Annals of Plant and Soil Research 22(3): 320-328 (2020)

Effect of containers, genotypes and fungicides on seedlings of rice (*Oryza sativa*) during storage

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Received: June, 2020; Revised accepted: July, 2020

ABSTRACT

The experiments were conducted in vitro conditions to evaluate the effect of containers genotypes of rice and fungicides on normal seedlings of rice (Oryza sativa) during storage. The results revealed that cotton bags (C_1) and 700 gauge polyline bags (C_2) recorded 69.6 and 68.8% normal seedlings, respectively, in the month of May which was statistically at par to each other in storage of seeds. In both containers, per cent normal seedlings were statistically at par in all the rice genotypes containing 12% moisture content. There were reductions in germination of all the rice genotypes with the increase in storage period. The per cent normal seedlings were found maximum (76.2%), after storage in restorer KMR-3, followed by IR-66 (74.5%) and variety Pant Dhan-11 (74.3%). Different fungicides improved seed germination and increased normal seedlings per cent in all the genotypes. The individual effect of fungicides indicated that Thiram was found the most effective and yielded maximum (72.4%) percentage of normal seedling followed by Thiram + Bavistin (72.3%). As per the cumulative effect, rice genotype KMR-3 resulted more normal seedlings in both containers when treated with Thiram.

Keywords: normal seedlings, rice, containers, genotypes, fungicides, storage

INTRODUCTION

Rice (*Oryza sativa* L) is one of the most important cereal crops for human consumption all over the world. For rice cultivation, the seed is a very important input. The rice seeds are required to be stored for sowing in the next season after a time gap of six months or one year Padhi *et al..* (2017). It is important to know that the seeds that are stored in a gene bank will grow to produce plants. Therefore, they must have a high viability at the start and during storage (Jyoti, 2017). For the farmers and seed industry, storage of seeds till the next sowing season is an important aspect. The deterioration in seed starts immediately after maturity in terms of reduction in seed germination, normal seedlings, viability and vigour. Stored seeds viability and vigour depends on the seed quality, genotypes, seed treatment, packing materials and storage conditions (Patil and Shekharguda 2007). If the viability and vigor is not maintained properly during storage period, it will be difficult to sell it as a seed material for the next season. Post-harvest storage life of paddy largely depends on the genotypes, treatment, packaging material and storage conditions (Naik and Chetti 2017). For reducing the 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. There are many factors which affect the seed quality and cause deterioration during storage (Singh and Vishunavat 2019). Due to the male sterility, the female parents of rice hybrids are poor storers (Patil and Shekharguda, 2007). Post harvest storage life of paddy largely depends on the genotypes, treatment, packaging material and storage conditions (Naik and Chetti 2017). The containers, genotypes and fungicidal treatment play a very important role during storage of rice (Singh and Vishunavat 2019). The present investigation was carried out to find out the effect of containers, genotypes, fungicides and their combined effect on normal seedling during storage in rice.

MATERIALS AND METHODS

The seeds of hybrid rice parents; CMS 58025 A, CMS 58025 B, IR- 66, KMR-3 and a variety, Pant Dhan-11 were collected from the G.B. Pant University of Agriculture and Technology, Pantnagar. Seed lots of different genotypes, used for various studies were taken from field and were sun dried to bring down the

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moisture to 12% before storage. Each seed sample was divided into 8 sub samples. Each sub sample was treated with Thiram (T1); Thiram + Bavistin (T2); Bavistin (T3); Captan (T4); Vitavax (T5), Chlorothalonil (T6); and Contaf (T8). For fungicidal treatment of seeds, half kilogram seed for each treatment were treated by mixing the fungicide in seed with hands. The seeds treated @ 2 g/kg seed with different fungicides as well untreated seeds of genotypes viz. CMS 58025-A, CMS-58025- B, IR- 66, KMR-3 and a variety, Pant Dhan-11 were divided into two lots and were stored in two types of containers viz. Cotton bags (C1) and Polyline bags with thickness of 700-gauge (C2) at room temperature for further studies. The observations were recorded at monthly intervals on normal seedlings. A proportionate root and shoot length was considered to be normal seedlings (Singh, 2000). Germination test was conducted to take the observations on normal seedlings. The tests were carried out using "Towel Paper Method". Towel papers were soaked in running water overnight. Four hundred seeds for each treatment were used in the replication for 100 seeds. Twenty five seeds per towel paper were seeded and rolled using butter paper at the top. These rolled towel papers were placed in an incubator at 20-30° C in inclined position for 14 days. After 14 days, germination counts were made for normal seedlings and results are statistically analyzed for presenting the data using OPSTAT software (Sheoran *et al.* 1998).

RESULTS AND DISCUSSION

The results (Table 1) indicated that with an increase in storage period there was adecrease in % normal seedlings in both types of containers polythene and cotton bags

Table 1: Effect of different treatments on per cent normal seedlings at different storage period in rice

Treatments	Storage Period				
	January	February	March	April	May
			Containers		
Polyline bags	77.63	75.47	73.75	71.13	69.68
	(62.30)	(60.74)	(59.53)	(57.76)	(56.81)
Cotton bags	79.93	74.97	73.22	71.82	68.85
	(61.76)	(60.35)	(59.14)	(58.24)	(56.27)
CD (P=0.05)	0.99	0.90	0.80	0.73	0.61
			Genotypes		
CMS 58025A	68.79	64.45	64.96	63.17	61.50
	(56.16)	(54.67)	(53.76)	(52.66)	(51.67)
CMS 58025B	67.92	66.04	63.96	61.33	59.71
	(55.56)	(54.43)	(53.16)	(51.59)	(50.62)
KMR-3	82.54	80.79	78.83	76.75	74.54
	(65.52)	(64.19)	(62.73)	(61.26)	(59.76)
IR-66	84.79	82.45	80.79	78.96	76.21
	(67.44)	(65.59)	(64.26)	(62.89)	(60.98)
Pant Dhan-4	82.36	80.33	78.86	77.17	74.38
	(64.45)	(63.86)	(62.77)	(61.61)	(59.67)
CD (P=0.05)	1.57	1.42	1.30	1.45	0.96
			Fungicides		
Thiram	81.73	79.40	77.80	74.47	72.40
	(65.39)	(63.61)	(62.43)	(60.15)	(58.70)
Thiram+ Bavastin	81.27	79.07	76.67	75.00	72.33
	(64.86)	(63.26)	(61.43)	(60.36)	(58.48)
Bavastin	77.93	75.33	74.20	72.27	70.07
	(62.37)	(60.71)	(59.79)	(58.46)	(57.02)
Captan	80.73	73.80	72.53	71.07	68.93
	(62.90)	(59.62)	(58.72)	(57.73)	(56.35)
Vitavax	75.87	74.00	72.53	71.13	69.00
	(61.16)	(59.68)	(58.64)	(57.70)	(56.29)
Chlorothalonil	77.13	74.93	73.07	71.12	69.47
	(61.77)	(60.23)	(58.96)	(57.69)	(56.58)
Contaf	76.67	74.73	72.67	70.67	68.13
	(61.50)	(60.18)	(58.78)	(57.45)	(55.79)
Check	71.93	70.27	68.40	60.07	63.80
	(58.20)	(57.09)	(55.95)	(54.48)	(53.10)
CD (P=0.05)	1.98	1.80	1.64	1.45	1.22

Values in parenthesis are angular transformed value

Container polythene bagsretained more percentage of normal seedlings at different storage periods from January to May as compared to cotton bags, although, significant difference was recorded in % normal seedlings in seeds stored in both of containers. Huynh and Gaur (2005) reported germination above MSSC (80%) after 6 months of storage in seeds in 700 gauge polythene bags. Patil and Shekharguda (2007) and Choudhury *et al.* (2011) also reported same results during storage in rice. Padhi *et al.* (2017) observed that seeds of paddy stored in 700 gauge polythene bags maintained more germination percentage during storage. Seed stored in polythene bags proved to be superior of viability (Jyoti, 2017).

With an increase in storage period, the per cent normal seedlings decreased in all the rice genotypes (Table 2). Maximum normal seedlings were recorded in genotype KMR3 (G_4) in January (84.7%) while the minimum per cent normal seedling was recorded in CMS 58025 B (67.9%) at similar period of storage. The same trend has been observed as regard to per cent normal seedling at different storage months, thus the maximum per cent normal seedlings were recorded in KMR-3 followed by IR-66, Pant Dhan-11 and CMS 58025 A, while minimum normal seedlings were recorded in CMS 58025 A. Same finding have been reported by Patil and Shekharguda (2007). They also reported maximum normal seedlings in KMR-3. The maximum percentage of normal seedlings was recorded in T_1 (Thiram) (81.7%) whereas the minimum normal seedlings was observed in T8 (Control) (71.9%). With the increase in storage period per cent normal seedling decreased irrespective of different seed treatments. At all the storage periods, Thiram and Thiram+ Bavastin proved to be the best and maintained maximum percentage of normal seedlings. Treatments Bavastin, Captan, Vitavax, Chlorothalonil and Contaf also improved percentage normal seedlings during storage as compared to check but found to be inferior to Thiram and Thiram+ Bavastin. Huynh and Gaur (2005) reported germination above MSSC (80%) after 6 months of storage in Vitavax, Thiram and Mencozeb treated stored seeds. Patil and Shekharguda (2007) also reported that Thiram improved the normal seedling in rice after storage in rice. Choudhury *et al.* (2011) reported that seeds treated with Thiram+ Bavistin had higher seed germination and seedling length. Jyoti *et al.* (2017) reported that seed stored with treatment of Thiram proved superior as it maintained good and maximum seedling length in rice during storage. Padhi *et al.* (2017) concluded that rice seed treated with Thiram can maintain higher germinability for longer period.

Table 2: Cumulative effect of containers, genotypes and fungicidal treatment on per cent normal seedling at different storage periods in rice

Containers	Genotypes	Thiram	Thiram+ Bavastin	Bavastin	Captan	Vitavax	Chloro-thalonil	Contaf	Check
Polyline bags	CMS 58025 A	68.47 (55.31)	67.67 (56.02)	64.19 (53.24)	66.40 (55.62)	66.25 (54.51)	65.47 (54.04)	61.67 (53.03)	62.33 (51.84)
	CMS 58025 B	68.87 (55.65)	65.13 (54.34)	63.33 (52.75)	62.67 (52.37)	65.87 (54.28)	64.27 (53.35)	61.99 (51.85)	59.73 (51.19)
	KMR-3	82.37 (66.15)	82.65 (66.08)	79.87 (63.38)	79.48 (63.22)	80.00 (63.74)	79.37 (63.10)	76.93 (61.38)	76.00 (58.03)
	IR-66	88.00 (70.57)	84.40 (67.26)	80.53 (64.16)	81.60 (64.73)	79.33 (63.04)	80.27 (63.78)	80.13 (63.77)	72.08 (58.74)
	Pant Dhan-4	81.53 (63.70)	79.80 (63.80)	79.60 (63.28)	77.20 (64.39)	76.53 (61.44)	77.60 (61.82)	79.46 (63.24)	70.73 (58.44)
Cotton bags	CMS 58025 A	71.07 (57.54)	68.93 (56.52)	64.80 (53.64)	57.20 (49.20)	59.47 (50.51)	66.93 (53.73)	65.20 (53.90)	61.20 (52.70)
	CMS 58025 B	64.00 (53.25)	68.20 (56.39)	66.27 (54.57)	61.33 (52.17)	63.60 (53.17)	64.80 (53.63)	61.20 (51.53)	58.93 (50.20)
	KMR-3	82.40 (64.39)	80.53 (63.96)	79.60 (63.26)	77.47 (61.70)	78.93 (63.12)	77.87 (61.64)	77.07 (61.06)	72.53 (58.46)
	IR-66	88.07 (69.22)	82.80 (65.40)	78.67 (62.81)	80.27 (63.77)	77.06 (61.46)	78.13 (62.39)	80.27 (63.91)	74.93 (59.11)
	Pant Dhan-4	82.71 (64.81)	83.00 (65.78)	78.13 (62.30)	79.47 (63.11)	77.87 (62.06)	78.80 (62.51)	79.07 (62.95)	72.00 (54.95)
	CD (P=0.05)	5.19							

Thegenotypes IR-66, KMR-3 and Pant Dhan-11 in containers with Thiram and Thiram+ Bavastin retained maximum percentage of normal seedlings and proved to be the best at all the storage periods. Genotypes CMS 58025A and CMS 58025B in containers with all treatments improved percentage of normal seedlings as compared to checks but gave minimum percentage of normal seedlings as compared to rest of the treatments combinations. Jyoti (2017) concluded that combination of Pusa Basmati-1, Thiram and polythene bags maintained maximum germination in rice during 24 weeks of storage.

It may be concluded from the study that seed stored in cotton bags and 700-gauge polyline bags were statistically at par in relation to normal seedlings in all the rice genotypes. The maximum normal seedlings was maintained in KMR-3, while minimum in CMS-58025-A and CMS-58025 B during storage period. Thiram treated seeds were proved to be the best and maintained maximum percentage of normal seedlings followed by Thiram+ Bavastin.

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