Effect of soil application of micronutrients on white rust and Alternaria blight in Indian mustard

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Introduction

Indian mustard [*Brassica juncea* (L.)Czern&Coss.]is one of the major oilseed crops cultivated in India and around the world. The productivity of mustard is maximum of 1738 kg ha^{-1} in the state of Haryana against the national productivity of around 1000 kg ha^{-1}. Despite considerable increase in productivity and production, a wide gap exists between yield potential and yield realized at farmer's field, which is largely due to biotic and abiotic stresses.Among biotic stresses, white rust caused by *Albugo candida*(Pers. Ex. Lev.)and Alternaria blight caused by *Alternariabrassicae*(Berk.)Sacc.have been reported to be most wide spread and destructive fungal diseases of rapeseed-mustard throughout the world (Kolte, 1985).Haryana state in India is the hot spot for both these diseases, where white rust usually appears early and become severe at the time of flowering, while Alternaria leaf blight, though also, appears early but remains severe at the time of siliquaeinitiation stage. Yield losses from 23 to 54.5 per cent due to both phases (leaf and stag head) of white rust and from 17-48 per cent due to Alternaria blight have been reported from India (Saharan, *etal*., 1984 and Saharan, 1991). Control of these diseases by use of different fungicides with varying degree of success has been reported in the literature (Mehta, *et al*., 2005). With the growing awareness of harmful effects of pesticides, use of disease tolerant cultivars, crop rotation, sanitation practices, bio-agents, plant extracts and even micronutrients to integrate with less fungicidal spray is gaining importance in recent years for environmental safety.Therefore, present study was carried to find out the effect of different micro nutrients in the form of $ZnSO_4$, ZnO, Borax [$Na_2B_4O_7.10H_2O$] and Gypsum [$CaSO_4.2H_2O$] as basal dose alone and alsowith their different combinations as soil application before sowing against both the diseases in Indian mustard.

Materials and Methods

Experiments were carried out in field plots (5mx3m) replicated thrice in randomized block design at Hisar, Haryana, India during*rabi* 2008-09 and 2009-10to test the effectiveness of different micronutrients alone and their different combinations as soil application before sowing against white rust and Alternaria blightin Indian mustard. The soil of the experimental plots was sandy loam in texture, low in organic carbon (0.28%) and available nitrogen (170 kg N ha^{-1}), medium in available phosphorus (20 kg P_2O_5 ha^{-1}) having Ece 0.30 dS m^{-1} and slightly alkaline in reaction (pH 7.7). All the experimental plots received recommended dose of fertilizers (80 kg N and 40 kg P_2O_5 ha^{-1}). Sowing was done on Nov. 04, 2008 and Nov. 10, 2008 using highly susceptible cultivar (Varuna) for both the years. Different pre sowing soil application treatments *viz.*, ZnO @ 15 kg/ha, $ZnSO_4$@ 15 kg/ha, Borax [$Na_2B_4O_7.10H_2O$] @ 15 kg/ha, Sulfur in the form of Gypsum [$CaSO_4.2H_2O$] @ 40 kg/ha alone and their various combinations along with fungicidal and untreated checks were given. Observations on per cent white rust was recorded at 60-70 DAS, while the observation on per cent Alternaria leaf blight was recorded at 90-100 DAS by the method suggested by Conn *et al.*, 1990. Observations on Alternaria pod blight severity were recorded 15 days before maturity and seed yield was also recorded in these treatments.

Results and Discussion

Perusal of data in Table 1 reveals that among soledoses of micronutrients, soil application of Gypsum @ 40 kg ha^{-1} as basal dose significantly reduced the white rust and Alternaria blight up to 19.4 and 21.3 per cent respectively and increased the seed yield upto 13.8 per cent in Indian mustard as compared to untreated check. While, among the combination of two doses i.e. Borax + Gypsum significantly reduced white rust up to 25.9 per cent and Alternaria leaf blight up to 31.5 per cent. However, among the combination of three doses of micronutrients, soil application of $ZnSO_4$ @ 15 kgha^{-1}+ Borax @ 10 kgha^{-1} + Gypsum @ 40 kg ha^{-1} as basal dose significantly reduced the white rust up to 33.2 per cent and Alternarialeaf blight up to39.4 per cent in Indian mustard as compared to untreated check. Significant increase in seed yield up to 24.3 per cent was also recorded in this treatment (Table 2).The effect of soil application of ZnO @ 15 kgha^{-1}+ Borax @ 10 kgha^{-1} + Gypsum @ 40 kg ha^{-1} as basal dosewas at par with the above best treatment in reducing both the diseases.

The present study clearly indicated that the dose of sulphur in the form of Gypsum had played a certain role in altering the resistance level of the host. However, further detailed studies on physiological aspects are needed to confirm the mechanism. The above findings have been advocated to minimize the losses due to both the fungal diseases for eco-friendly sustainability. Similar results with soil application of ZnO, Borax and recommended dose of sulphurwere also reported by Sandhu and Kaur (2010) where they observed minimum incidence of white rust and Alternaria blight.

Conclusion

Soil application of $ZnSO_4$ @ 15 kgha^{-1}+ Borax @ 10 kgha^{-1} + Gypsum @ 40 kg ha^{-1} as basal dose significantly reduced the severity of white rust up to 33.2 per cent and Alternarialeaf blight up to39.4 per cent in Indian mustard as compared to untreated check. Significant increase in seed yield up to 24.3 per cent was also recorded in this treatment.

Table 1: Effect of different treatments of micronutrients as soil application on white rust and Alternaria leaf blight in Indian mustard

Treatments	White rust severity (%)				Alternaria leaf blight severity (%)			
	2008-09	**2009-10**	**Mean**	**% decrease over control**	**2008-09**	**2009-10**	**Mean**	**% decrease over control**
ZnO @ 15 kg/ha	31.7 (34.3)	36.7 (37.3)	34.2 (35.8)	11.4	32.2 (34.6)	38.9 (38.6)	35.6 (36.6)	17.4
$ZnSO_4$ @ 15kg/ha	30.0 (33.2)	34.7 (36.1)	32.4 (34.7)	16.1	31.9 (34.4)	38.2 (38.2)	35.1 (36.3)	18.6
Borax @ 10 kg/ ha	32.2 (34.6)	38.3 (38.2)	35.3 (36.5)	8.5	33.9 (35.6)	39.4 (38.9)	36.7 (37.9)	14.8
Gypsum @ 40 kg/ ha	28.9 (32.5)	33.3 (35.2)	31.1 (33.9)	19.4	29.4 (32.8)	38.3 (38.2)	33.9 (35.6)	21.3
ZnO + Borax	27.2 (31.4)	35.5 (36.5)	31.4 (34.1)	18.7	30.6 (33.6)	35.6 (36.6)	33.1 (35.1)	23.2
ZnO + Gypsum	26.7 (31.3)	32.8 (34.9)	29.8 (33.1)	22.8	27.8 (31.8)	35.0 (36.3)	31.4 (35.9)	27.1
Borax+ Gypsum	25.0 (30.0)	32.2 (34.6)	28.6 (32.3)	25.9	25.6 (30.4)	33.3 (35.2)	29.5 (32.9)	31.5
ZnO + Borax+ Gypsum	22.8 (28.5)	29.4 (32.8)	26.1(30.7)	32.4	23.3 (28.9)	32.2 (34.6)	27.8 (31.8)	35.4
$ZnSO_4$+ Borax+ Gypsum	23.2 (28.8)	28.3 (32.1)	25.8 (30.5)	33.2	22.1 (28.0)	30.0 (33.2)	26.1 (30.7)	39.4
Spray Mancozeb @ 0.2%	18.9 (25.8)	21.1 (27.3)	20.0 (26.6)	48.2	20.0 (26.6)	23.9 (29.3)	22.0 (28.0)	49.0
Untreated check	33.9 (35.6	43.3 (41.2)	38.6 (38.4)	-	41.1 (39.9)	45.0 (42.1)	43.1 (41.0)	-
CD ($P \leq 0.05$)	3.6	3.1			2.8	3.0		

Values in parenthesis are angular transformed

Table 2: Effect of different treatments of micronutrients as soil application on seed yield in Indian mustard

Treatments	Seed yield (kg/ha)			
	2008-09	**2009-10**	**Mean**	**% decrease over control**
ZnO @ 15 kg/ha	1189	1409	1299	6.8
$ZnSO_4$ @ 15kg/ha	1205	1480	1343	10.4
Borax @ 10 kg/ ha	1178	1429	1304	7.2
Gypsum @ 40 kg/ ha	1265	1502	1384	13.8
ZnO + Borax	1236	1437	1337	10.0
ZnO + Gypsum	1281	1465	1373	12.9
Borax+ Gypsum	1320	1533	1427	17.4
ZnO + Borax+ Gypsum	1356	1647	1502	23.5
$ZnSO_4$ + Borax+ Gypsum	1366	1656	1511	24.3
Spray Mancozeb @ 0.2%	1393	1649	1521	25.1
Untreated check	1047	1415	1216	-
CD ($P \leq 0.05$)	42.7	41.9		