

## Effect of organic fertilizers, biofertilizers, antagonists and nutritional supplements on yield and disease incidence in Indian mustard in arid soil\*

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In the ongoing system of intensive agriculture, our sole dependence on inorganic fertilizers (mostly di-ammonium phosphate and urea) during the past decades have severely affected the sustainability of agricultural production. Each crop has its own nutritional requirement and continuous monocropping practice without nutrient additions has exhausted the available micronutrients and causes nutritional deficit in soils. Nutrient deficiency also leads to increased incidence of plant diseases, eg khera disease of paddy (Zn deficiency), heart dry rot of sugarbeet (boron deficiency), tirkak disease in cotton (N deficiency), tip burning in onion and garlic (K deficiency) etc. Also, our researches at Navgaon have proved that applying 40 kg K/ha to Indian mustard (*Brassica juncea* L.) (Czernjs & Coss.) reduce the infection of *Alternaria* blight and white rust diseases (Godika *et al.*

2001). Further, research trials have been conducted during winter (*rabi*) season 2006–07 and 2007–08 on mustard to improve soil health by adding biofertilizers, appropriate quantities of organic manures with balanced inorganic fertilizers.

Response of inorganic fertilizers and biofertilizers on mustard var. 'Varuna' was studied in microplots of 4 m × 3m size having basal application of 100% doses of fertilizers (80 kg N and 40 kg P/ha) in medium-textured sandy loam soils of Agricultural Research Station, Navgaon (Alwar), Rajasthan. The average rainfall was 595 mm/annum. Seed treatment with biofertilizers (lignite-based culture of *Azotobacter chroococum* and/or *Bacillus megatarium*, i.e. phosphate-solubilizing bacteria with the spore concentration of 2 × 10<sup>8</sup> cfu/g carrier) was given @ 30 g/culture/kg seed

Table 1 Response of inorganic fertilizers and biofertilizer on growth and yield attributes of mustard crop and on the appearance of diseases

Treatment	<i>Alternaria</i> blight (%)		White rust (%)	Plant height (cm)	Yield (tonnes/ha)
	Leaf	Pod	Leaf		
100% RDF	21.0	10.5	12.0	170.0	1.15
100% RDF + <i>Azotobacter</i> + PSB	16.0	12.0	11.6	170.3	1.27
100% RDF + <i>Azotobacter</i>	21.0	11.8	18.3	170.4	1.19
PSB alone	25.0	11.0	27.0	165.6	0.92
<i>Azotobacter</i> alone	20.3	11.0	15.5	165.9	0.86
100% RDF + <i>Trichoderma</i> + <i>Azotobacter</i> + PSB	10.3	6.5	7.0	173.6	1.37
<i>Trichoderma</i> + <i>Azotobacter</i> + PSB	23.0	15.0	15.8	165.7	1.01
<i>Trichoderma</i> + <i>Azotobacter</i>	23.6	12.0	19.3	168.1	0.67
<i>Trichoderma</i> alone	21.6	12.5	15.8	164.6	0.81
<i>Trichoderma</i> + PSB	23.6	13.1	15.9	165.4	0.94
Control (untreated)	21.0	16.3	37.0	152.2	0.62
SEm ±	3.1	0.4	0.4	0.9	0.2
C D (P=0.05)	8.64	1.15	1.290	2.590	0.6

RDF, Recommended dose of fertilizers; PSB, phosphate-solubilizing bacteria

\*Short note:

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supplied by the State Department of Agriculture. The control was kept without fertilization or seed treatment. In another

Table 2 Effect of organic fertilizers on growth and yield attributes of mustard crop and on the appearance of diseases

Treatment	<i>Alternaria</i> blight (%)		White rust (%)	Powdery mildew (%)	Plant height (cm)	Yield (tonnes/ha)
	Leaf	Pod	Leaf	Leaf		
FYM	18.6	7.5	15.0	6.0	178.2	1.61
Vermicompost	23.3	11.0	19.0	6.6	174.1	1.40
100% RDF	21.6	11.6	19.0	7.0	171.7	1.38
100% RDF + FYM	24.3	11.6	17.1	6.3	181.4	1.68
100% RDF + vermicompost	24.1	11.0	17.0	7.3	175.7	1.36
75% RDF	31.0	11.3	20.4	11.3	165.7	1.03
75% RDF + FYM	25.0	10.3	21.3	15.5	168.8	1.55
Control (untreated)	39.6	17.6	30.0	18.0	147.6	0.89
S Em ±	1.3	0.6	0.7	0.3	1.8	0.05
CD ( <i>P</i> =0.05)	3.8	1.8	2.0	0.9	5.3	1.0

Table 3 Effect of nutritional supplements and bio-regulator on growth and yield attributes of mustard crop and on the appearance of diseases

Treatment	<i>Alternaria</i> blight (%DI)		White rust (%)		Powdery Mildew (%)	Plant height (cm)	Yield (tonnes/ha)
	Leaf	Pod	Leaf	Staghead %	Leaf		
100% RDF	23.0	7.1	14.6	T	7.6	171.0	0.62
100% RDF + basal S	24.0	6.6	12.6	T	7.3	170.7	0.75
100% RDF + basal S + spray of 1% thiourea	16.6	7.0	11.3	T	7.3	177.2	0.84
Spray of 1% thiourea	21.6	7.3	18.0	T	7.5	159.2	0.79
100% RDF + 1% thiourea	23.3	6.3	11.8	T	7.3	171.8	0.83
Control	32.6	17.6	21.3	T	16.0	152.6	0.51
S Em ±	0.4	0.5	0.4		0.03	0.6	0.2
CD ( <i>P</i> =0.05)	1.3	1.6	1.3		1.08	1.97	0.7

RDF, Recommended dose of fertilizers; S, sulphur; DI, disease incidence

trial on organic fertilizers, 100% and 75% recommended doses of fertilizers were used along with farmyard manure @ 10 tonnes/ha or vermicompost @ 5 tonnes/ha. A trial was also conducted on the effect of nutritional supplement (sulphur) and bioregulator (thiourea). The treatments comprised 100% recommended dose of fertilizers in different combinations with the use of sulphur (25 kg/ha) and 1 spray of thiourea (0.1%) at 50% flowering stage of the crop. Untreated plots were kept for comparison. A spray of oxy dematon methyl 25 EC (1.25 ml/litre) was given on aphid appearance.

Results on the effect of inorganic fertilizers and biofertilizers on mustard are presented in Table 1. The results reveal maximum plant height (173.6 cm), grain yield (1.37 tonnes/ha) and minimum severity of *Alternaria* blight on leaf (10.0%), pod (6.5%) and white rust on leaf (7.0%), where 100% recommended dose of fertilizer (RDF) was combined with seed treatments with *Trichoderma*, *Azotobacter* and photo-solubilizing bacteria. Biofertilizers used along with recommended doses of fertilizers performed better than mere use of fertilizers, however, all the biofertilizers either used

alone or in combinations were superior to untreated control. Table 2 depicts the use of organic fertilizers (farmyard manure and vermicompost, with and without 100 and 75% doses of fertilizers. The plant height (181.4 cm) and yield (1.68 tonnes/ha) with 100% RDF + farmyard manure was maximum but statistically at par with farmyard manure alone (178.2 cm and 1.61 tonnes/ha, respectively). The disease severity of *Alternaria* blight on leaf (18.6%), on pod (7.5%) and white rust on leaf (15%) was minimum when farmyard manure was used alone.

Results on the effect of basal sulphur as nutritional supplement, spray of 0.1% thiourea (as bioregulator) at 50% flowering stage of crop with or without adoption of recommended dose of fertilizer are given in Table 3. The results reveal that 100% RDF + basal sulphur and thio-urea spray gave maximum plants height (177.2 cm), crop yield (0.84 tonnes/ha) and had minimum incidence of *Alternaria* blight on leaf (16.6%), on pod (7%), white rust on leaf (11.3%) and powdery mildew (7.3%). The treatment was followed by 100% RDF and thiourea spray which resulted in 71.8 cm height of plants, 0.83 tonnes/yield/ha, 23.3%

*Alternaria* blight on leaf, 6.3% on pod, 11.8% white rust on leaf and 7.3% powdery mildew on leaf.

The findings of these trials are in agreement with Goel (2003) who recorded maximum yield under N<sub>100</sub> P<sub>30</sub> K<sub>45</sub>, followed by N<sub>60</sub> P<sub>30</sub> K<sub>30</sub> and low incidences of brown spot and sheath blight diseases of rice under integrated nutrient management of major diseases in rice (*Oryza sativa* L.). A clear indication of plant nutrition and disease appearance is given by Nagaraja *et al.* (2006) that brown spot and blast in finger millet appears in severe form where adequate fertilizer is not given. As far as soil humus content and efficacy of antagonists concern, our findings are in close conformity to the findings of Ram (2006). The author further adds that soil-borne crop diseases are generally less on organic farms. Sivaprakasham (1991) has reported that plant debris, farmyard manure, composts improve crop productivity by improving nutrient status and soil tilth, besides increasing microbial activity in the soil.

Thus, it is concluded that the application of 100% recommended dose of fertilizer (NPK: 80: 40: 40 kg/ha) together with the use of *Trichoderma*, *Azotobacter* and PSB biocultures or 100% recommended dose of fertilizer along with farmyard manure (10 tonnes/ha) or 100% recommended dose of fertilizer with one spray of 0.1% thiourea at 50% flowering stage enhances plant height, seed yield in mustard crop and lowers the incidence of *Alternaria* blight and white rust diseases.

#### SUMMARY

Studies were made using organic fertilizers, inorganic fertilizers, biofertilizers, nutritional supplement and a bioregulator on the growth and yield attributes of mustard crop

and on the appearance of diseases. The use of biofertilizers (*Azotobacter* and PSB) and *Trichoderma* along with the recommended doses of fertilizers enhanced the plant growth, improved yield and revealed lesser incidences of *Alternaria* blight and white rust diseases. In another trial, organic manure resulted better growth, enhanced yield and reduced disease incidences in mustard crop. Plant growth and yield of mustard also promoted by basal use of elemental sulphur as a nutritional supplement, spray of thiourea (0.1%) at 50% flowering stage of the crop, along with the adoption of recommended doses of fertilizers (ie NPK, 80: 40: 40 kg/ha).

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