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Effect of seed treatments on storability of different genotypes of paddy (*Oryza sativa*)

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Abstract
A storage experiment was conducted to understand the effect of seed treatments on seed storage of three genotypes of paddy; NDR-359 (V_1), Vishnobhog (V_2) and Sahbhagi (V_3) at Seed Testing Laboratory, SHIATS Allahabad for 18 months during 2012-15. The three genotypes was taken from the seed Processing unit SHIATS, Allahabad and were treated with Neem Oil (T_1), Turmeric powder (T_2) and Carbendazim 12% (T_3) and T_0 was kept as control (untreated). The initial moisture content of paddy seeds was kept 13% which is a standard. The data were recorded on characters *Viz:* germination percentage, seedling vigour index, seed viability and field emergence after 18 months of storage. The effect of treatments on genotypes was significant on all characters after 18 months of storage. Mean comparison showed that the genotype NDR -359 (V_1) recorded significantly higher germination percentage (66.03%), seedling vigour index (953.89), seed viability (67.69%) and field emergence (59.91%) after 18 months. The treatment Carbendazim 12% (T_3) showed significantly better germination percentage (70.67%), seedling vigour index (1086.08), seed viability (72.83%) and field emergence (65.42%) after 18 months of storage period. The results indicates that the genotype NDR -359 (V1) treated with treatment Carbendazim 12% (T_3) was good in all quality characters.

Keywords: genotype, treatment, storage, viability, paddy.

1. Introduction
Rice (Rice (*Oryza sativa* L.) is the premier food crop in the world. The genetic classification of rice plant belongs to genus *Oryza* of family Gramineae (Poaceae). The basic number of chromosomes of genus *Oryza sativa* L. is 12 (2n=24). Rice is a monocotyledonous angiosperm. The genus, to which it belongs, Oryza, contains more than 20 species, only two of which are referred to as cultivated rice: *Oryza sativa*, cultivated in South-east Asian countries and Japan and Oryza glaberrima cultivated in West Africa. Rice was originally cultivated in tropical Asia, the oldest record dating 5000 years BC, but then extended also to temperate regions A storage experiment was conducted to understand the effect of organic in integrated management practices of seed production and storage containers along with organic (Insecticide and fungicides) and organic (botanicals) as seed treatment on seed variability of scented rice. (Raikar *et al.*, 2008) [14].

Seed storage is an essential segment of seed industry. In storage, viability and vigour of the seeds is regulated by many physico-chemical factors like moisture content of the seed atmospheric humidity, temperature, and initial seed quality, physical and chemical composition of seed, gaseous exchange, storage structure and packaging materials. As the seed is hygroscopic in nature, seed quality is affected by variation in moisture content, relative humidity and temperature. Neem pesticides play a vital role in pest management and hence have been widely used in agriculture. The action of neem products as pest control agents can be manifested at different levels and in different ways. This is a very important point to be noted since the farmer would be used to the "knock-out" effect of chemical pesticides. Neem extracts do not exhibit this type of effect on pests but affect them in several other ways. Saxena (1990) [18]. Fungicide application can improve the genetic potential &crop productivity yield In general most of the fungicides acts by inhibiting the energy metabolism, blocking biosynthesis or altering cell membranes of fungus. Carbendazium (Benzimazimidazoles) a systemic fungicide with curative & protection action, extensively used in agriculture, inhibit the development of germinal tube, formation of the aspersoria and growth of nucleus. Seed treatment with carbendazium 2g/kg is most effective method for the control of blast disease .Foliar application is recommended for the management of sheath blight disease. Unplanned and repeated use of fungicides showed phytotoxicity. They alter or inhibit physiological and metabolic activities in plants. They interfere with the formation of micro tubules by binding to protein sub unit- tublin which is involved in several cellular processes including mitosis and maintenance of cell shape. Carbendazim produced chromosomal aberration in somatic and germ cell of pearl millet and sunflower (Harichand *et al.*, 1991).

2. Materials and methods
Paddy Seeds of Varieties (NDR-359, VishnoBhog, Sahbhagi), were obtained from the Directorate of seed and farm, SHIATS Allahabad. Before subjecting the seeds to germination, vigour test, the seed Lot were divided into 24 sublets. The required quantities of seeds were treated with Neem Oil, Turmeric powder, and Carbendazim 12% at different quantities and were stored for 18 months. The seeds treated with neem oil 10ml/kg., turmeric powder 20 g/kg and (Carbendazim 12%) 2.5 g/kg, were kept for drying to reduce the moisture content up to 12%. After drying the seeds were stored under ambient condition for 18 months.

Germination percentage
One hundred seeds in four replications were taken from each treatment and the germination test was conducted using between paper methods as per ISTA Rules. The rolled paper towels were placed in the germinator in slanting position at a constant temperature of 25+10C and 95+1 per cent relative humidity. The number of normal seedlings was counted at the end of 14th day of the test; the count of germination was expressed in percentage.

Seedling vigour index
The vigour index of seedling was calculated by adopting the method suggested by **Abdual- Baki and Anderson (1973)** and expressed as whole number for each treatment by using the below formula.
Seedlings vigour index (VI) = Germination (%) x Seedling length (cm)

Seed Viability test (Tetrazolium test)
This test was performed before storage of seed and after 18 month of storage to compare the loss in viability during the storage. In this test 100 seeds were soaked in water overnight. Seed were then soaked in 0.1% aqueous solution of 2, 3, 4 Triphenyl Tetrazolium chloride at 25 ^{0}C in dark for 4 hour and were later rinsed 3-4 times with distilled water. Individual seeds were evaluated for viability. (Agarwal 1996).

Field emergence (%)
A sample of 100 seeds were drawn randomly from each of four replications in all the treatments and sown manually and covered with the fine soil. The spacing maintained between the seeds was 2.0 cm and between the rows was 15 cm. adequate soil moisture was maintained in the seed bed. The emergence count was taken on 17th day of sowing. The seedlings appearing on the surface of soil were considered as emerged. The field emergence values were expressed in percentage.

Statistical analysis
The analysis of variance was worked out to test the significant differences among genotypes by F- test and critical difference between treatments and genotypes. Fisher and Yates (1936) [7].

3. Result and discussion
Viability and vigour of the seed varied from source to source as the locality factors influenced the storability of seed. The seeds from different sources possess different quality values, physical structures and chemical composition. These factors determine the longevity of seed in the storage. The genotype V_1 (NDR -359) recorded higher germination percentage (66.03%), seedling vigour index (953.89), seed viability (67.69%) and field emergence (59.91%) as compared to V_3 (Sahbhagi) after 18 months of storage period. This is because with the advance in the storage period, irrespective of seed source all the seed quality parameters were gradually decreased. It is generally seen that reduction in germinability depends on duration of aging. Germination decreases with increase in ageing period, as seen by Mandal and Basu (1986) [11] in cereals, Dharmalingam (1995) [5] Hussaini *et al.* (1988) [9] and Ramamoorthy *et al.* (1989) [15] in maize due to natural aging. Seeds treated with Carbendazim T_3 recorded higher root length, shoot length and field emergence and seed viability compared to untreated control (T_0) and followed by neem oil (T_1). Seeds treated with carbendazim exhibited higher germination percentage (70.67%), seedling vigour index (1086.08), seed viability (72.83%) and field emergence (65.42%) and good health status because of inhibition of storage microflora and resulted in higher germination and vigour. This is in accordance with the findings of Singh *et al.*, (1996) [17] in onion who have reported Carbendazim and bavistin as an effective fungicide against *Alternaria alternata*, *Rhizopus* spp, *Fusarium* spp and exhibited higher germination and vigour index in seeds of onion and other crop seeds. Similar results were made by Raju and Sivaprakasan (1994) [13] in maize. Similar studies were made by other scientist using fungicides as protectants by Dhyani *et al* (1991) [6], in chilli with captafol, thiram and vitavax, Reddy and Reddy (1994) [16] in eggplant with thiram and delson and Ozer and Koycu (1998) [12] in paddy with thiram seed treatment.

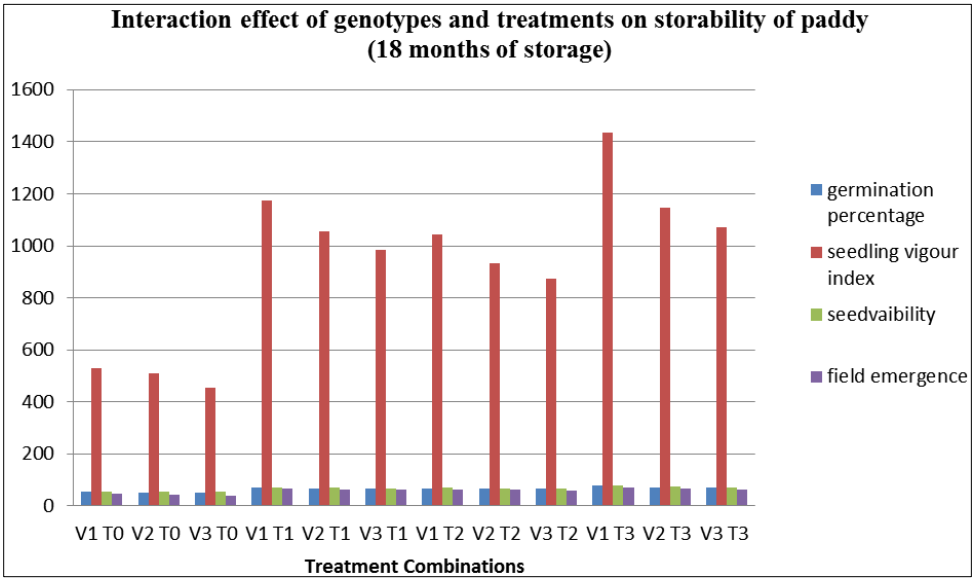
Table 1: Effects of seed treatments on genotypes at 18 months of storage period of Paddy

Factors		Germination percentage	Seedling vigour index	Seed viability	Field emergence
NDR-359	V_1	66.03	953.89	67.69	59.91
Vishnobhog	V_2	63.75	852.31	65.75	57.55
Sahbhagi	V_3	61.66	795.03	63.72	55.36
	Ftest	S	S	S	S
	SEd. (±)	0.41	13.38	0.38	0.43
	CD 5%	0.82	26.69	0.75	0.87
Seed treatment (T)					
Control	T_0	54.75	627.09	57.46	47.17
Neem oil	T_1	65.46	935.85	66.38	59.44
Turmeric Powder	T_2	64.38	819.28	66.21	58.41
Carbendazim 12%	T_3	70.67	1086.08	72.83	65.42
	F- test	S	S	S	S
	S.Ed. (±)	0.48	15.45	0.44	0.50
	C.D. at 5%	0.95	30.82	0.87	1.00

Seeds treated with carbendazim and neem oil recorded higher germination, rate of germination and vigour index might have played significant role in growth inhibition of storage fungi and attributed to higher germination, rate of germination and vigour index. This is in accordance with the findings of Raju and Sivaprakasan (1994) [13] in rice and other cereals crops, Singh *et al* (1996) [17] in onion. Similar observations were made by Kamble *et al.,* (1999) [10] in cucumber, pumpkin, watermelon and muskmelon and Gupta and Dharmsingh (1990) [8] in muskmelon and brinjal.

Table 2: Interaction effect of genotypes and treatments on storability of paddy (18 months of storage)

Treatments	Combination	Germination	Seedling vigour index	Seed Viability	Field Emergence
T1	V_1 T_0	53.50	529.82	56.00	45.75
T_2	V_2 T_0	51.25	511.47	53.75	42.75
T_3	V_3 T_0	50.25	455.32	55.50	40.75
T_4	V_1 T_1	71.25	1174.95	72.00	65.75
T_5	V_2 T_1	68.50	1055.27	70.25	62.75
T_6	V_3 T_1	67.25	984.55	68.75	61.25
T_7	V_1 T_2	68.75	1041.95	70.25	63.25
T_8	V_2 T_2	67.75	932.85	68.25	62.25
T_9	V_3 T_2	65.75	874.52	67.25	60.25
T_{10}	V_1 T_3	76.75	1436.65	79.25	71.25
T_{11}	V_2 T_3	72.00	1145.90	75.00	66.75
T_{12}	V_3 T_3	70.25	1069.42	72.50	64.75
Grand M		**65.27**	**934.38**	**67.39**	**58.95**
SE+-		1.65	53.52	1.51	1.74
CV		2.58	6.17	2.29	3.02
Range Max		76.75	1436.65	79.25	71.25
Range Min		50.25	455.33	53.75	40.75



In both the treatment combinations (V_1 T_3 and V_2 T_3), moisture content was low and Carbendazim proved to be effective fungicide. This is evidenced by higher germination, seedling length and field emergence during the storage period. This is in accordance with the findings of Biradar *et al.* (2007) [3] in rice**.**

4. Conclusion

Based on the results of present study, it was found that the genotypes V_1 (NDR-359) showed better quality parameters even after 18 months of storage period than other genotypes. Seeds treated with Carbendazim @ 12 % of seed and neem oil proved to be better for maintaining seed quality of paddy seeds for longer periods of storage. The interaction effect of seeds treated with carbendazim and stored under ambient conditions is proved to be better in maintaining the seed quality of paddy for longer periods of storage. The present study reiterated the importance of proper storage techniques and their impact on seed quality parameters of paddy seeds. Apart from correct storage, the original condition of the seeds needs to be taken into account before they are stored as insect damage could aggravate the problem. Seed treatments have a major role in protecting the seed during storage and can also play an important role in achieving uniform seedling emergence under certain conditions.

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