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Influence of containers, genotypes, fungicides and their combinations on seed rot in rice during storage

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ABSTRACT

The present investigation was undertaken to study the influence of containers (packaging material), genotypes and fungicides on per cent seed rot in rice during January to May in storage. In whole storage period seed rot incidence was recorded more in container cotton bags than in polythene bags. Minimum seed rot incidence was recorded in KMR-3, while maximum was recorded in CMS 58025 A. Seed treatment with fungicide Thiram reported minimum percentage of seed rot during all period of storage. As far as the cumulative influence is concerned, CMS 58025 A and CMS 58025 B in both containers (polythene bags and cotton bags) resulted more seed rot percentage, irrespective of all treatments of seed in comparison to other genotypes. Two fungicides *i.e.* Chlorothalonil and Contaf proved less effectiveness over rest of the treatments while Thiram treated seed showed minimum seed rot.

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INTRODUCTION

Paddy is a very important cereal crop all over the world. India has a maximum area under rice cultivation, thus stands second in production in the world. However, productivity wise, it stands amongst the low rice producing countries. Low yield attributed to several factors like socio-economic conditions, drought, lack of inputs and diseases and pests. With the introduction of high yielding rice cultivars especially the hybrid rice, it is observed that the new introduced varieties or hybrids are showing more susceptibility for several diseases. Among these seed-borne pathogens occupy an important place as regard to seed quality and yield losses (Singh and Vishunavat, 2015). For the seed industry storage of seeds till the next sowing season is an important aspect. Deterioration of seed begins immediately after physiological maturity and it is reflected in terms of reduction in seed viability and vigour. The viability and

vigour of seed mostly depends on the seed quality, genotypes, treatment of seed, packaging material and conditions of storage. For reducing the heavy financial losses which is caused by due to non selling of the seed in one season and have to store for the next season, the knowledge of storage of seed is very essential. Due to the male sterility, the female parents of rice hybrids are poor storers (Patil and Shekharguda, 2007). During the storage period there are many factors which affect the seed quality and cause seed detioration. Containers, genotypes and chemical seed treatment with fungicides play a very important role in seed rot during storage. The present investigation was conducted to know the influence of containers, genotypes, fungicides and their combinations on seed rot in rice during storage.

MATERIAL AND METHODS

The seed material has been collected from Crop Research Centre, G.B. Pant university of Agriculture and Technology, Pantnagar, U.S. Nagar (Uttrakhand), India, from crop showing varying diseases on rice under field conditions. Seeds from, hybrid rice parents'; CMS 58025 A, CMS 58025 B, were collected for proposed studies along with the seeds of restores; IR-66, KMR-3 and a established variety Pant Dhan-11 showing varying degree of severity of different diseases.

Germination test:

The test has been carried out using "Towel paper method". Two Towel paper (l x b) were soaked in running tap water overnight. Four hundred seeds for each treatment were used in the replication for 100 seeds. 25 seeds per towel papers placed in the incubator at 28-30^0 C in inclined position for 14 days. After 14 days germination was count for seed rot. The seed which show rotting symptoms and when pressed by thumb crash are considered to be rotten (such seeds don't germinate). Results were statistically analyzed for presenting the data (ISTA, 1996).

Effect of the storage on seed germination:

Seeds lots of different genotypes, used for studies were taken from field and were sun dried to bring down the moisture content to 12 per cent before storage.

Effect of containers:

Treated as well as untreated seeds were divided into two lots and stored in two types of containers- cotton bags (C_1) and 700- gauge polyline bags (C_2).

Effect of seed treatment:

Each seed sample was divided in 8 sub samples. Each sub sample is treated with Thiram, Thiram + Bavistin, Bavistin, Captan, Vitavax, Chlorothalonil and Contaf at the rate of 0.2 per cent along with one check.

Storage conditions:

These seed lots were stored at room temperature. At monthly intervals these seeds are examined for seed germination for knowing seed rot incidence.

RESULTS AND DISCUSSION

Table 1 indicates the effect of different containers on per cent seed rot during storage. In container C_2, the seed rot incidence was reported comparatively more compare of container C_1 during all the storage periods although there has not been any significant difference in per cent seed rot incidence in both types of containers. These results are in accordance with Kaur *et al.* (1990) who also concluded that maximum germination has been retained in seeds stored with initial moisture content of 10 per cent in 700 gauge polyline bags. Huynh and Gaur (2005) have reported germination above MSSC (80%) after 6 months of storage in Vitavax, Thiram and Mancozeb treated seeds, stored in ambient conditions and packed in 700-gauge polythene bags. Table 2 indicates the effect of genotype on per cent seed rot during storage period and it was found that seed rot incidence increases with an increase in period of storage. No seed rot was recorded in G_3 and G_4 in the month of

Table 1: Effect of different containers on per cent seed rot during storage period

Containers	Storage period				
	January	February	March	April	May
C_1	1.28 (4.17)	2.05 (5.86)	3.27 (7.81)	3.18 (7.61)	5.41 (7.75)
C_2	1.25 (4.15)	1.82 (5.64)	2.98 (7.20)	2.88 (7.05)	4.60 (9.48)
C.D. (P=0.05)	0.41	0.84	1.13	0.96	2.75

January but increased subsequently from February to May. The highest percentage of seed rot during all storage period was recorded in G_1 and G_2 which was significantly different from the all other genotypes, while G_3, G_4 and G_5 were statistically at par. These finding are in accordance with Kalavathi *et al.* (1989) who evaluated the storage potential of A lines their maintainer lines, restorers and their resultant F_1 hybrids and found IR 150 R followed by IR 101-98/96-2R as good storers and IR 58025 A was found to be poor storer. Duan and Ma (1992) also observed rapid decerase in seed germinability in CMS line during storage. Reddy *et al.* (1975) concluded that prolonged storage period decrease per cent seed rot germination in cultivar IR-8, Jaya and Padma. The maximum reduction on seed germination has been observed in variety Padma while, it was minimum in variety Jaya.

Table 3 indicates the effect of different seed treatment with fungicides on per cent seed rot during storage period. All the treatments were reported superior over check regarding to reduction in seed rot during the all storage period. Treatment T_6 although reduced the seed rot incidence in comparison to check but observed inferior to the other treatments during all the storage

Table 2: Effect of different genotypes on per cent seed rot at during storage period

Genotypes	Storage period				
	January	February	March	April	May
G_1	3.33 (10.35)	4.38 (11.64)	5.58 (13.60)	6.00 (14.69)	7.36 (17.34)
G_2	2.71 (9.25)	3.46 (10.34)	4.21 (13.85)	5.63 (13.10)	6.75 (18.55)
G_3	0.00 (0.00)	0.33 (1.26)	0.75 (2.66)	0.83 (2.90)	1.71 (5.32)
G_4	0.00 (0.00)	0.54 (2.20)	0.88 (2.75)	0.93 (3.39)	1.50 (4.67)
G_5	0.29 (1.19)	0.96 (3.31)	1.21 (4.03)	1.29 (4.05)	2.10 (6.30)
C.D. (P=0.05)	1.65	1.32	1.79	1.52	2.09

Table 3 : Effect of different fungicidal seed treatments on per cent seed rot during storage period

Treatments	Storage period				
	January	February	March	April	May
T_1	0.93 (3.48)	1.33 (4.32)	2.07 (5.85)	2.13 (5.40)	3.53 (7.99)
T_2	1.07 (3.86)	1.47 (4.46)	2.73 (7.00)	2.87 (7.00)	3.87 (8.55)
T_3	1.13 (3.98)	1.87 (4.95)	3.57 (7.23)	4.45 (8.83)	5.33 (9.62)
T_4	1.13 (3.98)	1.80 (5.10)	2.67 (6.73)	4.13 (8.17)	5.53 (9.62)
T_5	1.00 (3.59)	1.73 (5.42)	2.47 (7.80)	3.17 (8.03)	3.87 (8.27)
T_6	1.60 (4.53)	1.73 (5.76)	3.13 (8.84)	4.00 (9.44)	4.87 (10.05)
T_7	1.27 (4.05)	1.30 (5.45)	3.27 (7.72)	3.47 (8.34)	4.00 (8.98)
T_8	2.00 (5.79)	3.27 (9.77)	5.40 (11.86)	6.40 (13.52)	8.83 (15.58)
CD (P=0.05)	0.82	1.18	1.98	3.38	2.64

C_1 = Polythene bags, C_2 = Cotton bags, G_1 = CMS 58025 A, G_2 = CMS 58025 B,
G_3 = Restorer (IR-66), G_4 = Restorer (KMR-3), G_5 = Variety (Pant Dhan-11)
T_1 = Thiram, T_2 = Thiram + Bavastin, T_3 = Bavistin, T_4 = Captan, T_5 = Vitavax, T_6 = Chlorothalonil, T_7 = Contaf, T_8 = Check

Table 4 : Box plot statistics for CxGxT for five month storage

	January	February	March	April	May
Upper whisker	5.33	6.67	10.67	12.00	14.67
3rd quartile	2.67	2.83	4.67	6.00	8.67
Median	0.00	1.33	2.00	2.00	2.67
Ist quartile	0.00	0.00	0.67	1.33	2.00
Lower whisker	0.00	0.00	0.00	0.00	0.00
Nr. of data points	80.00	80.00	80.00	80.00	80.00

Treatments	January	February	March	April	May
$C_1 G_1 T_1$	2	2.67	3.33	3.33	4.01
$C_1 G_1 T_2$	2.33	2.33	3.33	3.33	4.33
$C_1 G_1 T_3$	2.67	4.67	6.67	7.33	11.33
$C_1 G_1 T_4$	2.67	4	6.33	8.67	11.33
$C_1 G_1 T_5$	2.67	4.47	4.67	6.67	8
$C_1 G_1 T_6$	3.67	2.67	5.33	8	10.67
$C_1 G_1 T_7$	3.33	6	7.33	8.67	9.33
$C_1 G_1 T_8$	5.33	7.33	9.33	10.67	13.33
$C_1 G_2 T_1$	2	2.27	3.33	7.33	8
$C_1 G_2 T_2$	2.67	2.17	5.33	5.33	8.67
$C_1 G_2 T_3$	2.67	2.67	5.67	7.67	8.67
$C_1 G_2 T_4$	2	3.33	4	8	11.33
$C_1 G_2 T_5$	2.67	4	4.67	7.33	9.33
$C_1 G_2 T_6$	3.33	3.33	4.67	5.33	10.67
$C_1 G_2 T_7$	3.67	4	4.67	6	14.67
$C_1 G_2 T_8$	4.67	6.67	8	13.33	20
$C_1 G_3 T_1$	0	0	0	0	1.33
$C_1 G_3 T_2$	0	0	0	0	2
$C_1 G_3 T_3$	0	0	0	0	0.67
$C_1 G_3 T_4$	0	0	0	0.67	2
$C_1 G_3 T_5$	0	0.67	2	0.67	0.67
$C_1 G_3 T_6$	0	0	0	0.67	2.67
$C_1 G_3 T_7$	0	0	0.67	1.33	1.33
$C_1 G_3 T_8$	0	3.33	4.67	5.33	7.33
$C_1 G_4 T_1$	0	0	0	0	0
$C_1 G_4 T_2$	0	0	0	1.33	2.67
$C_1 G_4 T_3$	0	0.67	0.67	1.33	2.67
$C_1 G_4 T_4$	0	0	0.67	1.33	2
$C_1 G_4 T_5$	0	0.67	1.33	1.33	2
$C_1 G_4 T_6$	0	0.67	1.33	1.67	2.67
$C_1 G_4 T_7$	0	0	1.33	2	2
$C_1 G_4 T_8$	0	2	2	2	2.67
$C_1 G_5 T_1$	0	0	1.33	1.67	2
$C_1 G_5 T_2$	0	0	1.67	2	2.33
$C_1 G_5 T_3$	0	0	1.33	1.67	2
$C_1 G_5 T_4$	0	0	1.33	1.67	2.67
$C_1 G_5 T_5$	0	0	2	2.67	3.33
$C_1 G_5 T_6$	0	1.33	1.67	2	2.33
$C_1 G_5 T_7$	0	1.67	2	3	3.33
$C_1 G_5 T_8$	4.33	2.67	3.33	4.67	5.33
$C_2 G_1 T_1$	2	3	2.67	3.33	7.33
$C_2 G_1 T_2$	2.67	2	4.33	6.33	8.67
$C_2 G_1 T_3$	2.67	4.67	6	7.33	7.33
$C_2 G_1 T_4$	3	3.33	4.67	5.33	10.67
$C_2 G_1 T_5$	2.67	2.67	4.67	6	8.67
$C_2 G_1 T_6$	3.33	4	5.33	5.33	9.33
$C_2 G_1 T_7$	4	4.67	7.33	7.33	8.7
$C_2 G_1 T_8$	2	4.67	8.67	9.33	10.67
$C_2 G_2 T_1$	2	2.07	3.33	5.33	6
$C_2 G_2 T_2$	2.67	2.33	3.67	6	6.67
$C_2 G_2 T_3$	2	2.67	5.33	6	7.33
$C_2 G_2 T_4$	2	2	4.67	6	8
$C_2 G_2 T_5$	2	2.27	3.33	5.33	10.33
$C_2 G_2 T_6$	2.67	3.33	4	6.33	8
$C_2 G_2 T_7$	3.33	4	5.33	7	13.33
$C_2 G_2 T_8$	5.33	6.33	10.67	12	20.67
$C_2 G_3 T_1$	0	0	0	0	0
$C_2 G_3 T_2$	0	0	0	0.33	0.67
$C_2 G_3 T_3$	0	0	1	1.33	1.67
$C_2 G_3 T_4$	0	0	1.33	1.67	2
$C_2 G_3 T_5$	0	0	0	0.67	1.33
$C_2 G_3 T_6$	0	0.67	1.33	1.33	1.33
$C_2 G_3 T_7$	0	0.67	0.67	1.67	2.67
$C_2 G_3 T_8$	1.33	2.67	4.33	4.33	5
$C_2 G_4 T_1$	0	0	0	0	0
$C_2 G_4 T_2$	0	0	0	0	0
$C_2 G_4 T_3$	0	0	1.33	2	2.67
$C_2 G_4 T_4$	0	0	0.67	1.33	2
$C_2 G_4 T_5$	0	0.67	1.33	1.67	2
$C_2 G_4 T_6$	0	0	0	0	1.33
$C_2 G_4 T_7$	0	0.67	1.33	1.33	1.33
$C_2 G_4 T_8$	0	2	2	6	4
$C_2 G_5 T_1$	0	0	0	0.67	0.67
$C_2 G_5 T_2$	0	0	0.67	1.33	1.67
$C_2 G_5 T_3$	0	0	0.67	1.33	2
$C_2 G_5 T_4$	0	0	1.33	1.67	2
$C_2 G_5 T_5$	0	1.33	1.67	2	2.33
$C_2 G_5 T_6$	0	0.67	1.33	2	2.67
$C_2 G_5 T_7$	0	1.33	1.67	2	2.67
$C_2 G_5 T_8$	1.33	2	4.67	4	4.67

Fig. 1: Heat map for different interaction of containers, genotypes and fungicidal seed treatments

periods. Asalmol and Zade (1994) studied the effect of pre-storage seed treatment with Thiram and found the fungicide effective against fast deterioration of seed quality. Sharma and Chahal (1996) concluded that Bavistin+Thiram (0.2%) effectively controlled the seed borne pathogens. Huynh and Gaur (2005) have reported germination above MSSC (80%) after 6 months of storage in Vitavax, Thiram and Mancozeb treated seeds, stored in ambient conditions and packed in 700-gauge polythene bags.

Fig. 1 indicates the combind effect of containers (pckaging materials), genotypes of rice and fungicidal treatment on per cent seed rot during period of storage. Higher percentage of seed rot incidence showed by genotype G_1 and G_2 in containers C_1 and C_2, irrespective of different treatments of seed, treatments in comparison to genotype G_3, G_4 and G_5 in same containers and same treatments. Treatments T_6 and T_7 showed less effectiveness over rest other of the treatments as there has been higher percentage of seed rot as compared to other treatments. In both the containers, an increase in per cent seed rot in all the genotypes, irrespective of various treatments of seed was observed with the increase in storage period (Fig.1).

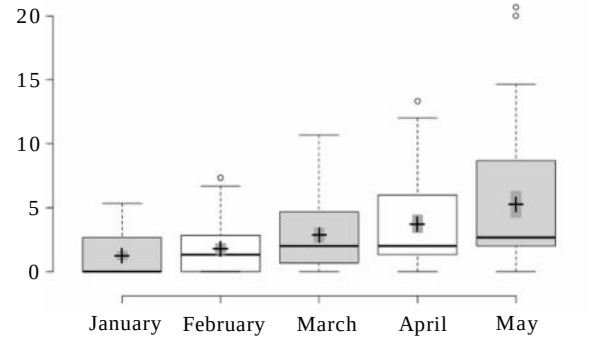

Fig. 2: Box plot statistics for CxGxT for five month storage

Conclusion:

In the present study, the packaging material cotton bags and 700 gauge polyline bags were found same for storage of seeds. In both the containers, per cent seed rot were statistically at par in all the genotype containing 12 per cent moisture. The maximum seed rot were recorded in CMS 58025 A and minimum in restorer KMR-3 followed by restorer IR-66, and Variety Pant Dhan-11 during storage. In all the genotypes, different fungicides reduced seed rot. The individual effect of fungicides indicate that Thiram was most effective followed by Thiram+Bavistin.

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