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RESEARCH PAPER

Studies on integrated nutrient management in mustard [*Brassica juncea* (L.) Czern & Cosson]

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Abstract : An experiment on integrated nutrient management in mustard [*Brassica juncea* (L.) Czern & Cosson] was conducted during *Rabi* season 2011-2012 at Students' Instructional Farm (SIF) of C.S. Azad University of Agriculture and Technology, Kanpur. Eight treatments replicated three were tested in Randomized Block Design. Result shows that significantly better growth attributes, yield attributes and grain yield (22.75 q/ha) were observed with combined application of RDF + vermicompost @ 5.0 t/ha over rest of the treatments. The minimum grain yield (19.15 q/ha) was received in treatment RDF (120:60:40:30 NPKS kg/ha). The application of RDF +vermicompost @ 5.0 t/ha also showed significantly higher gross income (Rs. 81575) and net profit (Rs. 35725) over rest of the treatments. While benefit : cost ratio was significantly higher (1.96) with the application of RDF (120:60:40: 30 NPKS kg/ha) over rest of the treatments except at par with RDF + vermicompost @ 2.0 t/ha. The minimum gross income (Rs. 69419/ha) was received in treatment RDF (120:60::40:30 NPKS kg/ha). While the minimum net income and B:C ratio was found in treatment RDF + FYM @ 6.0 t/ha.

Key Words : Integrated nutrient management, Mustard, Vermicompost, RDF, FYM

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INTRODUCTION

[*Brassica juncea* (L.) Czern & Cosson] is important edible oil in India next to groundnut. Rapeseed mustard oil is used primarily for cooking and these are species valued for vegetable, fodder, condiments and medicinal purposes. The Indian system of medicines referred to *Brassica compestris* as remedy for stomach and skin diseases, elephantiasis etc. Eruca oil is mostly used as lubricant. In India overall area under rape mustard has increased from 1.85 lac hectare to 67.17 lac ha. while the production is expected to jump by 12.32 lac tonnes to 71.12 lac tones. The average yield of rapeseed and mustard in country is 1103.0 kg/ha (The Solvent Extractors, Association of India *Rabi* Rapeseed mustard Crop Survey 2112-13). Due to continuous use of inorganic fertilizer resulted deterioration in soil health.

Major constraints responsible for low yield of rapeseed mustard in India are lack of high yielding biotic stress resistant varieties, cultivation under rainfed situation with imbalanced use of nutrient and poor dissemination of transfer of technology.

Integrated nutrient management (INM) involves efficient and judicious use of all the major components of plant nutrient sources *viz.*, chemical fertilizer in conjunction with animal manures, compost, green manures, legumes in cropping system, biofertilizer, crop residues or vegetable waste and other locally available nutrient sources for sustaining soil fertility, health and productivity.

Vermicompost is a good source of plant nutrient supply. It is a rich source of nitrogen (1.6%), phosphorus (0.54%), potash (0.80%), calcium (0.44%), magnesium (0.15%), sulphur

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(0.45%), zinc (24.43 ppm), iron (175.2 ppm), vitamins and growth hormones which enhance plant growth and microbial population. In contrary to synthetic fertilizers, vermicompost reduce soil toxicity by buffering action, prevent soil degradation and enhance soil fertility status.

Farm yard manure (FYM) supplies N, P and K in available farm to the plant through biological decomposition along with NPK, sulphur is a important secondary plant nutrient which is essential for proper growth and functioning of the plant. Mustard plant need sulphur in a great amount because of sulphur containing amino acid like methionine, cistine. It also result in consiberable amount of growth and yield of mustard alongwith an increase in the oil content of mustard varieties.

Keeping in view above facts, the present investigation was carried out with the objectives *viz.*, to find out effect of integration of inorganic and organic source of nutrition, suitable doses of nutrition and to assess the economics of the treatments.

MATERIAL AND METHODS

A field experiment was carried out during *Rabi* season 2011-12 at Students' Instructional Farm (SIF) of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) India. Experimental soil was loam in texture having 0.24 per cent organic carbon, 120.0 kg/ha available N, 12.0 kg available P, 183.04 kg available K with having pH 8.44. Eight treatments *viz.*, RDF (120 : 60 : 40 : 30 NPKS kg/ha), RDF + vermicompost @ 2.0 t/ha, T_3 : RDF + vermicompost @ 3.0 t/ha, RDF + vermicompost @ 5.0 t/ha, RDF + vermicompost @ 2.0 t/ha + FYM @ 3.0 t/ha, RDF + vermicompost @ 2.0 t/ha + FYM @ 4.0 t/ha, RDF + vermicompost @ 2.0 t/ha + FYM @ 5.0 t/ha and RDF + FYM @ 6.0 t/ha were replicated three times in Randomized Block Design. The crop was fertilized with organic manures like FYM and vermicompost which were applied 15-20 days before sowing. Thinning was done 15-20 days after sowing along with weeding. Two irrigations were given at flowering and pod formation stage. The weather during crop period was normal. In first week of January small quantity of rain (8.11 mm) and in first week of February 1.54 mm rainfall was received. The average temperature ranged 12.6^0-24.16^0C during crop period which was normal. The crop was harvested at physiological maturity on 22nd March, 2012. The data recorded regarding growth characters, yield attributes and yield were analysed with statistical analysis and significance of treatments were tested with the help of 'F' test.

RESULTS AND DISCUSSION

The data regarding growth characters *viz.*, plant height, fresh and dry weight of crop plant. number of branches and crop growth rate are summarized in Table 1. The highest plant height was recorded in RDF + vermicompost @ 5.0 t/ha (143.10 cm) followed by RDF + vermicompost @ 2.0 t/ha + FYM @ 5.0 t/ha (142.22) and the minimum plant height was recorded in only RDF (126.33 cm). Fresh and dry weight of plant was also found maximum (92.88 g and 24.37 g, respectively) in RDF + vermicompost @ 5.0 t/ha treatment and the minimum fresh and dry weight (51.66 g and 11.58 g, respectively) was recorded in RDF (120:60:40:30 NPKS kg/ha). Crop growth rate at 60 DAS and at 110 DAS was evaluated and maximum 0.355 g and 0.064 g per day, respectively was found in RDF + vermicompost @ 5.0 t/ha treatment and the minimum was recorded in RDF treatment (0.211 g and 0.018 g per day, respectively).

Yield attributes :

Data pertaining to yield attributes are summarized in Table

Table 1: Growth characters of mustard influenced by integrated nutrient management treatment

Sr. No.	Treatments	Plant height at maturity (cm)	Fresh weight/plant at maturity	Dry weight/ plant at maturity	Total no. of branches/ plant at maturity	Crop growth rate at 60 DAS	crop growth rate at 110 DAS
1.	RDF (120:60:40:30 NPKS kg/ha)	126.33	51.66	11.58	8.79	0.211	0.018
2.	RDF + vermicompost @ 2.0 t/ha	131.55	57.10	14.35	10.52	0.236	0.023
3.	RDF + vermicompost @ 3.0 t/ha	132.99	65.88	17.74	11.50	0.253	0.050
4.	RDF + vermicompost @ 5.0 t/ha	143.10	92.88	24.37	19.64	0.355	0.064
5.	RDF + vermicompost @ 2.0 t/ha + FYM @ 3.0 t/ha	139.33	70.77	18.96	12.77	0.272	0.052
6.	RDF + vermicompost @ 2.0 t/ha + FYM @ 4.0 t/ha	139.66	78.24	19.48	14.45	0.292	0.060
7.	RDF + vermicompost @ 2.0 t/ha + FYM @ 5.0 t/ha	142.22	83.18	20.89	16.97	0.316	0.058
8.	RDF + FYM @ 6.0 t/ha	131.10	54.5	13.25	9.7	0.217	0.024
	SE (d)	4.70	2.34	1.31	0.53	–	–
	C.D. (P=0.05)	10.08	5.03	2.81	1.15	–	–

2. The number of siliqua per plant was found maximum (286.53) in RDF + vermicompost @ 5.0 t/ha treatment followed by RDF + vermicompost @ 2.0 t/ha + FYM @ 5.0 t/ha (281.35) but were found at par and the minimum siliqua per plant *i.e.* 225.34 was recorded in RDF treatment deferred significantly among other treatments. The siliqua length was recorded minimum (4.36 cm) in RDF treatment and maximum (4.66 cm) in RDF + vermicompost @ 5.0 t/ha. Weight of siliqua in g per plant was also recorded in similar manner, highest weight of siliqua per plant (125.29 g) was recorded in RDF + vermicompost @ 5.0 t/ha followed by RDF + vermicompost @ 2.0 t/ha + FYM @ 5.0 t/ha (116.60 g) and the minimum weight of siliqua per plant *i.e.* 77.21 g per plant was recorded in RDF (control treatment). Number of seeds per siliqua was recorded maximum in (12.81) in RDF + vermicompost @ 5.0 t/ha and the minimum seeds per siliqua (11.75) recorded in RDF treatment differed significantly. The data regarding other treatments were significantly at par. Maximum seed weight per plant (12.99 g) was recorded in RDF + vermicompost @ 5.0 t/ha followed by RDF + vermicompost @ 2.0 t/ha + FYM @ 5.0 t/ha (11.37 g) and minimum seed weight per plant (7.54 g) was recorded in RDF (control treatment) differed significantly. The maximum test weight (3.71 g) was recorded in RDF + vermicompost @ 5.0 t/ha followed by RDF + vermicompost @ 2.0 t/ha + FYM @ 5.0 t/ha (3.65 g) and RDF + vermicompost @ 2.0 t/ha + FYM @ 4.0 t/ha (3.56) were significantly at par and minimum test weight was recorded (3.20 g) in RDF (control treatment).

Yield and economics :

Data regarding yield and economics are summarized in Table 3. The biological and grain yield of mustard showed significant impact of integrated nutrient management treatment. The maximum biological and grain yield, 102.41 q/ha and 22.75 q/ha, respectively was obtained by integrated

Table 2: Yield attributes of mustard influenced by integrated nutrient management treatment

Sr. No.	Treatments	Total no. of siliqua/ plant	Siliqua length (cm)	Weight of siliqua/plant (g)	No. of seeds/ siliqua	Seed weight/ plat (g)	Test weight (g)
1.	RDF (120:60:40:30 NPKS kg/ha)	225.34	4.36	77.21	11.75	7.54	3.20
2.	RDF + vermicompost @ 2.0 t/ha	241.38	4.44	86.30	12.28	9.53	3.30
3.	RDF + vermicompost @ 3.0 t/ha	248.50	4.46	93.33	12.25	9.98	3.40
4.	RDF + vermicompost @ 5.0 t/ha	286.53	4.66	125.29	12.81	12.99	3.71
5.	RDF + vermicompost @ 2.0 t/ha + FYM @ 3.0 t/ha	260.50	4.52	96.79	12.52	10.16	3.51
6.	RDF + vermicompost @ 2.0 t/ha + FYM @ 4.0 t/ha	265.22	4.60	112.96	12.57	11.01	3.56
7.	RDF + vermicompost @ 2.0 t/ha + FYM @ 5.0 t/ha	281.35	4.64	116.60	12.68	11.37	3.65
8.	RDF + FYM @ 6.0 t/ha	235.26	4.39	82.20	11.95	8.37	3.26
	SE (d)	12.67	0.07	5.0	0.31	0.49	0.14
	C.D. (P=0.05)	27.18	0.15	10.95	0.66	1.05	0.30

Table 3: Yield and economics of mustard influenced by integrated nutrient management treatment

Sr. No.	Treatments	Grain yield (q/ha)	Stover yield (q/ha)	Biological yield (q/ha)	Gross income (Rs/ha)	Harvest index (%)	Net profit (Rs/ha)	Benefit : cost ratio
1.	RDF (120:60:40:30 NPKS kg/ha)	19.15	57.45	76.60	69419.00	25.00	34049.00	1.96
2.	RDF + vermicompost @ 2.0 t/ha	20.15	64.48	84.63	73447.00	23.80	33837.00	1.85
3.	RDF + vermicompost @ 3.0 t/ha	20.25	68.26	88.01	75820.00	23.31	34210.00	1.82
4.	RDF + vermicompost @ 5.0 t/ha	22.75	79.26	102.41	81575.00	21.83	35725.00	1.77
5.	RDF + vermicompost @ 2.0 t/ha + FYM @ 3.0 t/ha	20.95	71.23	92.18	76782.00	22.72	33812.00	1.78
6.	RDF + vermicompost @ 2.0 t/ha + FYM @ 4.0 t/ha	21.05	73.46	94.51	77337.00	22.27	33367.00	1.75
7.	RDF + vermicompost @ 2.0 t/ha + FYM @ 5.0 t/ha	21.23	76.68	97.98	78491.00	21.73	33281.00	1.73
8.	RDF + FYM @ 6.0 t/ha	20.03	61.68	81.91	72788.00	24.45	30938.00	1.73
	SE (d)	0.71	4.65	6.06	1177.21	0.13	678.18	0.05
	C.D. (P=0.05)	1.52	9.98	13.01	2531.55	0.29	1454.49	0.11

use RDF + vermicompost @ 5.0 t/ha followed by RDF + vermicompost @ 2.0 t/ha + FYM @ 5.0 t/ha (97.98 q/ha and 21.23 q/ha, respectively) and RDF + vermicompost @ 2.0 t/ha + FYM @ 4.0 t/ha (94.51 q/ha and 21.05 q/ha, respectively) were significantly at par. Integrated use of RDF + vermicompost @ 2.0 t/ha and 3.0 t/ha recorded grain yield of mustard were 20.15 q/ha and 20.25 q/ha, respectively and minimum grain yield of mustard was recorded 19.15 q/ha under recommended dose of fertilizers. Integration of vermicompost @ 2.0 t/ha and @ 3.0 t/ha and integration of FYM 6.0 t/ha with recommended dose of fertilizers did not show the significant impact in terms of grain yield of mustard compared to control treatment. However, integration of RDF + vermicompost @ 5.0 t/ha with recommended dose of fertilizer showed greater response in terms of grain yield of mustard compared to control treatment. Similar findings were reported by Chand and Ram (2007), Tripathi *et al.* (2010) and Premi *et al.* (2005).

The economic parameters like net profit showed greater response of integrated use of vermicompost @ 5.0 t/ha along with recommended dose of fertilizers and received highest net profit *i.e.* Rs. 35725. While integration of FYM @ 6.0 t/ha along with recommended dose of fertilizers received lowest net profit of Rs. 30938. Benefit : cost ratio of RDF (control treatment) was higher *i.e.* 1.96 than other integrated nutrient management treatment because of less investment. RDF + vermicompost @ 5.0 t/ha treatment recorded maximum grain yield evaluated Rs. 1.77 of net profit by investing Rs. 1.00. The findings are also in conformity of Rao (2003), Kumpawat (2004) and Ramesh *et al.* (2009).

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