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Effect of black point on seed quality and germination of wheat

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Abstract
The impact of black point complex disease on wheat seed quality was studied using ten varieties during *Rabi* 2025-2026 at Junagadh Agricultural University, Junagadh. Infected seeds showed a mean 9.97% increase in 1000 grain weight compared to healthy seeds with GW 366 recording the highest increase at 12.1% in grain weight of infected seeds. Mean germination decreased by 4.31% in infected seeds with GW 322 shown maximum loss at 5.09%. Germination also declined with higher disease grades, where G4 and G5 seeds were mostly non-germinated. Among varieties, DBW 110 and GW 513 were least affected. Results shown that black point increase the grain weight and decrease germination percentage, indicating the need for proper seed treatment to ensure quality seed production in wheat.

Keywords: Wheat, Seed quality, Germination percentage and 1000 grain weight

Introduction
Wheat is the mandatory staple food crop for around 36 per cent of the global population (Kumar *et al*., 2019) [12]. Wheat belongs to the Family *Poaceae* (Braun *et al*., 2010) [4]. Wheat contributes more calories and proteins to the world diet than any other cereal crops (Adams *et al.,* 2002 and Shewry, 2009) [1, 27]. It is nutritious, easy to store and transport and can be processed into various types of food. Wheat flour is used to prepare bread, produce biscuits, confectionary products, noodles and vital wheat gluten or seitan. Wheat is considered good source of protein, dietary fiber, B-group vitamins and minerals. It is an excellent food for health building. Several biotic stresses restrict wheat production. More than 200 diseases affect wheat, around 50 of them lead to significant economic damage (Al-Sadi, 2016; Lalic *et al*., 2017; Riaz *et al*., 2017 and Sharma *et al*., 2017) [3, 13, 24, 26]. Approximately 20 per cent of the wheat crop is lost annually due to diseases. Major diseases of wheat include rusts, spot blotch, common root rot, smut, tan spot, septoria blotch, powdery mildew, fusarium head blight and blast. Black point is mainly cause by *Alternaria alternata* then followed by *Bipolaris sorokiniana*, *Curvularia lunata, Cladosporium cladosporioides*, *Cochliobolus sativus* and *Fusarium* spp. (Fakir *et al*., 1989; Dey *et al*., 1992; Fernandez and Conner, 2011) [7, 5, 8]. The black point disease was identified by a dark discoloration of the embryo sides of the wheat grains (Mak *et al*., 2006) [15]. Black point formation in susceptible varieties is linked to conditions of low vapour pressure deficit, low temperatures and high humidity. The development of symptoms depends on both environmental conditions and biotic factors during the grain development and ripening stages. Black point negatively affects germination and seedling emergence (Rahman and Islam, 1998) [21]. The decline in germination is associated with the level of black point severity (Malaker and Mian, 2002) [16]. Infection increase when extended wet conditions occur during the grain-filling stage. The disease is identified by brown to black discoloration that is typically confined to the embryo end of the kernel, while under severe infection the entire grain can become discolored and shriveled (Adlakha and Joshi, 1974) [2].

Materials and Methods
The present experiment was conducted at Research farm, Wheat Research Station, Junagadh Agricultural University, Junagadh during 2025-2026 in *Rabi* season. Ten wheat varieties (GW 366, GW 451, GW 322, GW 496, DBW 110, GW 273, GW 173, LOK 1, GJW 463 and GW 513) were taken for study of black point impact on seed quality and germination.

Healthy and black point infected grains were utilized for study the impact on quality parameters like grain weight with the use of digital balance in laboratory. For the determination of germination per cent 100 seeds per wheat varieties were taken. Infected seeds of each variety were surface sterilized with 2 per cent sodium hypochlorite solution for 1 minute, followed by rinsing with sterilized distilled water with three times. After sterilization, seeds were transferred to 9 cm Petri dishes (50 seeds per Petri dish) with two layers of blotter paper fully moistened with sterilized distilled water for germination. The Petri dishes were incubated in a growth chamber at 28 ± 1°C in darkness for three days at 90-95 per cent relative humidity and a 12 hrs. photoperiod with the same temperature (Li *et al*., 2014) [14]. Germination percentages were calculated after 7 days by counting the germinated seeds using the formula mentioned below (Momtaz *et al*., 2022) [17].

Quality parameter:

To measure the 1000 grain weight.

Germination percentage:

$$\text{Germination Percentage} = \frac{\text{Total number of germinated seed}}{\text{Total number of seeds tested}} \times 100$$

The seeds were sorted out into 6 different grades on the basis of severity of black point infection (Table 1) [Plate 1 (A)]. The grading was done according to a 0-5 rating scale as suggested by Gilchrist (1985) [9]. Based on grade of infection the infected seed germination percentage was also assessed at Laboratory condition. Method follow for germination determination was same as earlier given.

Result and discussion

The data presented in Table 2 revealed that mean 1000 grain weight of healthy seeds and infected seeds was 44.74 and 49.20 g, respectively. Mean per cent increase in infected seeds was 9.97 per cent. Minimum grain weight was found in variety GW 513 with 46.07 g of infected seeds, while maximum grain weight of infected seeds was found in variety GW 366 with 52.83 g. In variety GW 366 maximum increase of grain weight of infected seeds was 12.1 per cent compare to other variety. In variety DBW 110 and GW 513 least increase in seeds weight with 8.2 and 7.5 per cent compared to other variety which were used in experiment.

Mean decrease in germination was 4.31 per cent in black point infected seeds. Highest germination per cent found in infected seeds of variety GW 496 and GW 173 with 85.75 per cent. Maximum per cent loss of germination in variety GW 322 was 5.09 per cent. Two varieties DBW 110 and GW 513 has least decrease in germination up to 3.64 and 3.38 per cent, respectively. In infected seeds, germination was also decrease with increase of disease grade. In grade 0 maximum seed germination found and grade 5 less germination of infected seed was found. Normal seedling was found in grade 0, while came to the grade 1, grade 2 and grade 3 found abnormal seedling with partial germination. Whereas, in grade 4 and grade 5 mainly ungerminated seed was found [Plate 1(B)].

The results obtained in present study were similar with results of Partap and Solanki (2016) [19]. They founded that seeds weight increase with more disease incidence, in their experiment founded that seed weight of healthy and infected seed was 41.65 and 48.08 g, respectively. This experiment finding was also similar with result of Khulbe *et al*. (2011). They also founded that seed weight increase with increase the disease grade. The results obtained in present study on germination of seed were corroborate with more or less similar type of results as obtained by Momtaz *et al.* (2022). They reported about 95 to 89 per cent of germination was recorded for the seven wheat varieties in healthy seeds after 7 days, but in infected seed it was reduced from 84 to 76 per cent. Sharma *et al.* (2021) [25] also revealed that infection of black point in seeds reduced the germination. Similarly, Yadav *et al.* (2020) [29] observed that black point significantly decreased the germination percentage in infected seeds. Li *et al.* (2014) [14] also studied about germination percentage more decrease in grade 3 to 5, whereas in grade 1 and grade 2 no significant difference has been observed.

Table 1: Black point disease severity scale (Gilchrist, 1985)

Rating scale	Description
G_0	Grains free from any discoloration (apparently healthy)
G_1	Only tip of the embryo brown to blackish
G_2	Discoloration covering the whole embryo
G_3	Embryo with 1/4 of the grain discolored
G_4	Embryo with 1/2 of the grain discolored
G_5	Embryo with more than 1/2 of the grain discolored and shriveled

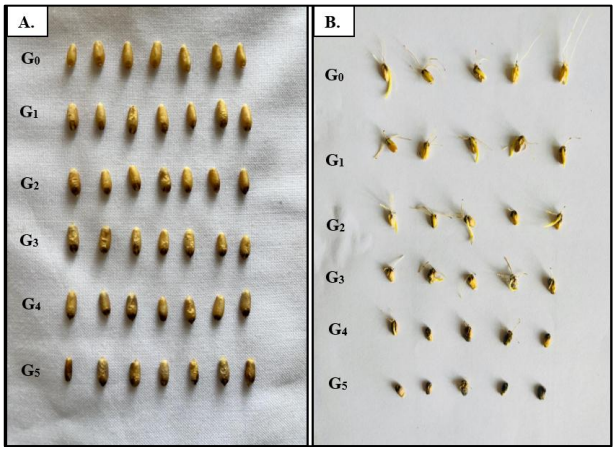
Table 2: Effect of black point on 1000 grain weight and seed germination of wheat

Variety	1000 grain weight (g)*			Germination (%)*		
	Healthy seed	Infected seed	Per cent increase	Healthy seed	Infected seed	Per cent loss
GW 366	47.13	52.83	12.1	70.09 (88.40)	67.00 (84.73)	4.87
GW 451	44.37	49.00	10.4	69.54 (87.78)	65.71 (83.07)	4.57
GW 322	45.03	50.00	11.0	68.34 (86.38)	64.46 (81.41)	5.09
GW 496	44.43	48.67	9.5	71.30 (89.72)	67.82 (85.75)	4.02
DBW 110	43.43	47.00	8.2	67.25 (85.05)	64.69 (81.73)	3.64
GW 273	44.9	49.67	10.6	68.07 (86.05)	64.20 ((81.06)	4.65
GW 173	43.4	47.40	9.2	70.39 (88.74)	67.82 (85.75)	3.82
LOK 1	45.73	50.03	9.4	68.07	64.46	4.30

				(86.05)	(81.41)	
GJW 463	46.13	51.33	11.3	69.49 (87.72)	65.95 (83.40)	4.79
GW 513	42.83	46.07	7.5	68.07 (86.05)	65.69 (83.05)	3.38
Mean	44.74	49.20	9.97	69.06 (87.23)	65.78 (83.17)	4.31
S. Em. ±	0.57	0.67	-	0.68	0.80	-
C. D. at 5%	1.69	2.0	-	2.0	2.36	-
CV%	2.37	2.63	-	1.70	2.11	-

*Mean of three repetitions

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



G_0: Grains free from any discoloration (apparently healthy)
G_1: Only tip of the embryo brown to blackish
G_2: Discoloration covering the whole embryo
G_3: Embryo with 1/4 of the grain discolored
G_4: Embryo with 1/2 of the grain discolored
G_5: Embryo with more than 1/2 of the grain discolored and shriveled

Fig 1: (A) Grade-wise black point infected seed (B) Grade-wise *in vitro* germination of healthy and infected wheat seed

Conclusions

Black point complex disease negatively impacted seed quality traits across wheat varieties. Seed weight of infected seed was increasing compare to healthy seeds. Germination per cent decrease in infected seeds compare to healthy seeds due to shrivelling and undersized seeds in black point infection.

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