



# EVALUATION OF SEED QUALITY AND DETECTION OF SEED BORNE FUNGI IN PADDY CULTIVARS OF GUJARAT, INDIA

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## Abstract

Paddy seed samples of four cultivars viz., Gurjari, GR-7, GR 13 and GR11 were collected from seven locations of middle Gujarat viz., Anand, Dabhoi, Thasara, Sansoli, Devataj, Nawagam and Godhara. Germination and seedling vigour of paddy seeds samples showed significant variations among the different locations and varieties. In nursery study, transplantable seedlings percentage was significantly higher in seed sample of variety Gurjari from Dabhoi location (74.50). Seeds of variety Gurjari collected from Dabhoi location showed better performance for all the seedling associated characters viz., seedling length (40.88 cm), fresh weight (13.06 gm), dry weight (3.03 gm), vigour index I (3045.33) and vigour index II (225.66). Similar pattern of result were also observed when seeds were subjected for germination test under laboratory condition. Studies on seed health status on these cultivars revealed that a total of 11 fungi were isolated from paddy seeds by using agar plate method. A fungi *F. semitectum* was found to be most prevalent and observed in all the seed samples, followed by *A. niger*. Two varieties GR-11 (Dabhoi) and GAR-13 (Nawagam) showed the presence of maximum number of fungi (7) where as the lowest number (2) were observed in the seeds of Gurjari (Anand and Dabhoi) and GR-7 (Devataj).

**Key words** : Paddy, seed mycoflora, seedling length, vigour index

## Introduction

Rice (*Oryza sativa* L.) is one of the main staple foods of man and is grown in almost all the tropical and subtropical regions of the world. Most of the diseases of rice are carried through seed and cause enormous losses to the crop. Microorganisms play an important role in affecting the quality of seed, of which fungi are the largest group. These pathogens are disastrous as they reduce seed vigour and weaken the plant at its initial growth stages. Apart from being seed-borne pathogens, fungi may grow on storage products. Most of the storage fungi are species of *Aspergillus* and *Penicillium*. These fungi may decrease seed germinability, cause seed discolouration, produce toxins that may be injurious to man and domestic animals and may reduce seed weight also (Neergaard, 1986).

Seed-borne diseases cause enormous losses to our crops. The infected seeds may fail to germinate, transmit disease from seed to seedling and from seedling to growing plants (Fakir *et al.*, 2002). Abnormal and diseased seeds in a seed lot also indicate poor health. Based on above information this research program was

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under taken to investigate the health, germination and seedling vigor of the paddy seeds collected from different locations of Gujarat and to compare the health and quality of seeds produced at different locations.

## Materials and Methods

Paddy seed samples of four cultivars viz., Gurjari, GR-7, GR 13 and GR11 were collected from seven locations of middle Gujarat viz., Anand, Dabhoi, Thasara, Sansoli, Devataj, Nawagam and Godhara.

### Crop varieties

1. **Gurjari** : RRS (Anand), Dabhoi, Thasara, Sansoli, Devataj, Nawagam and Godhara (seven locations).
2. **GR-7** : Dabhoi, Devataj, Nawagam (three locations)
3. **GR 13** : Dabhoi, Nawagam (two locations)
4. **GR11** : Dabhoi, Nawagam (two locations)

Isolation of the seed mycoflora was made from paddy seed samples by standard agar plate method (Bhale *et al.*, 2001). One hundred seeds randomly taken from each of the composite seed samples were assessed for isolation of seed mycoflora. Petri plates were incubated under 12/12 hr alternating light and dark period at 25±2°C for seven

days. After seven days of incubation, the fungal growth was examined under stereo binocular microscope for type and frequency of fungi occurrence.

$$\text{Frequency of occurrence (\%)} = \frac{\text{No. of seeds on which a fungal species occurs}}{\text{Total no. of seeds}}$$

Identity of seed mycoflora was confirmed by Agharkar Research Institute Pune.

A nursery experiment was also conducted during *kharif* season at the Main Rice Research Station, Nawagam. A total of 400 seed from each sample were sown in separate nursery bed. All the seedling characters like transplantable seedling %, seedling length, fresh weight and dry weight of seedlings, vigour index I and vigour index II were observed at 25 days after sowing.

Similar type of experiment was also conducted in laboratory for observation of seedling characters simultaneously. Rolled paper towel method was used by keeping 100 seeds from each sample in duplicate. Germination per cent and other seedling quality parameters were observed at the time of final count.

## Results and Discussion

### At nursery stage

Data presented in table 1 revealed that transplantable seedlings percentage was significantly higher in seed sample of variety Gurjari from Dabhoi location (74.50) followed by the same variety seeds from Godhara location (72.66). However, lowest was observed in variety GR-

11 from Nawagam (30.16). The seed borne fungi were found responsible for poor vigour and low seedling emergence in the nursery. The seedling emergence in seed sample might be low due to proliferation of pathogenic fungal species on germinating seedlings and resulting in seed and seedling death. Similar results were earlier reported by Singh and Maheshwari (2002).

Seeds of variety Gurjari collected from Dabhoi location showed better performance for all the seedling associated characters *viz.*, seedling length (40.88 cm), fresh weight (13.06 mg), dry weight (3.03 mg), vigour index I (3045.33) and vigour index II (225.66).

Gurjari seeds collected from Dabhoi location exhibited higher seedling quality parameters among all the seven locations. GR7 from Dabhoi location gave better performance as compared to Devataj and Nawagam location, similarly GR-11 and GAR-13 from Dabhoi location showed greater quality parameters as compared to Nawagam location.

So, it was manifested that seeds collected from Dabhoi location showed better seedling characters as compared to other location irrespective of variety. It might be occur due to better management practices, climatic conditions and due to presence of less seed borne pathogens.

### At laboratory conditions

The above result in field condition was confirmed by similar pattern of result during laboratory study. Data exhibited in table 2 indicated that due to bold seeded

**Table 1 :** Observations of seedling quality parameters at nursery stage.

Treatments	Transplantable seedling (%)	Seedling height (cm)	Seedling FW (gm)	Seedling DW (gm)	Vigour Index I	Vigour Index II
T <sub>1</sub> Gurjari Anand	34.16	23.20	5.57	1.15	793.00	39.33
T <sub>2</sub> Gurjari Dabhoi	74.50	40.88	13.06	3.03	3045.33	225.66
T <sub>3</sub> Gurjari Devataj	63.16	29.00	8.39	1.81	1832.33	114.66
T <sub>4</sub> Gurjari Godhara	72.66	37.69	12.68	2.94	2738.66	214.00
T <sub>5</sub> Gurjari Nawagam	58.66	26.71	7.86	1.62	1567.33	95.33
T <sub>6</sub> Gurjari Sansoli	65.08	31.21	10.11	2.15	2030.33	140.00
T <sub>7</sub> Gurjari Thasara	68.91	33.66	11.93	2.31	2320.33	159.33
T <sub>8</sub> GR-7 Dabhoi	53.83	23.45	10.03	2.54	1262.33	137.00
T <sub>9</sub> GR-7 Devataj	42.75	18.49	7.16	2.12	790.66	90.33
T <sub>10</sub> GR-7 Nawagam	41.75	19.34	7.85	2.25	807.66	94.00
T <sub>11</sub> GR-11 Dabhoi	71.25	38.53	11.28	2.93	2746.00	209.33
T <sub>12</sub> GR-11 Nawagam	30.16	17.59	4.57	2.22	530.66	67.00
T <sub>13</sub> GAR-13 Dabhoi	64.75	25.76	7.29	2.83	1668.00	183.33
T <sub>14</sub> GAR-13 Nawagam	48.91	17.48	5.86	2.44	854.33	119.66
C.D.	1.25	1.96	1.32	0.36	113.53	22.96
CV %	1.31	4.27	8.87	9.36	4.12	10.14

**Table 2 :** Observations of seedling quality parameters in laboratory conditions.

Treatments		100 seed wt. (g)	Germination %	Seedling height (cm)	FW (mg)	DW (mg)	Vigour Index I	Vigour Index II
T <sub>1</sub>	GurjariAnand	3.14	35.50	3.09	122.50	21.00	109.00	744.00
T <sub>2</sub>	GurjariDabhoi	3.26	92.50	8.37	284.50	43.00	774.00	3977.00
T <sub>3</sub>	GurjariDevataj	2.73	84.50	7.92	297.50	48.00	669.00	4050.00
T <sub>4</sub>	GurjariGodhara	2.97	92.00	9.40	312.00	48.00	865.50	4411.00
T <sub>5</sub>	GurjariNawagam	3.65	76.50	6.43	262.00	41.50	492.00	3183.00
T <sub>6</sub>	GurjariSansoli	3.49	85.50	6.68	227.50	38.00	578.50	3265.50
T <sub>7</sub>	GurjariThasara	3.15	89.50	6.00	233.50	39.00	537.50	3491.50
T <sub>8</sub>	GR-7 Dabhoi	1.87	71.50	4.80	260.50	34.00	343.00	2432.50
T <sub>9</sub>	GR-7 Devataj	2.29	42.50	3.05	137.50	17.50	129.50	741.50
T <sub>10</sub>	GR-7 Nawagam	2.18	42.50	4.45	232.50	38.00	188.50	1620.00
T <sub>11</sub>	GR-11 Dabhoi	1.47	90.00	6.03	253.00	42.00	543.00	3787.00
T <sub>12</sub>	GR-11 Nawagam	1.42	29.00	5.09	194.50	36.50	146.00	1061.50
T <sub>13</sub>	GR-13 Dabhoi	1.53	71.00	5.66	163.00	32.50	403.50	2315.00
T <sub>14</sub>	GR-13 Nawagam	1.55	54.50	5.35	164.50	32.50	290.00	1773.00
C.D.		0.29	9.77	2.10	10.49	7.53	189.42	812.70
CV %		5.35	6.61	16.57	2.16	9.55	20.23	14.29

variety Gurjari have higher 100 seed weight. Whereas, among all the locations variety Gurjari of Nawagam have highest 100 seed weight (3.65 g) and variety GR-11 of Nawagam have lowest 100 seed weight (1.42g). Germination per cent was highest in variety Gurjari collected from Dabhoi (92.50) whereas, lowest in GR-11 Nawagam (29.00). Maximum seedling length was observed in variety Gurjari from Godhara (9.40 cm) followed by Gurjari from Dabhoi (8.37 cm) while lowest in GR-7 Devataj. Highest fresh weight of seedlings was found in Gurjari from Godhara (312mg) and lowest in GR-7 Devataj (137.50 mg). Dry weight was highest in Gurjari from Devataj and Godhara (48mg) and lowest in GR-7 Devataj. The maximum Vigour Index I was found in Gurjari from Godhara (865.50) and lowest in Gurjari from Anand (109.00) and similar pattern were found in case of Vigour Index II. The common and dominant seed borne fungi were found to be inhibitory for seed germination and caused great loss in seedling vigour. This was in confirmation with findings of Pathania and Chandel (2004), Singh and Maheshwari (2002) and Telang (2010).

#### Seed mycoflora study

The second study on seed mycoflora of paddy cultivars collected from different paddy growing locations of middle Gujarat revealed that a total number of 11 fungi were isolated from paddy seeds (table 3). The associated fungi were *Fusarium semitectum*, *Aspergillus niger*, *Aspergillus fumigates*, *Aspergillus sp.*, *A. terreus*, *Curvularia pellescens*, *Curvularia prasadii*, *Cladisporium oxysporum*, *Drechslera halodes*,

*Penicillin sp.* and *Rhizopus stolonifer*. Similar results were reported by earlier workers (Wahid *et al.*, 2001; Javaid *et al.*, 2002; Nguefack *et al.*, 2007; Imolehin, Khan *et al.*, 2000; Odeunmi-Osikanlu and Kim & Lee, 1989).

Most frequently isolated fungi were *Fusarium semitectum*, which was found in all the seed samples, followed by *Aspergillus niger*. Similar result was also found by Butt *et al.* (2011). Two varieties GR-11 (Dabhoi) and GAR-13 (Nawagam) showed the occurrence of maximum number of fungi (7) whereas the lowest number (2) were observed in the seeds of Gurjari (Anand and Dabhoi) and GR-7 (Devataj).

A fungi *Aspergillus fumigates* was found only in two seed samples *i.e.* Gurjari from dabhoi and GAR-13 from Nawagam and *A. spp.* in Gurjari from Sansoli and GR-11 from Dabhoi. *Curvularia pellescens* in Gurjari from Godhara, Nawagam, Sansoli, Thasara and GR-7 from Nawagam, GR-11 from Dabhoi and GAR-13 from Nawagam. However *Curvularia prasadii* was present only in seed samples of GR-11 from Nawagam. *Cladisporium oxysporum* was observed in GR-7 from Dabhoi and GR-11 from Dabhoi. A fungus *Drechslera halodes* was found in Gurjari Anand, Gurjari Nawagam, GR-7 Dabhoi, GR-11 Dabhoi, GAR-13 Dabhoi and GAR-13 Nawagam. *Penicillin sp.* was isolated from Gurjari Godhara, Gurjari Sansoli, GR-7 Dabhoi, GR-7 and GAR-13 from Nawagam. A fungus *Rhizopus stolonifer* was isolated from Gurjari Sansoli, Gurjari Thasara and GR-11 Nawagam.

**Table 3 :** Frequency (%) occurrence of associated fungi withseeds of different paddy cultivars collected from different locations.

Treatments	<i>Fusarium semitectum</i> *	<i>A. niger</i> *	<i>A. fumigatus</i>	<i>A. terreus</i>	<i>A. spp.</i>	<i>Curvularia pellescens</i>	<i>Curvularia prasadii</i>	<i>Cladisporium oxysporum</i>	<i>Drechslera halodes</i>	<i>Penicillium sp.</i>	<i>Rhizopus stolonifer</i>
T <sub>1</sub> Gurjari Anand	74.39(92.8)	0.99(0.03)	00	00	00	00	00	00	4	00	00
T <sub>2</sub> Gurjari Dabhoi	65.95(83.4)	2.73(0.23)	00	00	00	00	00	00	00	00	00
T <sub>3</sub> Gurjari Devataj	15.63(7.3)	73.51(92.0)	10	00	00	00	00	00	00	00	00
T <sub>4</sub> Gurjari Godhara	33.99(31.2)	48.23(55.6)	00	00	00	10	00	00	00	7	00
T <sub>5</sub> Gurjari Nawagam	42.57(45.8)	2.73(0.23)	00	00	00	90	00	00	17	00	00
T <sub>6</sub> Gurjari Sansoli	29.44(24.2)	10.52(3.3)	00	00	10	10	00	00	00	18	20
T <sub>7</sub> Gurjari Thasara	33.36(30.2)	0.99(0.03)	10	00	00	42	00	00	00	00	17
T <sub>8</sub> GR-7 Dabhoi	38.05(38.0)	6.22(1.2)	00	00	00	00	00	8	4	4	20
T <sub>9</sub> GR-7 Devataj	87.22(99.76)	2.73(0.23)	00	00	00	00	00	00	00	00	00
T <sub>10</sub> GR-7 Nawagam	24.49(17.2)	2.73(0.23)	00	00	00	25	00	00	17	6	00
T <sub>11</sub> GR-11 Dabhoi	36.24(34.9)	0.99(0.03)	00	30	20	13	00	3	17	00	00
T <sub>12</sub> GR-11 Nawagam	29.35(24.0)	6.22(1.2)	00	00	00	00	22	00	10	5	10
T <sub>13</sub> GAR-13 Dabhoi	76.07(94.2)	2.73(0.23)	00	00	00	00	00	00	5	00	00
T <sub>14</sub> GAR-13 Nawagam	37.58(37.2)	2.73(0.23)	00	50	00	8	00	00	7	5	00
CD	13.63	6.06									
CV%	34.56	58.47									

\*Statistically analyzed.

Figure in parentheses are arc sine retransformed values.

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