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EFFECT OF SEED TREATMENT BY FUNGICIDES TO CONTROL STRIPE DISEASE ON YIELD AND PRODUCTIVITY OF BARLEY

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SUMMARY

Stripe disease of barley caused by *Drechslera graminea* (Rabenh.) Shoemaker is a widely distributed disease in many barley grown parts of the world, but it has assumed more importance with the introduction of some new high yielding varieties. The present investigations were undertaken during 2007-08 and 2008-09 crop seasons with a view of elicit information on effect of disease on productivity of barley. Study revealed that a reduction was observed in all the growth and yield parameters of barley due to stripe disease. Seed treatment with Raxil 2DS at 0.2 per cent concentration significantly improves the productivity of barley crop over rest of the other treatment used except Vitavax 5WP at 0.2 per cent concentration to which it was at par.

Key words : Stripe disease, Barley, Productivity, Straw, Harvest index

Barley (*Hordeum vulgare* L.) is the fourth important cereal crop in the world ranking next to maize, wheat and rice. It is one of the earliest domesticated food crops. Barley is hardier than wheat crop and is inherently equipped to adapt itself admirably well under limited inputs and marginal lands Kumar *et al.* (2013). Because of its most versatile agro climatic adaptability even the high yielding varieties of wheat could not replace barley in the wheat bowls of India on rainfed, saline, alkaline soils and dryland etc. The raw material of barley is utilized for malting and brewing purpose besides food grain and cattle feeds. Barley crop suffers from a number of diseases such as stripe rust, leaf rust, covered smut, loose smut, net blotch, stripe disease and leaf blight etc. which cause significant losses to crop yield. In India, it is an important *rabi* season cereal crop in Punjab, Rajasthan, Madhya Pradesh, Haryana, Uttar Pradesh and Bihar. Total area under this crop in India is 656.25 thousand ha, with a production of 1747.45 thousand tons and an average productivity of 2663 kg/ha in 2016-17. Total area under this crop in Haryana is 20 thousand ha with a production of 73 thousand tones and an average productivity of 3650 kg/ha during 2016-17 (Anonymous, 2018).

Among these fungal disease, stripe disease (*Drechslera graminea* (Rabenh.) Shoemaker is an important disease which may cause crop loss up to 70-72 per cent under epiphytotic conditions (Pant and Bisht, 1983). The disease has been reported from Europe, U.S.A, South Africa, Chin and Japan. Stripe disease incited by *Drechslera graminea* (Rabenh.) Shoemaker is very destructive disease of irrigated barley crop. This disease is very serious throughout the world, wherever barley is cultivated. It is also common in North India, particularly in Haryana and Rajasthan states and causes huge loss in grain yield. Due to the extensive cultivation of high yielding barley varieties, the problem of stripe disease has assumed a significant importance. The pathogen is seed borne in nature and it survives exclusively as mycelium on pericarp or hull of the seed. Diseased plant arise only from infected seeds and they become systematically infected, senescence early and produce a poor yield due to shrivelled seed. There is no spread of infection between plants during the growing season. The fungus produces masses of conidia (anamorph of *Drechslera graminea*) on leaves of diseased plants. These conidia are carried by the wind to developing seed on the ear of healthy plants with in the crop and in neighbouring crops. Developing barley seed is susceptible to infection from anthesis to soft dough stage (Teviotdale and Hall, 1976). Since, some of the spores germinate and infect the developing seed, there is potential for infection to multiply significantly from one season to next season. The pathogen has been reported as an obligate parasite, and practically no authentic record have been produced yet that conidia are produced on

artificial media. But on the other hand, it has been reported that this pathogen successfully sporulates on the lesions on the foliages and glumes under natural conditions.

In Haryana, the disease was first reported by Tyagi (1974) on variety C-138 and in 1976 Hari Chand further reported on many commonly grown varieties. The information on effect of seed treatment by different fungicides to tackle the stripe disease and its effect on productivity of barley is limited. Hence, the present investigation was aimed to obtain information on the above aspects.

MATERIALS AND METHODS

The present investigation entitled, "Effect of seed treatment by fungicides to control stripe disease on yield and Productivity of Barley" were carried out during 2007-08 and 2008-09 *rabi* seasons. The field experiments were conducted at the experimental research area of the Department of Plant Pathology, CCS Haryana Agricultural University, Hisar is located at 215.2 M above the mean sea level with a longitude of 75º46'E and latitude of 29º10'N has a wide range of temperature fluctuation during summer and winter seasons and is characterized as a Semi arid Zone. The minimum and maximum temperature ranges from 0ºC to 48ºC, respectively. The annual average rainfall is 430 mm. The major part of rainfall is received during monsoon season which occurs from July to September. A few millimeters of rainfall can be expected in winter too. During 2007-08 crop season the diseased plants were selected at the experimental research area, Department of Plant Breeding (Wheat and Barley section), CCS Haryana Agricultural University, Hisar in the seed production area of variety BH-393. At maturity these selected plants were harvested separately, thrashed and the seed obtained was used for carrying out further studies. Highly susceptible variety BH 393 was sown in a plot size of 4 x 1.5m to correlate the effect of disease on plant growth parameters, yield parameters and productivity of barley were calculated per plot.

RESULTS AND DISCUSSION

The experimental results of stripe disease of barley on plant yield parameters (Table) revealed that a reduction was observed in all the growth and yield parameters. Initial symptoms of the fungal infection appeared in the form of small yellow spots, later on elongating into yellow brown stripes. These stripes started from the base extended to the tip of leaf causing necrosis of the infected tissue (Plate B). When observed under microscope, the necrotic tissues showed abundant sub hyaline to yellow brown colored

TABLE 1
Effect of stripe disease of barley on growth and yield parameters

Parameter	Healthy plants	Diseased plants	t value	Reduction (%)
Growth Parameters				
Plant Height (cm)*	95.84	78.20	8.48**	18.40
Tillers/plant*	18.15	5.45	14.78**	69.97
Internodal length*				
1	17.30	7.85	7.50**	54.62
2	12.65	10.75	2.96**	15.01
3	13.35	12.00	3.68**	10.11
4	18.05	10.95	8.27**	39.33
5	25.00	21.15	3.36**	15.40
Ear head length with awn (cm)*	18.15	13.45	8.45**	25.89
Yield Parameters and Yield				
No. of grain earhead*	54.55	17.25	44.32**	68.37
1000-grain weight (g)	45.83	34.42	11.41**	24.89
Yield/plot (kg)	3.10	2.20	-----	29.03

*Average of twenty selected plants.
**Significant at 5% level of significance.

conidia. The conidia were thin walled, 2 to 7 septate and cylindrical in shape.

Effect of stripe disease of barley on growth and yield parameters

Barley variety BH-393, highly susceptible to stripe was sown in field. The results presented in Table1 indicate that stripe disease significantly retarded the plant height by 18.40 per cent (78.20 cm), significantly reduces the numbers of tillers/ plant by 69.97 per cent (5.45 tillers per plant), significantly reduces the internodes length i.e. by 54.62 per cent (7.85 cm), 15.01 per cent (10.75 cm), 10.11 per cent (12.00 cm), 39.33 per cent (10.95 cm) and 15.40 per cent (21.15 cm) of 1st, 2nd, 3rd, 4th and 5th internode, respectively and significantly reduces the length of ear head by 25.89 per cent (13.45 cm). The present findings are in accordance to the findings of Kumar (1994). Likewise, significant reduction in numbers of grains per ear head by 68.37 per cent (17.25), 1000- grain weight by 24.89 per cent (34.42 g) and yield/plot (kg) by 29.03 per cent (2.20 kg/plot) over healthy plant was observed in diseases affected plant. Similar observations have also been reported by Butler (1918), Drechsler (1923), Hari Chand (1976) Kumar (1994). Arabi *et al*., 2004 also found that inoculation of P. graminea significantly reduces the thousand grain weight of 10 cultivars of barley. Mehta *et al*. (1953) reported 20-30% reduction in yield in affected varieties, whereas Pant and Bisht (1983) reported that stripe disease reduced the yield upto 70-72% under epiphytotic conditions. The variation in yield losses among varieties may be explained to the difference in their genetic makeup and the adaphic characters under which they are grown. Stripe disease had a direct impact o grain yield of barley, and therefore, this pathogen should be considered when trying to manage barley disease (Arabi *et al.*, 2004).

One sided student's t-test was applied for testing whether reduction in yield parameters were statistically significant or not. At 5% level, of significance it has also been shown that reduction in yield was statistically significant for all parameters i.e. growth and yield.

Effect of seed treatment of productivity of barley

Data presented in Table 2 revealed that seed treatment with different fungicides significantly control the stripe disease and improves the productivity of barley crop. Among all the fungicides used in seed treatment, Raxil 2DS at 0.2 per cent concentration gave significantly highest grain yield (2.98 kg/plot) over rest of the other fungicides treatment except Vitavax 75WP at 0.2 per cent concentration to which it was statistically at par. Similarly, significantly highest straw yield (5.14kg/plot) and biological yield (8.12 kg/plot) was recorded in treatment where Raxil 2DS at 0.2 per cent concentration used as seed treatment over rest of the other treatment except Vitavax 75WP at 0.2 per cent concentration. Highest (36.8%) harvest index (HI) was recorded in treatment Vitavax 75 WP at 0.1 per cent concentration and Bavistin 50 WP at 0.2 per cent concentration.

TABLE 2
Effect of different fungicides used to control stripe disease on productivity of barley

Fungicides	Conc.	Grain yield/ plot (kg)	Straw yield/ plot (kg)	Biological yield/ plot (kg)	HI (%)
Vitavax 75 WP	0.1	2.66	4.56	7.22	36.8
Vitavax 75 WP	0.2	2.87	4.97	7.84	36.6
Raxil 2DS	0.1	2.82	4.91	7.73	36.5
Raxil 2DS	0.2	2.98	5.14	8.12	36.7
Bavistin 50 WP	0.1	2.55	4.41	6.96	36.6
Bavistin 50 WP	0.2	2.70	4.64	7.34	36.8
Captan 50 WP	0.1	2.42	4.26	6.68	36.2
Captan 50 WP	0.2	2.64	4.59	7.23	36.5
Thiram 75 WP	0.1	2.60	4.55	7.15	36.3
Thiram 75 WP	0.2	2.65	4.65	7.30	36.3
Control	-	2.10	3.67	5.77	36.4
L. S. D. (P=0.05)		0.11	0.22	0.37	

CONCLUSION

It is concluded from the findings that to get highest grain and straw production of barley seed treatment with Raxil 2DS at 0.2 per cent should be done.

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