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Field evaluation of fungicides against black point of wheat

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Abstract
A field experiment was conducted at Wheat Research Station, Junagadh Agricultural University, Junagadh during *Rabi* season 2025-2026 to evaluate fungicides against black point of wheat caused by *Alternaria alternata, Bipolaris sorokiniana* and *Curvularia lunata*. Wheat was inoculated at the milking stage and seven fungicides found effective in *in vitro* trial were sprayed at 15 days after inoculation. All treatments significantly reduced disease incidence compared to control (56.43%). Tebuconazole 50 + trifloxystrobin 25 WG at 0.075% was most effective, recording the lowest disease incidence of 23.61% and highest disease reduction of 57.99%. It was statistically at par with propiconazole 25 EC at 0.025% (24.95% disease incidence, 55.62% disease reduction), hexaconazole 4 + zineb 68 WP and azoxystrobin 18.2 + difenoconazole 11.4 SC. Copper hydroxide 53.8 DF and propineb 70 WP were least effective. The study indicates that triazole and strobilurin-based fungicides provide effective management of black point in wheat under field conditions.

Keywords: Wheat, Black point, *Alternaria alternata*, *Bipolaris sorokiniana*, Fungicide, Tebuconazole + trifloxystrobin

Introduction
Wheat often called the "King of Cereals" is a crucial staple food for about 36% of the world's population (Kumar *et al*., 2019) [7]. Belonging to the family *Poaceae* (Braun *et al*., 2010) [1]. Wheat (*Triticum aestivum* L.) is a self-pollinated crop. In India, three major types of wheat were cultivated *T. dicoccum* Schrank. (Emmer wheat) and *T. durum* Desf. (Macaroni or Durum wheat) *T. aestivum* L. (Bread wheat) (Peng *et al*., 2011) [12]. Wheat-based products are widely consumed in India, Pakistan and Iran (Kumar *et al*., 2011) [6]. Rich in protein, dietary fibre, B vitamins and minerals. Wheat is valued as a nutritious health food. However, the crop suffers from several fungal diseases that cause annual yield losses of 15 to 20 per cent. Key diseases include rusts, black point, blotches and head blight. Black point is complex disease; it is cause by many of the fungus. Among these, *B. sorokiniana* is the most common, followed by *A. alternata* and *C. lunata*. The disease is usually linked to high humidity and wetter patches in fields. The critical period for black point occurrence begins 30 days after heading and continues for 14 to 20 days (Moschini *et al*., 2006) [11]. During this time, warm temperatures above 17°C combined with daily relative humidity between 60 to 85 per cent promote higher incidence of black point. The black point disease has been reported from Punjab, Haryana, Jammu Kashmir, Uttar Pradesh, Uttarakhand, Himachal Pradesh, Bihar, Delhi, West Bengal, Orissa, Gujarat, Rajasthan, Maharashtra, Madhya Pradesh, Assam, Karnataka and Andhra Pradesh (Singh *et al*., 2018) [15]. The black point disease is identified by a dark discoloration of the embryo sides of the wheat grains (Mak *et al*., 2006) [9]. Diseased kernels are black and discolored at the ends of the seed. Embryos become often shriveled and brown to black in color.

Materials and Methods
A field trial was carried out at the Research Farm of the Wheat Research Station, Junagadh Agricultural University, Junagadh during 2025-2026 in *Rabi* season and evaluated the efficacy of fungicides for the management of black point of wheat. The fungicides found effective under *in vitro* condition against the test pathogen were used for field experiment as

per Table 1. Wheat plants were inoculated with spore suspension of *A. alternata, B. sorokiniana* and *C. lunata* ($3x10^5$ conidia ml^{-1}) prepared in sterilized distilled water at the milking stage with the help of a hand sprayer during evening hours. The fungicides found effective from *in vitro* trial were sprayed at 15 days after inoculation by dissolving at their effective concentration at the rate of 500-liter solution per hectare. The required quantity of respective fungicides was added to measured quantity of water so as to get desired concentration. Control was maintained without spraying of any fungicide.

Observations on per cent disease incidence were recorded from randomly selected five tagged plants from each treatment at harvesting time. The selected plant was evaluated into diseased seed out of total seeds then converted into per cent disease incidence (PDI) by using the formula given by Sesiz (2023) [13].

$$\text{Disease incidence (\%)} = \frac{\text{Number of infected seeds}}{\text{Number of seed taken}} \times 100$$

The per cent disease reduction over control was calculated with the help of following formula (Mathur *et al.,* 1971) [10].

$$\text{Disease control (\%)} = \frac{\text{PDI in control plot - PDI in treated plot}}{\text{PDI in control plot}} \times 100$$

Result

The data presented in Table 2 revealed that all the treatments were reduce the disease incidence compare to control under field condition. Among the different treatments tried, spraying of wheat crop with tebuconazole 50 + trifloxystrobin 25 WG at 0.075 per cent concentration showed minimum disease incidence (23.61%) with maximum disease reduction over control (57.99%) and found significantly superior over the rest of the treatments, but it was remained statistically at par with propiconazole 25 EC at 0.025 per cent concentration, hexaconazole 4 + zineb 68 WP and azoxystrobin 18.2 + difenoconazole 11.4 SC at 0.075 per cent concentration with 24.95, 26.29 and 26.90 per cent disease incidence and 55.62, 53.25 and 52.07 per cent disease reduction over control, respectively. Whereas, control plot showed maximum disease incidence of 56.43 with high disease pressure.

Discussion

The present results get similarity with finding of Iqbal *et al.* (2014) [5]. They reported minimum disease infection of black point in wheat with propiconazole 25 EC with 23.03 per cent disease incidence. Shrestha *et al*. (2017) [14] also reported among different doses of treatments propiconazole at the rate of 2ml/L water showed significant result for the efficient management. Kumar *et al*. (2021) [8] also found propiconazole 0.1% at boot leaf stage followed by second spray at 20 days interval proved to be best in reducing disease. Tiwari *et al.* (2022) [16] found similar result that propiconazole has low per cent disease incidence (25.80%) compare to other fungicidal treatment. Nil *et al.* shown propiconazole has highest efficacy against black point of wheat, which are in line with the present findings.

Table 1: Fungicides used for the management of black point of wheat under field condition

Sr. No.	Treatments	Concentration (%)	Quantity per 10 liters of water
1.	Copper hydroxide 53.8 DF	0.10	18.5 g
2.	Propineb 70 WP	0.15	21.5 g
3.	Difenoconazole 25 SC	0.025	10 ml
4.	Propiconazole 25 EC	0.025	10 ml
5.	Azoxystrobin 18.2+Difenconazole 11.4 SC	0.075	8.5 ml
6.	Tebuconazole 50+Trifloxystrobin 25 WG	0.075	10 g
7.	Hexaconazole 4+Zineb 68 WP	0.075	10.5 g

Table 2: Field evaluation of fungicides against black point of wheat

Treatments	Concentration (%)	Per cent disease incidence*	Per cent disease reduction over control
Copper hydroxide 53.8 DF	0.10	35.82 (34.25)	39.05
Propineb 70 WP	0.15	38.40 (38.59)	31.36
Difenconazole 25 SC	0.025	37.44 (36.96)	34.32
Propiconazole 25 EC	0.025	29.97 (24.95)	55.62
Azoxystrobin 18.2 + Difenconazole 11.4 SC	0.075	31.24 (26.90)	52.07
Tebuconazole 50 + Trifloxystrobin 25 WG	0.075	29.07 (23.61)	57.99
Hexaconazole 4 + Zineb 68 WP	0.075	30.85 (26.29)	53.25
Control	-	48.69 (56.43)	-
S. Em. ±		1.84	
C. D. at 5%		5.59	
C.V.%		10.48	

* Mean of three repetitions

Note: Data outside the parentheses are arcsine transformed, whereas inside are retransformed values.

Field view of experimental site

Conclusions

Total eight treatments along with control were applied under field condition. Among them, tebuconazole 50 + trifloxystrobin 25 WG at 0.075% showed minimum disease incidence (23.61%) with maximum disease reduction over control (57.99%) and found significantly superior over the rest of the treatments, but it was remained statistically at par with propiconazole 25 EC at 0.025 per cent concentration, hexaconazole 4 + zineb 68 WP at 0.075 per cent concentration and azoxystrobin 18.2 + difenoconazole 11.4 SC at 0.075 per cent concentration with 24.95, 26.29 and 26.90 per cent disease incidence and 55.62, 53.25 and 52.07 per cent disease reduction over control, respectively.

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