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Effect of integrated nutrient management on growth and yield of mustard (*Brassica juncea* L.) cultivar T-9 under Dehradun region (Uttarakhand)

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Abstract
In order to investigate the response of single or combined application of organic and inorganic fertilizers on growth and yield of mustard crop, field experiment was carried out during winter season (2017-18) at Research Block of S.G.R.R. (P.G) College. Dehradun, Uttarakhand. The layout of experimental field was laid in completely randomized block design with 8 treatments and 3 replications. The results indicated that among all the treatments, treatment T_3 (75 % RDF + 2.5 t FYM per ha) was found best with respect to plant height (158.8 cm), number of primary branches per plant (5.2), number of secondary branches per plant (5.83), dry matter accumulation (20.63 g), seed weight per plant (6.03 g) and seed yield (20.09 q per ha) at harvest. Results also indicated that all growth parameters were non-significant *viz.;* plant height and primary branches per plant at 45 days after sowing (DAS) and secondary branches (75 DAS) during initial stage, except dry matter accumulation. Based on present investigation, it can be concluded that 75 % RDF + 2.5 t FYM per ha improved growth and yield of mustard crop under present agro-climatic conditions.

Keywords: Plant height, primary branches, secondary branches, dry matter accumulation, yield (seed weight and seed yield)

Introduction
Mustard is an important oil seed crop in India. It secures unique position in Indian farming system with an impressive acreage next to food seeds. Despite the fact that nearly 33.8 per cent of the total cropped area in world (7.49 million ha) is under oil seeds, India is still facing a severe shortage of edible oils because the average productivity seed yield in India is about 697.9 kg per ha as against 917 kg per ha yield of the world (Ikisan, 2018) [3]. To meet the demand, substantial quantities of edible oils are being imported for the past few decades. In order to increase productivity of oilseed crops, the country is well concerned to improve their production. Oil seeds are energy rich crops but these are cultivated under energy starvation condition that causes low production of these crops (Swaminathan, 1980) [16].

India is the third largest oilseed producer of the world and among various oilseed crops grown, rapeseed-mustard occupies prominent position after groundnut but productivity of mustard crop is low as compared to other countries. The efforts for increasing the production under this crop both at national and state level needs to be increased as the demand of oilseed crop is increasing day by day due to more demand for human consumption and other industrial uses.

To overcome the huge gap between the production (due to low productivity) and consumption and for improving the productivity of mustard, it is necessary to identify the production constraints which are directly responsible for limiting the productivity of mustard. Inadequate use of organic manure & fertilizers and total dependence on inorganic fertilizers have not only identified as the critical constraints withholding mustard production but also adversely affecting the sustainability of agricultural crops causing environmental pollution. For the exploitation of yield potential of mustard crop, the judicious use of nutrients is considered to play a vital role.

Continuous use of inorganic fertilizers alone on the soil physico-chemical properties and environment besides their higher cost affects the health of soil. In coming decades, a major issue in designing sustainable agriculture system will be soil organic matter management and the balanced use of organic and inorganic fertilizers which will check the plant nutrient

depletion as well as maintain the soil health and ultimately improves the productivity of mustard crop.

INM improves the soil health and availability of nutrients which are responsible for better plant growth and development, hence yield of crop increases (Prasad *et al.*, 1991) [10]. Punia *et al.* (1997) [11] also suggested that seed yield of mustard improves with the application of organic manures because organic manures helps in availability of nutrients to the plant. Sadhu *et al.* (1997) [13] and Dhurandher *et al.* (1999) [1] observed that the positive response of INM (RDF along with 100 q FYM per ha) on growth and yield of mustard crop. Therefore, the aim of the present study was to investigate the effect of sole or combined application of organic manures and inorganic fertilizers on growth and yield of mustard crop.

Materials and Methods

The present study was carried out during winter season (2017-18) at Research Block of S.G.R.R. (P.G) College. Dehradun, Uttarakhand. Field experiments were conducted under sandy loam soil and laid out in completely randomized block design with 8 treatments and 3 replications. The recommended dose of fertilizers *i.e.*, 60:30:20 kg N, P_2O_5 and K_2O, respectively, were applied according to the farmer's practice. The dose of organic and inorganic fertilizers were applied according to experimental treatments. Full dose of phosphorus and potassium was applied at the time of sowing with half dose of nitrogen at the time of sowing and remaining at 30 days after sowing (DAS). The experiment included treatments T_1 (RDF), T_2 (FYM @ 10 t per ha), T_3 (75 % RDF + 2.5 t FYM per ha), T_4 (75 % RDF + 1.0 t VC per ha), T_5 (50 % RDF + 5.0 t FYM per ha), T_6 (50 % RDF + 1.5 t VC per ha), T_7 (25 % RDF + 5.0 t FYM per ha) and T_8 (25 % RDF + 2.0 t VC per ha). Seeds were sown during last week of October with 30×10 cm spacing. The crop was harvested during second week of March. The growth parameters *viz.:* plant height, primary branches per plant and dry matter accumulation were observed during all growth stages [*i.e.*, 45, 75 and 105 DAS and at harvest], while number of secondary branches per plant [*i.e.*, 75 and 105 DAS and at harvest], whereas yield parameters were observed after harvesting of the crop with following procedures:

The height of the five tagged plants was recorded from the ground level to the tip of the plant. Then, average height was computed.

The branches arising from the main shoot were taken as primary branches. The primary branches were recorded from the tagged plants in each experimental plots. Secondary branches are those which arises from, the primary branches of plant. The tagged plants in each experimental plot were used for recording the number of secondary branches of crop and expressed on per plant basis.

Five plants were randomly selected then removed border rows of experimental plot. Sun dried tagged plant were dried also in an oven at 65°C temperature. The dry weight of plant was recorded according to experimental treatments on weighing balance.

Pods of five tagged plants of each experimental plot were threshed and seed weight was recorded in grams and averaged to have seed yield per plant.

After threshing of the pods from the produce of each plot of experiment, then weight of clean seeds was recorded accurately and converted into quintals per hectare.

The data was subjected to analysis of variance with the method suggested by Panse and Sukhatme (1967) [8].

Results and Discussion

Plant Height (cm)

The data presented in (Table-1) indicates that the average plant height was increasing with age of the plant till harvest. However, the growth rate of plant was rapid from 45 to 75 days after sowing and thereafter, it showed decrease. Plant height was rapidly increased from 75 to 105-day after sowing as compared to crop duration of 105 days to harvest. At 45 DAS, the data was non-significant, whereas the maximum plant height (26.3 cm) was recorded under treatment T_3 (75 % RDF + 2.5 t FYM per ha). The data also indicated that the maximum plant height (128.2 cm, 157.4 cm and 158.8 cm) was obtained under treatment T_3 (75 % RDF + 2.5 t FYM per ha) during 75, 105 DAS and at harvesting, respectively, whereas the minimum plant height (106.2 cm, 124.0 cm and 124.8 cm) was obtained under treatment T_2 (FYM @ 10 t per ha). The increase in plant height under treatment T_3 is may be due to combined application of inorganic fertilizers and organic manure. The availability of nutrients maximum under integrated use of organic and inorganic fertilizers. These findings were similar to Patel *et al.* (1997) [9] and Sadhu *et al.* (1997) [13]. Hence, combined application of inorganic and organic fertilizers facilitates the availability of nutrients in the soil for a longer period therefore proper utilization of nutrients by plants leading to increase in plant height (Sati *et al.* 2018) [14].

Table 1: Effect of integrated nutrient management on plant height (cm) and number of primary branches per plant

Treatments	Plant height (cm)				Number of primary branches per plant			
	45 DAS	75 DAS	105 DAS	At harvest	45 DAS	75 DAS	105 DAS	At harvest
T_1	25.8	127.7	156.8	158.0	2.6	4.8	5.0	5.0
T_2	23.4	106.2	124.0	124.8	2.2	2.8	3.2	3.2
T_3	26.3	128.2	157.4	158.8	2.7	4.9	5.2	5.2
T_4	24.7	127.4	156.3	157.3	2.6	4.6	4.9	4.9
T_5	23.5	115.6	140.6	141.0	2.6	3.3	3.6	3.6
T_6	23.9	116.0	141.2	141.9	2.5	3.4	3.7	3.7
T_7	23.3	112.1	137.3	139.2	2.4	3.4	3.6	3.6
T_8	23.5	113.0	137.7	139.7	2.5	3.2	3.5	3.5
SEm±	1.71	3.66	4.87	4.90	0.30	0.33	0.37	0.37
C.D.	NS	10.68	14.21	14.30	NS	0.96	1.1	1.1

Table 2: Effect of integrated nutrient management on number of secondary branches per plant, dry matter accumulation, seed weight per plant (g) and seed yield (q per ha)

Treatments	Number of secondary branches			Dry matter accumulation				Seed weight per plant (g)	Seed yield (q/ha)
	75 DAS	105 DAS	At harvest	45 DAS	75 DAS	105 DAS	At harvest		
T_1	2.48	5.47	5.63	3.38	12.28	20.17	20.53	5.86	19.53
T_2	2.38	3.27	3.43	1.78	7.78	13.87	14.43	3.66	12.2
T_3	2.78	5.67	5.83	3.48	12.48	20.27	20.63	6.03	20.09
T_4	2.58	5.37	5.53	3.18	11.78	19.47	19.93	5.71	19.02
T_5	2.48	3.97	4.13	2.38	9.48	16.17	16.83	4.53	15.11
T_6	2.38	4.17	4.43	2.48	9.68	16.47	17.03	4.30	14.35
T_7	2.28	3.67	3.83	1.98	8.38	14.97	15.33	4.17	13.9
T_8	2.48	3.97	4.03	2.08	8.58	15.27	15.53	3.89	12.97
SEm±	0.18	0.31	0.31	0.18	0.70	0.90	0.90	0.42	1.30
C.D.	NS	0.91	0.91	0.54	2.10	2.70	2.70	1.23	3.91

Number of primary branches per plant

The data pertaining to number of primary branches per plant with respect to different fertilizers treatments have been presented in Table-1. Data indicated that number of primary branches per plant during 45 DAS were non-significant, whereas during 75 and 105 DAS and at harvest the maximum number of primary branches (4.9, 5.2, 5.2, respectively) produced under treatment T_3 (75 % RDF + 2.5 t FYM per ha). It may be due to increased plant height under treatment T_3. Judicious use of nitrogen (N) increased vegetative growth of plant, that's why the number of primary branches increased. These findings were supported by Roy and Tripathi (1985) [12], Mehta *et al.* (1995) [5] and Gurjar and Chauhan (1997) [2].

Number of secondary branches per plant

The data presented in (Table-2) indicated that average number secondary branches per plant was affected by alone or combined application of inorganic fertilizers and organic manure. At 75 DAS, the data was non-significant, whereas the maximum number of secondary branches (2.78) was recorded under treatment T_3 (75 % RDF + 2.5 t FYM per ha). The data also indicated that number of secondary branches were maximum under treatment T_3 at 105 DAS and at harvest (5.67, 5.83, respectively). It may be due to the number of primary branches were maximum under same treatment because secondary branches are arises from primary branches. These findings were similar to Roy and Tripathi (1985) [12], Mehta *et al.* (1995) [5] and Gurjar and Chauhan (1997) [2].

Dry matter accumulation per plant (g)

The data (Table-2) indicated that the maximum dry matter content under treatment T_3 (75 % RDF + 2.5 t FYM per ha) during all growth stages *i.e.* 45, 75, 105 DAS and at harvest (4.48 g, 15.48 g, 25.27 g and 25.63 g, respectively), while the minimum dry matter content was obtained under treatment T_2 [FYM @ 10 t per ha (2.78 g, 10.78 g, 18.87 g and 19.43 g, respectively)]. The branches (primary and secondary) increased the total number of leaves per plant, hence the total accumulation of photosynthates and better growth of plants with combined application of inorganic fertilizers and organic manures. These findings were similar to Lal and Dravid (1993) [4], Mondal *et al.* (1996) [6] and Patel *et al.* (1997) [9].

Seed weight per plant (g)

Effect of INM on seed weight per plant has been presented in Table-2. The weight of seed per plant was recorded after harvest. Data indicated that combined application of inorganic fertilizers and organic manures gave positive response on seed weight per plant. The maximum seed weight per plant (6.21 g) was recorded under treatment T_3 (75 % RDF + 2.5 t FYM per ha), whereas the minimum seed weight per plant (4.45 g) was recorded under treatment T_2 (FYM @ 10 t per ha). It may be due to plant growth, number of branches, seed weight per pod and pods per plant which are significantly higher under combined application of organic and inorganic fertilizers. These findings were supported by Mondal *et al.* (1997) [7], Singh and Singh (1997) [11, 15].

Seed Yield (q per ha)

It is evident from data (Table-2) that significantly maximum seed yield per ha (13.46 q) was recorded under treatment T_3 (75 % RDF + 2.5 t FYM per ha), whereas the minimum seed yield per ha (7.7 q) was recorded under treatment T_2 (FYM @ 10 t per ha). It is due to the number of pods per plant as well as seed weight per plant which are directly related to seed yield. These findings were similar to Mondal *et al.* (1996) [6], Mondal *et al.* (1997) [7] and Singh and Singh (1997) [11, 15].

References

1. Dhurandher RL, Pandey N, Tripathi RS. Integrated nutrient management in rice-mustard crop sequence under irrigated conditions. Journal of Oilseeds Research. 1999; 16(1):130-131.
2. Gurjar BS, Chauhan VS. Yield attributes and seed yield of Indian mustard *Brassica juncea* as influenced by varieties, fertility levels and spacing in Harsi command area. Indian Journal of Agronomy. 1997; 42(1):142-144.
3. Ikisan, 2018. http://www.ikisan.com/up-mustard-history. html. (accessed on 15 July, 2018).
4. Lal K, Dravid MS. Interaction effect of P, S, K_2SiO_3 and FYM manure on dry matter accumulation and utilization of P and S by mustard in Balsamand sandy soil of Hissar. Journal of Nuclear Agriculture and Biology. 1993; 22(3-4):184-188.
5. Mehta, Asha C, Malavia DD, Kaneria BB, Khanpara VD. Effect of phosphatic bio-fertilizers in conjunction with organic and inorganic fertilizers on growth and yield of groundnut. Indian Journal of Agronomy. 1995; 40(4):709-710.
6. Mondal SS, Saha BC, Mandal BK, Chatterjee BN, Chowdhary P Pal. Effect of potassium, sulphur, farmyard manure and crop residues on the yield of rice, mustard and potato in a Gangetic alluvial soil of West Bengal. Journal of Potassium Research. 1996; 12(4):382-390.
7. Mondal SS, Dasmahapatra AN, Chatterjee BN, Maiti PK. Effect of potassium on yield and oil content of sesame, mustard and groundnut on a K-deficient soil. Journal of Potassium Research. 1997; 13(2):153-158.

8. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi, India, 1967.
9. Patel RH, Meisheri TG. Effect of farmyard manure, nitrogen and source of fertilizer on growth, yield attributes and yield of Indian mustard. Indian Journal of Agricultural Sciences. 1997; 67(6):237-40.
10. Prasad PM, Chandra A, Varshney ML, Verma MM. Growth, yield, drymatter and nutrient uptake by mustard (*Brassica juncea* L.) in alluvial soil as influenced by phosphorus and organic matter. New Agriculturist. 1991; 2(l):31-34.
11. Punia SS, Gupta SK, Singh BP. Integrated nutrient management in Indian mustard *(Brassica juncea* L. Coss and Czern). Haryana journal of Agronomy. 1997; 13(2):8-10.
12. Roy RK, Tripathi RS. Effect of irrigation scheduling and fertility levels on the yield, yield attributes, water use efficiency and nutrient concentration of mustard. Annals of Agriculural Research. 1985; 6(1):1-11.
13. Sadhu AC, Malavia DD, Mathukia RK, Khanpara VD. Water and nutrient management in mustard (*Brassica juncea*) and their residual effect on rainy season groundnut (*Arachis hypogae*). Indian Journal of Agronomy. 1997; 42(2):342-347.
14. Sati UC, Raghav M, Singh DK, Singh S, Singh DK, Singh DK. Integrated nitrogen management in okra under Tarai conditions of Uttarakhand. International Journal of Chemical Studies. 2018; 6(1):1118-1122.
15. Singh, Jagdev, Singh KP. Integrated nutrient management in sunflower. Indian Journal of Agronomy. 1997; 42(2):370-374.
16. Swaminathan MS. Improving the production of oils and fats. Annals of Agricultural Research. 1980; 1(1):1-17.