

## INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT PRACTICES ON GROWTH AND SEED YIELD OF INDIAN MUSTARD (*BRASSICA JUNCIA* L.) CULTIVARS

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**Abstract:** A field investigation was carried out during *Rabi* seasons of 2013-14 and 2014-15 at Crop Research Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) to find out the influence of integrated nutrient management practices on growth and yield of Indian mustard (*Brassica juncea* L.) cultivars. Experiment consist five cultivars of Indian cultivars (Pusa Mustard 22, Pusa Mustard 26, Pusa Mustard 27, Pusa Vijay and Pusa Mahak) and four practices of integrated nutrient management practices (100% RDF, 75% RDF + 2 tonne Vermicompost, 75% RDF + 2 tonne Vermicompost + Bio-fertilizer and 75% RDF + 2 tonne Vermicompost + Bio-fertilizer). The growth and seed yield of mustard significantly influence by different treatments. The maximum dry weight, crop growth rate and seed yield recorded under the cultivar Pusa Vijay with application of 75% RDF+2t VC +Bio-fertilizer whereas maximum plant height were recorded under the cultivar Pusa mustard 27 with application of 75% RDF+2t VC +Bio-fertilizer in both the years years.

**Keywords:** Growth, Management, Mustard, Nutrient, Seed

### INTRODUCTION

Indian mustard [*Brassica juncea* L.] is an important oil seed crop of the world. It plays a major role in cooking edible oil demand of the country. Population of India is increasing rapidly and consequently edible oil demand is also going up day-by-day. Hence, it has become necessary to enhance the present production by developing superior varieties of Indian mustard. The contribution of rapeseed-mustard to the total oilseed production in India is 26.0 percent.

India is the third largest producer of rapeseed-mustard occupying 5.79 million hectares area with 6.31 million tonnes production (Piri *et al.*, 2011), but the average yield of rapeseed-mustard in India is only 1089 kg/ha due to the lack of optimum use of nutrients and improper management.

The integrated nutrient management practices is very necessary which is not only sustains high crop production over the years (Verma *et al.* 2010) but also improves soil health and environment (Vijaya Sankar Babu *et al.* 2007).. Vermicompost improves the soil physico-chemical properties along with direct release of macro as well as micronutrient; ultimately the crop yields and finally crop yields increase. Integration of chemical fertilizers along with vermicompost and Bio-fertilizers could be helping to improve soil fertility and productivity. Non-symbiotic bacteria like *Azotobacter* are potential bio-fertilizers. These are capable of contributing N to a number of non-legumes by tapping aerial nitrogen. Furthermore, activity of bio-fertilizers may be influenced by supply of nutrients like N to the soil. Therefore a field investigation was carried out to find out influence of integrated nutrient

management practices on growth and yield of Indian mustard (*Brassica juncea* L.).

### MATERIALS AND METHODS

A field experiment was conducted at Crop Research Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.) which is situated in Indo-Gangetic plains of Western Uttar Pradesh. The farm is geographically located at 29° 13' 96" N latitude, 77° 06' 43" E longitudes with an elevation of 228 metres above the mean sea level during *Rabi* seasons of 2013-14 and 2014-15 respectively. There were 20 treatment combinations comprising five new cultivar of mustard with four integrated nutrient management-INM practices. These treatments were assigned in split plot design with 3 replications. The soil of experimental site was sandy loam in texture, low in available nitrogen and organic carbon, medium in available phosphorus and potassium and alkaline in reaction. The recommended doses of fertilizers @ 120: 40: 40: 20 kg ha<sup>-1</sup> NPK and S were uniformly applied during both years of experiment. The source of fertilizers was urea, single super phosphate and muriate of potash. Phosphorus and potash were applied as basal, whereas half dose of nitrogen was applied as basal and the remaining half dose was applied in two split doses, first at 30 days after seed sowing and second at the time of flowering. Vermicompost was applied as per treatment and mix in the soil before sowing. The soil was inoculated with bio-fertilizers (*Azotobacter*) before sowing the crop as per treatment. The crop was sown in lines at row spacing of 45 cm apart on October 16 and 18 during 2013

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and 2014, respectively. The recommended seed rates of 5 kg/ha for Indian mustard were used. The other recommended agronomic practices were adopted to harvest the good yield.

## RESULTS AND DISCUSSION

### Growth parameters

Data on plant height, dry matter production and relative growth rate are presented in table 1, 2 and 3. A perusal of the table-1 depicting the observations on plant height reveals a significantly difference

between the treatment in all the observation record at 30, 60, 90 DAS and harvest. The tallest plant height were counts in cultivar Pusa Mustard 27 compare other variety during both years of experiments, however cultivar Pusa Mahak recorded minimum plant height due to varietal characteristics, this may be attributed to better proliferation of roots and increased uptake of nutrient.

In the case of integrated nutrient management maximum plant height recorded with application of 75% RDF+2t VC +Bio-fertilizer during both the years of experiment compare other treatments.

**Table 1.** Effect of different mustard cultivars and integrated nutrient management on plant height (cm) of Indian mustard at various crop growth stages during 2013-14 and 2014-15

Treatments	Plant height (cm)							
	30 DAS		60 DAS		90 DAS		At harvest	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
<b>Varieties</b>								
Pusa Mustard 22	43.85	43.59	118.21	117.49	163.97	162.97	190.67	189.50
Pusa Mustard 26	43.38	43.12	116.95	116.22	162.21	161.21	188.62	187.45
Pusa Mustard 27	46.69	46.42	125.86	125.14	174.58	173.58	<b>203.00</b>	<b>201.83</b>
Pusa Vijay	44.84	44.57	120.87	120.15	167.66	166.66	194.96	193.79
Pusa Mahak	41.39	41.12	111.57	110.85	154.76	153.76	179.96	178.79
<b>SEm±</b>	<b>0.74</b>	<b>0.79</b>	<b>1.98</b>	<b>2.12</b>	<b>2.75</b>	<b>2.95</b>	<b>3.20</b>	<b>3.43</b>
<b>C D (P=0.05)</b>	<b>2.40</b>	<b>2.57</b>	<b>6.47</b>	<b>6.93</b>	<b>8.97</b>	<b>9.61</b>	<b>10.44</b>	<b>11.18</b>
<b>INM levels</b>								
100% RDF	41.81	41.54	112.69	111.97	156.32	155.31	181.76	180.60
75% RDF+2t VC	43.45	43.18	117.14	116.41	162.48	161.48	188.93	187.76
75% RDF+2t VC +Bio-fertilizer	45.47	45.21	122.57	121.85	170.02	169.02	<b>197.70</b>	<b>196.53</b>
50% RDF+4t VC +Bio-fertilizer	45.40	45.12	122.34	121.64	169.73	168.73	197.37	196.20
<b>SEm±</b>	<b>0.72</b>	<b>0.71</b>	<b>1.92</b>	<b>1.90</b>	<b>2.67</b>	<b>2.64</b>	<b>3.10</b>	<b>3.06</b>
<b>C D (P=0.05)</b>	<b>2.06</b>	<b>2.04</b>	<b>5.56</b>	<b>5.52</b>	<b>7.71</b>	<b>7.68</b>	<b>8.97</b>	<b>8.90</b>

Data on dry matter production are presented in table 2, which is clearly indicated that plant dry weight (g/plant) significantly differ between the treatment in all the observation record at 30, 60, 90 DAS and at harvest. The maximum dry weight (g/plant) were recorded in the cultivar Pusa Vijay followed by Pusa Mustard 22 compare other cultivar during both the

years of experiments. The cultivar Pusa Mahak recorded minimum value of dry weight during investigation period. Nutrient apply through 75% RDF+2t VC +Bio-fertilizer recorded maximum dry weight compare other practices of INM, whereas minimum dry weight were found in 100 % RDF during both the years.

**Table 2.** Effect of different mustard cultivars and integrated nutrient management on plant dry weight at 30, 60, 90 DAS and at harvest during 2013-14 and 2014-15

Treatments	Plant dry weight (g/plant)							
	30 DAS		60 DAS		90 DAS		At harvest	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
<b>Varieties</b>								
Pusa Mustard 22	13.78	14.54	28.77	29.70	49.15	49.08	59.94	60.61
Pusa Mustard 26	13.23	13.97	27.62	28.52	47.18	47.15	57.54	58.21
Pusa Mustard 27	13.30	14.08	27.76	28.74	47.42	47.51	57.83	58.66
Pusa Vijay	14.38	15.24	30.00	31.12	51.25	51.44	<b>62.50</b>	<b>63.50</b>
Pusa Mahak	12.38	13.16	25.84	26.87	44.14	44.42	53.84	54.84
<b>SEm±</b>	<b>0.15</b>	<b>0.14</b>	<b>0.32</b>	<b>0.31</b>	<b>0.55</b>	<b>0.52</b>	<b>0.67</b>	<b>0.64</b>
<b>C D (P=0.05)</b>	<b>0.50</b>	<b>0.49</b>	<b>1.05</b>	<b>1.02</b>	<b>1.80</b>	<b>1.68</b>	<b>2.20</b>	<b>2.07</b>
<b>Nitrogen levels</b>								
100% RDF	13.01	13.78	27.16	28.12	46.40	46.50	56.60	57.39
75% RDF+2t VC	13.05	13.81	27.23	28.20	46.51	46.60	56.72	57.52
75% RDF+2t VC +Bio-fertilizer	13.96	14.77	29.13	30.16	49.76	49.86	<b>60.69</b>	<b>61.56</b>
50% RDF+4t VC +Bio-fertilizer	13.64	14.44	28.47	29.50	48.64	48.75	59.32	60.18
<b>SEm±</b>	<b>0.26</b>	<b>0.27</b>	<b>0.54</b>	<b>0.55</b>	<b>0.92</b>	<b>0.91</b>	<b>1.12</b>	<b>1.12</b>
<b>C D (P=0.05)</b>	<b>0.74</b>	<b>0.78</b>	<b>1.55</b>	<b>1.60</b>	<b>2.65</b>	<b>2.63</b>	<b>3.23</b>	<b>3.24</b>

Data on crop growth rate are presented in table 3 clearly indicated that crop growth rate (g/m<sup>2</sup>/day) significantly differs between the treatment in all the

observation record at 30-60 DAS, 60-90 DAS, 90 DAS to harvest. The cultivar Pusa Vijay were recorded maximum crop growth rate (g/m<sup>2</sup>/day)

followed by Pusa Mustard 22 compare other cultivar during both the years of experiments. The cultivar Pusa Mahak recorded minimum value of dry weight during investigation period. IMN through 75% RDF+2t VC +Bio-fertilizer recorded maximum crop growth rate (g/m<sup>2</sup>/day) compare other practices of INM, whereas minimum crop growth rate (g/m<sup>2</sup>/day) were found in 100 % RDF during both the years. The increase in growth parameters of mustard was due to increased in nutrient availability through

organics, as it releases major and minor nutrients gradually during whole growing season. Efficiency of organic sources, in general, is manifested in the fact that organic matters release nutrients after mineralization which improves the physical and physic-chemical properties of soil. Similar result was found with Yadav *et al.*, (2013) and Thaneshwar (2017). Nanwal *et al.* (2000) found that the growth of Indian mustard cultivars were increased with increasing levels of nitrogen along with Azotobacter.

**Table 3.** Effect of different mustard cultivars and integrated nutrient management on CGR at different growth stages during 2013-14 and 2014-15

Treatments	Crop growth rate (g/m <sup>2</sup> /day)					
	30-60 DAS		60-90 DAS		90 DAS to harvest	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
<b>Varieties</b>						
Pusa Mustard 22	0.50	0.51	0.65	0.68	0.36	0.38
Pusa Mustard 26	0.48	0.49	0.62	0.65	0.35	0.37
Pusa Mustard 27	0.48	0.49	0.63	0.66	0.35	0.37
Pusa Vijay	0.52	0.53	0.68	0.71	<b>0.38</b>	<b>0.40</b>
Pusa Mahak	0.45	0.46	0.58	0.61	0.32	0.35
<b>SEm±</b>	<b>0.005</b>	<b>0.006</b>	<b>0.007</b>	<b>0.008</b>	<b>0.004</b>	<b>0.005</b>
<b>C D (P=0.05)</b>	<b>0.018</b>	<b>0.020</b>	<b>0.022</b>	<b>0.026</b>	<b>0.013</b>	<b>0.014</b>
<b>INM levels</b>						
100% RDF	0.47	0.48	0.61	0.63	0.33	0.36
75% RDF+2t VC	0.47	0.48	0.62	0.64	0.34	0.37
75% RDF+2t VC +Bio-fertilizer	0.51	0.52	0.66	0.69	<b>0.37</b>	<b>0.39</b>
50% RDF+4t VC +Bio-fertilizer	0.49	0.50	0.64	0.67	0.36	0.38
<b>SEm±</b>	<b>0.009</b>	<b>0.010</b>	<b>0.012</b>	<b>0.013</b>	<b>0.007</b>	<b>0.008</b>
<b>C D (P=0.05)</b>	<b>0.027</b>	<b>0.029</b>	<b>0.036</b>	<b>0.037</b>	<b>0.020</b>	<b>0.021</b>

**Seed yield**

Seed yield data are presented in table 4 clearly indicated that seed yield (kg/ha) significantly differs between the treatment in all the observation. Seed yield was maximized under the cultivar Pusa Vijay followed by Pusa Mustard during both the years on mean basis. The cultivar Pusa Mahak recorded minimum value of dry weight during investigation period. IMN through 75% RDF+2t VC +Bio-fertilizer recorded maximum crop growth rate (g/m<sup>2</sup>/day) compare other practices of INM, whereas minimum crop growth rate (g/m<sup>2</sup>/day) were found in 100 % RDF during both the years.

The increased seed yield might be due to varietal characters and balance supply of major and minor nutrient. Addition of Vermicompost and biofertilizer (Azotobacter), besides its nutritional role might be involved in improving the physio- chemical properties of soil specially the moisture retention aggregate formation, soil aeration and enhanced microbial activity. The result of present study is conforming to Parihar *et al.* (2014), Satyajeet and Nanwal (2007) and Pal *et al.* (2008). Huang *et al.* (2007) found that the incorporation of inorganic fertilizers and biofertilizers along with organic fertilizers in Brassica campestris gave higher yields.

**Table 4.** Effect of mustard cultivars and integrated nutrient management on seed yield (kg ha<sup>-1</sup>) of mustard crop during 2013-14 and 2014-15

Treatments	Seed yield (kg ha <sup>-1</sup> )	
	2013-14	2014-15
<b>Varieties</b>		
Pusa Mustard 22	1664.17	1684.16
Pusa Mustard 26	1430.83	1450.83
Pusa Mustard 27	1491.67	1511.66
Pusa Vijay	<b>1940.83</b>	<b>1960.83</b>
Pusa Mahak	1367.50	1387.50
<b>SEm±</b>	<b>36.20</b>	<b>47.42</b>
<b>C D (P=0.05)</b>	<b>117.91</b>	<b>154.48</b>
<b>INM levels</b>		
100% RDF	1464.00	1484.00
75% RDF+2t VC	1498.67	1518.66

75% RDF+2t VC +Bio-fertilizer	<b>1688.66</b>	<b>1708.66</b>
50% RDF+4t VC +Bio-fertilizer	1664.66	1684.67
<b>SEm±</b>	<b>40.76</b>	<b>40.88</b>
<b>C D (P=0.05)</b>	<b>117.78</b>	<b>117.92</b>

## CONCLUSION

Based on above study suggested that Indian mustard cultivar Pusa Vijay with application of 75% RDF+2t VC +Bio-fertilizer (Azotobacter) integrated nutrient management practice give higher seed yield.

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