemical) but these treatments were found significantly higher as compared to treatments with absolute FYM or Vermicompost or their integration with 25% RDF.

Independent use of neither the chemical fertilizers nor the organic sources can sustain the fertility of soil and productivity of crops in high input production system (Thaneshwar*et al.*, 2017) [17]. The balanced nutrient management practices contributed to a great extent influencing the seed yield of mustard (Kumar *et al.*, 2018) [6].When organic fertilizer is coupled with organic manures, its effectiveness is greatly increased (FYM and vermicompost). It's possible that the balanced C:N ratio and the enhanced vegetative development improved the production of carbohydrates, which eventually increased yield. The findings of Satyajeet and Nanwal (2007) [13] and Parihar *et al.*, (2010) [8] are closely in line with the current trend of rising yield. In the early growth stages of the crop, the need for nitrogen is met by the application of urea, an inorganic form of nitrogen, and in the later growth stages of the crop, all of the plant nutrients are released from FYM, which has had a significant positive impact on yield and supplied plant nutrients throughout the period of crop growth. Agarwal and Kumar (1995) [2] and the good effect of combined application of FYM and liming improving acid soil condition for generating better seed yield of mustard similar

results found by Saha*et al*., (2010) [11]. FYM increase the adsorptive power of soil for cations and anions particularly phosphates and nitrates. These adsorbed ions are released slowly for the benefit of not only to the current crop but also to succeeding crops (Singh *et al*., 2013) [16] The controllable release of nutrients in the soil was caused by the mineralization of organic manure may have promoted improved crop development and resulted in an increase in yield when inorganic fertilizer and organic manure were applied together (Archarya*et al.*, 2012; Shahid*et al.*, 2013; Prasad *et al.*, 2014) [1, 14, 9]. The efficacy of inorganic fertilizer in improving grain yields was much pronounced when it was combined with organic manures (Pratap *et al.*, 2008) [10]

Table 2: Effect of organic and chemical sources of nutrients and their combinations on Cost of cultivation (₹ ha^{-1}), Gross return (₹ ha^{-1}), net return (₹ ha^{-1}) and B: C Ratio of mustard

Treatments		Cost of cultivation			Gross return			Net return			B:C Ratio		
		2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
T_1	FYM @20 t/ha (Absolute Organic with FYM)	34430	35030	34730	80293	82796	81544	45863	47766	46814	1.33	1.36	1.35
T_2	FYM @10 t/ha + 50 % NPK	31300	31900	31600	103902	107169	105535	72602	75269	73935	2.32	2.36	2.34
T_3	FYM @15 t/ha + 25 % NPK	32865	33465	33165	98045	101098	99571	65180	67633	66406	1.98	2.02	2.00
T_4	FYM @5 t/ha + 75 % NPK	29735	30335	30035	104348	107568	105958	74613	77233	75923	2.51	2.55	2.53
T_5	VC @10 t/ha (Absolute Organic with VC)	36430	37030	36730	90766	93556	92161	54336	56526	55431	1.49	1.53	1.51
T_6	VC @5t/ha + 50 % NPK	32300	32900	32600	110838	114268	112553	78538	81368	79953	2.43	2.47	2.45
T_7	VC @7.5 t/ha + 25 % NPK	34365	34965	34665	93101	95985	94543	58736	61020	59878	1.71	1.75	1.73
T_8	VC @2.5 t/ha + 75 % NPK	30235	30835	30535	103606	106809	105208	73371	75974	74673	2.43	2.46	2.45
T_9	100 % NPK (Absolute Chemical)	28170	28770	28470	95709	98676	97192	67539	69906	68722	2.40	2.43	2.41
S.Em.					2271	2186	1576	2271	2186	1576	0.08	0.08	0.06
CD (0.5 %)					6808	6554	4540	6808	6554	4540	0.24	0.23	0.16

Conclusion

Field experiments were carried out during *Rabi* 2020-21 to *Rabi* 2021-22 to assess the effect of organic and chemical sources of nutrients and their combinations on mustard in Incept sols of Gird region of Madhya Pradesh. The principal findings revealed that the integrated application of vermicompost (@5 t/ha with 50% NPK gave significantly higher grain yield and straw yield of mustard followed by FYM @10 t/ha with 50% NPK, respectively. In which the integrated application of vermicompost (@5 t/ha with 50% NPK gave higher net return and B:C ratio of mustard recorded in FYM @5 t/ha with 75% NPK, respectively.

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References

1. Acharya R, Dash AK, Senapati HK. Effect of integrated nutrient management on microbial activity influencing grain yield under rice-rice cropping system in an acid soil. Asian J Microbiology, Biotechnology and Environmental Sciences. 2012;14:365-368.
2. Agarwal RK, Praveen K. Integrated nutrient management in drylands. In: R.P. Singh, Sustainable Development of Dryland Agriculture in India. Scientific Publisher, Jodhpur; c1995. p. 139-156.
3. Arya V, Trivedi SK, Tomar PS, Verma SK, Singh M. Impact of integrated nutrient management on production and economics under pearl millet-mustard cropping sequence in Inception; c2022.
4. Economic Survey (2021-22), Statistical Tables, Ministry of Finance, Government of India; c2021.
5. Krishnakumar S, Saravanan A, Natarajan SK, Veerabadram V, Mani S. Microbial population and enzymatic activity as influenced by organic farming. Res J AgricBiol Sci. 2005;1:85-88.
6. Kumar S, Yadav KG, Goyal G, Kumar R, Kumar A. Effect of organic and inorganic sources of nutrients on growth and yield attributing characters of mustard crop (*Brassica juncea* L.). International Journal of Chemical Studies.2018;6(2):2306-2309.
7. Meena MD, Joshi PK, Jat HS, Chinchmalatpure AR, Narjary B, Sheoran P, *et al*. Changes in biological and chemical properties of saline soil amended with municipal solid waste compost and chemical fertilizers in a mustard–pearl millet cropping system. Catena. 2016;140:1-8.
8. Parihar CM, Rana KS, Parihar MD. Crop productivity and nutrient up take of pearl millet (*Pennisetum glaucum*) Indian mustered (*Brassica juncea*) cropping system as influenced by land configuration and direct and residual effect of nutrient management. Indian Journal of Agricultural Sciences. 2009;79(11):927-30.
9. Prasad SK, Singh MK, Singh Renu. Effect of nitrogen and zinc fertilizer on pearl millet under agri-hortisystem of eastern Uttar Pradesh. The Bioscan. 2014;9(1):163-166.
10. Pratap R, Sharma OP, Yadav GL. Effect of integrated nutrient management under varying levels of zinc on pearl millet yield. Annals of Arid Zone. 2008;47(2):197-199.
11. Saha R, Mishra VK, Majumdar B, Laxminarayan K, Ghosh PK. The effect of integrated nutrient management on soil physical properties and crop productivity under a maize-mustard cropping sequence in acidic soils of northeast India. Communications in Soil Science and Plant Analysis.2010;41(2):187-200.
12. Saha S, Prakash V, Kundu S, Kumar N, Mina BL. Soil enzymatic activity as affected by long term application of farm yard manure and mineral fertilizer under a rainfed soybean–wheat system in NW Himalaya. European Journal of Soil Biology. 2008;44(3):309-315.

13. Satyajeet, Nanwal RK. Integrated nutrient management in pearl millet-mustard cropping system. J Fertilizers. 2007;3(4):59-62.
14. Shahid M, Nayak AK, Shukla AK, Tripathi R, Kumar A, MohantyS, *et al*. Long term effect of fertilizer and manure applications on soil quality and yields in a sub-humid tropical rice-rice system. Soil Use and Management. 2013;29:322-332.
15. Shroff VN, Devasthali S. Earthworm farming-scope and limitations, In: Proceedings of National Seminar on Natural Farming; c1992. p. 126-142
16. Singh R, Gupta AK, Tulasa R, Choudhary GL, Sheoran AC. Effect of integrated nitrogen management on transplanted pearl millet (*Pennisetum glaucum* L) under rainfed condition. Indian Journal of Agronomy. 2013;58(1):81-85.
17. Thaneshwar Singh, Prakash V, Kumar J, Kumar M, Singh SRK. Effect of Integrated Nutrient Management on Growth and Yield of Mustard (*Brassica juncea* L.) in Irrigated Condition of Upper Gangetic Plain Zone of India. International Journal of Current Microbiology and Applied Sciences. 2017;6(1):922-932.