

Original Research Article

<https://doi.org/10.20546/ijcmas.2018.709.444>

Effect of Organic Management Practices on Growth, Yield Attributes and Grain Yield in Mustard (*Brassica juncea* (L.) Czern. and Coss.)

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ABSTRACT

Keywords

FYM, Organic practices, Mustard, Productivity, Soil fertility, Economics

Article Info

Accepted:

24 July 2018

Available Online:

10 September 2018

The study was undertaken to evaluate the long-term effect of organic management practices against integrated use of nutrient sources and chemical fertilizer treatments on mustard productivity and soil fertility. The integrated use of nutrient sources *viz.*, 50% recommended doses of NPKS through chemical fertilizer and 50% N through FYM provided highest seed yield, yield attributes and total uptake of N, P, K which was at par to the 100% chemical fertilizer (NPKS) treatment. The organic treatments received 100% recommended N combinantly through FYM + neem cake + vermicompost (1/3 from each source) along with different management practices provided lower yields. The reduction in dose of nutrients (50% FYM along with bone meal, PSB and *Azotobacter*) provided significantly lower yield and nutrient (NPK) uptake. The regular application of 100% nutrients through organic sources (FYM + VC+ NC) showed appreciable increase in organic carbon and availability of nutrients (NPK) and higher decline in soil pH and EC as compared to INM and fertilizer treatments. The availability of nutrients in 100% NPKS through chemical fertilizers and INM treatment was at par. The higher profit was obtained in INM treatment followed by 100% chemical fertilizer treatment. The conjunctive use of organic sources and fertilizer (INM) proved conducive in sustaining soil fertility and productivity of mustard in long run.

Introduction

Indian mustard (*Brassica juncea* (L.) Czern. and coss.) belongs to the family Cruciferae. India is one of the largest mustard growing countries in the world, occupying the first position in area and third in production after China and Canada. It is most important winter (*Rabi*) oil seed crop in northern India. Among the seven edible oilseed crop cultivated in

India, rapeseed-mustard (*Brassica* Spp.) contributed about 25% in the total production of oil seed crops. In India, mustard was cultivated over an area of about 6.20 million hectare with production and productivity of 7.36 million tonnes and 11.88 q ha⁻¹ respectively, during 2012-2013. In Uttar Pradesh, it is grown on 0.64 million hectare area with production of 0.79 million tonnes and productivity of 12.34 q ha⁻¹ (Anonymous,

2013). The excessive use of agrochemicals for the last 50 years though, helped in achieving commendable progress earlier, but the least attention to ecological agricultural principles resulted in deceleration of growth and stagnation in crop yield which cause serious concern and chain of several problems has been tackled in the recent decades. Indiscriminate use of chemical fertilizers and pesticides resulted several deleterious effects on soil, water and air causing their resultant pollution. This has reduced the productivity of the soil by deteriorating the soil health in terms of soil fertility and microbial activity. It improves physical, chemical and biological properties of soil with higher microbial biomass carbon and respiration activities. Despite many fold advantages of organic farming and organic foods, organic inputs do not respond immediately particularly in the soil with wide C: N ratio. It entails the use of compost, FYM, vermicompost, crop residues, green manures, green leaf manuring in crop rotation and biofertilizers to enrich the soil organic carbon, supply all essentially required plant nutrients and improve soil properties. Nutrient management through organics plays a major role in maintaining soil health due to buildup of soil organic matter, beneficial microbes and enzymes. Long-term addition of organic materials to soil resulted as an increase in organic matter, crop productivity and soil biological activity (Collins *et al.*, 1992).

Materials and Methods

The experiment was conducted at agronomy research farm of N.D. university of Agriculture and Technology, Faizabad (U.P.), at 26^o28 N latitude, 82^o12 E longitude and at an altitude of 113 m above the mean sea level. The experiment was conducted under randomized block design with 6 treatments and 4 replications during the year 2013-14. Soils of experimental field was silt loam in

texture, low in organic carbon, available nitrogen and available sulphur, medium in available phosphorus, potassium and alkaline in reaction. The mustard variety, NDR-8501 was sown in 15th nov, 2013 at the rate of 5 kg ha⁻¹ after application of treatments wise manure and fertilizers with 60 cm row spacing to evaluate the observation regarding growth attributes and yield components. Three irrigations were applied during crop season at branching stage 30 DAS, flowering stage 50 DAS and pod filling stage 85 DAS. The crop was harvested on 20th march 2014. Different aspects taken in the investigation were growth attributes e.g. plant height, primary branches plant⁻¹, Secondary branches plant⁻¹, no. of siliqua plant⁻¹, no. of seed siliqua⁻¹ test weight (weight of 1000 seed in gm) respectively.

Observation recorded

Plant height

Five plants were selected randomly from each plot and tagged. The height was measured at the time of 30, 60, 90 days and at the harvest stage, in cm with the help of meter scale from the base of the plant to top of the plant and mean value was computed.

Number of primary and secondary branches:

Five selected tagged plants were also used for counting of primary and secondary branches at harvest. Total number of primary and secondary branches were counted separately and mean value have been computed for primary and secondary branches plant⁻¹.

Number of siliqua plant⁻¹

The siliqua of five randomly selected plants were separated and counted. The average value was reported as number of siliqua plant⁻¹.

Number of seed siliqua⁻¹

Twenty randomly selected siliqua taken from respective five plant, where threshed and seeds were counted. The average number of seed was reported as number of seed siliqua⁻¹.

Test weight

Sample of seeds was drawn from the produce of each net plot and one thousand seeds were counted from each treatment. The counted seeds were weighed and recorded as test weight.

Seed yield

Each net plot was threshed separately. The weight of seeds was recorded and finally converted into quintal ha⁻¹.

Stover yield

Stover yield was computed by deducting the seed yield from the total biological yield and converted into quintal ha⁻¹.

Results and Discussion

This study included plant height, number of primary branches plant⁻¹, number of secondary branches plant⁻¹, siliqua plant⁻¹, seed siliqua⁻¹ and test weight.

Plant height

The maximum plant height (186 cm) at harvest stage was recorded in INM treatment, received 50% recommended doses of NPKS through chemical fertilizer and 50% N through FYM which was at par to the pure organic treatments received 100% recommended N through FYM + vermicompost + neem cake and fertilizer treatment received 100% NPKS through fertilizers alone. Arya *et al.* (2007) reported that integrated use of fertilizers with

organic materials significantly enhanced average plant height and plant biomass in mustard. Similar findings were also observed by Nagdive *et al.* (2007) and Dongarwar *et al.* (2007) (Table 1).

Number of primary branches

The number of primary branches was found maximum in T₁ (50% RDF of NPKS +50% FYM) over T₅ (50% FYM+BM+AZ+PSB) which gave lower number of primary branches per plant. It was clearly indicated that integration of FYM as a organic source with 50% RDF of NPKS as inorganic source proved most significant in terms of increasing number of branches per plant. Branching is a major yield contributing character. The present study and the results thereof corroborated by findings of several workers. The results were most closely corroborated with Singh and Singh (2005) and Dongrawar *et al.* (2007).

Number of Secondary branches

It is clear from the data recorded that the effect of different organic management practices was significant on the number of secondary branches/plant and found more number of secondary branches per plant in T₁ (50% RDF of NPKS +50% FYM) which was found similar to T₆ (100% RDF of NPKS) comparison to T₅ (50% FYM+BM+AZ+PSB) gave lower number of secondary branches per plant.

Application of 50% inorganic and 50% organic fertilizers after soil test value might have increased the availability of nitrogen being an essential constituent of nucleic acid, protoplasm and protein, plays a fundamental role in metabolism, growth, development and transmission of heritable characters therefore, no. of secondary branches also increased by this condition. These results were in

conformity with those of Prasad and Ehsanullah (1988) and Nagdive *et al.*, (2007).

Number of siliqua plant⁻¹

The data showed in Table 2, the number siliqua plant⁻¹ was varied from 248.0 to 283.0 and lowest and highest value given by (T₅): 50% FYM+BM+AZ+PSB and (T₁): 50% NPKS+50% FYM. Addition of 50% RDF of

NPKS as a inorganic source and 50% FYM as a organic sources responses well and gave significantly higher number of siliqua per plant comparison to other treatment combinations. The results are in agreement with those of Ramesh *et al.*, (2009) who observed higher values of growth and yield attributes due to integrated application of fertilizers with FYM and biofertilizers.

Table.1 Effect of various organic management practices on growth and yield attributing characters

Treatments combinations	Plant height (cm)	No. of primary branches	No. of secondary branches	No. of siliqua/plant	No. of seed/siliqua	Test weight (gm)
T₁: 50% NPKS + 50%FYM	186	5.16	16	283	13.2	4.41
T₂:FYM + VC + NC	181	5.01	13	266	11.8	4.39
T₃: T₂ +HW + PP	183	5.07	14	273	12.6	4.40
T₄: T₂ + AZ + PSB	180	5.04	14	271	12.3	4.42
T₅:50% FYM +BM+ AZ+ PSB	174	4.80	11	248	11.2	4.38
T₆: 100% NPKS	184	5.10	16	277	12.9	4.40
CD (5%)	3.09	0.06	0.51	6.28	0.32	0.015
Sem (±)	9.0	0.18	1.5	18.3	0.96	NS

Table.2 Effect of various organic management practices on growth and yield attributing characters

Treatment combinations	Grain yield (q/ha)	Stover yield (q/ha)	Harvest Index (H.I.)
T₁: 50% NPKS 50%FYM	18.6	52.1	26.30
T₂:FYM + VC + NC	15.6	43.5	26.39
T₃: T₂ + HW + PP	16.8	46.5	26.54
T₄:T₂+AZ+PSB	16.4	44.9	26.75
T₅: 50% FYM +BM+ AZ + PSB	13.7	38.7	26.14
T₆: 100% NPKS	17.3	48.3	26.37
SEM±	0.64	1.86	-
CD (P=0.05)	1.9	5.4	-

RDF=Recommended Dose of Fertilizer, PSB= Phosphorus Solubilizing Bacteria, BM= Bone Meal, FYM= Farm Yard Manure, AZ= Azotobacter, VC= Vermicompost, NC= Neem Cake, PP= Plant Protection, HW= Hand Weeding, RDF of NPKS was applied @ of 120:60:40:4

Number of seeds Siliqua⁻¹

As data depicted in Table 2 the number of seeds siliqua⁻¹ ranges from 11.2 to 13.2 and lowest and highest value given by (T₅): 50% FYM+BM+AZ+PSB and (T₁): 50% NPKS+50% FYM. T₁ gave the highest value which was significantly superior over T₅ treatment. It was clear that integrated application of FYM @ 8.0 tonne ha⁻¹ with 50% doses of RDF of NPKS gave significant response comparison to sole organic or inorganic source. A number of investigators have observed increases in these attributes in mustard crop viz., Tripathi *et al* (2010), Chaurasiya *et al.*, (2009), Ramesh *et al.* (2009) and Kashved *et al.*, (2010). The results of present study are in agreement with the findings of above workers.

Thousand grain- test weight

The data pertaining to 1000 seed weight (test weight) have been given in Table 2 Results revealed that variations in 1000 seed weight of different treatments were non-significant. However, the maximum test weight (4.42g) was recorded in treatment T₄ (100% nutrients through organics + PSB + Azotobacter) closely followed by INM treatment- T₁ (50% NPKS + 50% N through FYM) and 100% fertilizer treatment (T₆). The lowest test weight (4.38g) was recorded in treatment T₅ having only 50% N through FYM with bone meal (P source) and seed treatment with Azotobacter + PSB. Similar results have been reported by Kasved *et al.* (2010) and Tripathi *et al.* (2010).

Grain and stover yield

The grain yield varied from 13.7 to 18.6 q ha⁻¹ whereas stover yield ranges from 38.7 to 52.1 q ha⁻¹ in our present investigation. Integration of organic source (FYM) with inorganic sources (RDF of NPKS) gave significantly

higher yield in terms of grain and stover. The application of sulphur with FYM and inorganic nutrients increases the size of grain and vigourness of grain due to its pivotal role in oil synthesis in all oilseed crops. Treatment T₁: (50% RDF of NPKS +50% FYM) which gave highest grain (18.6qha⁻¹) and stover (52.1qha⁻¹) yield comparison to the yield of T₅: (50% FYM+BM+AZ+PSB) 13.7 qha⁻¹, 38.70qha⁻¹. Our results are corroborated with Laxminarayan *et al.*, (2006) and Aulakh *et al.*, (2010).

Harvest index

The data of harvest index, presented in Table 2 did not show any significant differences among the various treatments. However, the highest value (26.75) was obtained in the treatment received 100% N through organic sources (FYM + VC + NC) alone with seed treatment of PSB + Azotobacter (T₄) closely followed by treatment T₃- having management practices (hand weeding and plant protection) along with 100% N through organic manures and T₆- 100% nutrients (NPKS) through chemical fertilizers. The minimum value of harvest index (26.14) was obtained in treatment T₅- received only 50% N through FYM with bone meal, PSB and Azotobacter. Present investigation is in close conformity with the findings of Abraham *et al.* (2008) and Maheshbabu *et al.* (2008).

In conclusion, integrated use of nutrients regularly viz., 50% recommended dose of NPKS through chemical fertilizers and 50% N equivalent farm yard manure provided higher yield of mustard which was comparable to 100% recommended NPKS through chemical fertilizers alone. Integrated use of nutrients regularly viz., 50% recommended dose of NPKS through chemical fertilizers and 50% N equivalent farm yard manure provided higher yield of mustard which was comparable to 100%

recommended NPKS through chemical fertilizers alone.

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How to cite this article:

Ashok Kumar, Alok Kumar, Pushpendra Kumar, Yogesh, L.K. Yadav and Rajesh Kumar. 2018. Effect of Organic Management Practices on Growth, Yield Attributes and Grain Yield in Mustard (*Brassica juncea* (L.) Czern. and Coss.). *Int.J.Curr.Microbiol.App.Sci.* 7(09): 3585-3590. doi: <https://doi.org/10.20546/ijcmas.2018.709.444>