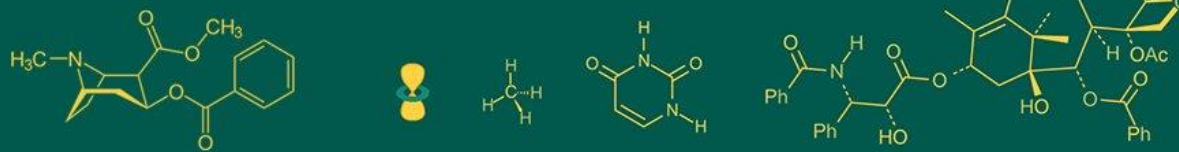


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Seed health evaluation of farmers saved wheat seeds of popular cultivars

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Abstract

Total 70 seed samples of different variety were collected from the farmers of different villages of Samastipur and Muzaffarpur districts of Bihar state for studies of seed health status of wheat seeds. Collected seed samples were categorized in four categories *i.e.*, Shrivelled, discoloured or black point, damaged, infected and healthy seeds. In Samastipur seed samples average shrivelled, discoloured, damaged and healthy seeds were found 8.53%, 8.16%, 6.57% and 76.72% respectively. While in case of Muzaffarpur seed samples average shrivelled, discoloured, damaged and healthy seeds were found 7.68%, 5.54%, 4.88% and 81.90% respectively. Study on germination percentage by standard paper towel method, in Samastipur and Muzaffarpur seed samples average seed germination percentage recorded were 72.87% and 74.47% respectively and seedling vigour were recorded 1923.56 and 2309.60 in Samastipur and Muzaffarpur seed samples respectively. Investigation on normal seedlings, abnormal seedlings, dead seeds and infected seeds percentage, Samastipur seed samples recorded average 72.78, 5.08, 22.13 and 24.86 percent however, Muzaffarpur seed samples recorded average 74.42, 6.02, 14.55 and 27.27% respectively. Study on bunt and loose smut disease detection, all seed samples were free from bunt and loose smut infection.

Keywords: Wheat seed health, farmers saved seed, infected seed, germination percentage, seedling vigour etc.

Introduction

In India, the farmers are growing wheat crop mainly for consumption purpose and they save a portion of produce to use them as a seed for next season. These farmers saved seeds are not tested for their quality. Obviously, the farmers saved seeds are of poor health and quality and often infected by seed borne pathogens. These poor qualities of infected wheat seeds fail to germinate and if germinated the young seedlings from infected seeds die in few days, resulting in poor germination, post emergence damping off and cause seedling blight. The seed borne pathogens present in the seeds or associated with seeds will remain alive in dormant condition with seed lots as long as the seed remains viable. Wheat crop is affected by approximately 120 different diseases, among them, 42 diseases are seed borne and 35 diseases are caused by fungi (Hasan *et al.*, 2005) [12]. Coincidentally, seed borne diseases of wheat are more destructive in nature and it occurs worldwide. Seeds provide natural substrate for the growth of fungi gets associated with externally or internally or both to the seeds. Fungi associated with seeds as contaminant can cause seed abnormalities, poor germination as well as seedling damage resulting in development of disease at later stages of plant growth by systemic or local infection (Bateman G. L. and Kwasna 1999; Khanzada, KA *et al.*, 2002, Ranjan *et al.*, 2023) [6, 15, 18]. They not only reduce the quality of seed but also transmitted from one season to other and may introduced new pathogens in a disease free area, causing quantitative and qualitative crop losses and permanent contamination of the soil (Ora *et al.*, 2011) [17].

Therefore, using a good quality seed and performing seed health test to detect the presence of seed borne fungi becomes paramount to manage the diseases for healthy crop establishment. Considerable work has been done on seed health and detection of seed borne pathogens in wheat seeds from different geographical region of the country (Sharma and Chahal, 1996; Gopalakrishnan and Valluvaparisadan, 2009; Gopalakrishnan *et al.*, 2010; Archana and Prakash, 2013; Sharma and Kapoor, 2016; Singh *et al.*, 2018; Ranjan *et al.*, 2023) [20, 10, 11 4, 19, 22, 18].

But, the information on seed health of wheat varieties collected from farmers of different location in Bihar is scanty. Thus, farmers saved wheat seeds can be infected by many seed borne pathogens. Seed associated mycoflora and seed borne diseases are mainly responsible for low yield and production of poor quality wheat seeds in Bihar.

In view of the above facts and importance of seed health of wheat seeds, the present study was taken up to determine the seed health of farmers saved seeds like germination%, normal seedling, abnormal seedling, dead seed, seedling vigour and extent of different seed borne mycoflora associated with different popular wheat varieties collected from farmers of different location.

Materials and Methods

Collection of wheat seed samples

Total 70 seed samples of different variety were collected from 25 different locations of the farmers of Samastipur (23 samples) and Muzaffarpur district (47 samples) of Bihar state. The collected seed samples were kept in cloth bag and stored in a well ventilated room of the laboratory in Department of Plant Pathology, RPCAU, Pusa, Bihar (India).

Categorization of seed sample into healthy, shrivelled and discoloured or black point seeds

400 seeds were taken randomly from each collected samples for the study of seed quality the method suggested by Neergaard (1977) [16] and divided into four categories. Each category was spread on a Petri plate or on blotter paper and examined. Each sample was categorized in percentage like shriveled seeds; discoloured (greenish brown or Dark brown to black) or black point seeds; damaged seeds mechanically or insect and healthy seeds.

Determination of Germination

The seeds germination percent were recorded by Between Paper (BP) or Paper Towel method (Anonymous, 1985) [3]. After 7-9 days unrolled the towels, and data on percent seed germination, normal seedlings, abnormal seedlings and dead seeds were recorded separately for each seed samples following the rules of ISTA, 2001 [14].

Categories of normal and abnormal seedlings

Normal seedlings

Normal seedlings were categorized by intact seedling with all essential structures, well developed, complete in proportion and healthy.

Abnormal seedlings

Those seedlings do not showed capacity of continue development into normal plant under favourable condition categorised into abnormal seedlings like seminal roots missing/stunted or broken and decayed due to primary infection, coleoptiles missing /split deformed or bent over, leaf missing /extending less than halfway of the coleoptile, shredded or deformed, discoloured or decayed as a result of primary infection.

Dead Seeds

These seeds are unviable, showing no any kind of root and shoot growth (lack of germination), due to damaged embryo.

Measurement of plant shoots and root growth

From each sample five normal seedlings were randomly selected and their individual shoot length and root length was measured.

Determination of Seedling Vigour

Vigour index of each seedling were calculated by following the formula given by Baki and Anderson, 1972 [5].

Vigour Index = (Mean of root length + Mean of shoot length) x% seed germination.

Detection of seed borne pathogen in seed samples

Detection of bunt from wheat seed sample

For detection of bunt disease from samples Sodium-hydroxide (NaOH) seed soak method was used (Agarwal and Verma, 1983) [2]. The seeds were soaked in 0.2% NaOH solution for 24 hr at 20 °C. After 24 hr wash the seed 3 to 4 times with sterilized distilled water and kept small amount of water in beaker for observation. The infected portion of the seeds appears as jet black and shiny, in contrast to the pale yellow healthy seed. When black seeds are ruptured in a drop of water, a stream of teliospores is released was observed (Agarwal and Mathur, 1992) [1].

Detection of loose smut in poly house

Seeds from each sample were sown in poly house in pot. After the emergence of complete ear heads the smutted plants were counted in each pot and percent loose smut incidence were calculated on the basis of total number of plants infected.

Results & Discussion

Study of seed health and quality of wheat seeds samples

Collection of wheat seed samples

Total 70 seed samples of wheat collected from farmers of different villages of Samastipur (23 samples from 10 villages) and Muzaffarpur (47 samples from 15 villages) districts of Bihar were analysed for seed health and quality.

Categorization of seed sample into healthy, shriveled, discoloured or black pointed and damaged seeds

Total 70 seed samples collected from farmers were categorized into four categories viz., shriveled seeds, discolored (greenish brown or Dark brown to black) or black point seeds, damaged seeds mechanically or insect and healthy seeds. The results were presented in table 1. In case of Samastipur seed samples in S-6 has detected highest percentage of shrivelled seeds (29.75%) and lowest in S-14 (2.75%). The highest discoloured seeds found in S-12 (15.75%) and lowest in S-23 (2.25%). The highest damaged seeds found in S-7 (26.25%) and lowest in S-10 (0.5%). The highest healthy seeds found in S-23 (91%) and lowest in S-7 (51.25%). However, in Samstipur district the recorded average shrivelled seeds (8.53%), discoloured seeds (8.16%), damaged seeds (6.57%) and average healthy seeds (76.72%).

While in case of Muzaffarpur seed samples in M-47 has detected highest percentage of shrivelled seeds (19.25%) and lowest in M-26 (2.25%). The highest discoloured seeds found in M-2 (13.5%) and lowest in M-13 (1.5%). The highest damaged seeds found in M-2 (10.75%) and lowest in

M-47 (1.5%). The highest healthy seeds found in M-4 (91.75%) and lowest in M-2 (61.75%). However, in Muzaffarpur district the recorded average shrivelled seeds (7.68%), discoloured seeds (5.54%), damaged seeds (4.88%) and average healthy seeds (81.89%).

Determination of Germination

Variation in seed germination percentage was observed among all the collected wheat seed samples, used in this present study (Table 2). In case of Samastipur seed samples seed germination percentage varied from 47 to 95%. In seed samples, S-10 & 11 has recorded highest percentage of seed germination (95%) and lowest seed germination was recorded in S-18 (47%). The average seed germination percentage recorded was 72.87%. While in case of Muzaffarpur seed samples germination percentage varied from 40 to 97%. In seed sample M-23 has recorded highest percentage of seed germination (97%) while it was recorded lowest in M-37 (40%). The average seed germination percentage recorded was 74.47%.

Determination of Seedling Vigour

Variation in vigour index was recorded among all the collected wheat seed samples, used in this present study. The results were presented in table 2. In case of Samastipur seed samples in S-8 has recorded highest vigour index (2498.64) and recorded lowest in S-18 (1307.54). The average vigour index recorded was 1923.56. While, in case of Muzaffarpur seed samples in M-6 was recorded highest vigour index (4483.76) and lowest recorded in seed samples of M-39 (1057.8). The average vigour index recorded was 2309.60.

Categorization of normal and abnormal seedlings, dead seeds and infected seeds

Percentage of normal seedlings, abnormal seedlings, dead seeds and infected seeds was varied among seed samples used in this study and results were presented in Table 3. In case of Samastipur seed samples in S-10 & 11 has recorded highest% of Normal seedlings (95%) and lowest in S-18 (47%). The highest percentage of abnormal seedlings found in S-22 (12%) and lowest in S-1, 10, 11 & 15 (2%). The highest percentage of dead seed found in S-18 (46%) and lowest in S-10 & 11 (3%). The highest percentage of infected seed found in S-9 (46%) and lowest in S-10 (11%). The average normal seedlings, abnormal seedlings, dead seeds and infected seeds percentage recorded as 72.78, 5.18, 22.13 and 24.86% respectively.

While in case of Muzaffarpur district seed samples M-23 has recorded highest percentage of Normal seedlings (97%) and lowest in M-37 (40%). The highest percentage of abnormal seedlings found in M-46 (13%) and lowest in M-9 & 23 (1%). The highest percentage of dead seed found in M-37 & 39 (56%) and lowest in M-10, 23 & 25 (2%). The highest percentage of infected seed found in M-46 (45%) and lowest in M-25 (4%). The average normal seedlings, abnormal seedlings, dead seeds and infected seeds% observed as 74.42, 6.20, 19.55 and 27.27% respectively.

Detection of seed borne pathogens in wheat seed samples Detection of bunt from wheat seed sample

Detection of bunt of wheat from seed samples was done by 0.2% NaOH by Seed soak method. Bunt was not observed in any wheat seed samples collected from farmers.

Detection of loose smut in poly house

For detection of loose smut disease, all the seed samples were sown in pot in poly house and observed the smutted plants after the emergence of complete ear head, there was no loose smut disease recorded from any wheat seed samples collected from farmers.

Discussion

Quality seeds play crucial role in the healthy and disease free crops production. Many seed associated mycoflora and seed borne pathogens are transmitted by seeds and it serves the carrier of many diseases, which causes considerable yield losses of wheat crops. Wheat crop is one of the most important cereal food crops in the world. Wheat seeds carry number of fungal pathogens, they causes many seed borne diseases in field and also affect the seed germination, seedling vigour, plant growth and yield.

Mycoflora associated with wheat seeds as externally, internally and as concomitant contamination with crop debris, soil particles, inert matter etc. Mycoflora associated with seeds as on or in the seed may result in prolonged dormancy, cause reduced germination and seedling vigour and many diseases in field (Christensen and Lopezf, 1963) [8].

In the present investigations, total 70 wheat seed samples of different variety were collected from the farmers of different villages of Samastipur and Muzaffarpur districts of Bihar state to study the quality and health status of wheat seeds.

In the study of categorization of collected wheat seed samples recorded the presence of shrivelled, discoloured, damaged and infected seeds together with healthy seeds. In Samastipur seed samples, shrivelled seeds ranges from 2.75 to 29.75%, discoloured seeds ranges from 2.25 to 15.75%, damaged seeds ranges from 0.5 to 26.25% and healthy seeds ranges from 51.25 to 91%. While in case of Muzaffarpur district seed samples, shrivelled seeds ranges from 2.25 to 19.25%, discoloured seeds ranges from 1.5 to 13.5%, damaged seeds ranges from 1.5 to 10.75% and healthy seeds ranges from 69.75 to 91.75%. Such variation of presence of shrivelled, discoloured, damaged seeds and healthy seeds could be due to physiological and chemical nature of the seeds and agricultural practices followed during cultivation, environmental condition, use of poor quality and infected seeds with pathogenic and non-pathogenic seed mycoflora. Sharma (1986) [21] has also reported such kind of seeds and other impurities associated with wheat seeds.

Study of germination percentage of seed samples, variation in seed germination percentage was observed among all the seed samples collected from different location of Muzaffarpur and Samastipur district of Bihar. In Samastipur seed samples, seed germination percentage varied from 47 to 95%, while in case of Muzaffarpur seed samples, germination percentage varied from 40 to 97%. The variation in the germination percentage may be occurred due to variation in genetic makeup or the association of seed borne pathogens with seeds. However, reduced germination percentage was found to be related with the presence of discolouration or black point infection and mycoflora associated with wheat seeds. Similar to our findings, many reports also showed the reduced germination of wheat seeds is related to presence of discolouration or black point infected seeds reported by Chowdhury, 2008; Hossain, 2000 [7, 13].

In the study of categorisation of normal and abnormal seedlings, dead and infected seeds in percent varied among seed samples used in this study. In case of Samastipur seed samples, Normal seedlings ranges from 47 to 95%, abnormal seedlings ranges from 2 to 12%, dead seed ranges from 3 to 46% and infected seed ranges from 11 to 46%. While in case of Muzaffarpur district seed samples, normal seedlings ranges from 40 to 97%, abnormal seedlings ranges from 1 to 13%, dead seed ranges from 2 to 56%, and infected seed ranges from 4 to 45%.

In study of seedling vigour, variation in vigour index was recorded among all the collected wheat seed samples, used

in this present study. In case of Samastipur seed samples vigour index ranges from 1307.54 to 2498.64, while in case of Muzaffarpur seed samples vigour index ranges from 1057.8 to 4483.76. Similar to our findings, Hossain (2000)^[13], Varshney (1990)^[24], Conner *et al.*, (1996)^[9] and Toklu *et al.*, (1999)^[23] observed that, discolouration of seed or black point infected seeds severely hamper the seed germination and seedling emergence of wheat.

In the study of detection of bunt and loose smut of wheat from seed samples, bunt and loose smut disease of wheat was not observed in any wheat seed samples collected from farmers of Samastipur and Muzaffarpur district of Bihar.

Table 1: Result of categorization of collected seed sample into healthy, shriveled, discoloured or black pointed and damaged seeds.

1. District: Samastipur

Samples	Categorization of collected wheat seed samples in percent			
	Shriveled seed*%	Discoloured seed*%	Damaged seed*%	Healthy seed*%
S-1	13.5	14	17.25	55.25
S-2	19.5	6.75	2.75	71
S-3	10	6	9.75	74.25
S-4	4.75	7	2.75	85.5
S-5	7.25	9	10.5	73.25
S-6	29.75	13	3.5	53.75
S-7	9.75	12.75	26.25	51.25
S-8	6.25	11.25	3.25	79.25
S-9	14.75	14	8.5	62.75
S-10	9	4	0.5	86.5
S-11	6.25	8.5	3	82.25
S-12	4.5	15.75	7	72.75
S-13	11	6.5	2	80.5
S-14	2.75	7.25	8.5	81.5
S-15	5.25	9	0.75	85
S-16	5.75	7.75	16.25	70.25
S-17	3.75	9.75	8.75	77.75
S-18	6.75	5.5	2.25	85.5
S-19	4.5	4	3	88.5
S-20	5.75	4.75	6	83.5
S-21	6	5.5	2.5	86
S-22	5.5	3.5	3.5	87.5
S-23	4	2.25	2.75	91
Average	8.53	8.16	6.57	76.72
CD at 5%	5.368	4.391	4.173	7.74
SEm±	1.898	1.553	1.476	2.737
CV	44.499	38.052	44.889	7.135

* Average of Four Replications

2. District: Muzaffarpur

Samples	Categorization of collected wheat seed samples in percent			
	Shriveled seed*%	Discoloured seed*%	Damaged seed*%	Healthy seed*%
M-1	5.5	7.25	4	83
M-2	14	13.5	10.75	61.75
M-3	5.5	2	4	88.5
M-4	2.75	1.75	3.75	91.75
M-5	2.5	4	2.75	90.75
M-6	8.5	4.5	7.5	79.5
M-7	10.5	5.5	3.75	80.25
M-8	4.75	4.75	4.5	86
M-9	6.25	4.75	3.5	85.5
M-10	6.75	5.5	5	82.75
M-11	8	6.5	4.5	81
M-12	5	6.5	2.5	86
M-13	3.75	1.5	4.5	90.25
M-14	9.75	6	4.75	79.5
M-15	12.25	6.25	3.25	80.75
M-16	8.25	4.75	3.5	83.5
M-17	9.75	3.75	6.5	80
M-18	10.5	2	10.25	79.75
M-19	2.5	8	5.25	84.25
M-20	5.75	2.75	5.5	86
M-21	9.75	3	6	81.25
M-22	8.5	6.25	3.75	81.5
M-23	16	4.5	5.75	73.75
M-24	14	8	7.75	70.25
M-25	5	4	3.75	87.25
M-26	2.25	7	2	88.75
M-27	6	4	8.25	81.75
M-28	3.75	8.5	2	85.75
M-29	7.75	6.25	3	83
M-30	9.75	4	4.5	81.75
M-31	9	5.75	9.75	75.5
M-32	9.25	6.25	3.25	81.25
M-33	12.25	12.25	5.75	69.75
M-34	9.75	4	6	80.25
M-35	5.5	6.75	3.25	84.5
M-36	3.75	5.25	3.5	87.5
M-37	8.25	6	8.5	77.25
M-38	4	8	2.75	85.25
M-39	4.75	5.75	6	83.5
M-40	7	13.25	2.75	77
M-41	6.25	5.75	7	81.25
M-42	5.5	5.25	2.5	86.75
M-43	5.75	2.5	5.5	86.25
M-44	7	6	2.75	84.25
M-45	4.25	4.5	8.75	82.5
M-46	14.25	2.5	3.5	79.75
M-47	19.25	3.75	1.5	75.5
Average	7.68	5.54	4.88	81.89
CD at 5%	3.17	3.002	3.268	5.199
SEm±	1.133	1.073	1.168	1.858
CV	29.492	39.966	47.723	4.536

* Average of Four Replications

Table 2: Result of seed germination in percent and seedling vigour index of collected wheat seed samples.

1. District: Samastipur

Samples	Germination %	Root length* (cm)	Shoot length* (cm)	Seedling length (cm)	Seedling vigour Index*
S-1	87	15.24	12.7	27.94	2430.78
S-2	60	17.3	15.02	32.32	1939.2
S-3	79	14.04	13.54	27.58	2178.82
S-4	67	11.82	12.3	24.12	1616.04
S-5	85	12.32	12.1	24.42	2075.7
S-6	70	12.7	11.34	24.04	1682.8
S-7	56	14.42	13.64	28.06	1571.36
S-8	87	14.6	14.12	28.72	2498.64
S-9	85	12.2	12.2	24.4	2074
S-10	95	12.2	12.02	24.22	2300.9
S-11	95	12.88	12.4	25.28	2401.6
S-12	66	12.9	13	25.9	1709.4
S-13	67	12.6	12	24.6	1648.2
S-14	64	14.4	12.6	27	1728
S-15	94	12.2	11.6	23.8	2237.2
S-16	85	15.22	14	29.22	2483.7
S-17	61	13	14.6	27.6	1683.6
S-18	47	13.06	14.76	27.82	1307.54
S-19	54	13.9	13.96	27.86	1504.44
S-20	59	11.4	11.8	23.2	1368.8
S-21	63	15	14.2	29.2	1839.6
S-22	63	15.2	14.16	27.94	1760.22
S-23	85	13.2	12.7	25.9	2201.5
Average	72.87	13.55	13.07	26.57	1923.56
CD at 5%		3.002	N/A		384.331
SEm±		1.067	1.058		136.608
CV		17.598	18.088		15.848

* Average of Five Seedlings

2. District: Muzaffarpur

Samples	Germination %	Root length* (cm)	Shoot length* (cm)	Seedling length* (cm)	Seedling vigour Index*
M-1	87	12.84	11.26	24.1	2096.7
M-2	90	15.12	14.72	29.84	2685.6
M-3	88	11.86	16.36	28.22	2483.36
M-4	95	22.62	12.52	35.14	3338.3
M-5	92	13.86	15.56	29.42	2706.64
M-6	82	29.28	25.4	54.68	4483.76
M-7	89	25.78	21.78	47.56	4232.84
M-8	60	18.1	19.38	37.48	2248.8
M-9	93	15.8	14.5	30.3	2817.9
M-10	92	14.2	14.36	28.56	2627.52
M-11	62	15.06	13.32	28.38	1759.56
M-12	90	17.6	14.8	32.4	2916
M-13	47	15.4	15.96	31.36	1473.92
M-14	61	11.5	11.48	22.98	1401.78
M-15	88	15.36	16.46	31.82	2800.16
M-16	84	16.2	15.64	31.84	2674.56
M-17	86	16.9	16.8	33.7	2898.2
M-18	88	15.9	15.3	31.2	2745.6
M-19	84	16.1	13.9	30	2520
M-20	77	14.82	16.4	31.22	2403.94
M-21	90	17.06	15.36	32.42	2917.8
M-22	84	13.94	12.2	26.14	2195.76
M-23	97	15.24	14.38	29.62	2873.14
M-24	82	11.58	16.76	28.34	2323.88
M-25	95	15.52	16.1	31.62	3003.9
M-26	74	14.32	12.66	26.98	1996.52
M-27	87	15.9	15.82	31.72	2759.64
M-28	44	12.7	16.36	29.06	1278.64
M-29	55	14.54	13.82	28.36	1559.8
M-30	76	16.86	12.24	29.1	2211.6
M-31	90	16.8	20	36.8	3312
M-32	95	13.44	18.14	31.58	3000.1
M-33	42	13	15.8	28.8	1209.6
M-34	49	14.76	15.36	30.12	1475.88
M-35	80	16.6	15.8	32.4	2592
M-36	80	14.6	15.2	29.8	2384
M-37	40	15.2	12.24	27.44	1097.6
M-38	46	25	25.6	50.6	2327.6
M-39	41	11.2	14.6	25.8	1057.8
M-40	65	11.8	14	25.8	1677
M-41	78	12.4	12	24.4	1903.2
M-42	55	12.8	11.8	24.6	1353
M-43	60	10.4	12.8	23.2	1392
M-44	48	13	11.4	24.4	1171.2
M-45	43	14.8	13.6	28.4	1221.2
M-46	79	13.4	15.2	28.6	2259.4
M-47	88	12.02	18.46	30.48	2682.24
Average	74.47	15.38	15.39	30.78	2309.60
CD at 5%		4.525	3.899		529.387
SEm±		1.621	1.397		189.604
CV		23.988	20.527		18.675

* Average of Five Seedlings

Table 3: Result of normal seedling, abnormal seedling, dead seed and infected wheat seed samples in percent.

1. District: Samastipur

Samples	Normal Seedlings (%)	Abnormal Seedlings (%)	Dead Seeds (%)	Infected Seeds (%)
S-1	87	2	11	31
S-2	60	4	36	25
S-3	79	7	14	23
S-4	67	3	30	21
S-5	85	4	11	34
S-6	70	7	23	17
S-7	56	7	37	13
S-8	87	4	9	25
S-9	85	8	7	46
S-10	95	2	3	11
S-11	95	2	3	16
S-12	66	4	30	21
S-13	67	5	28	29
S-14	64	6	30	22
S-15	94	2	4	14
S-16	85	4	11	23
S-17	61	9	30	34
S-18	47	7	46	42
S-19	54	5	41	39
S-20	59	6	35	19
S-21	63	4	33	23
S-22	63	12	25	26
S-23	85	3	12	18
Average	72.78	5.08	22.13	24.86

2. District: Muzaffarpur

Samples	Normal Seedlings (%)	Abnormal Seedlings (%)	Dead Seeds (%)	Infected Seeds (%)
M-1	87	8	5	44
M-2	90	6	4	30
M-3	88	7	5	35
M-4	95	2	3	25
M-5	92	3	5	24
M-6	82	6	12	16
M-7	89	8	3	15
M-8	60	10	30	35
M-9	93	1	6	18
M-10	92	6	2	10
M-11	62	12	26	30
M-12	90	3	7	23
M-13	47	9	44	52
M-14	61	7	32	32
M-15	88	6	6	18
M-16	84	4	12	18
M-17	86	4	10	13
M-18	88	4	8	20
M-19	84	8	8	29
M-20	77	9	14	20
M-21	90	3	7	15
M-22	84	9	7	30
M-23	97	1	2	6
M-24	82	11	7	33
M-25	95	3	2	4
M-26	74	6	20	22
M-27	87	7	6	21
M-28	44	10	46	30
M-29	55	5	40	26
M-30	76	6	18	33
M-31	90	3	7	24
M-32	95	3	2	29
M-33	42	3	55	33
M-34	49	6	45	44
M-35	80	3	17	23
M-36	80	7	13	23
M-37	40	4	56	30
M-38	46	6	48	33
M-39	41	3	56	31
M-40	65	5	30	30
M-41	78	12	10	21
M-42	55	6	39	40
M-43	60	8	32	37
M-44	48	3	49	39
M-45	43	5	52	40
M-46	79	13	8	45
M-47	88	9	3	33
Average	74.42	6.02	19.55	27.27

Conclusion

The study of wheat seed health and quality from Samastipur and Muzaffarpur districts revealed significant variation in seed characteristics. Seeds were categorized into healthy, shriveled, discolored, and damaged, with Samastipur showing a higher percentage of shriveled and damaged seeds than Muzaffarpur. Germination rates varied between

40-97%, with the highest vigour index recorded in Muzaffarpur. Seedling analysis indicated differences in normal and abnormal seedlings, dead seeds, and infected seeds, with infection rates being higher in Muzaffarpur. Importantly, no bunt or loose smut diseases were detected, highlighting the overall health of the collected wheat seed samples.

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