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Nutrient content, Nutrient Uptake and Nutrient use efficiency of Double Zero Indian Mustard (PDZM-31) as effected by different Nutrient Management Practices

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ABSTRACT: A field experiment was conducted at Meerut, Uttar Pradesh, to assess the effect of different nutrient management practices on nutrient content, nutrient uptake and nutrient use efficiency of Indian mustard (*Brassica juncea* L.). Increment in use of inorganic fertilizers without inclusion of organic nutrient sources has intensified nutrient deficiencies of major and micro nutrients in plants. It also has degraded the soil health and pollution in environment. Integration of major and micronutrients with organic manures sustains the soil health and stabilizes the crop production by improving productivity. Standardization of Integrated Nutrient Management approach involving FYM, biofertilizers and inorganic fertilizers can maintain soil health and sustain crop productivity. Indian mustard cultivar Pusa Mustard 31(PDZM -31) was grown during winter (*rabi*) season of 2020-21. The treatments comprised of Control (T_1), 100% N (T_2), 100% NP (T_3), 100% NPK (T_4), 125%NPK (T_5), 100% NPK+ S@40kg ha^{-1} (T_6), 100%NPK+ Zn @5kg ha^{-1} (T_7), 100% NPK + B @1kg ha^{-1} (T_8), 75% NPK+ VC @ 2t ha^{-1} (T_9), 75%NPK+FYM @ 6t ha^{-1} (T_{10}), 75% NPK + VC @ 2t ha^{-1}+ Azotobacter (T_{11}) and 75% NPK + FYM @ 6t ha^{-1} + Azotobacter (T_{12}) and analysed in RBD comprising of 3 replications. Results revealed that treatments T_{11} and T_{12} had significant influence on Nutrient content, Nutrient uptake by seed and stover and on Nutrient use efficiency of Indian mustard.

Keywords: Nutrient management, Nutrient content, Nutrient uptake, Nutrient use efficiency, Double zero Indian mustard.

INTRODUCTION

Indian mustard (*Brassica juncea* L.) is commonly known as *raya* or *laha*. It is an important oilseed crop in the world. It plays an important role in meeting edible oil demand of the country. Indian mustard is chiefly cultivated in Uttar Pradesh, Rajasthan, Madhya Pradesh, Haryana, and Gujarat. Its cultivation is also being extended to non-traditional areas of cultivation in southern states like Karnataka, Tamil Nadu and Andhra Pradesh.

Among the various cultivated oilseed crops, the contribution of Rapeseed and Mustard is around 26%. Rapeseed and Mustard is grown on an area of 6.9 million hectares, 73.41 Mt of production and 1.03 Mt ha^{-1} productivity in India (Anonymous 2021). India is ranked third after Canada and China sharing about 11.0% of the global rapeseed-mustard production (72.41 mt) and 24.7% and 29.4% in terms of area and production, respectively, of oilseeds in India during 2018-19. The estimated demand of oilseeds by 2030 is 82-101 mt and contribution of rapeseed-mustard is projected to be 16.4-20.5 mt, accounting its share of 20-25% in production (Chauhan *et al*., 2020).

Technical constraints such as lack of implementation of improved cultural practices, cultivation on lands with low fertility status and economical constraints such as exploitation by middlemen followed by high market prices are some of the major constraints for mustard production in India. Added to this is the use of high yielding varieties of mustard which has led to increased depletion of nutrients from the soil. Consumption of nutrients have remained lower as compared to their removal. This imbalance between nutrient availability, supply and removal cannot be overcome by application of fertilizer alone. This can be achieved through improvisation of Nutrient Use efficiency through balanced and integrative use of different nutrients. Enhancing Nutrient use Efficiency can build up soil fertility which in turn leads to better productivity of the crop. Integration of major and micronutrients with organic manures sustains the soil health and stabilizes the crop production by improving productivity. Standardization of Integrated Nutrient Management approach involving FYM, biofertilizers and inorganic fertilizers can maintain soil health and sustain crop productivity. Among the various agronomic factors that are known to enhance crop production, fertilizer and nutrient management play a significant role. The efficiency of fertilizer nitrogen is only 40-50%, phosphorous 15-20% and Sulphur 10-12% in Indian soils and this could be enhanced by efficient use of inputs (Hegde *et al.,* 2004). The soil quality improves with the application of organic manures like FYM, leaf compost and Vermicompost (Meena *et al.*, 2014). Nutrient uptake by mustard and nutrient use efficiency increases due to integrated nutrient management practices (Shekhawat *et al*., 2012). Integrated application of FYM, PSM and Azospirillum promotes significantly higher nutrient uptake in mustard (Singh *et al.*, 2014).

The nutrient requirement of Indian mustard, in general is high and inadequate nutrient use often leads to low productivity of the major nutrient elements, which is insufficient in most of the Indian soils, plays appreciably an important role in *Brassica juncea*. Knowledge of the concentration of the dosage of plant nutrients in a crop and the amount of nutrients removed by a particular crop from the soil may be a useful guide for the recommendation of a sound nutrient management Programme. Use of chemical fertilizers in combination with organic manure is essentially required to improve the soil health (Prasad *et al.,* 2017). Chemical fertilizers alone cannot sustain the desired levels of crop production under continuous farming. Integrated nutrient management is very essential as it not only sustains crop production (Verma *et al*., 2016) but also improves soil health and ensures safe environment (Babu *et al.*, 2017). For sustainable crop production, integrative effect of organic, inorganic and bio-fertilizers is important. Biofertilizers and organic manures play a significant role in sustaining soil health. Nitrogen, phosphorous and potassium as major nutrients and Sulphur, boron among the secondary nutrients play an important role in influencing the yield and quality of mustard. Moreover, balanced fertilization is an important aspect of crop production technology. The balanced nutrient management through conjunctive use of organic, inorganic and biofertilizers facilitate profitable and sustainable crop production and maintain soil quality (Singh and Sinsinwar 2016). There is a great scope for enhancing the production of Indian mustard by increasing the area under cultivation and improvising its productivity by the application of organic manures (FYM) with balanced fertilization keeping in view, the soil fertility status and soil health.

Though some information about mustard nutrition is available but the role of nutrient use efficiency on effecting the productivity of crop under the influence of different organic, inorganic nutrients and biofertilizers needs to be worked out. The suitable treatment of different nutrients with appropriate dosages is to be worked out to understand nutrient uptake, availability and achieve maximum yield.

MATERIAL AND METHODS

The experiment was carried out at Crop Research Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) to study the influence of different nutrient management practices on productivity and profitability of Double Zero Indian Mustard in Randomized Block Design with 12 treatments, replicated three times. The maximum and minimum temperatures recorded were 35.21°C and 4.89°C during the crop growth period. Maximum temperature ranged from 18.13°C to 34.01°C during maturity phase of the crop. Relative humidity varied from 26.57%to94.86%during crop growth period. The area receives mean annual rainfall of 845mm. The soil of the experimental field was sandy loam in texture, lowin available nitrogen (220.7 kg ha^{-1}) and organic carbon (0.48%), medium in available phosphorous (13.8 kg ha^{-1}) and potassium (247.2 kg ha^{-1}) and slightly alkaline (pH 7.8) in reaction with electrical conductivity of 0.22 dSm^{-1}. The gross and net plot size were 6m × 4.5m and 4.8m×2.7m respectively. The crop variety Pusa Mustard 31(PDZM-31) was sown on 19 October 2020 and harvested on 20 March 2021. The seed rate was 5 kg ha^{-1}. Seeding was done in the row to row spacing of 45 cm and plant to plant spacing of 15cm. There commended dose of nitrogen (120kgha^{-1}) was applied in two equal split, the half as basal and the remaining half was top dressed 2 times at the time of first and second irrigation. The whole quantity of potassium (40 kg ha^{-1}) was applied as basal dose through Murate of Potash at 8-10 cm depth along with half dose of nitrogen prior to sowing. Phosphorous was applied as basal dose (60kgha^{-1}) through DAP. Vermicompost and FYM were applied in the field as per treatments at the time of sowing. The sulphur was applied through Gypsum in the field as per treatments. Boron was applied through borax at the time of sowing. Zinc was applied at the time of sowing in the form of Zinc sulphate.

The seed was treated with Azotobacter@200g/10kg seed which was applied as per treatments before the sowing. One thinning was done after 30 days of sowing to maintain a plant-to-plant distance of about 15 cm. Weeding and hoeing operation were performed manually after first and second irrigation at proper soil moisture condition of the soil. The observations recorded included Seed yield (q ha^{-1}), Stover yield (q ha^{-1}), Biological yield (q ha^{-1}), Harvest index (%), N (%), P (%), K (%), S (%), B (ppm) and Zn (ppm) content in seed and stover, N, P, K, S, B and Zn uptake by seed and stover, Nutrient use efficiency of Nitrogen, Phosphorous and Potassium. Indian mustard plants were collected treatment wise for determination of N, P, K content in grain and stover. Five Indian mustard plants having intact leaves (dry and green) were selected randomly from sample row (2^{nd} row of plot) of each plot. The plants were chopped (2mm size), homogenized and a representative sample was dried at 70°C for 72 hrs to make it free from moisture. Similar procedure was adopted for the analysis of the grain samples also. Nitrogen was determined by Kjeldahl's method as described by Piper (1960). Well ground seed and straw samples were digested in diacid mixture on HNO_3 and $HClO_4$ (4:1) and P concentration in the extract was estimated calorimetrically by method as described by Chapman and Pratt (1961). Potassium concentration in the diacid extract was determined by flame photometrically as per procedure given by Black (1965). Sulphur in the extract can also be estimated by a colorimetric method using bariumchromate. Digestion of samples was done by di-acid mixture using double distilled water. The zinc content in seed and stover was estimated with atomic absorption spectrophotometer (AAS) by Lindsay and Norvell (1978) method. The plant samples were analyzed for available B, by extracting with hot 0.02M $CaCl_2$ (Aitken and Callum 1987). In this method, 5 mL of plant extract, 2 mL of buffer and 2 mL of azomethine-H indicator was added to the tube and volume was made upto 10mL with distilled water. After 2h, absorbance was taken at 420 nm with spectrophotometer. Nutrient uptake was calculated by multiplying nutrient content with yield and correction factor divided by 100. Agronomic efficiency is calculated by the following formula where Y_t is yield under test treatment (kg ha^{-1}), Y_0 is yield under control (kg ha^{-1}) and A_t is units of nutrient applied in the test treatment.

$$AE = \frac{Y_t - Y_o}{A_t}$$

The Physiological efficiency (PE) indicates the ability of crop to transform acquired nutrient into economic yield and expressed as kg of grains produced per kg of nutrient absorbed. It is calculated by the following formula where Y_t is yield under test treatment (kg ha^{-1}), Y_0 is yield under control (kg ha^{-1}), U_t is uptake under test treatment, U_o of nutrient in control.

$$PE = \frac{Y_t - Y_o}{U_t - U_o}$$

Partial factor productivity indicates productions of a crop in comparison to its nutrient input. It is expressed ask g of grains produced per kg of nutrient applied and is worked out as

$$PFP = \frac{Y}{N}$$

Statistical analysis of the data was done as per the standard analysis of variance technique for the experimental designs following SPSS software-based programme, and the treatment means were compared at $P< 0.05$ level of probability using t-test and calculating CD values.

RESULT AND DISCUSSION

Nutrient content in seed and stover. Data regarding the influence of different nutrient management practices on N, P, K, S, Zn and B content per cent in seed and stover during *rabi* season 2020-21 in mustard crop is presented in Table 1.

Table 1: Influence of different nutrient management practices on seed and stover content in Indian mustard.

Sr. No.	Seed yield (q/ha)	N content (%)		P content (%)		K content (%)		S content (%)		Zn content (ppm)		B content (ppm)	
		Seed	Stover	Seed	Stover	Seed	Stover	Seed	Stover	Seed	Stover	Seed	Stover
T_1	8.89	3.19	1.26	0.55	0.20	0.75	1.17	0.49	0.21	43.35	38.04	22.04	120.90
T_2	13.79	3.40	1.34	0.57	0.21	0.93	1.34	0.51	0.23	47.26	39.32	24.14	121.85
T_3	16.75	3.41	1.35	0.62	0.22	0.94	1.36	0.51	0.23	47.30	38.29	25.38	122.86
T_4	18.77	3.40	1.36	0.64	0.22	0.97	1.45	0.51	0.24	47.41	38.74	25.33	123.70
T_5	22.38	3.43	1.39	0.66	0.24	1.33	1.61	0.52	0.25	48.01	39.32	25.84	124.42
T_6	21.96	3.39	1.38	0.63	0.25	1.23	1.46	0.62	0.33	49.32	39.63	26.38	124.40
T_7	20.17	3.37	1.37	0.61	0.21	1.21	1.44	0.57	0.23	56.05	66.05	26.53	124.97
T_8	18.37	3.38	1.36	0.62	0.23	1.22	1.46	0.53	0.23	49.65	40.03	41.09	285.89
T_9	20.07	3.44	1.42	0.65	0.25	1.27	1.56	0.52	0.25	49.21	40.98	28.85	136.14
T_{10}	20.67	3.45	1.43	0.66	0.27	1.27	1.55	0.52	0.24	49.52	40.24	28.65	136.65
T_{11}	22.54	3.46	1.44	0.67	0.29	1.29	1.56	0.53	0.25	50.24	40.40	29.02	137.79
T_{12}	22.66	3.48	1.45	0.68	0.30	1.30	1.57	0.53	0.26	49.85	40.53	29.43	138.26
SEm ±	**0.48**	**0.01**	**0.02**	**0.01**	**0.01**	**0.01**	**0.01**	**0.003**	**0.008**	**0.15**	**0.15**	**0.19**	**0.28**
CD (P=0.05)	**1.41**	**0.04**	**0.05**	**0.04**	**0.03**	**0.05**	**0.03**	**0.008**	**0.024**	**0.44**	**0.44**	**0.57**	**0.83**

Among the different nutrient combinations, it can be observed that the maximum N content in seed and stover was found in T_{12} and was statistically at par with T_9, T_{10} and T_{11}. Significantly higher P content in seed (0.68%) was found in treatment T_{12} which was found to be statistically at par with T_4, T_5, T_9, T_{10} and T_{11}. T_{12} recorded maximum P content (0.30 %) in stover which was statistically at par with T_{10} and T_{11}. Treatment T_5 showed maximum K content (1.33%) in seed which remained at par with T_{11} and T_{12} whereas, T_5 recorded significantly higher K content in stover. Treatment T_6 recorded significantly higher S content (0.62 %) in seed and stover than rest of the other treatments. Treatment T_7 exhibited maximum Zn content (56.05 %) in seed and stover which was significantly higher than other treatments. Treatment T_8 exhibited maximum B content (41.09 ppm) in seed and stover which was significantly higher than rest of the treatments. The lowest N, P, K, S, Zn & B content in seed and stover was recorded in T_1 (Control).

Nutrient uptake. Treatment T_{12} exhibited maximum nitrogen uptake by seed (78.8kg ha^{-1}) and total uptake (187.8 kg ha^{-1}) which was found to remain at par with T_5, T_6 and T_{11}. Maximum phosphorous uptake by seed (15.4 kg ha^{-1}) was exhibited by T_{12} which was found to remain at par with $T_5$and T_{11}. Total uptake(37.9 kg ha^{-1})

was significantly higher in ttreatment T_{12} which was found to remain at par with T_{11}. Among the various treatments, T_5 exhibited maximum potassium uptakebe seed (29.7 kg ha^{-1}), stover (123.0 kg ha^{-1}) and total uptake (152.7 kg ha^{-1}) which was at parwith T_{11} and T_{12}. The maximum sulphur uptake by seed (13.6 kg ha^{-1}) and total uptake (38.9 kgha^{-1}) was found in treatment T_6 which was significantly higher than other treatments. The maximum zinc uptake by seed (133.3 gha^{-1}) and total up take (489.2gha^{-1}) was found in treatment T_7(100%NPK+Zn@5kgha^{-1})which was significantly higher than other treatments. Treatment T_8 (100%NPK +B@1kgha^{-1}) exhibited maximum boron uptake by seed(75.5gha^{-1}) and total uptake(1930.2gha^{-1}). The lowest Total uptake of N, P, K, S, Zn and B was obtained in T_1. The results might be owing to super optimal supply of nutrient sources to crops as well as due to indirect effect resulting from reduced loss of organically supply nutrients this finding is confirmed with Chaturvedi *et al.* (2010). Total uptake of potassium and sulphur by mustard was higher under soil test recommendations of NPK + FYM which might be due to higher availability of the plant nutrients from the soil reservoir and additional quantity of the nutrients supplied by FYM. Higher biomass production may be the most pertinent reasoning for higher uptake of nutrients in the treatments referred above supported by Arbad and Ismail (2011). Additional amount of nutrient supplied by biofertilizers or farmyard manure and the beneficial effects of organic matter addition attained in connection with the improvement in physico-chemical properties of the soil was the reason for higher uptake of nutrient **(**Das *et al.*, 2010). The results of present study are in close conformity with the findings of Brar *et al.* (2016); Bijarnia *et al*. (2017); Bisht *et al.* (2018); Sahoo *et al*. (2018).

Table 2: Influence of different nutrient management practices on nutrient uptake in Indian mustard.

Sr. No.	N uptake		P uptake		K uptake		S uptake		Zn uptake		B uptake	
	Seed	total	Seed	Total	Seed	Total	Seed	Total	Seed	Total	Seed	Total
T_1	27.1	69.1	4.9	14.4	6.6	61.0	4.5	14.4	38.5	214.8	19.6	579.8
T_2	46.9	102.3	7.8	20.4	12.9	91.7	7.1	20.9	65.2	296.0	33.3	748.6
T_3	57.1	114.5	10.4	24.2	15.7	99.7	8.6	23.1	79.2	314.5	42.5	797.6
T_4	63.9	123.0	12.0	26.1	18.2	110.0	9.6	24.8	88.9	334.0	47.5	829.9
T_5	76.9	149.9	14.9	33.2	29.7	152.7	11.5	30.6	107.4	407.9	57.8	1008.7
T_6	74.5	146.7	13.8	32.8	27.1	138.9	13.6	38.9	108.3	409.1	57.9	1002.2
T_7	68.1	134.0	12.3	27.3	24.4	125.1	11.6	27.6	133.3	489.2	53.6	924.5
T_8	62.2	123.3	11.4	26.3	22.5	117.7	9.7	25.0	91.22	350.9	75.5	1930.2
T_9	69.0	139.1	13.1	31.0	25.6	136.4	10.5	28.7	98.7	388.9	57.9	1021.8
T_{10}	71.4	142.6	13.6	33.0	26.2	138.1	10.8	28.5	102.3	391.6	59.2	1041.6
T_{11}	78.0	152.4	15.2	37.3	29.1	146.1	12.0	31.2	113.2	415.0	65.4	1094.8
T_{12}	78.8	153.8	15.4	37.9	29.4	147.2	12.1	31.9	112.9	417.3	66.7	1105.0
SEm ±	1.7	3.0	0.48	1.05	0.81	3.01	0.2	0.7	2.3	8.19	1.4	27.7
CD (P=0.05)	5.0	8.9	1.42	3.09	2.39	8.85	0.8	2.1	6.76	24.05	4.3	81.4

Nutrient use efficiency

Nitrogen. Among the various treatments it can be seen that maximum Agronomic efficiency of nitrogen (12.42) was obtained by the application of 75% NPK+VC@2 tha^{-1} (T_9) whereas, the lowest Agronomic efficiency (1.68) was recorded in 100% NPK. Highest physiological efficiency (70.11) was recorded by the application of 100% NP (T_3) and next in order was T_4 and T_{12}. The lowest was physiological efficiency was obtained in T_2. Maximum partial factor productivity (25.17) was obtained in T_{12} which remained at par with T_{11}. However, the lowest partial factor productivity was recorded in T_2.

Highest Agronomic efficiency (30.59) was found in T_{12} which was at par with T_{11} whereas the lowest was obtained by the application of T_3. Similar trend was observed in case of Partial factor productivity of various treatments. Significantly higher Partial factor productivity was obtained by the application of 75% NPK + FYM@ 6t ha^{-1} + Azotobacter (T12) which was found to be statistically at par to T_{11} and the lowest PFP (27.91) was recorded in T_3. Physiological efficiency was found to be non-significant.

Potassium. Highest Agronomic efficiency (45.88) was found in T_{12} which was at par with T_{11} whereas the lowest (24.69) was obtained by the application of T_4. Similarly maximum Partial factor productivity (56.65) was found in T_{12} which was at par with T_{11} whereas the lowest (44.77) was obtained by the application of T_5. It can be observed that highest Physiological efficiency (85.84) was obtained in T_4 and lowest (30.96) was recorded in T_8.

The combined application of macro and micronutrients with farmyard manure and biofertilizer (Azotobacter) could increase the uptake of nutrients due to better microbial activity and root growth under affable soil physical condition created by farmyard manure. The result corroborated the findings of Kacchave and Hurgat (2000). The finding on the increase in content and uptake of nutrient by application of chemical fertilizers with FYM and biofertilizers are in agreement with the observations made by Singh *et al*. (2014); Sharma (2016); Reddy and Singh (2018); Rohit *et al.* (2019).

Table 3: Influence of different nutrient management practices on Nutrient use efficiency of Indian mustard Phosphorous.

Sr. No.	Agronomic efficiency			Physiological efficiency			Partial factor productivity		
	N	P	K	N	P	K	N	P	K
T_1	—	—	—	—	—	—	—	—	—
T_2	4.08	—	—	21.01	—	—	11.49	—	—
T_3	2.46	11.95	—	70.11	141.06	—	13.95	27.91	—
T_4	1.68	16.46	24.69	64.06	139.71	85.84	15.64	31.28	46.92
T_5	8.99	17.99	26.99	34.19	134.68	58.27	14.92	29.85	44.77
T_6	10.88	21.77	32.66	28.74	146.94	63.76	18.30	36.60	54.90
T_7	5.31	18.80	28.20	35.70	153.38	55.13	16.81	33.62	50.44
T_8	7.90	15.80	23.70	39.23	145.41	30.96	15.31	30.62	45.93
T_9	12.42	24.84	37.26	34.05	136.23	59.09	22.30	44.60	50.18
T_{10}	7.64	26.17	39.26	33.31	119.21	51.66	22.97	45.94	51.68
T_{11}	6.44	30.34	45.51	26.76	128.64	43.33	25.05	50.10	56.36
T_{12}	4.32	30.59	45.88	42.57	115.77	34.45	25.17	50.35	56.65
SEm ±	**0.43**	**0.93**	**1.35**	**2.88**	**8.10**	**3.14**	**0.43**	**0.89**	**1.20**
CD (P=0.05)	**1.27**	**2.77**	**4.06**	**8.50**	**NS**	**9.42**	**1.29**	**2.66**	**3.62**

CONCLUSIONS

It can be concluded that the integrated application of inorganic fertilizers, organic manures and biofertilizers gives better productivity in Indian mustard. Among the various nutrient management practices, treatment T_{11} (75% NPK + VC@ 2t ha^{-1} + Azotobacter) and T_{12} (75% NPK + FYM@ 6t ha^{-1} + Azotobacter) exhibited significant influence on nutrient content, nutrient uptake, nutrient use efficiency and productivity of Indian mustard.

FUTURE SCOPE

In terms of future scope of using vermicompost and inorganic fertilizers in mustard cultivation, there is likely to be continued interest in both options. Vermicompost is gaining popularity as an environment friendly and sustainable alternative to inorganic fertilizers. As consumers become more aware of the impact of chemicals on the environment and human health, the demand of organic food products is increasing, and the use of vermicompost may help meet this demand. However, inorganic fertilizers are likely to remain a popular option due to their efficiency and effectiveness in providing essential nutrients to plants. With advances in research and technology, there may be opportunities to develop more targeted and precise applications of inorganic fertilizers that can minimize waste and environmental impact. Overall, the future scope of using vermicompost and inorganic fertilizers in mustard cultivation will likely depend on arrange of factors, including consumer demand, environmental regulations, and technological advancements. Farmers and researchers will continue to explore the best ways to optimize crop yield and quality while minimizing the impact on the environment.

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REFERENCES

Aitken, R. L. and Callum, M. L. E. (1988). Boron toxicity in soil solution. *Australian Journal of Soil Research*, *26*, 605–610.

Anonymous (2021). Agricultural Statistics at a glance. Directorate of Economics and Statistics, Department of Agriculture, Cooperation and Farmers Welfare, Government of India.

Arbad, B. K. and Ismail, S. (2011). Effect of integrated nutrient management on soybean (Glycine max)–safflower (*Carthamus tinctorius*) cropping system. *Indian Journal of Agronomy*, *56*, 340-344.

Babu, M., Mastan, Reddy, C., Subramanyam, A. and Balaguravaiah, D. (2017). Effect of integrated use of organic and inorganic fertilizers on soil properties and yield of sugarcane. *Journal of the Indian Society of Soil Science*, *55*, 161-166.

Black, C. A. (1965). Methods of Soil Analysis Part-II, American Society of Agronomy, Madison, Wisconsin, U.S.A.

Bijarnia, A. L., Yadav, R. S., Rathore, P. S., Singh, S. P., Saharan, B. and Choudhary, R. (2017). Effect of integrated nutrient management and weed control measures on growth and yield attributes of mustard (*Brassica juncea* L.). *Journal of Pharmacognosy and Phytochemistry*, *6*(4), 483-488.

Bisht, S., Saxena, A. K. and Singh, S. (2018). Effect of integrated nutrient management on growth and yield of mustard (*Brassica juncea* L.) cultivar T-9 under Dehradun region (Uttarakhand). *International Journal of Chemical Studies*, *6*(4), 1856-1859.

Brar, A. S., Sidhu, P. S., Dhillon, G. S. (2016). Response of brown sarson (*Brassica campestris* var. brown Sarson) to integrated nutrient management in mid hill conditions of Himachal Pradesh. *International Journal of Agriculture Science*, *12*(2), 319-325.

Chaturvedi, S., Chandel, A. S., Dhyani, V. C. and Singh, A. P. (2010). Productivity, profitability and quality of soybean (*Glycine max*) and residual soil fertility as influenced by integrated nutrient management. *Indian Journal of Agronomy*, *55*, 133-137.

Chauhan, J. S., Choudhary, P. R., Pal, S. and Singh, K. H. (2020). Analysis of seed chain and its implication in rapeseed-mustard (*Brassica* spp.) production in *India Journal Oilseeds Research*, 37(2), 71-84.

Das, A., Patel, D. P., Munda, G. C. and Ghosh, P. K. (2010). Effect of organic and inorganic sources of nutrients on yield, nutrient uptake and soil fertility of maize (*Zea mays*) mustard (*Brassica campestris*) cropping system. *Indian Journal of Agricultural Sciences*, *80*, 85–88.

Hegde, D. M. and Sudhakara, Basu, S. N. (2004). Balanced fertilization for nutritional quality in oilseeds. *Fertilizer News*, *49*(4), 57-62, 65-66.

Kacchave, K. G. and Hurgat, S. B. (2000). Effect of different rates and sources of sulphur on yield, nutrient uptake and quality of mustard. *65th Annual convention of Indian Society of Soil Science*, 222.

Lindsay, W. L. and Norvell, W. A. (1978). Development of a DTPA soil test for zinc, iron, manganese and copper. *Soil Science Society of America Journal*, *42*, 421-448.

Meena, J. S., Verma, H. P. and Pancholi, P. (2014). Effect of fertility levels and biofertilizers on yield, quality and economics of cowpea. *Agriculture for Sustainable Development*, *2*(2), 162-164.

Piper, C. S. (1960). Soil and plant analysis. The University of Adelaide, Australia.

Prasad, J., Karmakar, S., Kumar, R. and Mishra, B. (2017). Influence of integrated nutrient management on yield and soil properties in maize in an alfisol of Jharkhand. *Journal of the Indian Society of Soil Science*, *58*(2), 200- 204.

Reddy, G. N. K. and Singh, R. (2018). Effect of integrated nitrogen management on the growth and yield of mustard (*Brassica juncea* L.). *Journal of Pharmacognosy and Phytochemistry*, *7*(3), 617-619.

Rohit, K., Akhila, N. D., Suhana, P.G. Anupam, D. and Sanjay, S. (2019). Impact of Integrated nutrient management on nutrient uptake of mustard crop. *International Journal of Chemical Studies*, *7*(3) 1284-1287.

Sharma, J. (2016). Influence of Vermicompost and Different Nutrients on Performance of Indian Mustard [*Brassica juncea* (L.) Czern and Coss] in Typic Haplustepts. M.Sc. (Ag.) Thesis, Maharana Pratap Agricultural University and Technology, Udaipur.

Shekhawat, K., Rathore, S. S., Premi, O. P., Kandpal, B. K. and Chauhan, J. S. (2012). Advances in agronomic management of Indian mustard (*Brassica juncea* L.). *International Journal of Agronomy*, *10*, 1-14.

Singh, R., Anil, K. S. and Pravesh, K. (2014). Performance of Indian mustard (*Brassica juncea* L.) in response to integrated nutrient management. *Journal of Agricultural Research*, *7*(2), 104-107.

Singh, R. and Sinsinwar, B. S. (2016). Effect of integrated nutrient management on growth, yield, oil content and nutrient uptake of Indian mustard (*Brassica juncea* L.) in eastern part of Rajasthan, *Indian Journal of Agricultural Sciences*, *76*(5), 322-324.

Singh, R., Singh, A. K. and Kumar. P. (2014). Performance of Indian mustard (*Brassica juncea* L.) in response to Integrated Nutrient Management. *Journal of Agricultural Research*, *1*(1), 9-12.

Verma, Gayatri, Mathur, A. K., Bhandari, S. C. and Kanthaliya, P. C. (2016). The long-term effect of integrated nutrient management on properties of a typic Haplustept under maize-wheat cropping system. *Journal of the Indian Society of Soil Science*, *58*(3), 299-302.

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