

Foliar Application of Different Fungicides for Management of Karnal Bunt Disease in Wheat Seed

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ABSTRACT Karnal bunt is an important designated disease of wheat adversely affecting the yield and trade globally. The disease is seed, soil and air borne causing qualitative and quantitative losses in terms of quality and seed yield. The affected seeds are partially or completely converted into black powdery mass. The disease has become a limiting factor in the export of wheat because the importing country insists on zero tolerance levels for the fear of introducing the disease. The management of the disease through sprayings of fungicides/bioagents during heading stage of the crop appears to be the best and most important option. Efficacy of different fungicides, bio-agents and their combinations were assessed against the disease in wheat variety HD 2687 during *Rabi* 2006-07 and *Rabi* 2007-08 as foliar sprays at the time of anthesis. Foliar application of 0.1% Tilt (0.06%), 0.25% Vitavax Power (0.06%), 0.05% Tilt+0.4% *Tv* (0.07%), 0.05% Tilt (0.07%), 0.125% Bavistin+0.4% *TV* (0.08%) were found most effective and were statistically at par as against control (0.28%).

Key words: Karnal bunt disease, Wheat, Foliar spray, Control

Karnal bunt disease also known as kernel smut or partial bunt is caused by *Tilletia indica* Mitra, Syn *Neovossia indica* (Mitra) Mundkur and was first reported from Karnal by Mitra in 1931 [1]. The disease is recorded from all the wheat growing states of India maximum being in Punjab, Haryana, HP and Uttar Pradesh. The disease is particularly prevalent in the tarai and high fertility irrigated areas of the Northwest plains of India. The disease is also reported from Afghanistan, Iraq, Mexico, Sweden, Syria, Turkey, Russia and Nepal.

Karnal bunt (KB) disease occurred sporadically and remained confined to a few pockets only before 1970's. But as a result of green revolution in the country leading to changed cropping systems and enhanced inputs, the disease assumed epiphytotic proportions, causing substantial qualitative and quantitative losses in wheat. Joshi *et al.* [2] reported losses between 0.2 to 0.5 per cent of total production which increased to 20 percent in the year of epidemic occurrence [3, 4]. Singh [5] also suggested 0.3-0.5% loss in yield during the most severe years from 1982 to 1989 particularly in Uttar Pradesh. Apart from causing losses in yield and seed vigour, this

designated disease is also responsible for rejection of grains in international trade. An importing country insists on zero tolerance levels for fear of introducing the disease in areas where the disease is not known to occur. Strict quarantine regulations have been imposed on the import of bunted seed. Freshly collected infected grains emit a foul smell, like rotten fish, due to the presence of trimethylamine, and the wheat products from severely infected grains are unpalatable [6]. KB is a seed, soil and air borne disease and the conducive environment especially in the months of February and March play a significant role in the prevalence of the disease at different times. Management of disease is difficult due to the different modes of perpetuation and long survival of teliospores (3-5 years) in the soil and seed. fungicidal treatments and sprayings and the most important seems a good option for its management. Hence present study was undertaken to evaluate the efficacy of bio-agents as *Trichoderma viride* and *Pseudomonas fluorescense* alone and in combination with chemical fungicides as Propiconazole, Carbendazim and Carboxin as foliar sprays against KB disease during the *Rabi* seasons of 2006-07 and 2007-08.

MATERIALS AND METHODS

Efficacy of different chemicals alone as carbendazim (0.25%), propiconazole (0.05%), propiconazole (0.1%), carboxin (0.25%) and bio-agents as *Trichoderma viride* (0.4%), *Pseudomonas fluorescens* (0.4%) and in combinations as propiconazole (0.05%) + *Trichoderma viride* (0.3%), carbendazim (0.125%) + *Trichoderma viride* (0.3%), carboxin (0.125%) + *Trichoderma viride* (0.3%), and *Pseudomonas fluorescens* (0.3%) + *Trichoderma viride* (0.3%) were assessed against Karnal bunt disease in wheat variety HD 2687 during Rabi 2006-07 and Rabi 2007-08 as foliar application at the time of anthesis. Data on incidence of Karnal bunt, seed yield/plot, 1000-seed weight, seed germination and vigour were taken for each treatment after seed harvest. The trial was conducted in plots of 1.8x5 m² size in three replications. First foliar spraying was done at booting stage of the crop followed by second spraying after an interval of 15 days.

The infection of KB was detected by sodium hydroxide seed soak technique [7]. In this technique, the wheat seeds are soaked overnight in 0.2% solution of NaOH. Next morning the seeds are taken out of solution and spread on a blotter sheet to remove excess moisture. On examination, the KB infected seeds/portions of seeds give appearance of shiny jet-black colour. The infection is confirmed as stream of jet-black spores ooze out when bunted seed are pricked under a microscope. The seeds discoloured due to other reasons turn brown to dull black in colour. Karnal bunt infection was calculated on number basis and expressed in percentage. Seed germination and seed vigour were analysed by paper towel method [8].

RESULTS AND DISCUSSION

The symptom of the disease could not be seen at the field level as the earheads and grains were infected at random i.e. neither all the earheads nor all the grains in a spike get infected. The seeds were thus harvested and analysed for observations on disease incidence, yield, 1000-seed weight and germination from each plot.

The portion of wheat seed affected with *T. indica* was transformed into teliospores of the fungus and was observed as black powder. The intensity of



Karnal bunt infected and healthy wheat seed

disease infection was variable on individual kernels which varied from tip infection to completely bunted kernels. Severely damaged grains are identified very easily since the tissues along the suture and adjacent endosperm are replaced with spores.

The results (Table 1) of the experiment revealed that none of the sprayed chemicals could give complete control of the disease. However, spraying of fungicides/ bio-agents at heading stage was found effective in reducing the KB infection. Foliar application of 0.1% Tilt (0.06%), 0.25% Vitavax Power (0.06%), 0.05% Tilt + 0.4% TV (0.07%), 0.125% Bavistin + 0.4% TV (0.08%), 0.05% Tilt (0.07%) controlled the disease most effectively and were statistically at par as against 0.28% infection recorded in control. KB being a designated disease, the Central Seed Certification Board has permitted a maximum of 0.05 and 0.25 per cent infected seed by number in foundation and certified seed, respectively [9]. Though, the spraying of these fungicides/ bio-agents had insignificant effect on other parameters viz., seed yield, 1000-seed weight, seed germination and vigour.

Singh *et al* [10] reported that bio-agents like *Trichoderma viride*, *T. harzianum* and *Gliocladium deliquescence* reduced the germination of teliospores. *T. viride* when applied to soil or earheads, reduced the incidence of Karnal bunt infected grains from 1.63 per cent in control to 0.8 per cent and 0.65 per cent, respectively under natural condition. Under artificial conditions, the bioagent applied 48 hours prior to pathogen or simultaneously reduced the number of infected grains from 13.4 per cent to 9.2 and 6.4 per cent, respectively. According to [11],

Table 1. Mean effect of fungicides and bio-agents on disease infection, seed yield, seed weight and seed germination

Treatments	% infection*	Yield (q/acre)	1000-seed wt. (g)	% seed germination
Untreated	0.28 a	15.9	36.20	97.1 ab
Tilt (0.1%)	0.06 d	14.5	36.56	97.4 ab
Vitavax Power (0.25%)	0.06 d	18.5	35.93	97.8 a
Bavistin (0.25%)	0.25 ab	15.9	35.32	96.2 abc
TV (0.4%)	0.22 b	15.4	35.45	96.8 ab
P.fluorescence (0.4%)	0.25 ab	16.6	35.05	96.2 abc
Tilt+TV (0.05+0.4%)	0.07 d	15.9	35.77	96.3 abc
Bavistin+TV (0.125+0.4%)	0.08 d	14.7	35.71 ab	96.0 bc
Vitavax+TV (0.125+0.4%)	0.24 ab	16.1	35.26	96.3 abc
P.f +TV (0.4+0.4%)	0.14 c	15.7	34.93	96.1 abc
Tilt (0.05%)	0.07 d	16.0	36.71 <i>Tv</i>	96.5 ab
LSD0.05	0.04	NS	NS	1.6

*based on seed infection

single spraying of Triadimefon and Carbendazim @ 0.2 per cent at heading stage controlled the disease upto 82-87.5 per cent. Tilt (Propiconazole) @ 500 ml/ha gave 71.4, 91.0 and 100 per cent disease control in one, two and three sprays, respectively at Gurdaspur and Ludhiana during 1984-85 to 1986-87. Tilt has been found very effective in controlling Karnal bunt disease and enhancing 1000-grain weight [12]. According to [13] also it is expected that disease can be managed by spraying fungicide, with the onset of favourable conditions if these coordinates with the susceptible stage of the crop.

Thus, the incidence of Karnal Bunt disease can be managed from spreading and getting established in the seeds by spraying of fungicides/ bio-agents at the time of heading. The prevalence of infection in the field of course depends very much on weather conditions and host susceptibility.

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